Appendix C

Hydrologic and Hydraulic Analyses for North Ranch Wash

Hydrologic and Hydraulic Analyses for North Ranch Wash
Northeast Corner of Thornydale and Sumter
T12S, R13E, Section 17
Pima County, Arizona

Prepared For:

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June 2022

ARROYO ENGINEERING, LLC
Water Resources & Civil Engineering Consultants

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I. INTRODUCTION

A. Project Site

This Drainage Report has been prepared in support of a rezoning application and site plan for the project site prepared by Baker and Associates Engineering, Inc. (BAE).

The property site is located within unincorporated Pima County at the northeast corner of the intersection of Thornydale Road and Sumter Drive within Township 12S, Range 13E, Section 17. The project site is partially developed. The project site is bordered by North Ranch subdivision (M&P 39/58) to the north, two residential properties to the east, Thornydale Road to the west, and Sumter Drive to the south. A Location Map is provided in Appendix A.

B. Project Understanding and Approach

Two watercourses, regulated by both Pima County and the Federal Emergency Management Agency (FEMA), are located on the project site. The two watercourses combine to form a single FEMA 100-year floodplain for the North Ranch Wash, which is designated as "Zone A." By definition, Zone A is a floodplain determined by approximate methods. Consequently, there are no site-specific hydrologic data, hydraulic model, or floodplain mapping which can be used to define the onsite floodplain at a level of detail required for site development. New hydrologic analyses and new hydraulic model have been completed to define the existing and proposed 100-year floodplain on the site.

C. Purpose of Report

The initial purpose of the hydrologic and hydraulic analyses is to support the rezoning application for the project site. Because of the subsequent development requirements related to the site plan (for submittal to Pima County) and a Conditional Letter of Map Revisions (CLOMR) (for submittal to FEMA), the analyses have been completed at a level of detail appropriate for use as part of future submittals. In addition, the hydraulic model will extend beyond the southern property line to near Linda Vista Boulevard because of potential mapping needs as part of the CLOMR.

D. Existing Studies

Hydrologic and hydraulic modeling was completed for the North Ranch Wash as part of the North Ranch Wash Floodplain Study (Technical Data Notebook [TDN], Arroyo Engineering and SCE Engineering, March 14, 2019). The North Ranch Wash study area includes the entire North Ranch Wash watershed located upstream of the North Ranch subdivision. The Thornydale/Sumter project site is located south of the North Ranch subdivision, outside of the North Ranch Wash study area.

The 2019 TDN was approved by the Pima County Regional Flood Control District (RFCD) and the Town of Oro Valley. The TDN was subsequently modified and approved by FEMA on June 23, 2021 as Letter of Map Revision 20-09-1981P.

E. Report Requirements

This Drainage Report has been prepared in accordance with Pima County Regional Flood Control District Technical Policy TECH-114, "Requirements for Content of Hydrologic and Hydraulic Drainage Reports," (revised date 11/2/2015). This report is limited to only address drainage conditions specific to the North Ranch Wash.

II. EXISTING CONDITIONS

A. North Ranch Wash

Two watercourses, regulated by both Pima County and FEMA, are located on the project site. The onsite watercourses are two branches of the North Ranch Wash. The watercourses are referenced as the "west branch" (NR-W) and "east branch" (NR-E) within this report.

B. FEMA Floodplains

The FEMA floodplain on the project site is shown on Flood Insurance Rate Map 04019C2270L (FEMA, June 16, 2011). The two onsite watercourses combine to form a single FEMA 100-year floodplain for the North Ranch Wash, which is designated as "Zone A." Zone A is a "special flood hazard area subject to inundation by the 1% annual chance flood, no base flood elevations determined."

C. Existing Studies

Hydrologic and hydraulic modeling was completed for the North Ranch Wash as part of the North Ranch Wash Floodplain Study (Technical Data Notebook [TDN], Arroyo Engineering and SCE Engineering, March 14, 2019). The North Ranch Wash study area includes the entire North Ranch Wash watershed located upstream of the North Ranch subdivision. The Thornydale/Sumter project site is located south of the North Ranch subdivision, outside of the North Ranch Wash study area.

