PURVIS FARM TRAFFIC IMPACT STUDY

20160

Mr. JD Padilla
Post Modern Development
144 N Mason Street
Fort Collins, CO 80524

Community Planning

Landscape and Placemaking

Infrastructure Engineering

Surveying and Mapping

Branding

March 2022

SANDERSON STEWART

ENDURING COMMUNITY DESIGN

FELSBURG HOLT & ULLEVIG
connecting & enhancing communities

MEMORANDUM

DATE: April 15, 2022

TO: Justin Currie

FROM: Charles M. Buck, P.E., PTOE

SUBJECT: Traffic Engineering Review

PROJECT: Purvis Farm FDP and Final Subdivision Plat
FHU Reference No. 199201-02

I have reviewed the materials provided for the Purvis Farm development, located in the northeast quadrant of the SH 60 (1st Street) and WCR 13 (Colorado Boulevard) intersection. Submittal materials including documents and drawings were provided. I have examined the materials specifically from the perspective of traffic engineering and transportation planning but not general civil or utility engineering. I have the following comments:

Traffic Impact Study, Sanderson Stewart, 03/25/2022

1. The methods and assumptions employed in this report are appropriate and acceptable. Previous comments have been adequately addressed.
2. Pages 36 and 37 provide recommendations for roadway improvements. Purvis Farm will be responsible for all improvements adjacent to the site that are caused by this development's traffic impacts, including:
   a. Northbound right-turn lane and southbound left-turn lane at Colorado Boulevard/Ballantine Boulevard.
   b. Northbound right-turn lane at Colorado Boulevard/Emmer Lane.
   c. Westbound right-turn lane at State Highway (SH) 60/Silver Plume Road.
3. The consultant and Town staff will coordinate on how these improvements will be integrated into the ultimate vision for these roadways.
4. An updated traffic analysis will be required when a detailed site plan with specific uses for the commercial site comes in for review.

Construction Drawings), Sanderson Stewart, 03/25/2022

5. Sheets C6.5 and C6.14 have Colorado Boulevard mislabeled as SH 60.
6. Sheets C6.23 and C6.24 show Colorado Boulevard widening; see comment #3 above.
7. Sheets C6.21, and C6.22 show intersection details on SH 60 and on Colorado Boulevard.
8. Sheet C7.1 and C7.2 show signing and striping for internal streets. Prior comments have generally been addressed. Sheet C7.2 is missing a STOP sign on westbound Sebright Lane at Silver Plume Road.
9. Sheet 7.3 shows signing and striping at SH 60/Silver Plume Road. The STOP sign is missing southbound at SH 60.
10. Sheet C7.4 shows striping and signage along Colorado Boulevard. See above comment #3 above. Ballantine Boulevard is mislabeled on this sheet as "Barley Moon Drive". A westbound STOP sign is missing at Colorado and Ballantine.

The above are my comments on the Purvis submittal. Please call or email me with any questions.

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INTRODUCTION

This traffic impact study (TIS) assesses the traffic-related impacts associated with the proposed development of the Purvis Subdivision in Johnstown, Colorado on the surrounding transportation system. This report also provides recommendations to mitigate any such impacts. The methodology and analysis procedures used in this study employ the latest technology and nationally accepted standards in the areas of site development and transportation impact assessment. Recommendations made in this report are based on professional judgment and these principles.

SITE LOCATION AND DESCRIPTION

The Purvis Farm PUD is located in Section 6, Township 4 North, Range 67 West, Parcels 106906000005 and 105906300040 in Weld County, Colorado. The site is bordered by State Highway 60 (W South 1st Street) on the south, Colorado Boulevard (Weld County Road 13) on the west, agricultural land use to the north including an existing oil and gas facility, and Podtburg Village to the east. Figure 1 on the following page depicts the study area.

SITE DEVELOPMENT PLAN

The site development plan for Purvis Farm PUD proposes construction on a total of 109 acres, approximately 102 acres to be developed now in three phases with an estimated buildout year of 2025, and approximately 6.96 acres for future development with a buildout year of 2028. Construction of 232 single-family homes, 52 duplex units, and 97 townhome units is proposed on the 102-acre parcel. The 6.96-acre parcel is proposed to contain a 16,680 square-foot office building, a 2,500 square-foot convenience store, two 2,400 square-foot fast food restaurants with drive-thrus, and a 21,500 square-foot shopping center. Access to Purvis Farm is proposed via one right-in/right-out movement access on State Highway 60 (SH 60) and two full-movement accesses on Colorado Boulevard (Weld County Road 13) – one at Ballentine Boulevard and the second on the northern end of the site. Figure 2 on page 3 illustrates the lot configuration.

EXISTING CONDITIONS

Streets

The development of Purvis Farm PUD will directly impact the adjacent streets and intersections by increasing area traffic and changing existing traffic patterns. The following paragraphs describe the existing area roadways that are most likely to be affected by this development.

Colorado Boulevard (Weld County Road 13)

Colorado Boulevard (WCR 13) is classified as a major arterial by the Johnstown Transportation Master Plan (TMP). Colorado Boulevard has a typical two-lane cross section with a 22-foot pavement width and gravel shoulders. South of Carlson Boulevard it has detached sidewalk and curb/gutter on the west side, but throughout the rest of the study area it has no curb and gutter or sidewalks. The posted speed limit on Colorado Boulevard is 35 mph.

State Highway 60 (W South 1st Street)

State Highway 60 (SH 60) is classified by the Johnstown TMP as a major arterial and a non-rural principal highway (NR-A) by the Colorado Department of Transportation (CDOT). SH 60 has a typical three-lane cross section with turn lanes at intersections and a center two-way left-turn lane (TWLTL) when further from intersections. West of Colorado Boulevard it has no curb and gutter but does have a sidewalk on the south side of the street. As it approaches Carlson Boulevard (western

Figure 1. Study Area

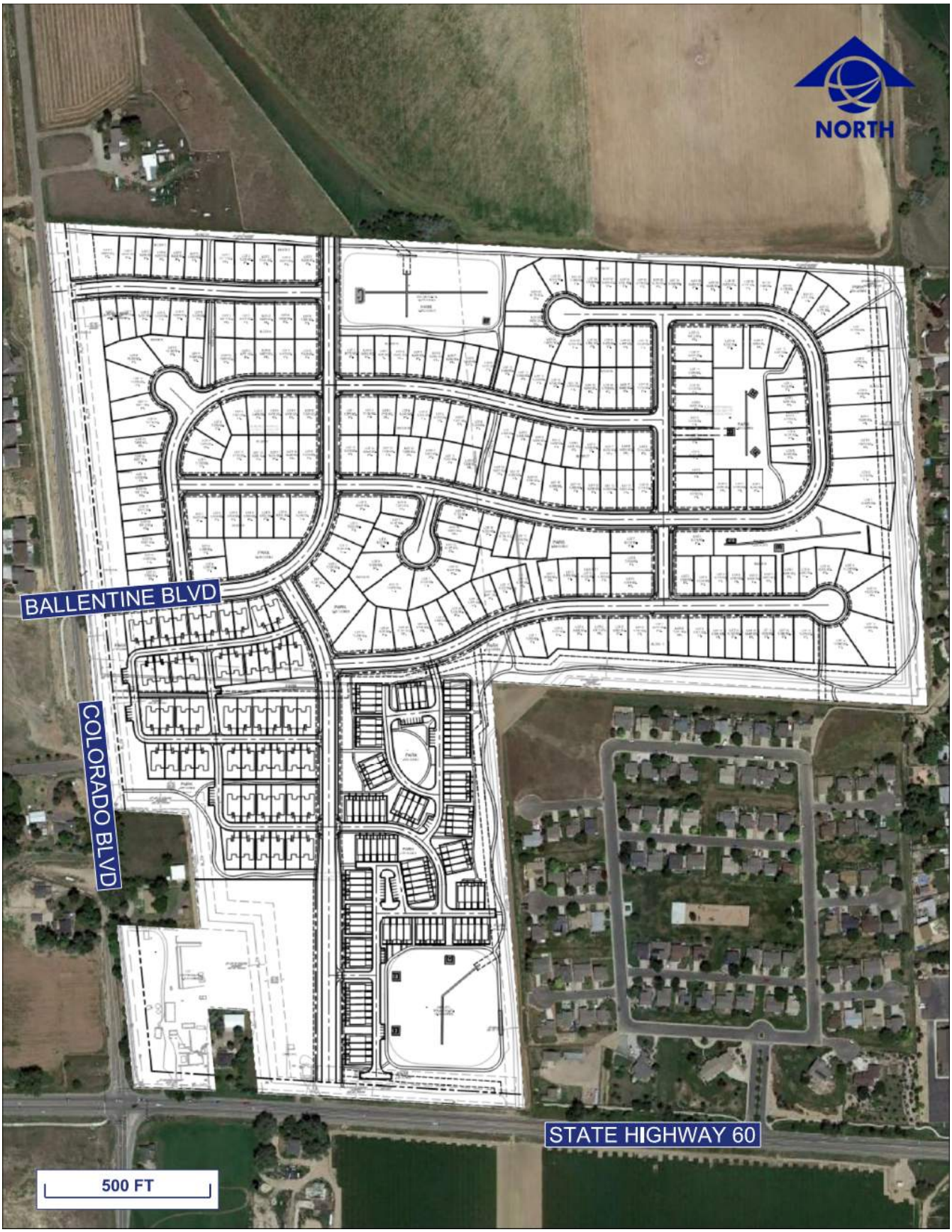

Figure 2. Site Layout

side of study area) it has curb/gutter and sidewalk on the north side of the street. To the east of Colorado Boulevard, it has no curb/gutter or sidewalks. There is a portion with curb, gutter, and detached sidewalks on the north side only located approximately 1,200 feet east of Colorado Boulevard. The posted speed limit on SH 60 is 55 mph in the study area. The North Front Range Metropolitan Planning Organization's (NFR MPO) 2040 Long Range Plan recommends expansion of SH 60 from 2-lanes to 4-lanes between Interstate 25 and County Road 15 (funding source Johnstown-CDOT) in 2030.

Ballentine Boulevard

Ballentine Boulevard is classified as a local road by the Johnstown TMP and by CDOT. Ballentine Boulevard has a paved surface width of approximately 38 feet with on-street parking, curb/gutter, and sidewalk on both sides. There is no posted speed limit on Ballentine Boulevard, but the Town of Johnstown mandates the speed limit is 25 mph.

Weld County Road 50 (East CR 14)

Weld County Road 50 (WCR 50) is classified as a major arterial by the Johnstown TMP. WCR 50 is a two-lane roadway with a paved surface of 24 feet, gravel shoulders and no sidewalks. The posted speed limit on WCR 50 is 55 mph.

Carlson Boulevard

Carlson Boulevard is classified as a local road by the Johnstown TMP. It has a paved surface width of approximately 40 feet south of SH 60 and 60 feet north of SH 60 with curb/gutter and sidewalks on both sides. The posted speed limit is 25 mph.

Intersections

The following paragraphs describe the existing major study area intersections that are most likely to realize traffic-related impacts as a result of the Purvis Farm PUD:

Colorado Boulevard/SH 60

The intersection of Colorado Boulevard and SH 60 has four legs and is controlled by a signal. The northbound approach has a shared thru/left-turn lane and a right-turn slip-lane separated by a painted median and raised island. The westbound approach has a dedicated left-turn lane and a shared thru/right-turn lane. The southbound approach has a dedicated right-turn lane and a shared thru/left-turn. The eastbound approach has separate left-turn, thru, and right-turn lanes. The eastbound and westbound approaches have protected/permissive left-turn phasing and the northbound right-turn slip lane operates under yield control. All remaining movements are permissive.

Colorado Boulevard/Ballentine Boulevard

The intersection of Colorado Boulevard and Ballentine Boulevard is a three legged "T" intersection with stop-control on the eastbound approach (Ballentine Boulevard). There is a southbound right-turn deceleration lane and an acceleration/merge lane for eastbound right-turning vehicles.

WCR 50/Colorado Boulevard

The intersection of WCR 50 and Colorado Boulevard is a "T" intersection with stop-control on the northbound approach (Colorado Boulevard). All approaches have a single entering and exiting lane.

SH 60/Carlson Boulevard

The intersection of SH 60 and Carlson Boulevard has four legs and is stop-controlled on the northbound and southbound approaches (Carlson Boulevard). The northbound approach has a shared thru/left-turn lane and dedicated right-turn lane. The

southbound approach has a 34-foot unmarked width for all movements. The eastbound and westbound approaches each have separate left-turn, thru, and right-turn lanes, and there are two westbound exiting lanes. The Johnstown TMP recommended signalization at this intersection between 2013 and 2020.

Bicycle/Pedestrian Facilities

There is sidewalk along the south side of SH 60 between Colorado Boulevard and Carlson Boulevard, and on the north side of SH 60 starting approximately 425 feet east of Carlson Boulevard and continuing until approximately 1050 feet west of Carlson Boulevard. There is sidewalk along both sides of Carlson Boulevard and Ballentine Boulevard. There are no bicycle or pedestrian facilities along Colorado Boulevard or WCR 50, and there are no bike lanes on any of the study area streets. The Johnstown, Milliken, & Windsor Short-Range Transit Plan, developed in 2006, recommended bicycle routes connecting Johnstown to Milliken and Windsor, and to the larger cities of Greeley, Fort Collins, and Loveland.

Johnstown Transportation Master Plan (TMP)

The February 2008 Town of Johnstown Transportation Master Plan (TMP) provides the following recommendations for improvements to streets and intersections in the study area. The listed recommendations have not been completed as of the writing of this report:

1. Paving Colorado Boulevard north of SH 60 to meet Johnstown street standards was recommended to occur in the near-term time period (before 2013). South of WCR 50, it is recommended that Colorado Boulevard be improved to meet Johnstown street standards in the mid-term time period (between 2014 and 2020). Colorado Boulevard is fully paved within the study area but only some portions adjacent to developments have been completed to include curb/gutter and sidewalk.

2. Signalization of the SH 60/Carlson Boulevard intersection was recommended to occur in the mid-term time period. This signal has not yet been constructed and it is not anticipated to be installed before the Purvis Farm PUD Full Buildout (2028) timeframe.

3. It is recommended that WCR 50 be improved to meet Johnstown street standards east of Colorado Boulevard in the long-term time period (between 2021 and 2035).

