TECHNICAL MEMORANDUM

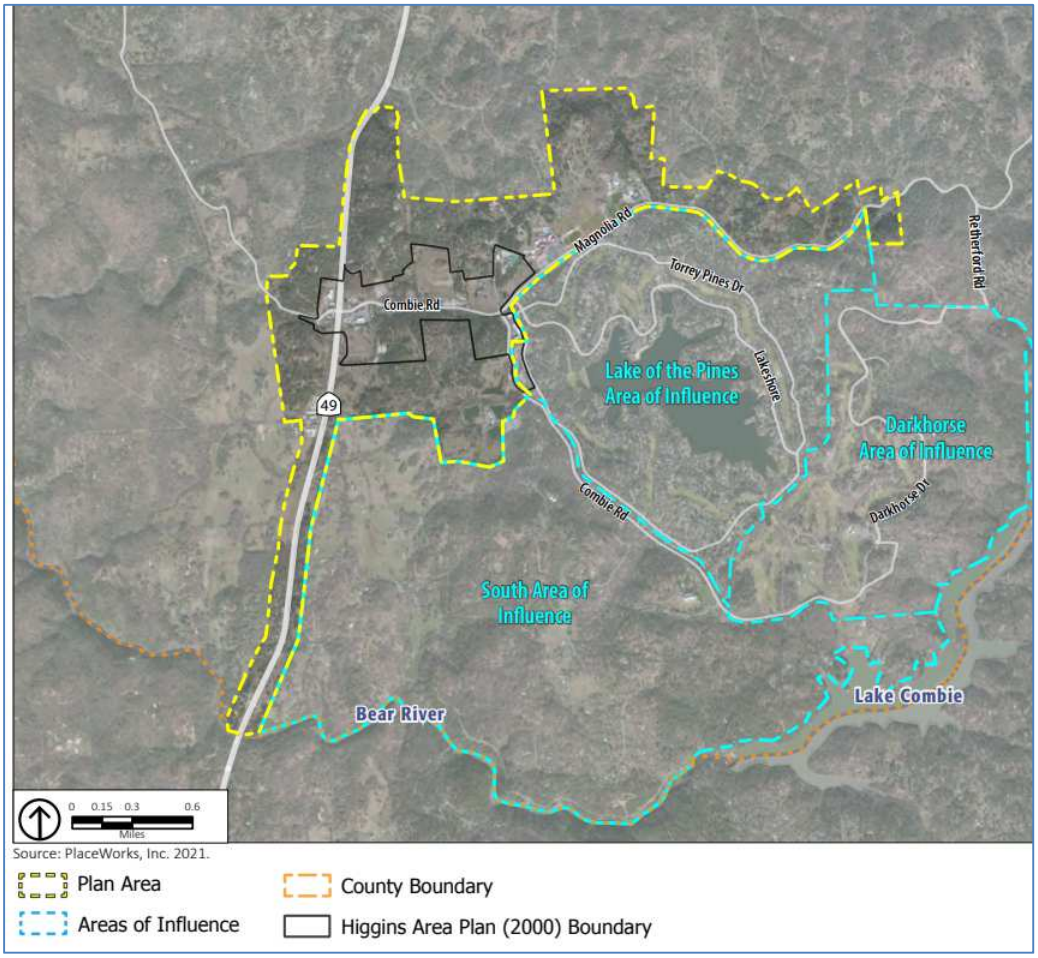
Date:	March 30, 2022		
To:	Bruce Brubaker and Janet Chang, PlaceWorks	*Project No.:*	091-054 South County Area Plan Preparation
From:	Arthur Chen and Seitu Coleman, TJKM	*Jurisdiction:*	Nevada County
Subject:	**Greater Higgins Area Plan Existing Conditions Traffic Analysis Memo**		