The 2019 TDN was approved by the Pima County Regional Flood Control District (RFCD) and the Town of Oro Valley. The TDN was subsequently modified and approved by FEMA on June 23, 2021 as Letter of Map Revision 20-09-1981P.

III. PROPOSED CONDITIONS

For proposed conditions, onsite flow corridors along the west branch and the east branch of the North Ranch Wash will generally be maintained along their natural flow paths. For onsite portions of the west branch, the 100-year flow is split into two separate flow paths under existing conditions. For proposed conditions, the east flow path will be eliminated and all west-branch flows will be directed into the western flow path.

The footprint o the proposed development is shown on the Developed Conditions Floodplain Map in Appendix A. Where areas of the proposed development encroach into the 100-year floodplain and/or the erosion hazard setback, bank protection is proposed. For the areas of proposed bank protection, the proposed 100-year floodplain boundaries will lie along the limits of the bank protection. For the areas that remain natural, the floodplain boundaries generally correspond to the existing conditions floodplain boundaries.

IV. HYDROLOGIC AND HYDRAULIC ANALYSIS

A. Hydrology

1. Offsite North Ranch Wash

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A hydrologic and hydraulic analysis for the North Ranch Wash, located north of the North Ranch subdivision, was previously completed to determine 100-year peak discharges, flood depths, and floodplain boundaries using FLO-2D (North Ranch Floodplain Study, 2019). The Watershed Map from the 2019 study is provided in Appendix A.

The 100-year discharges were calculated at various locations within the North Ranch Wash study area. Exhibit 4 from the 2019 North Ranch Floodplain Study is provided in Appendix A to display the calculated 100-year discharges for the recording cross sections located at the downstream limit of the study area. These discharges, which flow through the North Ranch subdivision and then across the project site within the two onsite watercourses, are summarized in the following table.

North Ranch Wash FEMA 100-Year Discharges			
Location Downstream limit of FIS	Concentration Pt. (for this project)	Recording Section	Q_{100} (cfs)
West branch	NR-W	212	303
East branch	NR-E	210	531

2. Onsite North Ranch Wash

The west branch and the east branch of the North Ranch Wash flow through the North Ranch subdivision, combine with onsite flows from the North Ranch subdivision, and then enter the project site along the north property line. The flows from the North Ranch subdivision enter the watercourses both by direct discharge and detention basin outflows.

The 100-year peak discharges along the west branch and the east branch of the North Ranch Wash for locations on and near the project site were determined by combining hydrographs from the upstream North Ranch Wash and the downstream flows from both the North Ranch subdivision and the onsite contributions from the project site.

For the upstream flows from the North Ranch Wash, 100-year hydrographs were obtained from the FLO-2D model (North Ranch Floodplain Study, 2019).

For the downstream flows from the North Ranch subdivision and the project site, hydrologic calculations were performed and hydrographs generated using the web-based PC-Hydro 7.1, in accordance with guidelines from the PC-Hydro User Guide (Pima County Regional Flood Control District, 2019; Arroyo Engineering, 2007). Hydrologic data sheets are included in Appendix B. Watersheds are shown on the project maps in Appendix A.

Hydrograph summations did not include any peak-flow reduction effects from the North Ranch detention basins. From an evaluation of the offsite and onsite hydrographs, it was determined that the difference in the time to peak for 1) the offsite flows (3.3 hours) in North Ranch Wash and 2) the local flows (15 minutes) from the North Ranch subdivision and the project site were so large that the offsite flows and the onsite runoff contributions are mutually exclusive. In other words, the local flows have no effect on the regional peak flows along the North Ranch Wash.

The hydrograph analyses are included in Appendix B. Summary tables are provided as follows.