4. Widening of SH 60 to four lanes through the study area is recommended to occur in the long-term time period.

Traffic Volumes

Weekday AM and PM peak hour turning movement counts were collected for study area intersections on Tuesday, October 6, 2020. The traffic data was collected using Miovision Scout video-based systems. In general, the weekday AM and PM peak hour periods were found to occur from 7:00 to 8:00 AM and 4:30 to 5:30 PM. Raw count data was converted to passenger car equivalents (PCEs) and adjusted for seasonal variation using seasonal adjustment factors from nearby CDOT continuous counters in Weld County. A factor was also applied to account for a 3% reduction in traffic volumes due to the effects of the COVID-19 pandemic, provided by the North Front Range Metropolitan Planning Organization (NFRMPO). Because the counts were collected during the COVID-19 pandemic, there may be differences in travel patterns compared to before or after the pandemic. Figure 3 on the following page summarizes the calculated Existing Conditions (2020) peak hour turning movement volumes for the AM and PM peak hours. Detailed traffic count data worksheets are included in Appendix A.

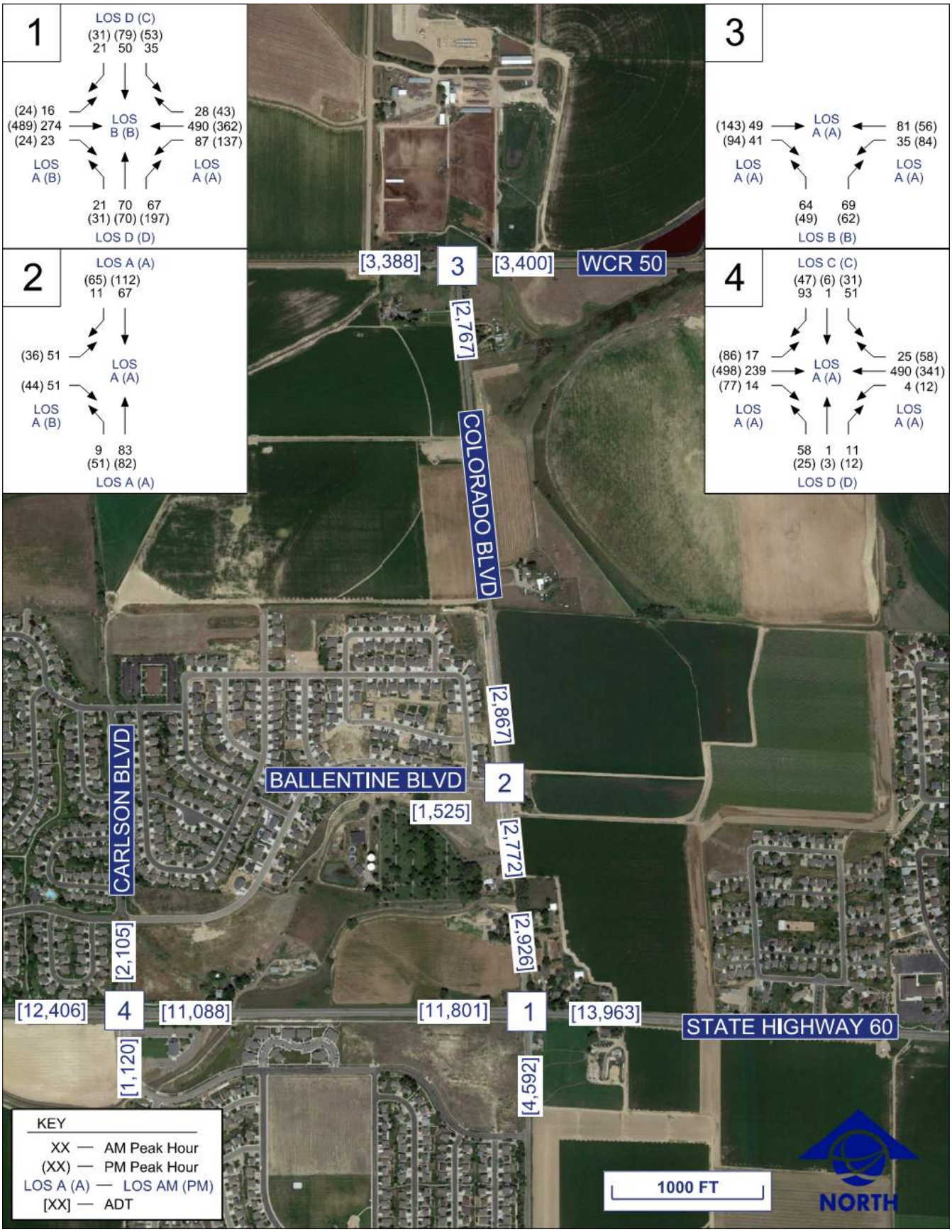

Figure 3. Existing Conditions (2020) Peak Hour Traffic Volumes (PCEs)

Intersection Capacity (2020)

Intersection capacity calculations for Existing Conditions (2020) were performed for the study area intersections using Synchro Version 10, which is based on the Highway Capacity Manual, 6th Edition (Transportation Research Board, 2016). Level of service (LOS) is defined as a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. LOS is a quantitative measure of the performance of an intersection with values ranging from LOS A, indicating good operation and low vehicle delays, to LOS F, which indicates congestion and longer vehicle delays. LOC C is typically considered a minimum acceptable threshold, though exceptions are made in certain cases.

The results of the Existing Conditions (2020) intersection capacity calculations showed that the Colorado Boulevard/Ballentine Boulevard and WCR 50/Colorado Boulevard intersections operate at LOS B or better on all approaches during the AM and PM peak hours. The Colorado Boulevard/SH 60 intersection operates at LOS D on the northbound approach during both peak hours, and LOS D on the southbound approach during the AM peak hour. The SH 60/Carlson Boulevard intersection operates at LOS D on the northbound approach during both peak hours. Projected 95th percentile queuing is moderate at the Colorado Boulevard/SH 60 intersection, with longer queues on SH 60. Queue lengths at other study intersections are minimal. Table 1 below presents the results of the Existing Conditions (2020) intersection capacity calculation results. LOS results at each intersection approach can also be found in Figure 3 on page 6. Detailed capacity calculation worksheets for each of the study area intersections for the Existing Conditions (2020) can be found in Appendix B.

Table 1: Existing Conditions (2020) Capacity Calculations

Intersection	Approach	Existing (2020)					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized*					
Colorado Boulevard & SH 60	EB	8.0	A	6	11.9	B	12
	WB	7.4	A	12	8.1	A	9
	NB	36.4	D	4	35.1	D	4
	SB	35.1	D	4	34.4	C	5
	Intersection	12.2	B	--	14.6	B	--
Intersection Control		*One-Way Stop-Control (EB)*					
Colorado Boulevard & Ballentine Boulevard	EB	9.9	A	1	10.4	B	1
	NB	0.7	A	0	3.0	A	1
	SB	0.0	A	0	0.0	A	0
	Intersection	3.9	A	--	3.2	A	--
Intersection Control		*One-Way Stop-Control (NB)*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.2	A	1	4.8	A	1
	NB	10.1	B	1	12.0	B	1
	Intersection	4.7	A	--	4.1	A	--
Intersection Control		*Two-Way Stop-Control (NB, SB)*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	1.1	A	1
	WB	0.1	A	0	0.3	A	0
	NB	25.8	D	2	27.5	D	1
	SB	19.2	C	2	23.2	C	2
	Intersection	4.8	A	--	3.3	A	--

Crash History

Historical crash data was obtained from CDOT and the Town of Johnstown Police Department for the 5-year period from January 1, 2015 through December 31, 2019 for the study intersections. The crash data was analyzed using CDOT interactive Safety Performance Functions (SPFs) for the purpose of calculating crash frequencies to compare to expected means for similar types of roadways and obtaining a Level of Service of Safety (LOSS) for each intersection. LOSS is CDOT's method to assess roadway performance, and therefore safety problems, by severity and frequency of crashes. It alleviates the need for a linear relationship between safety and exposure. It determines the magnitude of the safety problem which ultimately helps to prioritize safety countermeasures while accounting for variances in traffic volumes and crash data. LOSS I represents low crash frequencies (below the 20th percentile) which ultimately means a low potential for crash reduction, while LOSS IV represents high crash frequencies (above the 80th percentile) which means there is a higher potential for crash reduction at a location. The results of the LOSS analysis can be seen in Table 2 below. It should also be noted that only urban intersection models were available for public use even though one of the intersections in this study is in a more rural setting.

Table 2: Crash History – Frequency and Severity Statistics & LOSS

Intersection	2015-2019 DEV[1]	Reported Crashes[2]	Crash Type			Crashes Per Year (CPY)[3]		LOSS[4]	
			PDO	Injury	Fatality	Total CPY	Injury & Fatality CPY	Total LOSS	Injury & Fatal LOSS
Colorado Boulevard/SH 60	16038	15	12	3	0	3.55	1.08	I	I
Colorado Blvd/Ballentine Blvd	3863	3	3	0	0	0.56	0.13	III	II
WCR 50/Colorado Boulevard	4844	0	0	0	0	0.30	0.15	II	II
SH 60/Carlson Boulevard	13075	22	17	5	0	4.60	1.44	II	IV

[1] Daily Entering Volume (DEV) estimated from 2020 peak hour counts and Weld County and 2019 CDOT published ADTs

[2] Crashes reported from January 1, 2010 to December 31, 2019

[3] Crashes per Year were calcualated using CDOT SPFs which correct for regression to the man bias using Empirical Bayes procedure

[4] Level of Service of Safety (LOSS)

Crash frequencies (crashes per year [CPY]) were calculated for project intersections utilizing CDOT SPF interactive spreadsheets as described previously. The frequencies were obtained by dividing the total number of crashes reported at an intersection by the number of years during which the crashes were reported (5) and then statistically adjusting for regression to the mean bias using the Empirical Bayes procedure, all calculated within the CDOT-provided spreadsheets and based on CDOT crash databases. The highest crash frequency (4.60 total CPY) and the highest number of crashes (22) occurred at the intersection of SH 60/Carlson Boulevard. The intersection of Colorado Boulevard/SH 60 had a crash frequency of 3.55 crashes per year with 15 reported crashes. Crash frequencies for the other study area intersections ranged from 0.30 total CPY to 0.56 total CPY. Injury and fatality crash frequencies ranged from 0.13 CPY to 1.44 CPY.

As illustrated in Table 2 above, most intersections in the study area are LOSS I or II, indicating low to moderate potential for crash reduction. However, the Colorado Boulevard/Ballentine Boulevard intersection is LOSS III, indicating moderate to high potential for crash reduction. The SH 60/Carlson Boulevard intersection is LOSS IV for injury and fatal crashes, which is likely because 5 of the 22 (23%) crashes reported at the intersection involved injuries. It is noted that a signal installation at this intersection is anticipated in the future which will possibly help reduce crash frequency and severity at this intersection.

Sanderson Stewart also evaluated collision type for the purpose of identifying any significant trends in the crash data. Table 3 on the following page presents the results of that analysis.

Table 3: Crash History – Collision Type

	Collision Type						
	Right Angle	Rear End	Sideswipe SD	Fixed Object	Overturn	Wild Animal	Total
Colorado Boulevard/SH 60	4	7	2	0	1	1	15
Colorado Blvd/Ballentine Blvd	0	3	0	0	0	0	3
WCR 50/Colorado Boulevard	0	0	0	0	0	0	0
SH 60/Carlson Boulevard	16	3	0	3	0	0	22

Rear-end and right-angle crashes were the most commonly reported collision type for study area intersections. The intersection of Colorado Boulevard/SH 60 had 47% (7 of 15) rear end crashes. Rear-end crashes could be due to slowing turning vehicles from the mainline conflicting with the high volume of thru traffic. Half of the rear-end crashes were on SH 60 and half occurred on Colorado Boulevard.

The intersection of SH 60/Carlson Boulevard had 73% (16 of 22) of crashes caused by a right-angle collision. Right-angle collisions are often the most common type at stop-controlled urban intersections. In this case, the majority (all but one) of the crashes occurred when drivers on Carlson Boulevard were making a left turn onto SH 60 and were hit by a vehicle traveling straight on SH 60. Right-angle crashes are likely common at this intersection because of the high volume of thru movements on the mainline conflicting with turning or thru movements from the minor street. It is also possible that vehicles on the minor leg have trouble judging adequate gaps on the mainline to perform turning or thru movements, or that they attempt to perform the movement with inadequate gaps due to the high volume. The Johnstown Transportation Master Plan has suggested a signal be installed at this intersection as a medium range project (2010 through 2020) which could help reduce crash frequency and severity.

All of the crashes that occurred at Colorado Boulevard/Ballentine Boulevard were rear-end crashes and one occurred on each approach to the intersection. There were no notable collision type trends at other study area intersections, partly due to low total crash numbers.

It is important to note that all of the previous evaluations are somewhat speculative in nature, and more detailed information about individual crashes would be needed to determine exact causes for each collision.

TRIP GENERATION

This study utilized Trip Generation, 11th Edition, published by the Institute of Transportation Engineers (ITE), which is the most widely accepted source in the United States for determining trip generation projections. These projections are used to analyze the impacts of a new development on the surrounding area. For the purposes of this study, Land Use Code 210 – Single Family Detached Housing and Land Use Code 215 – Single-Family Attached Housing were used for the residential portion of the site, which is anticipated to be completed by 2025. The trips generated by the commercial portion of the site, which is anticipated to be completed by 2028, were calculated using Land Use Code 710 – General Office Building, Land Use Code 851 – Convenience Store, Land Use Code 822 – Strip Retail Plaza (< 40k), and Land Use Code 934 – Fast-Food Restaurant with Drive-Through Window. Table 4 on the following page illustrates the results of the trip generation calculations for both the residential and commercial portions of the site.