List of Tables

List of Figures

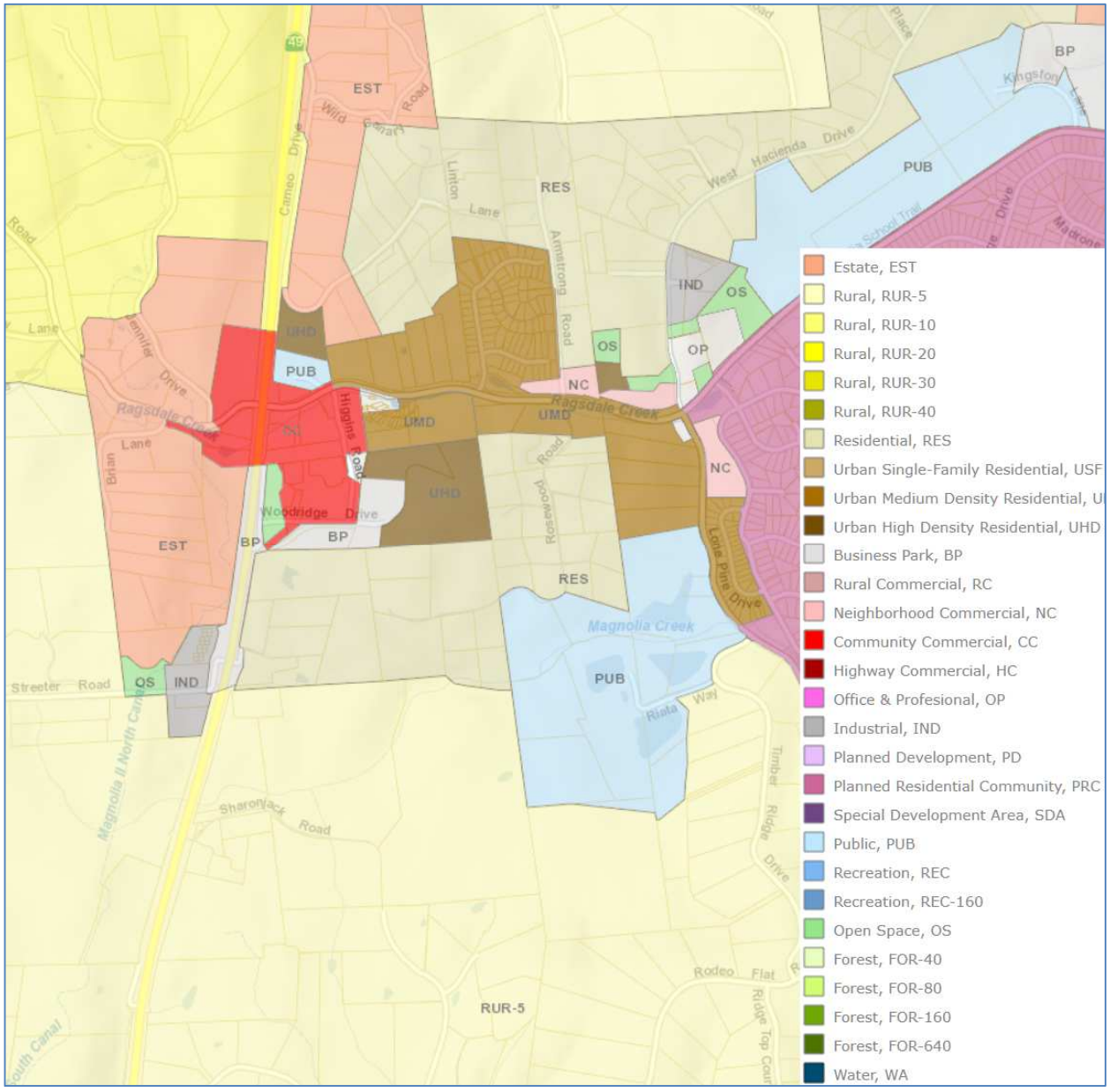
The Greater Higgins Area Plan encompasses approximately 300 acres in south Nevada County near the Lake of the Pines residential development. The Greater Higgins Area Plan's Plan Area (Plan Area) is much bigger than the original 2000 Higgins Area Plan, and stretches from Highway 49 near Bear River in the south to Brewer Road in the north and follows Magnolia Road to Darkhorse Drive to the east. Figure 1 shows a map of the Plan Area.

Figure 1 – Plan Area Map



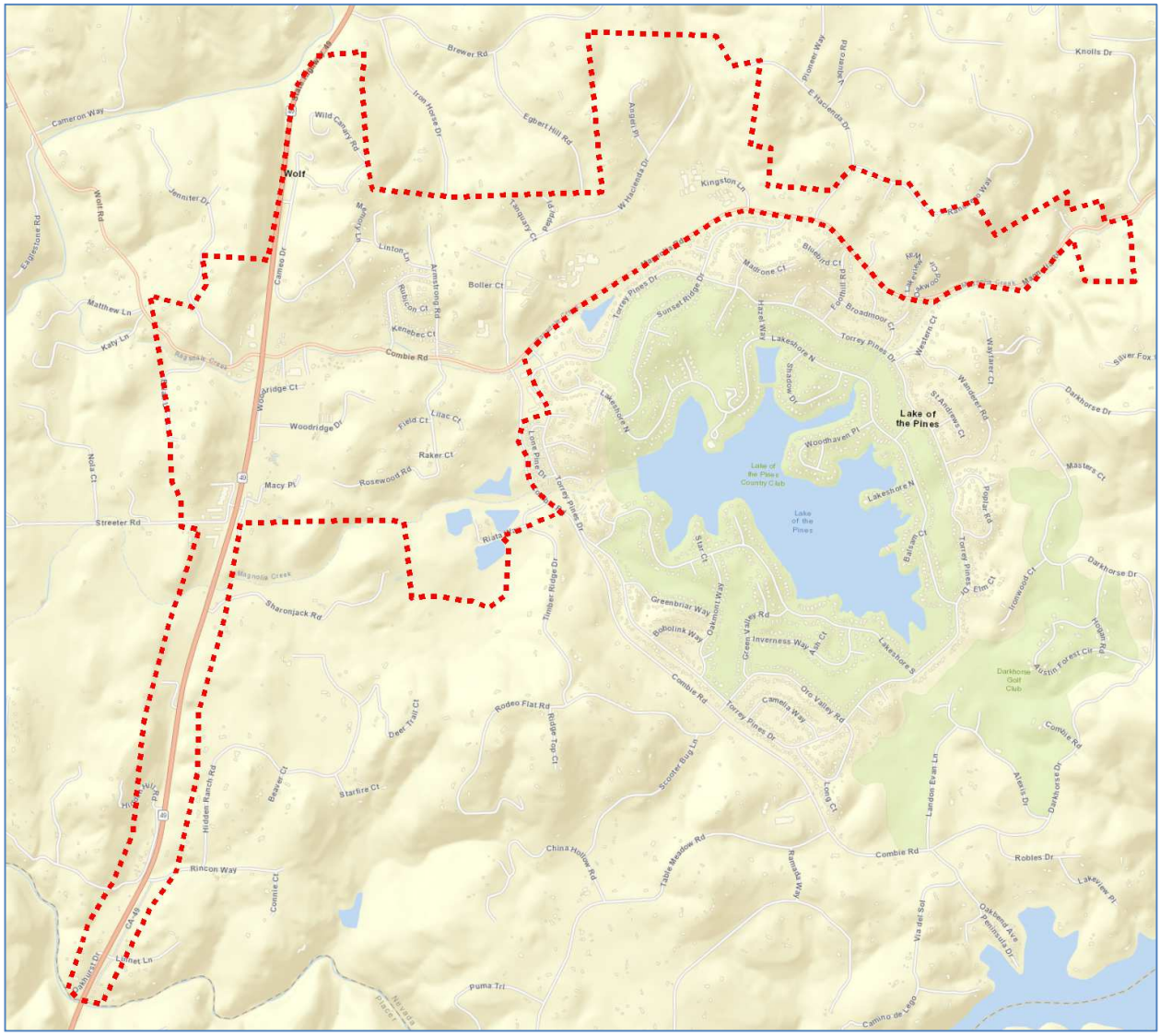
The majority of the Plan Area is currently planned for residential use, with the exception of the Combie Road and Highway 49 intersection, which is zoned community commercial, and the Combie Road and Magnolia Road intersection, which is zoned commercial, office, public, and industrial. There is currently a CVS drug store, a shopping plaza with a Starbucks and a Subway sandwich shop, along with two gas stations. The drug store is located near the Higgins Marketplace development which also houses a supermarket. The rest of the Plan Area comprises of rural single-family homes on large estates; and a mobile home park. Figure 2 shows the county General Plan map for the Plan Area.