Summary of Hydrograph Contributing Flows to the North Ranch Wash				
Location	Conc. Pt.	Hydrograph Q_{100} (cfs)	Time to Peak (hrs)	Hydrograph Duration (hrs)
NR Wash – West Branch	NR-W	303	3.37	>4.5
NR subdivision	W-1	47	0.27	1.5
NR subdivision	W-2	105	0.25	1.5
Project site (local)	W-3 (local)	49	0.23	1.0
NR Wash – East Branch	NR-E	531	3.28	>4.5
NR subdivision	NR-E1(local)	37	0.25	1.5
NR subdivision	E-1	74	0.23	1.5
Project site (local)	NR-E3(local)	22	0.25	1.5

Summary of Hydrograph Summations for North Ranch Wash		
Location	Conc. Pt.	Hydrograph Q_{100} (cfs)
NR Wash – West Branch	NR-W	303
	NR-W1	303
	NR-W2	303
	NR-W3	303
NR Wash – East Branch	NR-E	531
	NR-E1	531
	NR-E2	531
	NR-E3	531

B. Hydraulics

1. Floodplain Mapping

Detailed hydraulic models were prepared, using RiverCAD and HEC-RAS software, for onsite watercourses. Concentration points and 100-year floodplains are shown on the Existing Conditions Floodplain Map and Developed Conditions Floodplain Map provided in Appendix A. HEC-RAS summary output sheets are included in Appendix C. HEC-RAS input files are provided separately.

C. Erosion Hazard Setbacks

In accordance with Pima County regulations, erosion hazard setbacks along regulatory watercourses are based on the corresponding 100-year discharge. Setbacks for the project site are listed as follows:

Erosion Hazard Setbacks for North Ranch Wash		
Concentration Point	Q_{100} (cfs)	Setback (ft)
NR-W3	303	25
NR-E3	531	50

V. REFERENCES

Arroyo Engineering and SCE Engineering, *North Ranch Wash Floodplain Study Technical Data Notebook*, March 14, 2019.

Federal Emergency Management Agency, *Flood Insurance Study for Pima County and Incorporated Areas, Arizona,* June 16, 2011.

Perry Engineering, *Tentative Plat for Mountain Vista Ridge*, August 14, 2018.

Pima County Regional Flood Control District, *Design Standards for Stormwater Detention and Retention*, November, 2015.

Pima County Regional Flood Control District, *PC-Hydro User Guide,* 2019; Arroyo Engineering, 2007.

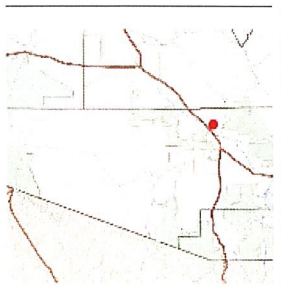
U.S. Army Corps of Engineers, Hydrologic Engineering Center, *HEC-RAS River Analysis Systems*, Version 3.1.3, May 2005.

Appendix A. Exhibits

Location Map

Legend

Parcels



Notes:

5/16/2022

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Feet

Pima County GIS

This map is static output from an internet mapping site and no warranty is expressed or implied as to the accuracy, reliability, currency or completeness of the data, and is for reference only

CI=2'
NAVD88

0 300 600

SCALE

North Ranch Wash

NR-W
303 cfs

NR-E
531 cfs

North Ranch Subdivision

W-1
47 cfs

NR-W1
303 cfs

Thornydale Rd.

W-2
105 cfs

E-1
74 cfs

Basin E

NR-E1
531 cfs

Basin W

NR-W2
303 cfs

NR-E2
531 cfs

Project Site

NR-W3
303 cfs

NR-E3
531 cfs

Sumter Drive

Mountain Vista Ridge

LEGEND

Local watershed boundary

Flow arrow

Project site

E-1
73 cfs

Concentration point with 100-year discharge

NR-E
531 cfs

100-year discharge at FLO-2D recording section
(North Ranch Floodplain Study, Arroyo Engineering, March 2019)