Table 4: Trip Generation Summary

Land Use	Independent Variable		Average Weekday			AM Peak Hour			PM Peak Hour		
	Intensity	Units	total	enter	exit	total	enter	exit	total	enter	exit
Residential Build Out (2025)											
Single-Family Detached Housing[1]	232	Dwelling Units	2188	1094	1094	162	42	120	218	137	81
Single-Family Attached Housing[2]	149	Dwelling Units	1073	536	537	72	22	50	85	48	37
Total Residential Gross Trips (2025)			**3261**	**1630**	**1631**	**234**	**64**	**170**	**303**	**185**	**118**
Total Residential Internal Capture Trips (2028)			**866**	**433**	**433**	**29**	**4**	**25**	**75**	**48**	**27**
Commercial Build Out (2028)											
General Office Building[3]	16.68	1000 Sq. Ft.	181	90	91	25	22	3	24	4	20
Internal Capture Trips**			118	63	55	8	5	3	9	4	5
Convenience Store[4]	2.5	1000 Sq. Ft.	1906	953	953	156	78	78	123	63	60
Internal Capture Trips**			738	341	397	21	9	12	50	23	27
Pass-By Trips** (Avg Rate = 51%)			596	312	284	69	35	34	37	20	17
Fast Food Restaurant with Drive Through[5]	4.8	1000 Sq. Ft.	2244	1122	1122	214	109	105	159	83	76
Internal Capture Trips**			982	545	437	52	37	15	83	37	46
Pass-By Trips** (Avg Rate = 49%)			619	283	336	79	35	44	38	23	15
Strip Retail Plaza (<40k)[6]	21.5	1000 Sq. Ft.	1171	585	586	51	31	20	142	71	71
Internal Capture Trips**			460	210	250	6	3	3	57	25	32
Pass-By Trips** (Avg Rate = 34%)			242	128	114	16	10	6	29	16	13
Total Commercial Gross Trips (2028)			**5502**	**2750**	**2752**	**446**	**240**	**206**	**448**	**221**	**227**
Total Commercial Internal Capture Trips (2028)			**2298**	**1159**	**1139**	**87**	**54**	**33**	**199**	**89**	**110**
Total Gross Trips			**8763**	**4380**	**4383**	**680**	**304**	**376**	**751**	**406**	**345**
Total Internal Capture Trips			**3164**	**1592**	**1572**	**116**	**58**	**58**	**274**	**137**	**137**
Total Pass-By Trips			**1457**	**723**	**734**	**164**	**80**	**84**	**104**	**59**	**45**
Total New External Trips			**4142**	**2065**	**2077**	**400**	**166**	**234**	**373**	**210**	**163**

(1) Single-Family Detached Housing - Land Use Code 210* — Units = Dwelling Units
- Average Weekday — Average Rate = 9.43 (50% entering, 50% exiting)
- Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: — Average Rate = 0.70 (26% entering, 74% exiting)
- Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: — Average Rate = 0.94 (63% entering, 37% exiting)

(2) Single-Family Attached Housing - Land Use Code 215* — Units = Dwelling Units
- Average Weekday — Average Rate = 7.20 (50% entering, 50% exiting)
- Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: — Average Rate = 0.48 (31% entering, 69% exiting)
- Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: — Average Rate = 0.57 (57% entering, 43% exiting)

(3) General Office Building - Land Use Code 710* — Units = 1000 SF GFA
- Average Weekday — Average Rate = 10.84 (50% entering, 50% exiting)
- Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: — Average Rate = 1.52 (88% entering, 12% exiting)
- Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: — Average Rate = 1.44 (17% entering, 83% exiting)

(4) Convenience Store - Land Use Code 851* — Units = 1000 SF GFA
- Average Weekday — Average Rate = 762.28 (50% entering, 50% exiting)
- Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: — Average Rate = 62.54 (50% entering, 50% exiting)
- Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: — Average Rate = 49.11 (51% entering, 49% exiting)

(5) Fast-Food Restaurant with Drive-Through Window - Land Use Code 934* — Units = 1000 SF GFA
- Average Weekday — Average Rate = 467.48 (50% entering, 50% exiting)
- Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: — Average Rate = 44.61 (51% entering, 49% exiting)
- Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: — Average Rate = 33.03 (52% entering, 48% exiting)

(6) Strip Retail Plaza (<40k) - Land Use Code 822* — Units = 1000 SF GFA
- Average Weekday — Average Rate = 54.45 (50% entering, 50% exiting)
- Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: — Average Rate = 2.36 (60% entering, 40% exiting)
- Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: — Average Rate = 6.59 (50% entering, 50% exiting)

**Trip Generation, 11th Edition*, Institute of Transportation Engineers, 2021

***Trip Generation Handbook, 3rd Edition*, Institute of Transportation Engineers, 2017

The residential buildout of Purvis Farm PUD is projected to generate 3,261 gross average weekday trips with 234 trips (64 entering/170 exiting) generated during the AM peak hour and 303 trips (185 entering/118 exiting) generated during the PM peak hour. The commercial portion of the site is projected to generate 5,502 gross average weekday trips with 446 trips (240 entering/206 exiting) during the AM peak hour and 448 trips (221 entering/227 exiting) during the PM peak hour.

Upon full buildout of the site (2028), Purvis Farm PUD is projected to generate a total of 8,763 gross average weekday trips with 680 trips (304 entering/376 exiting) generated during the AM peak hour and 751 trips (406 entering/345 exiting) generated during the PM peak hour.

Trip generation projections provide an estimate of the total number of trips that would be generated by a proposed development. However, to estimate the net number of new trips made by personal vehicles external to the site, adjustments must often be made to account for internal capture trips, pass-by trips, and trips made by alternate modes.

Internal capture (IC) trips are trips that do not have origins or destinations external to a project site. Since IC trips occur internally, they do not have an impact on external traffic operations. IC trips most often occur in mixed-use developments where residential, commercial, and office-related land uses exhibit a high rate of internal trip exchange. Since Purvis Farm PUD includes residential, office, and retail land uses, internal capture trips were calculated for the site. Average IC rates were 36.3% for the average weekday, with 17.1% for the AM peak hour and 36.5% for the PM peak hour. The IC trips would not be applicable to the residential portion of the site until full buildout of the commercial area is completed.

Pass-by trips are trips that are made as intermediate stops on the way from a point of origin to a primary trip destination. Pass-by trips are attracted from traffic "passing by" on an adjacent street that offers direct access to that site. Pass-by trips are primarily attracted by commercial type land uses such as shopping centers, restaurants, convenience markets, and gas stations and were therefore calculated for the Purvis Farm PUD commercial area.

Trips made by alternate modes (walking, biking, transit) are also anticipated for Purvis Farm PUD, but were not included in the analysis. It is anticipated, based on local observation and on the lack of available bike and pedestrian infrastructure, that relatively few trips during the peak hours would be made by alternate modes. Excluding alternate mode trips from the analysis also adds a measure of conservatism to the analysis of traffic impacts.

With adjustments made for internal capture and pass-by trips, Purvis Farm PUD is projected to generate a total of 4,142 net new external trips on a typical weekday with 400 trips (166 entering/234 exiting) during the AM peak hour and 373 trips (210 entering/163 exiting) during the PM peak hour upon full buildout of the development.

TRIP DISTRIBUTION

Trip distribution is an estimate of site-generated trip routing, which can be determined by several methods, such as computerized travel demand models, calculation of travel time for various available routes, and/or simple inspection of existing traffic patterns within the project area. For both the residential and commercial trip assignments, Sanderson Stewart utilized distribution percentages that were calculated for the recent nearby Johnstown Village development and were confirmed with data collected for this study. Figures 4 and 7 on pages 13 and 16 present the calculated trip distribution scheme for this study.

TRAFFIC ASSIGNMENT

Traffic assignment is the procedure whereby site-generated vehicle trips are assigned to study area streets, intersections, and site access driveways based on the calculated trip distribution and the physical attributes of the development site. Using this approach, site-generated trips for Purvis Farm PUD were assigned to the study area street network for the purposes of projecting future traffic volumes for analysis. The results of the traffic assignment exercises for the Residential Buildout (2025) and Full Buildout (2028) scenarios are also illustrated in Figures 4 and 7 on pages 13 and 16, respectively.

TRAFFIC IMPACTS

Traffic Volumes

Based on Town of Johnstown Master TIS guidelines, three future analysis years were utilized for the purposes of calculating future traffic projections for this study. These are the Residential Buildout year (2025), Full Buildout year (2028), and Long-Term Horizon year (2040).

In addition to site-generated trips, background traffic volumes will also likely increase for study area streets and intersections due to growth and development in the Town of Johnstown. To account for that growth, Sanderson Stewart used a 3% growth rate applied to the Existing Conditions (2020) volumes with all adjustments made for seasonal variation, COVID-19 impacts, and conversion to PCEs. This growth rate was based upon information from the Town of Johnstown and calculated from the 2008 TMP. Additional growth was calculated utilizing the build-up method by adding trips anticipated for the nearby Johnstown Village and Keto Maplewood developments. Figures 5, 8, and 10 on pages 14, 17, and 19 show the background volumes for each future analysis year without the addition of site trips from Purvis Farm PUD.

Future scenario traffic projections for the study area were then calculated by combining existing traffic volumes with anticipated background growth, nearby developments, and site-generated traffic assignments. Figures 6, 9, and 11 on pages 15, 18, and 20 illustrate the resulting Residential Buildout (2025), Full Buildout (2028), and total Long-Term Horizon (2040) scenario peak hour traffic volume and ADT projections.

Internal Roadways

The internal site volumes for the Full Buildout (2028) traffic projections were used to determine the appropriate site access roadway classifications. The north-south access roadway between State Highway 60 and the northern end of the commercial development is determined to be a two-lane Collector roadway, with an 80-foot right-of-way, per the Johnstown Transportation Master Plan (TMP). The roadway segments north of the commercial development area on the north-south road, as well as the east-west roadway that aligns with Ballentine Boulevard, are determined to be residential collectors with a 65-foot right-of-way. The most northern access roadway from Colorado Boulevard and the northern north-south roadway will both be designed as local roadways. The local internal daily roadway volumes are illustrated in Figure 12 on page 21.

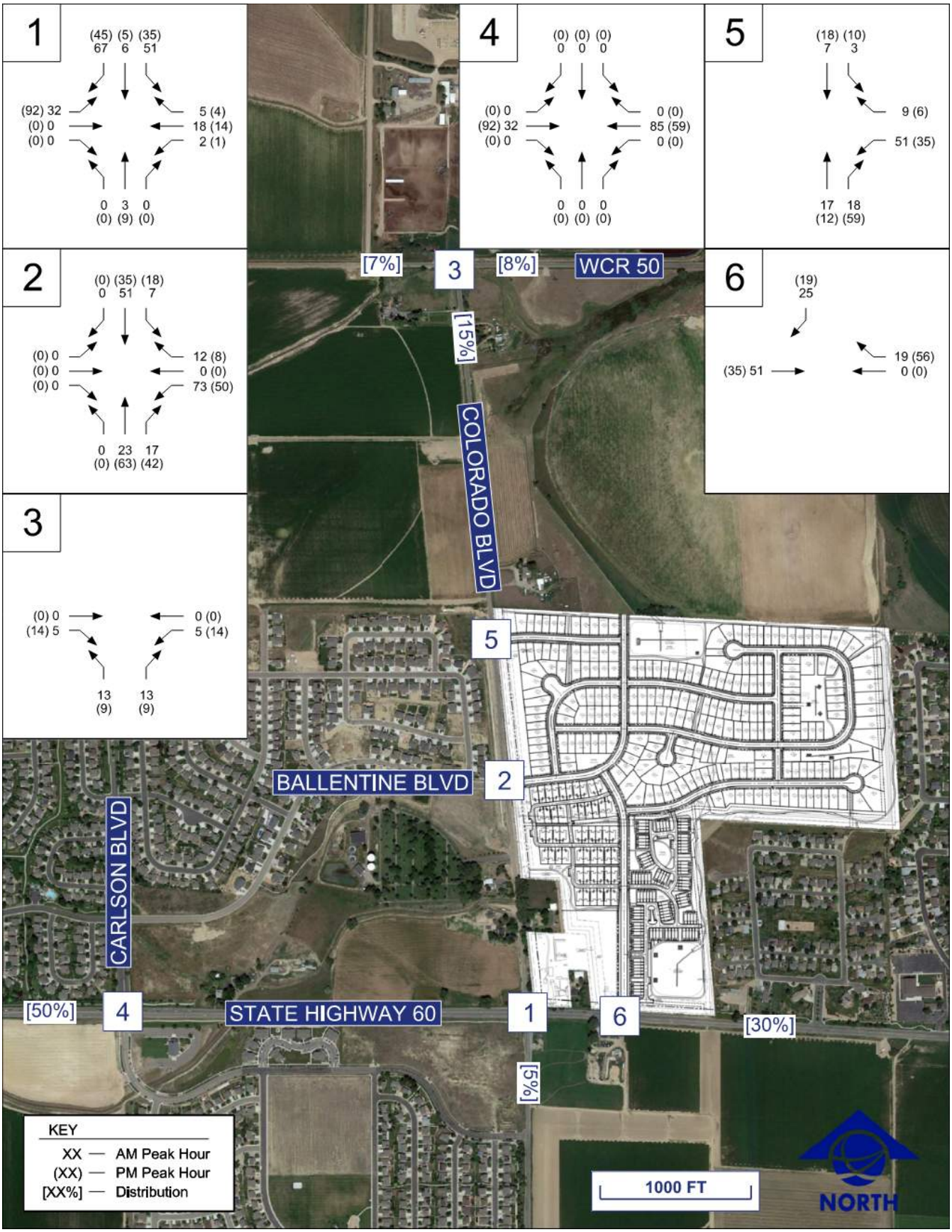

Figure 4. Residential Buildout (2025) Trip Distribution and Traffic Assignment Summary