Figure 2 – County General Plan Map for Plan Area



The primary circulation route in the Plan Area is Combie Road; its intersection with Highway 49 makes up Higgins Corner, a major commercial center. Combie Road continues eastward and intersects with Magnolia Road, then heads south. On the east side of the Plan Area, Magnolia Road intersects with Retherford Road. Figure 3 shows the circulation map of the Plan Area.

Figure 3 – Circulation Map of Plan Area



The Nevada County Transportation Commission Model (NCTC Model) will be used to model the buildout scenario under current planning assumptions. The Nevada County model has a base year of 2018 and a forecast year of 2040. The model has been calibrated and validated for the 2018 base year at a county level. Calibration and validation are processes that ensure that results from various modules in the model compare well to observed data. Model documentation will have additional information about the validation statistics.

Before using the model for the current assumptions, the model validation was checked in the Greater Higgins Plan Area. Model volumes were compared to traffic counts in the study area to make sure it was performing well. Table 1 shows the daily model validation and Table 2 shows the peak hour validation.

As can be seen from Table 1, volumes for all roadway facility types match traffic counts and are within the expected targets.

Table 1 - Daily Validation in the Plan Area

Facility Type	Traffic Counts	NCTC Model Volumes	% Difference	Target
State Highway	75,248	77,582	3%	+/-15%
Minor Arterials	36,158	34,404	-5%	+/-20%
Major Collectors	27,395	31,043	13%	+/-20%
Other Roads	5,833	2,782	-52%	n/a
Total	1,44,634	1,45,811	1%	+/-15%

Table 2 shows the validation for AM and PM peak hours. There were very few peak hour counts in the Plan Area and hence the validation could not be prepared by roadway functional class.

Table 2 Peak Hour Validation in the Plan Area

Facility Type	Traffic Counts	NCTC Model Volumes	% Difference	Target
State Highway - AM peak hour	4,992	4,215	-16%	n/a
State Highway - PM peak hour	6,465	6,644	3%	n/a

Given that the model was performing reasonably well, it was used to analyze the buildout scenario as shown below. Dwelling units in the Greater Higgins Plan Area were increased from 1,038 to 1,106 as shown in Table 3.

Table 3- Residential Land Uses in the NCTC Model for Plan Area

	Single-Family Dwelling Units	**Multi Family Dwelling Units**
Greater Higgins Area Plan Parcel data	1,106	5
NCTC Model 2018 Base	1,038	5
NCTC Model 2040 Forecast	1,228	475

The NCTC Model was updated with detailed Greater Higgins Area parcel land use data and re-ran for the base year. Daily, AM and PM peak hour conditions were reported. Following are the volumes maps and turning movement tables.