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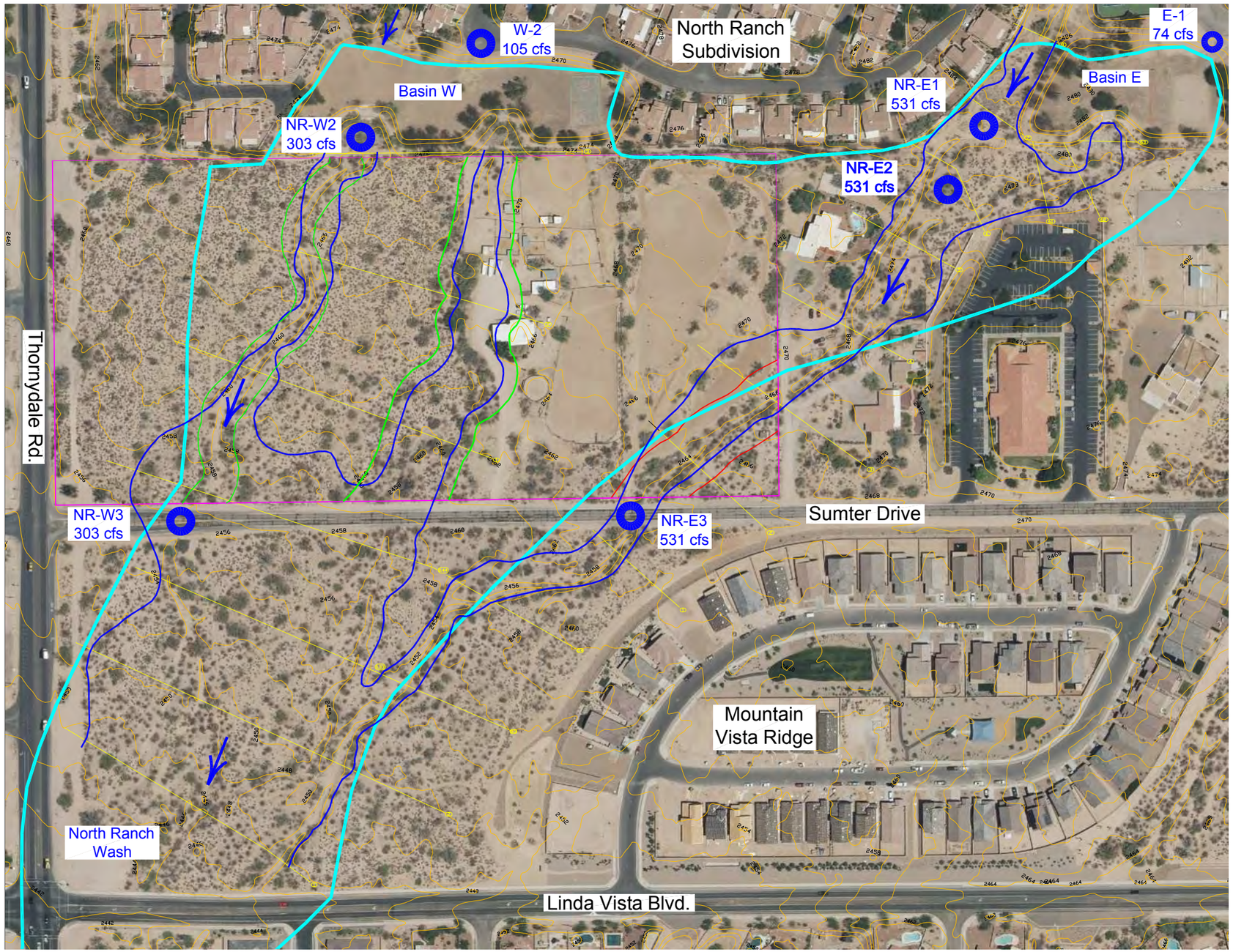
EXISTING CONDITIONS HYDROLOGY MAP



CI=2'
NAVD88

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SCALE

LEGEND

- 100-year existing floodplain
- FEMA 100-year floodplain (Zone A)
- 25-ft erosion hazard setback
- 50-ft erosion hazard setback
- HEC-RAS cross section
- Project boundary
- Flow arrow
- NR-E3 531 cfs — Conc. point with 100-year discharge