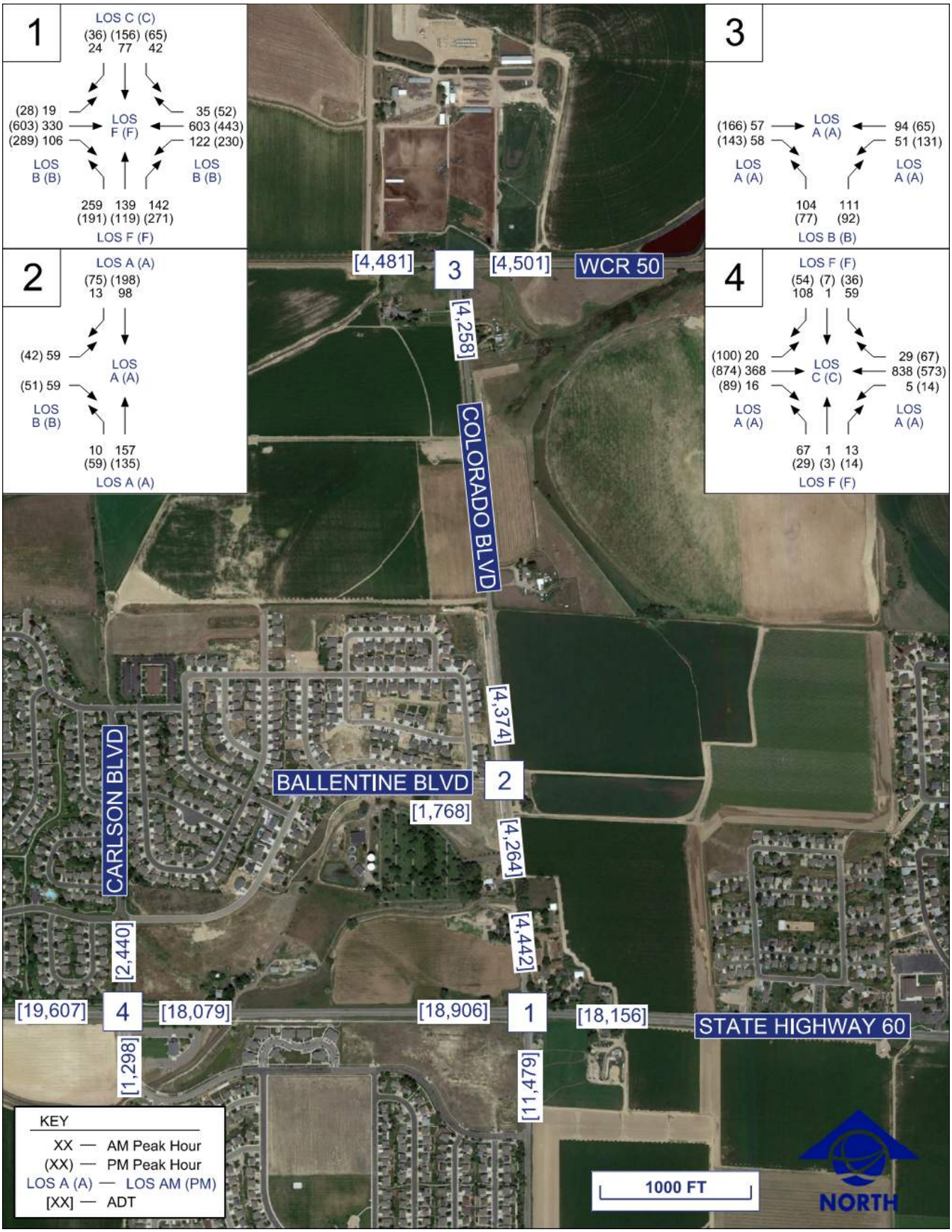

Figure 5. 2025 Background Volumes

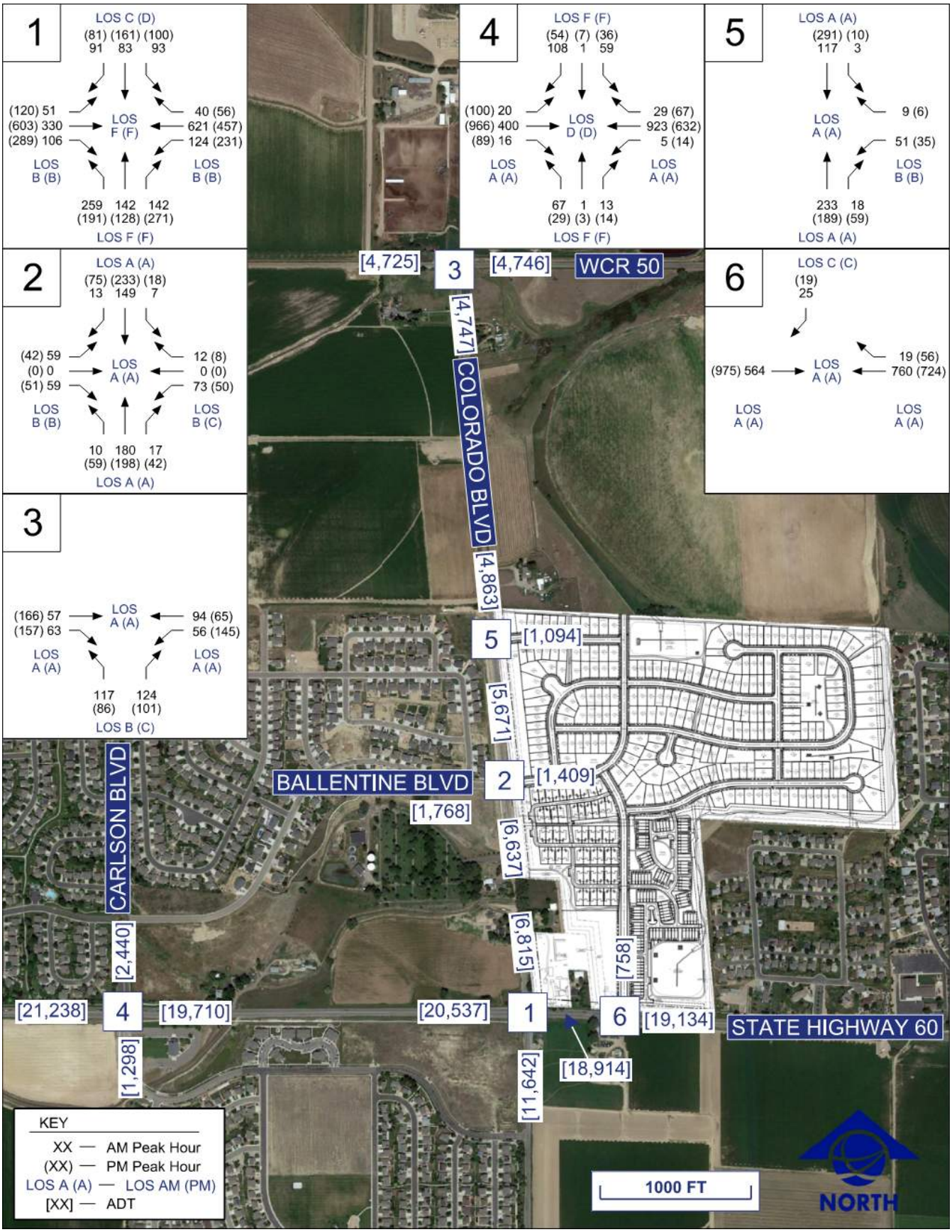

Figure 6. Residential Buildout (2025) Traffic Projections

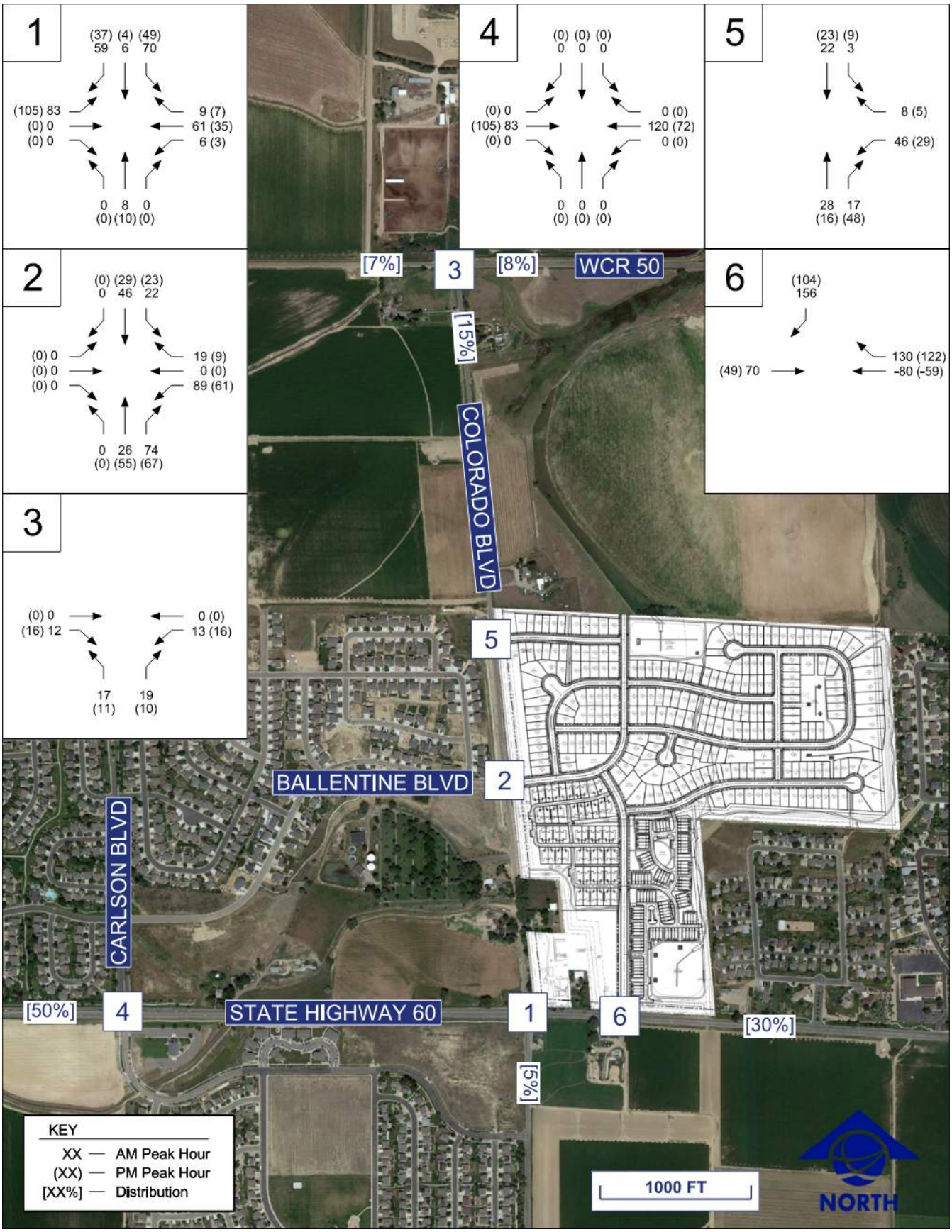

Figure 7. Full Buildout (2028) Trip Distribution and Traffic Assignment Summary

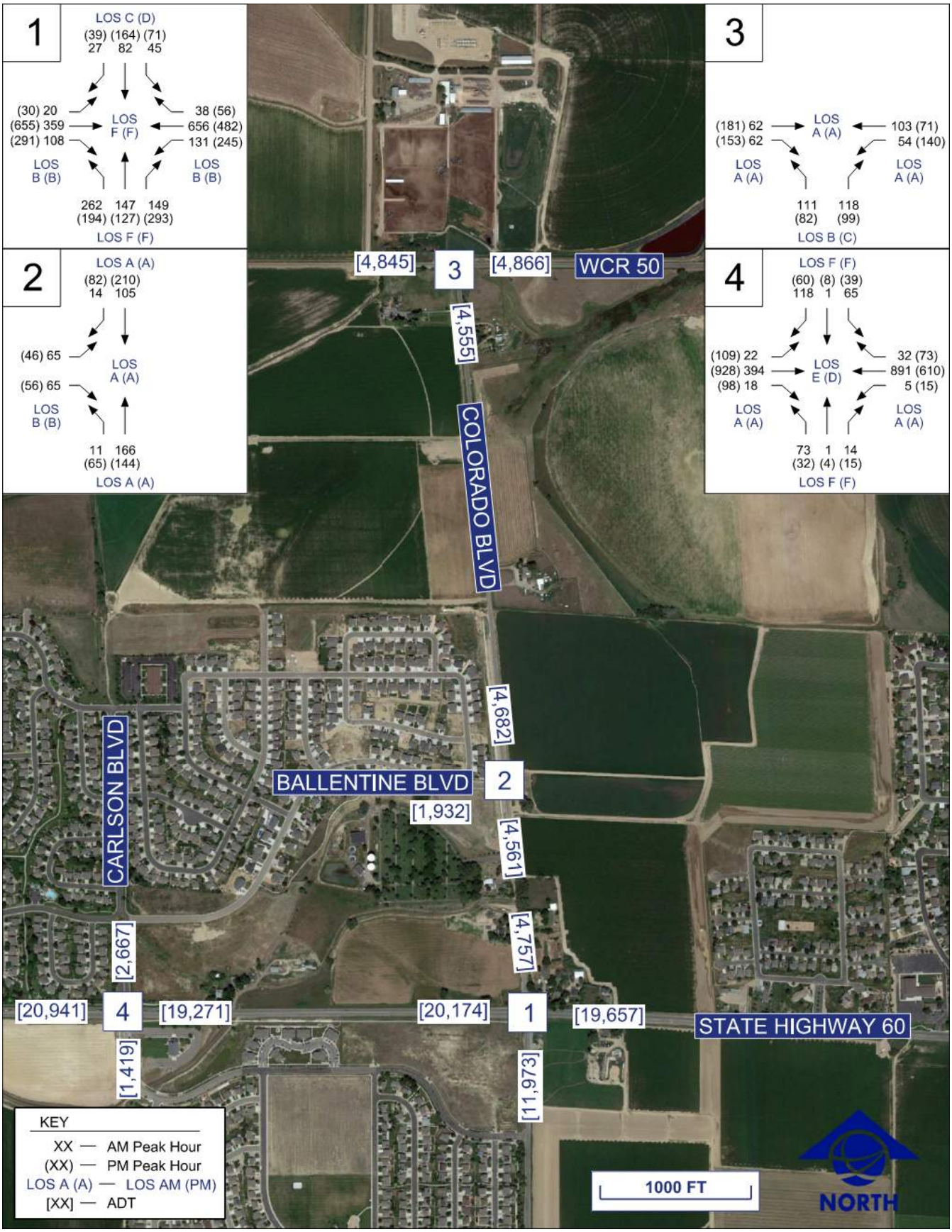

Figure 8. 2028 Background Volumes

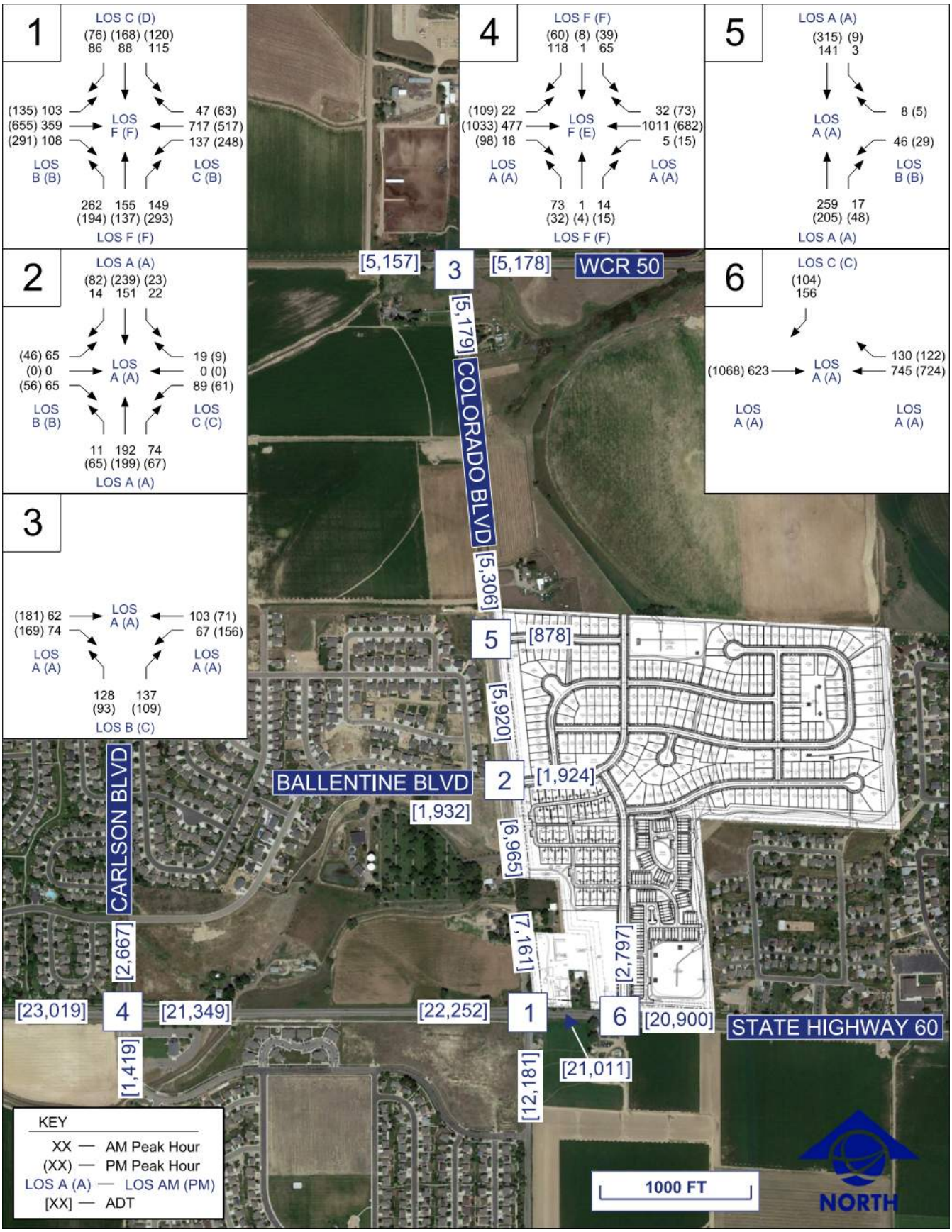

Figure 9. Full Buildout (2028) Traffic Projections

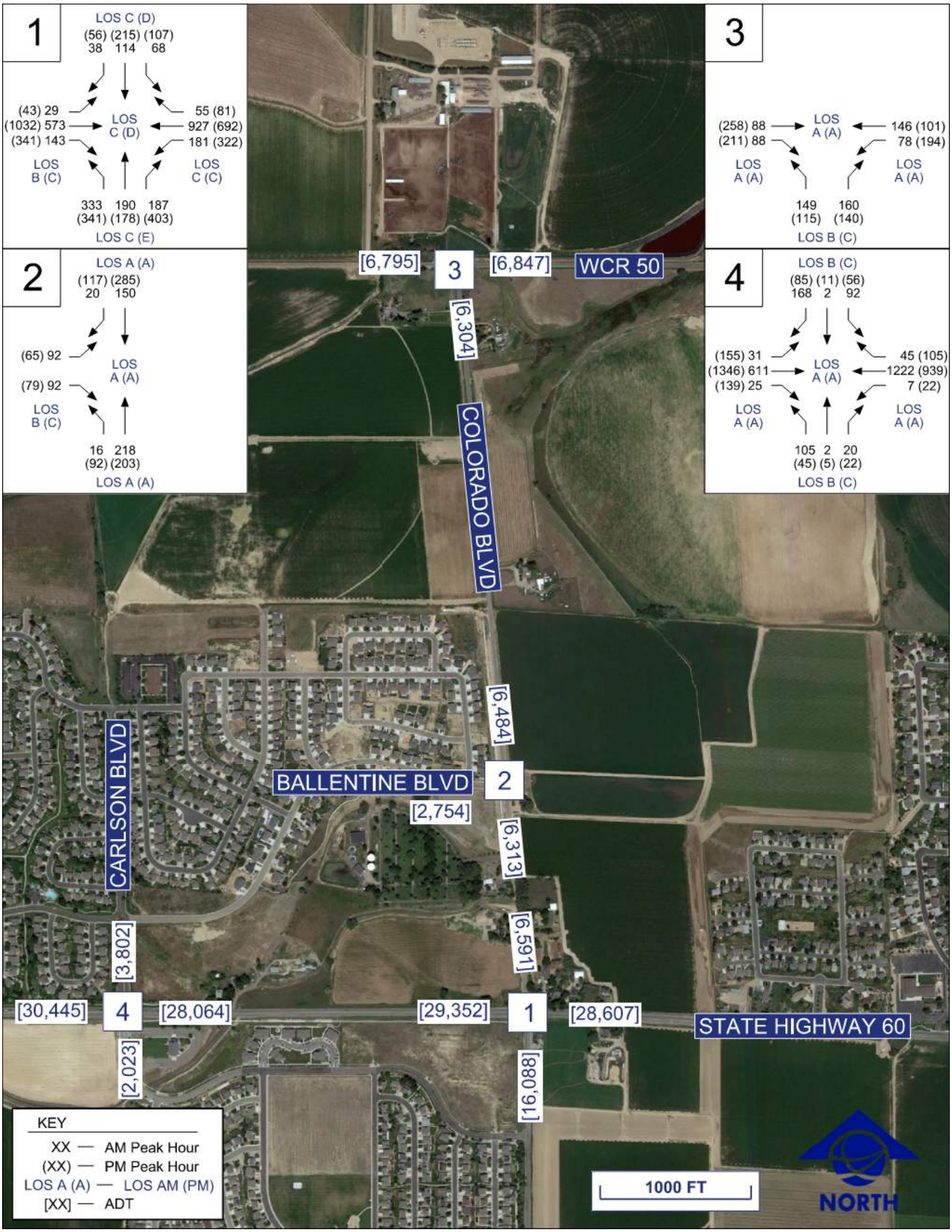

Figure 10. 2040 Background Volumes

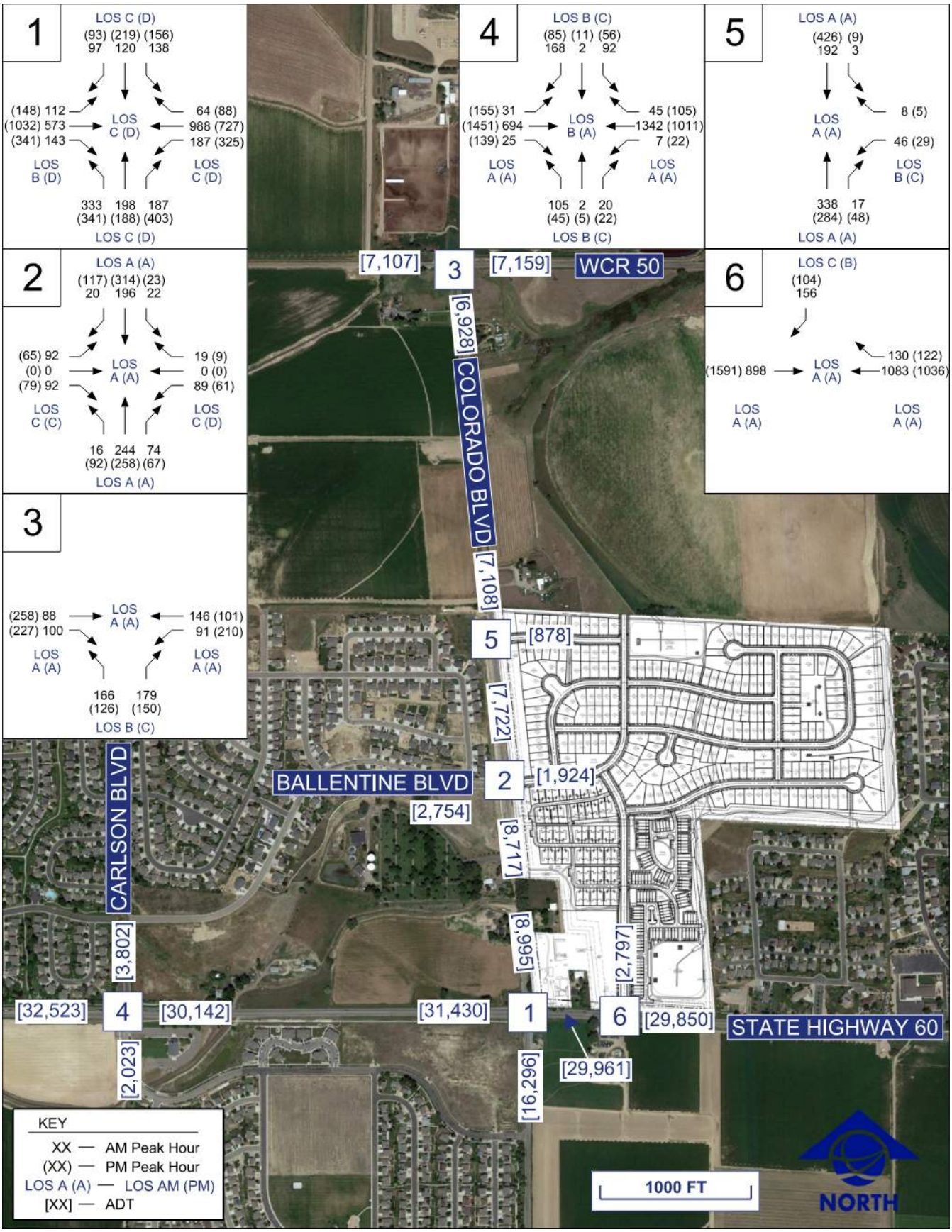

Figure 11. Long-Term Horizon (2040) Traffic Projections