Figure 4 – Daily Volumes from Model in Plan Area

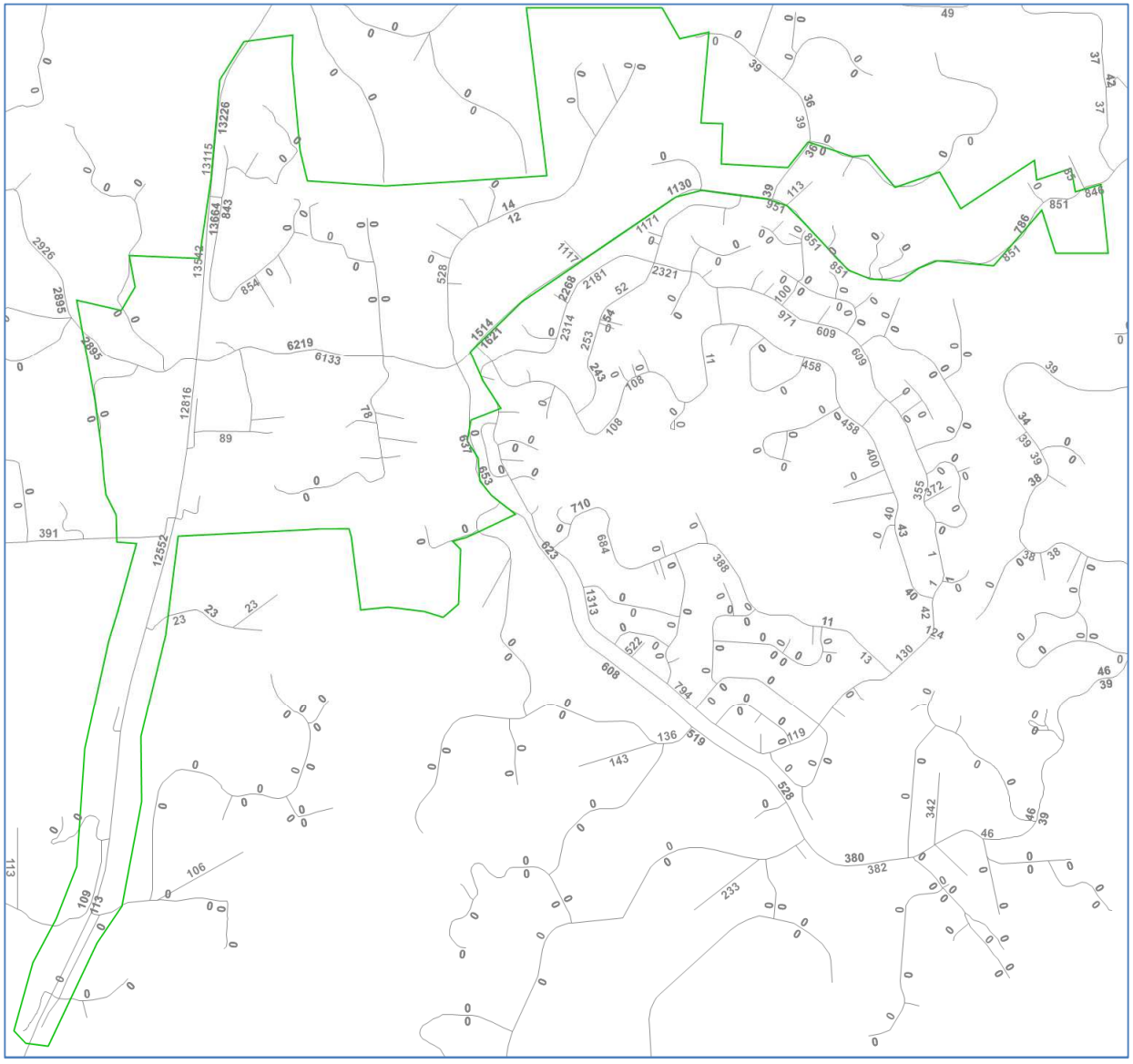


Figure 5 – AM Peak Hour Volumes from Model in Plan Area

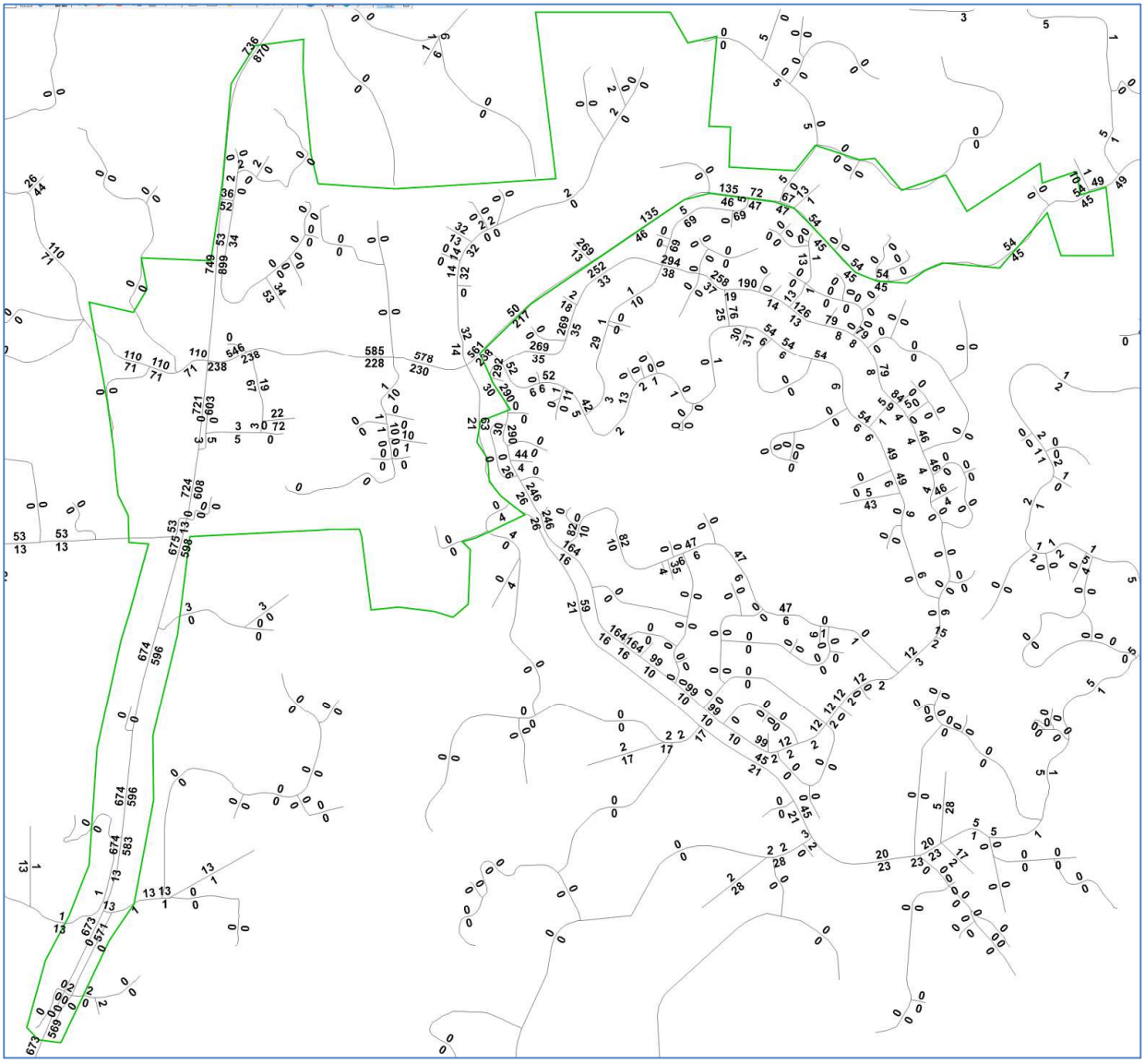