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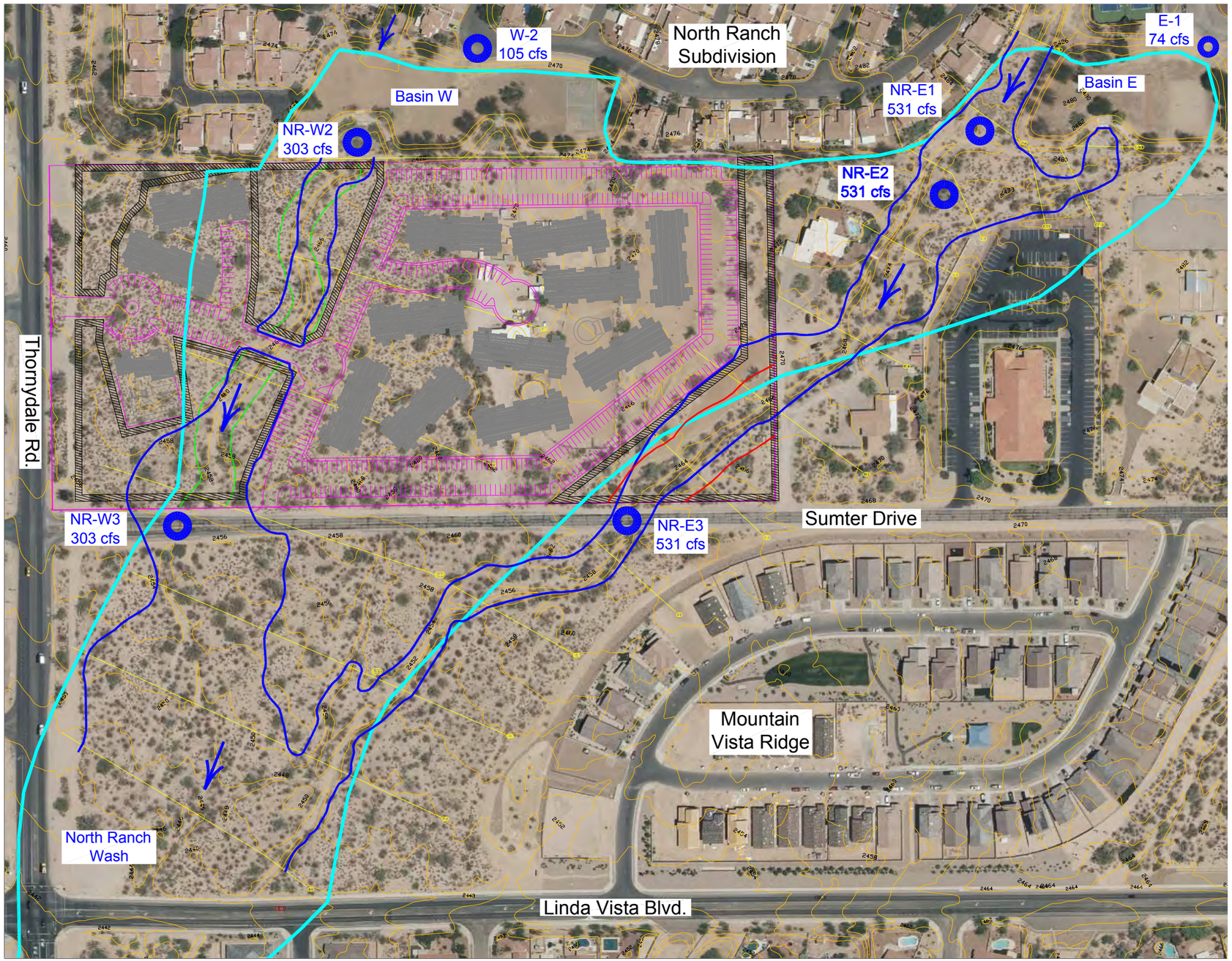
EXISTING CONDITIONS FLOODPLAIN MAP



CI=2'
NAVD88

0 200 400
SCALE

LEGEND

- 100-year developed floodplain
- FEMA 100-year floodplain (Zone A)
- 25-ft erosion hazard setback
- 50-ft erosion hazard setback
- HEC-RAS cross section
- Project site, with proposed footprint
- Flow arrow
- NR-E3 531 cfs — Conc. point with 100-year discharge

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DEVELOPED CONDITIONS FLOODPLAIN MAP