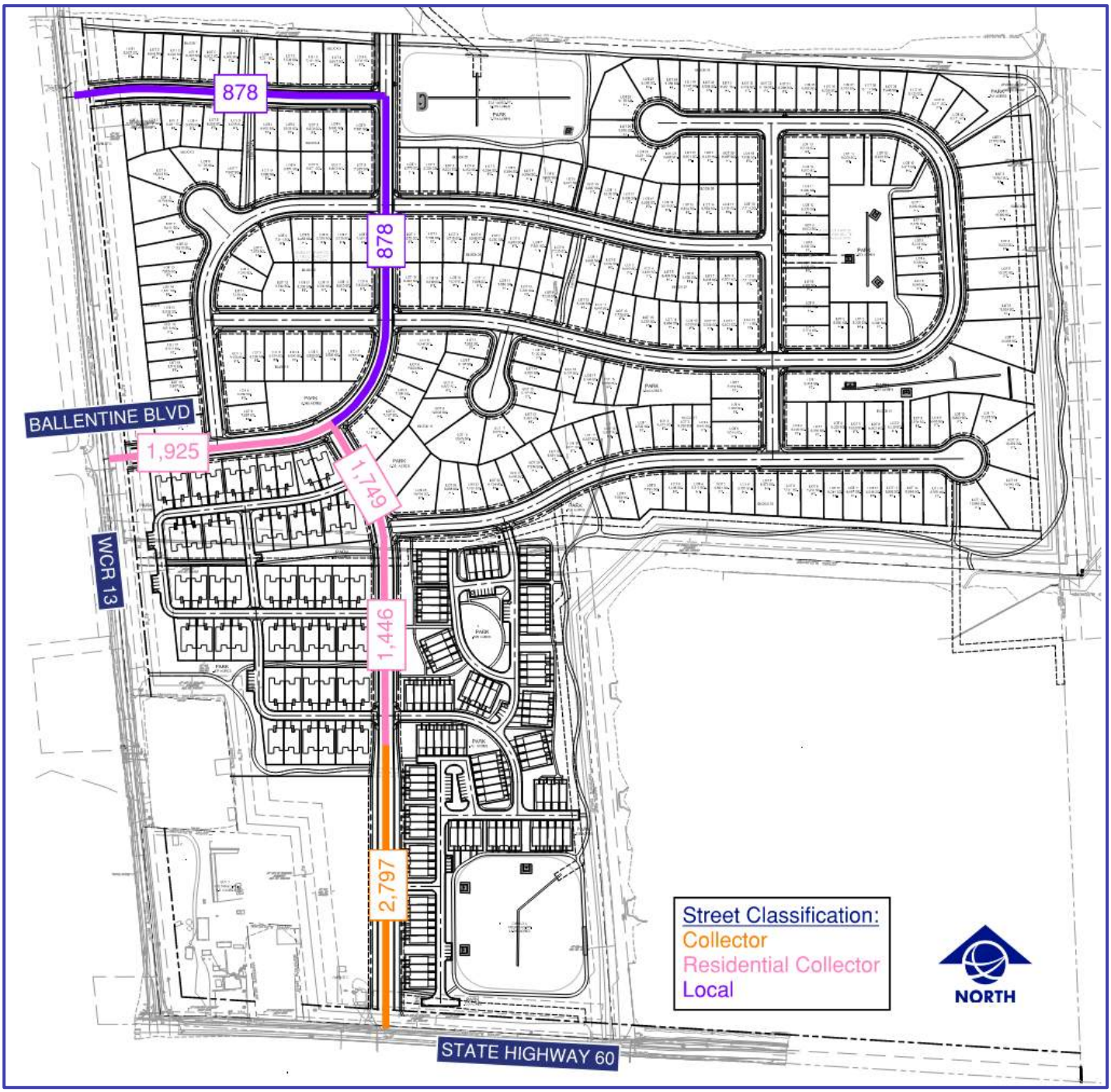

Figure 12. Internal Roadway Volumes for Full Buildout (2028)

Intersection Capacity (2025 & 2028)

Intersection capacity calculations for the future projections presented in Figures 6-11 were performed using Synchro, Version 10. Site access intersections were initially presumed to be stop-controlled. Peak hour factors (PHFs) for the future scenarios were assumed to be 0.92 for all intersections, as that is the default value utilized by the HCM. The assumed values were utilized to not overestimate future congestion in the study area. Figures 6-11 also show the LOS results at each intersection.