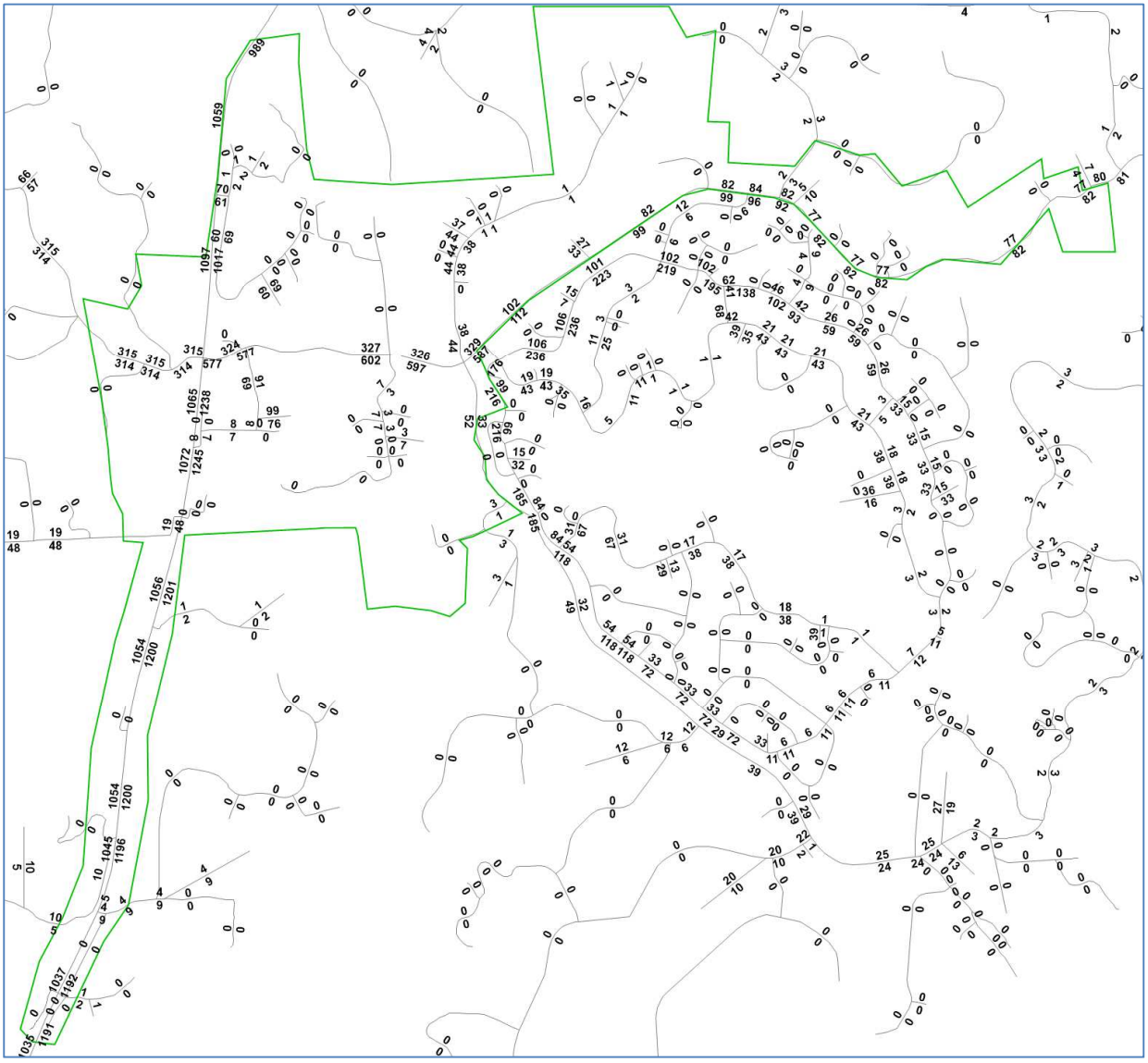


Figure 6 - PM Peak Hour Volumes from Model in Plan Area



The Greater Higgins Area Plan will study 10 intersections, which are listed below.