Appendix B. Hydrology

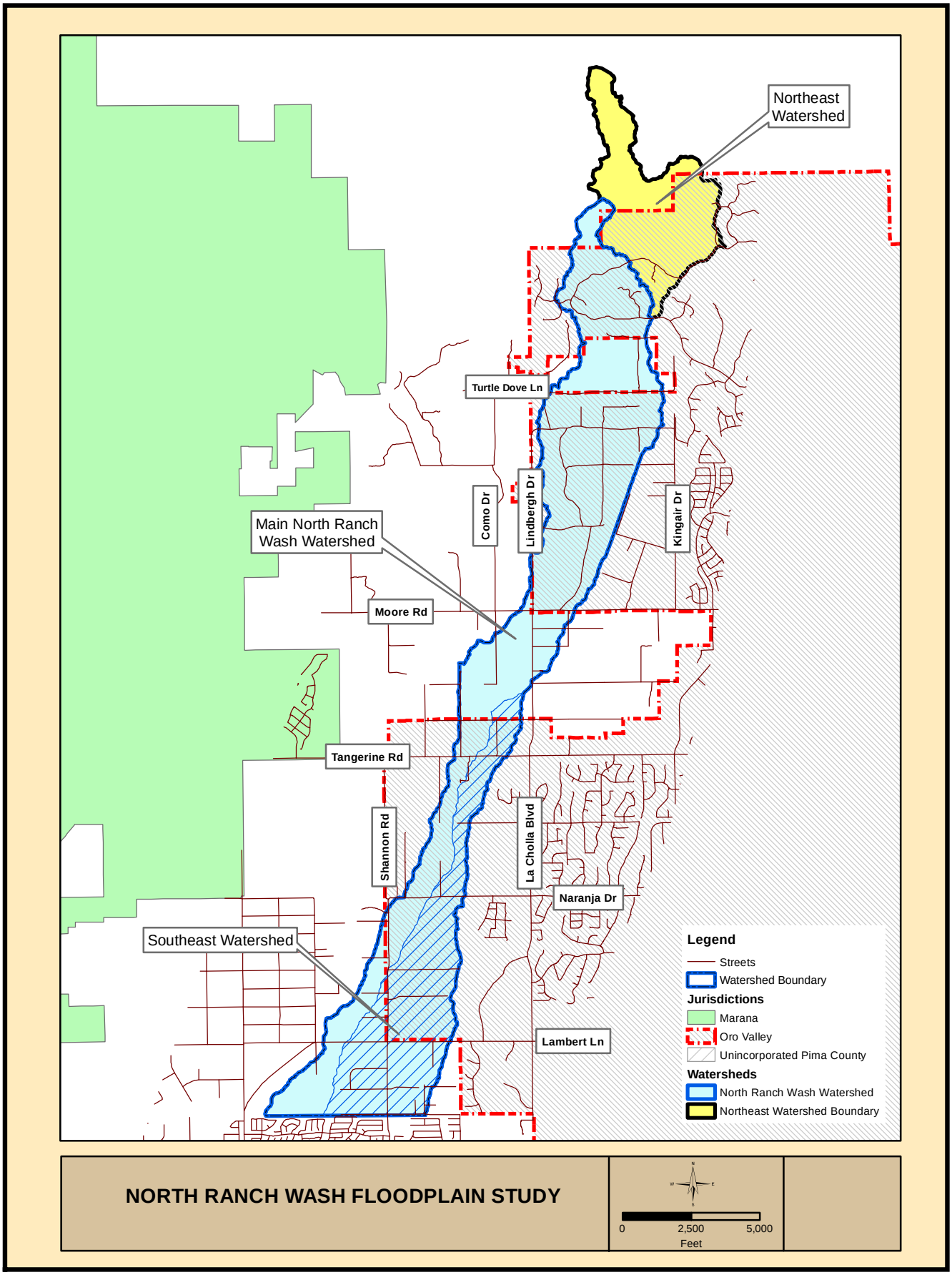

Figure 1.1 Watershed Map for Study Area

N
W E
S
0 300 600 Ft
Contour Interval=2'

Camino Alto
Camino Christy
Shannon Rd
Thornydale Rd
Lambert Lane
Pecos Way
PIMA COUNTY
ORO VALLEY

NORTH RANCH WASH FLOODPLAIN STUDY
100-YEAR FLOODPLAIN MAPS (SHEET 4 OF 4)

Date: 4/4/19

PIMA COUNTY FLOOD CONTROL
Pima County Regional Flood Control District
201 N Stone 9th Floor
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Legend