Per guidance from the Town of Johnstown, it was assumed that there would be no improvements to the intersections of Colorado Boulevard/SH 60 or SH 60/Carlson Boulevard until after the Full Buildout (2028) scenario. Therefore, initial capacity calculations for all 2025 and 2028 scenarios were performed assuming existing street geometry.

Tables 5-8 on pages 22-25 show detailed intersection capacity results for all four 2025 and 2028 scenarios. The tables and capacity calculation worksheets for the background volumes and total volume scenarios for both years can be found in Appendices C (2025) and D (2028).

Capacity calculations for the Long-Term Horizon (2040) background and total volumes were not performed with existing geometry, as it is expected that any improvements needed in 2025 or 2028 would be installed by 2040, as well as construction of an additional thru lane on SH 60 and a traffic signal at the SH 60/Carlson Boulevard intersection. As a result, Long-Term Horizon (2040) capacity results are presented later in this report in Tables 10 and 11 on pages 29 and 30 following the recommended improvements section.

2025 Background Volumes

Intersection capacity was calculated for the 2025 background volumes scenario using the peak hour volumes shown in Figure 6. Capacity results are projected to be similar to Existing Conditions (2020), with failing northbound and average intersection capacity projected at the Colorado Boulevard/SH 60 intersection during both peak hours. Lengthy 95th percentile queues are projected on most approaches. LOS F is also projected on the northbound and southbound approaches at the SH 60/Carlson Boulevard intersection during both peak hours with moderate queuing. All other intersections and approaches are projected to operate at LOS C or better. Capacity results can be found in Table 5 below.

Table 5: 2025 Background Capacity Calculations

Intersection	Approach	Background Volumes (2025)					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized*					
Colorado Boulevard & SH 60	EB	13.2	B	7	17.2	B	15
	WB	14.9	B	17	13.6	B	11
	NB	299.2	F	20	644.5	F	17
	SB	27.9	C	6	34.0	C	12
	Intersection	81.2	F	--	107.3	F	--
Intersection Control		*One-Way Stop-Control (EB)*					
Colorado Boulevard & Ballentine Boulevard	EB	10.6	B	1	12.0	B	1
	NB	0.4	A	0	2.4	A	1
	SB	0.0	A	0	0.0	A	0
	Intersection	3.3	A	--	2.8	A	--
Intersection Control		*One-Way Stop-Control (NB)*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.7	A	1	5.5	A	1
	NB	11.4	B	2	14.8	B	2
	Intersection	6.0	A	--	5.3	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB)*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.9	A	1
	WB	0.0	A	0	0.2	A	1
	NB	185.8	F	6	190.9	F	4
	SB	91.6	F	8	212.4	F	7
	Intersection	20.1	C	--	16.4	C	--

Residential Buildout (2025)

Intersection capacity was calculated for the Residential Buildout (2025) scenario using the peak hour volumes shown in Figure 7. At the intersection of Colorado Boulevard/SH 60, the northbound and overall intersection capacity are projected to be LOS F during both peak hours, with LOS D on the southbound approach during the PM peak hour. Projected 95th percentile queuing is expected to remain extremely lengthy. At the SH 60/Carlson Boulevard intersection, northbound, southbound, and overall intersection capacity is projected to be LOS D or worse during both peak hours. All other intersections and approaches, including the site access intersections, are projected to operate at LOS C or better. Capacity results can be found in Table 6 below.

Table 6: Residential Buildout (2025) Capacity Calculations

Intersection	Approach	Residential Buildout (2025)					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized*					
Colorado Boulevard & SH 60	EB	13.1	B	7	16.5	B	15
	WB	18.2	B	18	16.0	B	12
	NB	598.0	F	21	1568.0	F	18
	SB	29.4	C	12	41.6	D	15
	Intersection	140.6	F	--	228.0	F	--
Intersection Control		*Two-Way Stop-Control (EB/WB)*					
Colorado Boulevard & Ballentine Boulevard	EB	11.6	B	1	13.9	B	1
	WB	13.5	B	1	18.7	C	1
	NB	0.4	A	0	1.6	A	1
	SB	0.3	A	0	0.4	A	0
	Intersection	4.6	A	--	3.8	A	--
Intersection Control		*One-Way Stop-Control (NB)*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.8	A	1	5.8	A	1
	NB	11.9	B	2	16.2	C	2
	Intersection	6.4	A	--	5.9	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB)*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.8	A	1
	WB	0.0	A	0	0.2	A	1
	NB	326.1	F	7	309.5	F	4
	SB	150.2	F	10	378.8	F	9
	Intersection	31.6	D	--	25.9	D	--
Intersection Control		*One-Way Stop-Control (WB)*					
Colorado Boulevard & Northern Site Access	WB	11.3	B	1	12.8	B	1
	NB	0.0	A	0	0.0	A	0
	SB	0.2	A	0	0.3	A	0
	Intersection	1.6	A	--	1.0	A	--
Intersection Control		*One-Way Stop-Control (SB)*					
SH 60 & RIRO Site Access	EB	0.0	A	0	0.0	A	0
	WB	0.0	A	0	0.0	A	0
	SB	15.5	C	1	15.0	C	1
	Intersection	0.3	A	--	0.2	A	--

2028 Background Volumes

Intersection capacity was calculated for the 2028 background volumes scenario using the peak hour volumes shown in Figure 8. Results are expected to worsen from the 2025 Background scenario, with overall intersection capacity at the SH 60/Carlson Boulevard intersection projected to be LOS D or worse during both peak hours. The southbound approach at the Colorado Boulevard/SH 60 intersection is projected to worsen to LOS D during the PM peak hour and 95th percentile queues are projected to be extremely long. Capacity results can be found in Table 7 below.

Table 7: 2028 Background Capacity Calculations

Intersection	Approach	Background Volumes (2028)					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized*					
Colorado Boulevard & SH 60	EB	13.7	B	8	18.8	B	17
	WB	16.5	B	21	15.6	B	13
	NB	338.9	F	20	829.0	F	18
	SB	28.0	C	7	35.8	D	14
	Intersection	88.4	F	--	132.0	F	--
Intersection Control		*One-Way Stop-Control (EB)*					
Colorado Boulevard & Ballentine Boulevard	EB	10.8	B	1	12.5	B	1
	NB	0.5	A	0	2.5	A	1
	SB	0.0	A	0	0.0	A	0
	Intersection	3.5	A	--	3.0	A	--
Intersection Control		*One-Way Stop-Control (NB)*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.6	A	1	5.6	A	1
	NB	11.9	B	2	16.1	C	2
	Intersection	6.1	A	--	5.6	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB)*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.9	A	1
	WB	0.0	A	0	0.2	A	1
	NB	355.1	F	8	335.4	F	5
	SB	160.4	F	11	388.2	F	10
	Intersection	37.3	E	--	30.0	D	--

Full Buildout (2028)

Intersection capacity was calculated for the Full Buildout (2028) scenario using the peak hour volumes shown in Figure 9. Northbound and overall intersection capacity is projected to be LOS F during both peak hours at both the Colorado Boulevard/SH 60 intersection, with LOS D on the southbound approach during the PM peak hour and severe queuing on most approaches. The SH 60/Carlson Boulevard intersection is projected to operate at LOS E or worse overall and on the northbound and southbound approaches during both peak hours. All other intersections and approaches, including the site access intersections, are projected to operate at LOS C or better. Capacity results can be found in Table 8 on the following page.

Table 8: Full Buildout (2028) Capacity Calculations

Intersection	Approach	Full Buildout (2028)					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized*					
Colorado Boulevard & SH 60	EB	14.1	B	8	18.0	B	17
	WB	27.4	C	25	18.8	B	14
	NB	922.2	F	22	1890.6	F	19
	SB	31.6	C	13	54.8	D	17
	Intersection	198.7	F	--	264.9	F	--
Intersection Control		*Two-Way Stop-Control (EB/WB)*					
Colorado Boulevard & Ballentine Boulevard	EB	12.7	B	1	14.8	B	1
	WB	15.6	C	1	21.4	C	1
	NB	0.3	A	0	1.6	A	1
	SB	0.9	A	1	0.5	A	1
	Intersection	5.1	A	--	4.4	A	--
Intersection Control		*One-Way Stop-Control (NB)*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	3.0	A	1	5.9	A	1
	NB	12.8	B	2	18.3	C	3
	Intersection	6.8	A	--	6.5	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB)*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.9	A	1
	WB	0.0	A	0	0.2	A	1
	NB	768.0	F	10	607.9	F	6
	SB	332.4	F	14	656.2	F	12
	Intersection	70.2	F	--	47.3	E	--
Intersection Control		*One-Way Stop-Control (WB)*					
Colorado Boulevard & Northern Site Access	WB	11.8	B	1	13.0	B	1
	NB	0.0	A	0	0.0	A	0
	SB	0.2	A	0	0.2	A	0
	Intersection	1.4	A	--	0.8	A	--
Intersection Control		*One-Way Stop-Control (SB)*					
SH 60 & RIRO Site Access	EB	0.0	A	0	0.0	A	0
	WB	0.0	A	0	0.0	A	0
	SB	24.7	C	3	19.5	C	2
	Intersection	2.3	A	--	1.0	A	--

Mitigation Alternatives

Mitigation improvement options were evaluated to address existing concerns and/or projected impacts for study area streets and intersections. The following paragraphs provide details on that analysis.

Auxiliary Turn Lanes

Auxiliary right and left-turn lane warrants were evaluated based on the requirements outlined in the State of Colorado's *State Highway Access Code, Volume 2, March 2002* for Existing Conditions (2020), 2025 background and Residential Buildout, 2028 background and Full Buildout, and Long-Term Horizon (2040) background and total scenarios. The State Highway Access Code determines turn-lane warrants based upon roadway classification, peak vehicle per hour volumes and posted speeds. SH

60 is classified as a "Non-Rural Regional Principal Highway (NR-A)" by CDOT. Colorado Boulevard and WCR 50 are classified as major arterials in the Johnstown TMP, which directs that Johnstown major arterial classification is equivalent to CDOT NR-A classification for the purposes of evaluating the need for auxiliary lanes. On NR-A designated roads, a right-turn deceleration lane is required for any access with a projected peak hour ingress turning volume greater than 25 vehicles per hour (vph). Right-turn acceleration lanes are required for any access with a projected peak hour egress right-turning volume greater than 50 vph when the posted speed is greater than 40 mph. A right-turn acceleration lane may also be required at signalized intersections if a free-right turn is needed to maintain an appropriate level of service. Left-turn deceleration lanes are required for any access with a projected peak hour ingress turning volume greater than 10 vph. A left-turn acceleration lane is generally not required on roadways with a posted speed of less than 45 mph, signalized intersections, or where the acceleration lane would interfere with the left-turn ingress movements to any other access. The *State Highway Access Code* also directs that a continuous auxiliary lane should be built where two or more accesses have speed change lanes that overlap or are close together, and that left-turn deceleration lanes get priority where topography only allows one lane.

Auxiliary turn lane warrants were evaluated at all non-signalized intersections for all scenarios based upon posted speeds and anticipated traffic volumes. Results are illustrated in Table 9 on the following page and summarized below:

- **Colorado Boulevard/Ballentine Boulevard intersection:** A northbound left-turn deceleration lane is warranted based on the Existing Conditions (2020) scenario. Northbound right-turn and southbound left-turn deceleration lanes are projected to be warranted based on the Residential Buildout (2025) scenario.

- **WCR 50/Colorado Boulevard intersection:** Eastbound right-turn and westbound left-turn deceleration lanes and a northbound right-turn acceleration lane are all warranted based on the Existing Conditions (2020) scenario.

- **SH 60/Carlson Boulevard intersection:** No additional turn lanes are warranted at this intersection beyond what is already existing.

- **Colorado Boulevard/Northern Site Access intersection:** A northbound right-turn deceleration lane is projected to be warranted based on the Residential Buildout (2025) scenario.

- **SH 60/RIRO Site Access intersection:** A westbound right-turn deceleration lane is projected to be warranted based on the Residential Buildout (2025) scenario and a southbound right-turn acceleration lane is projected to be warranted based on the Full Buildout (2028) scenario.

All above turn lanes are warranted based on traffic volumes and not existing or projected capacity deficiencies. Although the warranted lanes are not required for capacity purposes, they may increase safety at intersections as volumes grow by separating turning vehicles from the thru movement.