1) Combie Rd. / Highway 49
2) Combie Rd. / Magnolia Road
3) Combie Rd. / Higgins Road
4) Magnolia Road / Lakeshore North
5) Woodridge Dr. / Highway 49
6) Cameo Dr. / Highway 49
7) Streeter Rd. / Highway 49
8) Rincon Way / Highway 49
9) Combie Rd. / Armstrong Road / Rosewood Road
10) Rodeo Flat Rd. / Combie Road South

In addition to intersections, 4 study segments were analyzed.

1) Combie Road between Highway 49 and Higgins Road
2) Combie Road South of Magnolia Road
3) Magnolia Road between Combie Road and Lakeshore Drive
4) Highway 49 South of Wolf Road

Figure 7 shows the location of the intersection and segment counts.

Figure 7 – Intersection and Segment Count Locations

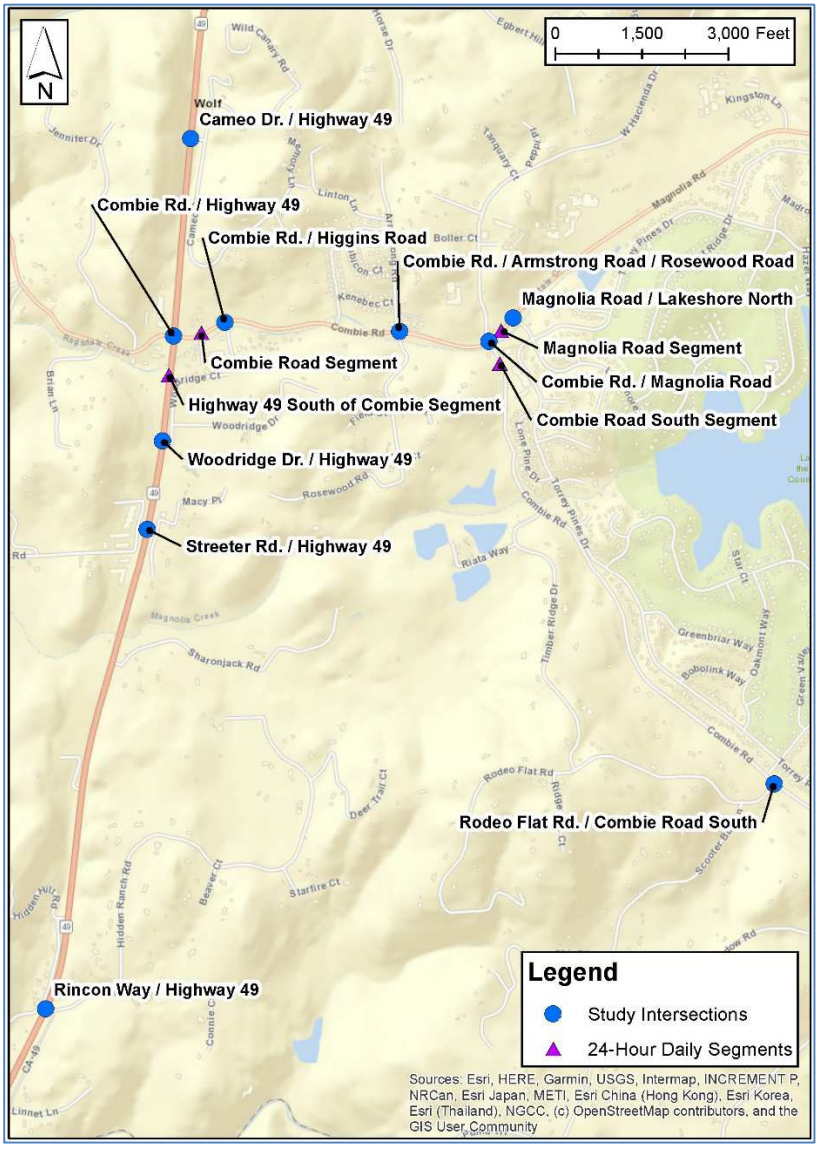


Table 4 shows the model and count turning movements for the 10 study intersections in the Plan Area.

Table 4- Turning Movements in the Plan Area

ID	Turn Move	2022 Counts		2018 Model	
		AM	PM	AM	PM
1. Combie Road / Highway 49	NBL	49	164	69	258
	NBT	561	842	461	825
	NBR	306	405	72	155
	SBL	294	177	123	372