- FLO-2D Computational Boundary
- FEMA Floodplain Limiits
- 2910 Existing Contours
- Jurisdiction Boundary
- Flood Limits
- WSE Contour
- Q=xx cfs ## FLO-2D Recording Cross Section (No. and Q)

Flow Depth Legend

- >0.2 ft - 0.5 ft
- >0.5 ft - 1.0 ft
- >1.0 ft - 2.0 ft
- >2.0 ft - 3.0 ft
- >3.0 ft

Certificate No. 23987
EDITH GRIFFITH METTEY
4-4-19
Expires 12/31/20

Certificate No. 25331
LARRY L. ROBERTS
4-4-19
Expires 3-31-2022

North Ranch Wash FLO-2D
HYDCROSS.OUT

THE MAXIMUM DISCHARGE FROM CROSS SECTION 210 IS: 531.47 CFS
AT TIME: 3.28 HOURS
THE TOTAL VOLUME OF DISCHARGE IS: 60.15 AF

HYDROGRAPH AND AVERAGE FLOODPLAIN HYDRAULICS FOR CROSS SECTION NO: 210

VELOCITY = AVERAGE CROSS SECTION VELOCITY = DISCHARGE DIVIDED BY AVERAGE DEPTH AND TOTAL WIDTH
RESOLVED VEL = AVERAGE OF THE SUM OF THE MAGNITUDE OF THE RESOLVED VELOCITY VECTORS FOR EACH CROSS SECTION ELEMENT (FOR ONLY ONE CELL = RESOLVED VELOCITY VECTOR AND ALWAYS POSITIVE)

TIME (HRS)	TOPWD (FT)	DPTH (FT)	WSEL (FT/FT)	VELOCITY (FPS)	RES. VEL (FPS)	DISCHARGE (CFS)
0.50	0.00	0.00	0.00	0.00	0.13	0.00
1.00	0.00	0.00	2510.88	0.00	0.10	0.00
1.50	248.53	0.06	2510.93	1.81	0.45	24.86
2.00	223.68	0.16	2511.03	3.05	0.75	106.26
2.50	198.82	0.15	2511.02	3.41	0.79	98.84
3.00	223.68	0.30	2511.18	3.83	1.10	256.05
3.50	248.53	0.49	2511.37	3.96	1.56	486.26
4.00	223.68	0.37	2511.25	4.03	1.33	332.24
4.50	173.97	0.27	2511.15	4.77	1.30	226.62