Table 9: Auxiliary Turn Lane Warrant Summary

AUXILIARY TURN LANE WARRANTS		Colorado Blvd & Ballentine Blvd		WCR 50 & Colorado Blvd		SH 60 & Carlson Blvd		Colorado Blvd & Northern Site Access		SH 60 & RIRO Site Access	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
2020	NB RT Deceleration										
	NB RT Acceleration			YES*	YES*	NO	NO				
	NB LT Deceleration	NO	YES*								
	SB RT Deceleration	EXIST	EXIST								
	SB RT Acceleration					EXIST	EXIST				
	SB LT Deceleration										
	EB RT Deceleration			YES*	YES*	EXIST	EXIST				
	EB RT Acceleration	EXIST	EXIST								
	EB LT Deceleration					EXIST	EXIST				
	WB RT Deceleration					EXIST	EXIST				
	WB RT Acceleration										
	WB LT Deceleration			YES*	YES*	EXIST	EXIST				
2025	NB RT Deceleration	NO	YES					NO	YES		
	NB RT Acceleration			YES*	YES*	NO	NO				
	NB LT Deceleration	NO	YES*								
	SB RT Deceleration	EXIST	EXIST								
	SB RT Acceleration					EXIST	EXIST			NO	NO
	SB LT Deceleration	NO	YES					NO	NO		
	EB RT Deceleration			YES*	YES*	EXIST	EXIST				
	EB RT Acceleration	EXIST	EXIST								
	EB LT Deceleration					EXIST	EXIST				
	WB RT Deceleration					EXIST	EXIST			NO	YES
	WB RT Acceleration	NO	NO					NO	NO		
	WB LT Deceleration			YES*	YES*	EXIST	EXIST				
2028	NB RT Deceleration	YES	YES					NO	YES		
	NB RT Acceleration			YES*	YES*	NO	NO				
	NB LT Deceleration	YES*	YES*								
	SB RT Deceleration	EXIST	EXIST								
	SB RT Acceleration					EXIST	EXIST			YES	YES
	SB LT Deceleration	YES	YES					NO	NO		
	EB RT Deceleration			YES*	YES*	EXIST	EXIST				
	EB RT Acceleration	EXIST	EXIST								
	EB LT Deceleration					EXIST	EXIST				
	WB RT Deceleration					EXIST	EXIST			YES	YES
	WB RT Acceleration	NO	NO					NO	NO		
	WB LT Deceleration			YES*	YES*	EXIST	EXIST				
2040	NB RT Deceleration	YES	YES					NO	YES		
	NB RT Acceleration			YES*	YES*	NO	NO				
	NB LT Deceleration	YES*	YES*								
	SB RT Deceleration	EXIST	EXIST								
	SB RT Acceleration					EXIST	EXIST			YES	YES
	SB LT Deceleration	YES	YES					NO	NO		
	EB RT Deceleration			YES*	YES*	EXIST	EXIST				
	EB RT Acceleration	EXIST	EXIST								
	EB LT Deceleration					EXIST	EXIST				
	WB RT Deceleration					EXIST	EXIST			YES	YES
	WB RT Acceleration	NO	NO					NO	NO		
	WB LT Deceleration			YES*	YES*	EXIST	EXIST				

* warranted based on background volumes

Traffic Signals

Traffic signal warrants were evaluated for all scenarios at the Colorado Boulevard/Ballentine Boulevard intersection using criteria outlined in the Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD presents several warrants that can be considered based on traffic volumes, school crossings, crash history, and others. For the purposes of this analysis, all but Warrants 4, 5, and 9 (Pedestrian Volume, School Crossing, and Intersection Near a Grade Crossing) were evaluated. Those warrants were not evaluated because pedestrian volumes were not counted at the intersection and there are no school or railroad crossings near the intersection. Additionally, due to the residential nature of area land uses, satisfaction of the Peak Hour warrant alone should not be considered as warranting a signal, as it is primarily meant for application at office complexes, manufacturing plants, or other high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

It was found that no signal warrants are met for Existing Conditions (2020) or any future scenario at the Colorado Boulevard/Ballentine Boulevard intersection.

The Peak Hour warrant was evaluated at the SH 60/Carlson Boulevard intersection for all scenarios. No other warrants were evaluated as there was only peak hour volume data available. Although Peak Hour warrant results alone do not provide a thorough analysis on the need for a signal, it was shown that the Peak Hour warrant is projected to be met starting in 2025 due to background growth on the network. Based on recommendations in the Johnstown TMP and existing and future capacity results at the intersection, it is likely that a signal will be needed by 2025 or 2028. A full signal warrant study would provide a recommendation as to when this signal should be installed.

A summary table of traffic signal warrant results as well as detailed calculation worksheets can be found in Appendix E.

Operational Concerns

Approximately 1,300 feet to the east of the intersection of Colorado Boulevard/SH 60, the posted speed limit on SH 60 increases from 45 mph to 55 mph, which results in high speeds on a section of corridor that has signalization, local access points, and congestion. It is suggested that the Town of Johnstown perform a speed study on this roadway to determine if 55 mph is an appropriate speed in this setting. A lower speed limit on SH 60 in the vicinity of multiple accesses to Johnstown Village, Purvis Farm PUD, and the intersections with Colorado Boulevard and Carlson Boulevard could improve safety throughout the corridor.

Residential Buildout (2025) Improvements

Both 2025 projected volume scenarios (with and without the Purvis Farm PUD) were evaluated with warranted turn lanes and other potential improvements. However, additional lanes on SH 60 or installation of a signal at the SH 60/Carlson Boulevard intersection were not considered as the Town of Johnstown stated these improvements are not programmed to be completed before 2025. Detailed intersection capacity summary tables and capacity calculation worksheets for both 2025 scenarios can be found in Appendix F.

2025 Background Volumes: The signal timing plan at the Colorado Boulevard/SH 60 intersection was optimized, which greatly improved capacity on the northbound leg from LOS F to LOS D. The warranted turn lanes at the Colorado Boulevard/Ballentine Boulevard and WCR 50/Colorado Boulevard intersections had a very minor impact on capacity, which was projected to be LOS B or better at both intersections without turn lanes. The southbound approach at the SH 60/Carlson Boulevard intersection is not currently striped with separate lanes but the approach has width to accommodate at least two approach lanes. When evaluated with a southbound right-turn lane and shared thru/left-turn lane, the intersection showed a minor improvement to capacity, but it is still projected to operate at LOS E or F on the minor approaches. Capacity results can be found in Table 10 below.

Table 10: 2025 Background Capacity Calculations – Improved

Intersection	Approach	Background Volumes (2025) Improvements					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized - signal timing optimized*					
Colorado Boulevard & SH 60	EB	23.4	C	10	34.5	C	22
	WB	33.8	C	26	32.1	C	16
	NB	41.4	D	17	54.9	D	14
	SB	20.2	C	4	23.2	C	8
	Intersection	31.9	C	--	35.4	D	--
Intersection Control		*One-Way Stop-Control (EB) NB LT Lane*					
Colorado Boulevard & Ballentine Boulevard	EB	10.6	B	1	11.9	B	1
	NB	0.4	A	0	2.4	A	1
	SB	0.0	A	0	0.0	A	0
	Intersection	3.3	A	--	2.8	A	--
Intersection Control		*One-Way Stop-Control (NB) EB RT, WB LT Lanes*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.7	A	1	5.5	A	1
	NB	11.1	B	2	13.4	B	2
	Intersection	5.8	A	--	5.0	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB) SB RT Lane*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.9	A	1
	WB	0.0	A	0	0.2	A	1
	NB	185.8	F	6	190.9	F	4
	SB	38.8	E	3	125.1	F	5
	Intersection	14.3	B	--	11.8	B	--

Residential Buildout (2025): With the signal timing plan optimized at the Colorado Boulevard/SH 60 intersection the capacity results are more balanced across each approach. Although more approaches are projected to operate below LOS C, the intersection average delay is improved to LOS D and only the northbound approach is projected to operate at LOS E, with the remaining approaches at LOS C or D. Warranted turn lanes again showed a minor improvement to already-acceptable capacity results at the remaining intersections along Colorado Boulevard and at both site access intersections. The SH 60/Carlson Boulevard intersection was again evaluated with separated southbound right-turn and shared thru/left-turn lanes, which improved overall intersection capacity from LOS D to LOS C but did not improve minor leg capacity above LOS F. Capacity results can be found in Table 11 on the following page.

Table 11: Residential Buildout (2025) Capacity Calculations – Improved

Intersection	Approach	Residential Buildout (2025) Improvements					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized - signal timing optimized*					
Colorado Boulevard & SH 60	EB	24.7	C	11	43.8	D	24
	WB	48.3	D	29	50.8	D	19
	NB	67.6	E	19	60.6	E	15
	SB	22.2	C	8	21.6	C	11
	Intersection	43.1	D	--	45.2	D	--
Intersection Control		*Two-Way Stop-Control (EB/WB) auxiliary lanes*					
Colorado Boulevard & Ballentine Boulevard	EB	11.6	B	1	13.8	B	1
	WB	13.4	B	1	17.9	C	1
	NB	0.4	A	0	1.6	A	1
	SB	0.3	A	0	0.4	A	0
	Intersection	4.6	A	--	3.8	A	--
Intersection Control		*One-Way Stop-Control (NB) auxiliary lanes*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.8	A	1	5.8	A	1
	NB	11.5	B	2	14.3	B	2
	Intersection	6.2	A	--	5.4	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB) SB RT Lane*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.8	A	1
	WB	0.0	A	0	0.2	A	1
	NB	326.1	F	7	309.5	F	4
	SB	52.9	F	4	204.3	F	5
	Intersection	21.6	C	--	17.5	C	--
Intersection Control		*One-Way Stop-Control (WB), NB RT lane*					
Colorado Boulevard & Northern Site Access	WB	11.3	B	1	12.4	B	1
	NB	0.0	A	0	0.0	A	0
	SB	0.2	A	0	0.3	A	0
	Intersection	1.6	A	--	1.0	A	--
Intersection Control		*One-Way Stop-Control (SB), WB RT lane*					
SH 60 & RIRO Site Access	EB	0.0	A	0	0.0	A	0
	WB	0.0	A	0	0.0	A	0
	SB	15.3	C	1	14.6	B	1
	Intersection	0.3	A	--	0.2	A	--

Full Buildout (2028) Improvements

Both 2028 projected volume scenarios (with and withouth the Purvis Farm PUD) were evaluated with warranted turn lanes and other potential improvements. However, additional lanes on SH 60 or installation of a signal at the SH 60/Carlson Boulevard intersection were not considered as the Town of Johnstown stated these improvements are not programmed to be completed before 2028. Detailed intersection capacity summary tables and capacity calculation worksheets for both 2028 scenarios can be found in Appendix G.

2028 Background Volumes: Once again, optimization of the signal timing plan at the Colorado Boulevard/SH 60 intersection greatly improved results on failing approaches and provided a more balanced delay across the intersection approaches. Only one approach is projected to operate at LOS E during the PM peak hour and the other approaches are projected to operate at LOS D or better during both peak hours. The Colorado Boulevard/Ballentine Boulevard and WCR 50/Colorado Boulevard intersections are both projected to operate at acceptable levels both with and without the warranted turn lanes. The separated southbound left-turn lane at the SH 60/Carlson Boulevard intersection is projected to have a minor impact on capacity, improving overall intersection capacity to LOS D or C, with the minor approaches projected to remain at LOS F. Capacity results can be found in Table 12 below.

Table 12: 2028 Background Capacity Calculations – Improved

Intersection	Approach	Background Volumes (2028) Improvements					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized - signal timing optimized*					
Colorado Boulevard & SH 60	EB	23.4	C	11	42.8	D	25
	WB	39.1	D	28	47.7	D	19
	NB	51.1	D	18	68.4	E	15
	SB	21.0	C	5	23.5	C	9
	Intersection	36.4	D	--	45.9	D	--
Intersection Control		*One-Way Stop-Control (EB) NB LT Lane*					
Colorado Boulevard & Ballentine Boulevard	EB	10.8	B	1	12.5	B	1
	NB	0.5	A	0	2.5	A	1
	SB	0.0	A	0	0.0	A	0
	Intersection	3.5	A	--	3.0	A	--
Intersection Control		*One-Way Stop-Control (NB) EB RT, WB LT Lanes*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.6	A	1	5.6	A	1
	NB	11.4	B	2	14.4	B	2
	Intersection	5.9	A	--	5.2	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB) SB RT Lane*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.9	A	1
	WB	0.0	A	0	0.2	A	1
	NB	355.1	F	8	335.4	F	5
	SB	52.5	F	4	204.8	F	6
	Intersection	25.2	D	--	20.2	C	--

Full Buildout (2028): Signal optimization at the Colorado Boulevard/SH 60 intersection becomes less effective with the addition of the Purvis Farm PUD full buildout trip volumes. Northbound delay is still greatly improved but multiple approaches are now projected to operate at LOS D, E, or F, including the overall intersection results. All remaining intersections with Colorado Boulevard and both site access intersections are projected to continue to operate at acceptable levels with and without warranted turn lanes. The addition of the separated southbound left-turn lane at the SH 60/Carlson Boulevard intersection shows little improvement, with failing LOS on both minor approaches and the intersection overall. Capacity results can be found in Table 13 on the following page.

Table 13: Full Buildout (2028) Capacity Calculations – Improved

Intersection	Approach	Full Buildout (2028) Improvements					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized - signal timing optimized*					
Colorado Boulevard & SH 60	EB	34.9	C	15	45.5	D	30
	WB	74.8	E	48	85.2	F	25
	NB	87.3	F	27	94.9	F	18
	SB	30.4	C	14	26.2	C	15
	Intersection	61.3	E	--	62.1	E	--
Intersection Control		*Two-Way Stop-Control (EB/WB) auxiliary lanes*					
Colorado Boulevard & Ballentine Boulevard	EB	12.7	B	1	14.7	B	1
	WB	14.8	B	1	20.0	C	1
	NB	0.3	A	0	1.6	A	1
	SB	0.9	A	1	0.5	A	1
	Intersection	5.0	A	--	4.3	A	--
Intersection Control		*One-Way Stop-Control (NB) auxiliary lanes*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	3.0	A	1	5.9	A	1
	NB	12.2	B	2	15.7	C	2
	Intersection	6.6	A	--	5.8	A	--
Intersection Control		*Two-Way Stop-Control (NB/SB) SB RT Lane*					
SH 60 & Carlson Boulevard	EB	0.5	A	1	0.9	A	1
	WB	0.0	A	0	0.2	A	1
	NB	768.0	F	10	607.9	F	6
	SB	100.0	F	6	347.7	F	7
	Intersection	46.9	E	--	32.0	D	--
Intersection Control		*One-Way Stop-Control (WB), NB RT lane*					
Colorado Boulevard & Northern Site Access	WB	11.7	B	1	12.7	B	1
	NB	0.0	A	0	0.0	A	0
	SB	0.2	A	0	0.2	A	0
	Intersection	1.4	A	--	0.8	A	--
Intersection Control		*One-Way Stop-Control (SB), WB RT lane*					
SH 60 & RIRO Site Access	EB	0.0	A	0	0.0	A	0
	WB	0.0	A	0	0.0	A	0
	SB	21.7	C	3	17.7	C	2
	Intersection	2.0	A	--	0.9	A	--

Long-Term Horizon (2040) Improvements

Intersection capacity was calculated for the 2040 scenarios (with and without Purvis Farm PUD) using the peak hour volumes shown in Figures 10 and 11. Both 2040 projected volume scenarios were evaluated with warranted turn lanes and other potential improvements, including an additional thru lane in each direction on SH 60 through the study area and a traffic signal at the SH 60/Carlson Boulevard intersection, as directed by the Town of Johnstown. Capacity results reflect improvements implemented in the 2025 and 2028 scenarios as well as all additional improvements necessary to improve capacity to acceptable levels, within reason and within the geometric constraints of each intersection. Intersections not improved beyond LOS D would likely require additional thru or turning lanes or signalization. Detailed intersection capacity summary tables and capacity calculation worksheets for both 2040 scenarios can be found in Appendix H.