ID	Turn Move	2022 Counts		2018 Model	
		AM	PM	AM	PM
	SBT	738	675	618	711
	SBR	67	36	8	13
	EBL	22	36	14	16
	EBT	123	61	42	49
	EBR	152	123	14	248
	WBL	344	421	89	105
	WBT	85	84	33	43
	WBR	187	222	424	176
2. Combie Road / Magnolia Road	NBL	115	84	45	19
	NBT	38	5	2	1
	NBR	44	42	17	13
	SBL	31	20	7	30
	SBT	14	11	0	1
	SBR	75	95	7	13
	EBL	92	34	7	14
	EBT	467	535	215	544
	EBR	181	97	8	39
	WBL	51	32	12	11
	WBT	536	342	526	295
	WBR	49	13	23	23
3. Combie Road / Higgins Road	NBL	81	151	9	35
	NBT	0	0		
	NBR	66	141	9	57
	SBL	0	0		
	SBT	0	0		
	SBR	0	0		
	EBL	0	0		
	EBT	658	537	219	546
	EBR	18	31	19	31
	WBL	104	118	49	38
	WBT	609	434	536	290
	WBR	0	0		
4. Magnolia Road / Lakeshore North	NBL	271	202	519	243
	NBT	0	0		
	NBR	149	26	59	15
	SBL	0	0		
	SBT	0	0		
	SBR	0	0		
	EBL	0	0		
	EBT	430	196	157	98
	EBR	110	401	81	490
	WBL	94	23	8	16
	WBT	367	184	42	86
	WBR	0	0		
5. Woodridge Drive / Highway 49	NBL	0	0		
	NBT	911	1,395	603	1,238
	NBR	19	79	5	7
	SBL	13	13	0	0
	SBT	1,306	1,121	721	1,065

ID	Turn Move	2022 Counts		2018 Model	
		AM	PM	AM	PM
	SBR	0	0		
	EBL	0	0		
	EBT	0	0		
	EBR	0	0		
	WBL	3	1	3	8
	WBT	0	0		
	WBR	8	34	0	0
6. Cameo Drive / Highway 49	NBL	0	0		
	NBT	798	1,087	855	974
	NBR	6	9	44	43
	SBL	2	1	9	18
	SBT	1,109	924	728	1,041
	SBR	0	0		
	EBL	0	0		
	EBT	0	0		
	EBR	0	0		
	WBL	7	1	21	55
	WBT	0	0		
	WBR	4	1	15	14
7. Streeter Road / Highway 49	NBL	30	25	3	1
	NBT	916	1,440	595	1,200
	NBR	3	2	0	0
	SBL	0	2	0	0
	SBT	1,284	1,084	674	1,054
	SBR	35	35	50	18
	EBL	23	37	12	46
	EBT	0	0	0	0
	EBR	20	41	1	2
	WBL	1	0	0	0
	WBT	1	0	0	0
	WBR	1	3	0	0
8. Rincon Way / Highway 49	NBL	0	0		
	NBT	949	1,459	571	1,192
	NBR	10	13	0	0
	SBL	5	5	1	9
	SBT	1,306	1,132	673	1,036
	SBR	0	0		
	EBL	0	0		
	EBT	0	0		
	EBR	0	0		
	WBL	7	5	0	0
	WBT	0	0		
	WBR	3	4	12	4
9. Combie Road / Armstrong Road / Rosewood Road	NBL	3	11	7	3
	NBT	0	0	0	0
	NBR	2	2	3	1
	SBL	11	24	0	0
	SBT	0	0	0	0

ID	Turn Move	2022 Counts		2018 Model	
		AM	PM	AM	PM
	SBR	9	25	0	0
	EBL	13	30	0	0
	EBT	732	660	227	596
	EBR	1	9	1	6
	WBL	0	3	0	0
	WBT	700	487	578	325
	WBR	11	18	0	1
10. Rodeo Flat Road / Combie Road South	NBL	2	1	0	2
	NBT	141	79	44	27
	NBR	0	0		
	SBL	0	0		
	SBT	192	62	19	38
	SBR	13	23	1	11
	EBL	13	11	15	5
	EBT	0	0		
	EBR	0	0	2	1
	WBL	0	0		
	WBT	0	0		
	WBR	0	0		

Per Nevada County Transportation Impact Analysis guidelines, Synchro was used to analyze these intersections and assign level of service values to them. LOS definitions are discussed below in Table 5.

Table 5 – LOS Definitions for Intersections

Level of Service	Interpretation	V/C Ratio
A	Uncongested operations; all queues clear in a single signal cycle.	Less Than 0.60
B	Very light congestion; an occasional approach phase is fully utilized.	0.60 to 0.69
C	Light congestion; occasional backups on critical approaches.	0.70 to 0.79
D	Significant congestion on critical approaches, but intersection functional. Cars required to wait through more than one cycle during short peaks. No long-standing queues formed.	0.80 to 0.89
E	Severe congestion with some long-standing queues on critical approaches. Blockage of intersection may occur if traffic signal does not provide for protected turning movements. Traffic queue may block nearby intersections(s) upstream of critical approach(es).	0.90 to 0.99
F	Total breakdown, stop-and-go operation.	1.00 and Greater

Table 6 shows the Synchro / Highway Capacity Manual analysis for the 10 study intersections.

Table 6 – Levels of Service for Greater Higgins Area Study Intersections (Peak Hour)

#	Intersection	Control[1]	HCM Methodology	Peak Hour[2]	Existing Conditions	
					Average Delay[3]	LOS[4]
1	SR 49/Wolf Rd/Combie Rd	Signal	HCM 2000	AM	**33.9**	C
				PM	**30.8**	C
2	Combie Rd/Magnolia Rd	Signal	HCM 6th	AM	52.6	D
				PM	27.0	C
3	Combie Rd/Higgins Rd	Signal	HCM 6th	AM	**22.2**	C
				PM	**24.1**	C
4	Magnolia Rd/Lakeshore North	Signal	HCM 6th	AM	17.0	B
				PM	12.6	B
5	SR 49/Woodridge Rd	TWSC	HCM 6th	AM	12.0	B
				PM	16.3	C
6	SR 49/Cameo Dr	TWSC	HCM 6th	AM	**>50**	**F**
				PM	**>50**	**F**
7	SR 49/Streeter Rd	TWSC	HCM 6th	AM	**>50**	**F**
				PM	**>50**	**F**
8	SR 49/Rincon Way	TWSC	HCM 6th	AM	**>50**	**F**
				PM	**>50**	**F**
9	Combie Rd/Armstrong Rd/Rosewood Rd	TWSC	HCM 6th	AM	**>50**	**F**
				PM	**38.0**	**E**
10	Rodeo Flat Rd/Combie Rd South	TWSC	HCM 6th	AM	13.2	B
				PM	9.9	A