Long-Term Horizon (2040) Intersection Capacity

2040 Background Volumes: With recommended improvements, the Colorado Boulevard/SH 60 intersection is projected to operate at LOS D or E on the northbound and southbound approaches and the intersection overall during the PM peak hour with queuing projected to remain quite long. Improvements include one additional lane in each direction on SH 60, separate northbound and southbound left-turn lanes, permissive/protected phasing for all left-turns, right-turn overlap phasing for the northbound, southbound, and eastbound approaches, and an optimized signal timing plan. The Colorado Boulevard/Ballentine Boulevard intersection is projected to operate at LOS C or better both with and without the warranted northbound left-turn deceleration lane. The WCR 50/Colorado Boulevard intersection is projected to require separate northbound left-turn and right-turn lanes in order to remain above LOS D. The SH 60/Carlson Boulevard intersection is projected to operate well with the additional east/west thru lane in each direction and a traffic signal operating under a basic two-phase plan. It is also recommended that upon construction of the signal the northbound approach should be re-striped to provide a dedicated left-turn lane and shared thru/right-turn lane, as there is a higher volume of northbound left turns. Capacity results can be found in Table 14 below.

Table 14: 2040 Background Capacity Calculations with Improvements

Intersection	Approach	Background Volumes (2040)					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized - optimized signal plan, additional lanes*					
Colorado Boulevard & SH 60	EB	19.4	B	8	34.6	C	23
	WB	27.3	C	15	34.8	C	18
	NB	27.4	C	10	60.7	E	15
	SB	25.8	C	5	41.5	D	10
	Intersection	25.0	C	--	39.4	D	--
Intersection Control		*One-Way Stop-Control (EB) NB LT Lane*					
Colorado Boulevard & Ballentine Boulevard	EB	12.7	B	2	16.8	C	2
	NB	0.5	A	0	2.6	A	1
	SB	0.0	A	0	0.0	A	0
	Intersection	4.2	A	--	3.8	A	--
Intersection Control		*One-Way Stop-Control (NB) auxiliary lanes*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	2.7	A	1	6.1	A	1
	NB	11.8	B	2	18.4	C	3
	Intersection	6.0	A	--	6.4	A	--
Intersection Control		*Signalized - additional lanes*					
SH 60 & Carlson Boulevard	EB	6.8	A	4	6.1	A	9
	WB	8.7	A	9	0.4	A	8
	NB	17.3	B	3	26.2	C	2
	SB	15.9	B	3	25.8	C	3
	Intersection	9.5	A	--	5.6	A	--

Long-Term Horizon (2040) Total Volumes: With the addition of the Purvis PUD site trips to the 2040 background volumes, the Colorado Boulevard/SH 60 intersection is projected to operate at LOS D overall during the PM peak hour, including on all approaches. These conditions exist with all improvements noted for the background volumes and re-optimization of the signal timing plan. The Colorado Boulevard/Ballentine Boulevard intersection is projected to operate at LOS D on the westbound Purvis Farm PUD approach during the PM peak hour with all warranted turn lanes. Separate westbound left- and right-turn lanes are not projected to improve capacity above LOS D. Traffic signal warrants are not projected to be met in 2040, and the westbound approach is projected to experience delay and queuing only slightly into the LOS D threshold during PM peak hour. The WCR 50/Colorado Boulevard intersection is projected to operate at LOS C or better with the separate northbound left- and right-turn lanes required for the 2040 Background Volumes scenario. The SH 60/Carlson Boulevard intersection is projected to operate at LOS C or better with the 2040 Background Volumes improvements. Both new site access intersections are projected to operate at LOS C or better with warranted turn lanes. Capacity results can be found in Table 15 below.

Table 15: Long-Term Horizon (2040) Capacity Calculations with Improvements

Intersection	Approach	Long-Term Horizon (2040)					
		AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	95th % Queue (veh)	Avg Delay (s/veh)	LOS	95th % Queue (veh)
Intersection Control		*Signalized - optimized signal plan, additional lanes*					
Colorado Boulevard & SH 60	EB	18.5	B	8	38.6	D	19
	WB	33.8	C	16	45.7	D	14
	NB	33.5	C	10	44.5	D	14
	SB	32.6	C	6	45.4	D	11
	Intersection	29.4	C	--	42.5	D	--
Intersection Control		*Two-Way Stop-Control (EB/WB) auxiliary lanes*					
Colorado Boulevard & Ballentine Boulevard	EB	15.9	C	2	21.9	C	3
	WB	18.5	C	2	32.2	D	2
	NB	0.4	A	0	1.9	A	1
	SB	0.7	A	1	0.4	A	0
	Intersection	6.0	A	--	5.9	A	--
Intersection Control		*One-Way Stop-Control (NB) auxiliary lanes*					
WCR 50 & Colorado Boulevard	EB	0.0	A	0	0.0	A	0
	WB	3.0	A	1	6.3	A	1
	NB	12.4	B	2	21.0	C	3
	Intersection	6.5	A	--	7.2	A	--
Intersection Control		*Signalized - additional lanes*					
SH 60 & Carlson Boulevard	EB	6.9	A	5	6.8	A	10
	WB	9.6	A	11	4.9	A	6
	NB	18.5	B	3	21.8	C	2
	SB	17.0	B	3	21.6	C	3
	Intersection	10.0	B	--	7.2	A	--
Intersection Control		*One-Way Stop-Control (WB), NB RT lane*					
Colorado Boulevard & Northern Site Access	WB	13.2	B	1	15.3	C	1
	NB	0.0	A	0	0.0	A	0
	SB	0.1	A	0	0.2	A	0
	Intersection	1.2	A	--	0.8	A	--
Intersection Control		*One-Way Stop-Control (SB), WB RT lane*					
SH 60 & RIRO Site Access	EB	0.0	A	0	0.0	A	0
	WB	0.0	A	0	0.0	A	0
	SB	17.5	C	2	14.9	B	1
	Intersection	1.2	A	--	0.5	A	--

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The preceding analysis has shown that the proposed Purvis Farm PUD in Johnstown, Colorado will generate increased traffic demand on area streets and intersections, thereby resulting in various impacts to off-site intersections. Through the planned development, it is estimated that approximately 3,261 gross trips could be generated daily in the Residential Buildout (2025) timeframe. The Full Buildout (2040) scenario is projected to generate approximately 4,142 new external trips daily.

An evaluation of Existing Conditions (2020) intersection capacity showed that most intersections currently operate at LOS C or better, except the northbound and southbound approaches at the Colorado Boulevard/SH 60 intersection and the northbound approach at the SH 60/Carlson Boulevard intersection, which operate at LOS D. There is moderate queuing on SH 60 at the signalized intersection. A northbound left-turn deceleration lane is warranted on Colorado Boulevard at Ballentine Boulevard based on the Existing Conditions (2020) and using the warrants in the State of Colorado State Highway Access Code.

A crash history analysis found that the Colorado Boulevard/SH 60 and SH 60/Carlson Boulevard intersections had 3.55 and 4.60 crashes per year, respectively. The SH 60/Carlson Boulevard intersection has an injury and fatality LOSS IV due to the high number of right-angle crashes involving injuries. This intersection had 16 of 22 (73%) right-angle crashes, which is often seen at unsignalized intersections with high speeds and/or volumes where drivers may misjudge gaps. None of the other study area intersections had any significant crash trends.

Intersection capacity analysis results for the Residential Buildout (2025) and Full Buildout (2028) scenarios projected worsening capacity at the Colorado Boulevard/SH 60 and SH 60/Carlson Boulevard intersections for both the Background Volume scenarios and with Purvis Farm PUD trips added to the network. Queueing is significant on the Carlson Boulevard approaches and at all approaches at the Colorado Boulevard/SH 60 signalized intersection.

Sanderson Stewart evaluated the suitability of auxiliary turn lanes and traffic signal control at study area intersections. Though the warranted auxiliary acceleration and deceleration lanes shown in Table 9 are anticipated to improve safety, they would not significantly change the anticipated capacity throughout the study area. No signal warrants are projected to be met for any future scenario at the Colorado Boulevard/Ballentine Boulevard intersection.

Proposed improvements for the Residential Buildout (2025) and Full Buildout (2028) scenarios included signal optimization, which balanced out delay between all approaches, and striping separate southbound lanes on Carlson Boulevard, which had a minimal impact on overall intersection capacity. Other improvements included installation of warranted turn lanes, which slightly improved already acceptable capacity results at the remaining stop-controlled intersections.

Intersection capacity was evaluated for the Long-Term Horizon (2040) background and total volume scenarios with previously recommended improvements, other improvements anticipated to occur on the network per the Johnstown TMP, and additional improvements needed to improve capacity. Capacity results show that even with additional east/west thru lanes on SH 60 and separate northbound and southbound left-turn, thru, and right-turn lanes, the signal at Colorado Boulevard/SH 60 is still projected to operate at LOS D or worse on multiple approaches during the PM peak hour for both the 2040 Background Volumes and Long-Term Horizon (2040) volumes with Purvis Farm PUD trips included. Additional thru or turn lanes would likely improve capacity to acceptable levels in the future. LOS D is projected on the westbound approach from the Purvis Farm PUD site at the intersection of Colorado Boulevard and Ballentine Boulevard with all warranted turn lanes. Although not projected to be warranted, a traffic signal would improve operations to acceptable levels at this intersection.

Recommendations

The following list of recommendations is based on the analysis results from this study and the professional judgment of the author. All improvements recommended based on existing or background volumes are due to conditions present prior to any development of Purvis Farm PUD.

Existing Conditions (2020) Volumes Recommendations:

- A northbound, left-turn, deceleration lane is warranted and should be installed to improve safety at the Colorado Boulevard/Ballentine Boulevard intersection.

- At the WCR 50/Colorado Boulevard intersection, eastbound right-turn and westbound left-turn deceleration lanes and an acceleration lane for northbound right-turning vehicles are all warranted and should be installed to improve safety.

- The southbound approach at the SH 60/Carlson Boulevard intersection should be striped to provide separate right-turn and shared thru/left-turn lanes.

- A traffic signal should be installed at the Carlson Boulevard/SH 60 intersection as soon as feasible to improve safety. The Existing Conditions (2020) crash analysis provided data that summarized a high crash rate and the high potential (Injury and Fatality LOSS IV) for crash reduction at the intersection. The Johnstown TMP recommended signalization at this intersection by 2020.

2025 Background Volumes Recommendations:

- All Existing Conditions (2020) recommendations should be installed.

- The signal timing plan at the Colorado Boulevard/SH 60 intersection be optimized to provide a more balanced delay across all approaches.

- A traffic signal should be installed at the Carlson Boulevard/SH 60 intersection to improve safety and prevent extreme delay projected in the 2025 and 2028 scenarios. The increased trips from Johnstown Village, Keto Maplewood, and Purvis Farm PUD push the intersection to meet the Peak Hour MUTCD signal warrant starting with the 2025 Background volumes.

Residential Buildout (2025) Recommendations:

- All Existing Conditions (2020) and 2025 Background Volume recommendations should be installed.

- Northbound right-turn and southbound left-turn deceleration lanes should be installed at the Colorado Boulevard/Ballentine Boulevard intersection. At the Colorado Boulevard/Northern Site Access intersection, a northbound right-turn deceleration lane should also be installed, and a westbound right-turn deceleration lane should be installed at the SH 60/RIRO Site Access intersection.

- The three site access intersections for Purvis Farm PUD should be stop-controlled with stop signs posted on the minor approaches. The access roadway from SH 60 should be a collector standard, the access roadway at Colorado Boulevard/Ballentine Boulevard should be a residential collector standard, and the northern access roadway on Colorado Boulevard should be a local standard.

2028 Background Volumes Recommendations:

- All Existing Conditions (2020) and 2025 Background Volumes recommendations should be installed.

Full Buildout (2028) Recommendations:

- All Existing Conditions (2020), 2025 Background Volumes, and Residential Buildout (2025) recommendations should be installed.

- An acceleration lane for southbound right-turning vehicles should be installed at the RIRO Site Access intersection on SH 60.

2040 Background Volumes Recommendations:

- All Existing Conditions (2020), 2025 Background Volumes, and 2028 Background Volumes recommendations should be installed.

- Widening of the corridor of SH 60, as suggested in Johnstown's TMP to four lanes with curb and gutter, should be considered with the multiple anticipated nearby developments, and should be completed by the Johnstown TMP horizon year of 2035.

- At the Colorado Boulevard/SH 60 intersection it is recommended that separate left-turn, thru, and right-turn lanes be installed on the northbound and southbound approaches with protected/permissive left-turn phasing on all approaches. Right-turn overlap phases should also be added and the timing plan should be optimized to balance delay across all approaches.

- Separate northbound left- and right-turn approach lanes should be constructed on Colorado Boulevard at its intersection with WCR 50 to maintain acceptable capacity.

- Approach lanes on the northbound approach at the SH 60/Carlson Boulevard intersection should be re-striped to provide a separate left-turn lane and shared thru/right-turn lane.

Long-Term Horizon (2040) Recommendations:

- All Existing Conditions (2020), 2025 Background Volumes, Residential Buildout (2025), Full Buildout (2028), and 2040 Background Volumes recommendations should be installed.

Other Recommendations:

- It is suggested that CDOT perform a speed study on SH 60 based on the recent growth of several adjacent developments. The posted speed raises to 55 mph approximately 1,300 feet east of the intersection with Colorado Boulevard/SH 60. Reducing the speed limit approaching the access to several developments and the intersection with Colorado Boulevard may improve safety and reduce crashes along SH 60. This request will need to come from the Town of Johnstown.

- All transportation-related improvements shall be designed in accordance with Town of Johnstown and/or CDOT standards (where applicable) and the MUTCD.