Notes
[1]TWSC - Two-way stop control
[2]AM - Morning peak hour; PM - Evening peak hour
[3]Average intersection delay shown in seconds per vehicle for signalized intersections; Worst movement delay shown in seconds per vehicle for side-street stop controlled intersections
[4]LOS - Level of Service
Bold indicates unacceptable delay and level of service.
These results are based on assumed signal timings and are susceptible to change. Any changes in signal timing or lane geometry updates may have significant impacts on the delay and level of service.

Intersection Summary

Under Existing Conditions, four study intersections operate at LOS E/F during at least one peak period. The remaining six study intersections operate at acceptable LOS D or better during both a.m. and p.m. peak hours. It should be noted that the attached analysis is subject to change based on existing signal timing and lane geometries. TJKM developed signal timing based on phasing observed via Google maps

images, and California Manual on Uniform Traffic Control Devices (CA MUTCD) signal timing guidelines. TJKM based lane geometries based on Google map street view and satellite images, which included lane geometries from December 2020 and May 2016. Existing Conditions traffic volumes and peak hour factors were based on counts conducted on February 1st and February 3rd, 2022, while school was in session.

LOS F occurs on intersections where the minor road intersecting with the major road takes significantly longer to make a left turn. For example, the Highway 49/Cameo Dr has the worst delay on the left turn out from Cameo into the State highway, hence the average delay is high. Since LOS for intersections look at the worst leg of the intersection, the ones intersecting with Highway 49 will have significant wait times to exit the intersection.

Road Segment Summary

For the study segments, the Nevada County Regional Transportation Plan peak hour level of service thresholds were used (based off of Highway Capacity Manual 2010). Level of service is determined by the roadway's operational class. Segments #1-3 are classified as two lane arterials; whereas segment #4 is a divided four-lane arterial. Table 7 shows the level of service thresholds for western Nevada County.

Table 7 – LOS Definitions for Roadway Segments (Peak Hour)

Operational Class	LOS B	LOS C	LOS D	LOS E
Minor Two-Lane Highway	330	710	1,310	2,480
Major Two-Lane Highway	330	710	1,310	2,480
Two-Lane Arterial	-	850	1,540	1,650
Four-Lane Arterial, Undivided	-	1,760	3,070	3,130
Four-Lane Arterial, Divided	-	1,850	3,220	3,290
Notes: Based on Highway Capacity Manual, Transportation Research Board, 2010. Two-lane highway and arterial LOS based on HCM 2010, Exhibit 15-30, Class II Rolling, 0.09 K-factor, and D-factor of 0.6 Four-lane arterial LOS based on HCM 2010, Exhibit 16-14, K-factor of 0.09, posted speed 45 mi/h				

Roadway counts were conducted and the results are summarized below in Table 8.

Table 8 – Level of Service for Greater Higgins Area Study Segments (Peak Hour)

Segment #	Segment Name	AM Peak Volume	PM Peak Volume	AM LOS	PM LOS
1	Combie Road (Three-lane Arterial)	1,420	1,485	**D**	**D**
2	Combie Road South of Magnolia Road (Two-lane Arterial)	417	406	B	B
3	Magnolia Road between Combie Road and Lakeshore Drive (Three-lane Arterial)	1,155	1,286	C	C
4	Highway 49 South of Wolf Road (Four-lane Arterial, Divided)	2,157	2,579	C	C

The only roadway segment to have a LOS of "D" is Combie Road near Highway 49 for existing conditions. LOS D symbolizes that the flow rate is approaching unstable levels, and that any incident can make the roadway heavily congested. The other roadway segments (including Highway 49 at Combie Road) are operating at acceptable levels.

Conclusion

The analysis shows that intersections in the Greater Higgins Plan Area are operating at acceptable levels, except for intersections where minor roads intersect busy arterials (Highway 49, for example). Traffic at these stop-sign controlled intersections must wait for an opening in the traffic flow on the major arterial to be able to safely enter into the travel lanes, and the arterials have fewer openings during peak hours.

The intersection of Combie Road/Magnolia Road also has a level of service that is close to unacceptable (Level of Service D) during the morning peak hour, which is likely because of vehicles dropping off students at the three schools near that intersection.

The roadway segments in the Plan Area also operate at acceptable levels during the peak hours, except Combie Road near SR49 which operates at LOS D according to Nevada County guidelines. The volumes at the peak periods are, however close to the threshold between C and D so one can expect Combie to operate at a more reasonable level during off-peak periods. There is also an additional lane in the westbound direction to alleviate the traffic load.

The count volumes for the four segments show that traffic volumes in the Higgins area are close to pre-COVID pandemic levels, since the LOS on these segments are very similar to the ones found in the Nevada County Transportation Commission RTP.