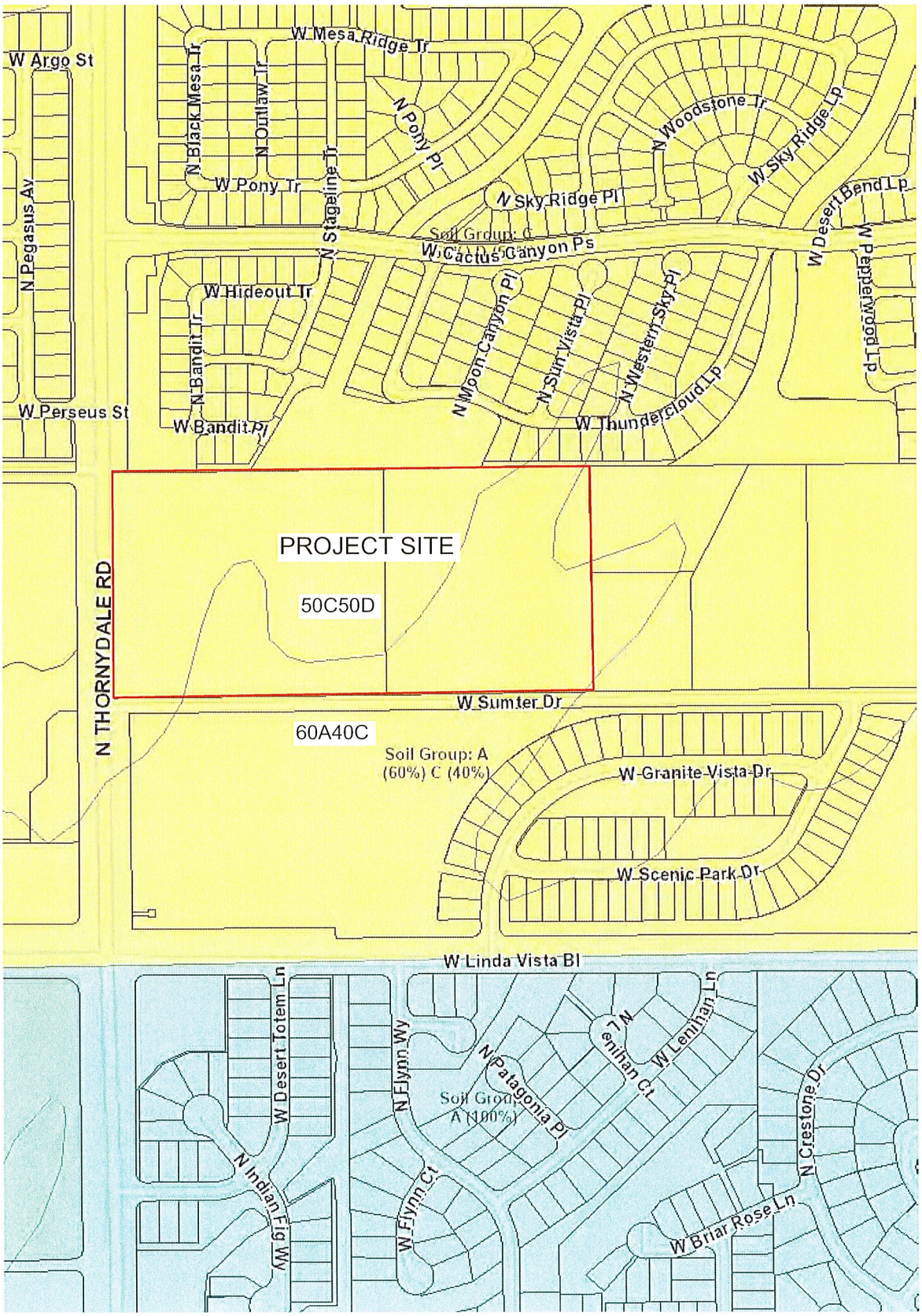
THE MAXIMUM DISCHARGE FROM CROSS SECTION 212 IS: 303.01 CFS AT TIME: 3.37 HOURS
THE TOTAL VOLUME OF DISCHARGE IS: 30.48 AF

HYDROGRAPH AND AVERAGE FLOODPLAIN HYDRAULICS FOR CROSS SECTION NO: 212

VELOCITY = AVERAGE CROSS SECTION VELOCITY = DISCHARGE DIVIDED BY AVERAGE DEPTH AND TOTAL WIDTH
ESOLVED VEL = AVERAGE OF THE SUM OF THE MAGNITUDE OF THE RESOLVED VELOCITY VECTORS FOR EACH CROSS SECTION ELEMENT (FOR ONLY ONE CELL = RESOLVED VELOCITY VECTOR AND ALWAYS POSITIVE)

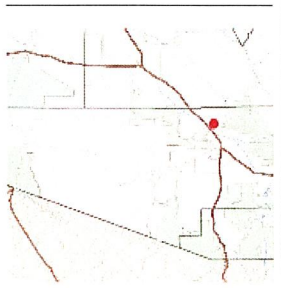
TIME (HRS)	TOPWD (FT)	DPTH (FT)	WSEL (FT/FT)	VELOCITY (FPS)	RES. VEL (FPS)	DISCHARGE (CFS)
0.50	0.00	0.00	0.00	0.00	0.13	0.00
1.00	0.00	0.00	2496.01	0.00	0.25	0.00
1.50	521.91	0.07	2496.08	2.63	1.01	101.33
2.00	447.35	0.06	2496.07	2.61	1.11	74.22
2.50	397.65	0.05	2496.06	2.46	0.96	44.91
3.00	422.50	0.06	2496.07	2.89	1.13	71.89
3.50	422.50	0.13	2496.14	4.98	1.95	282.61
4.00	347.94	0.09	2496.10	4.89	1.72	151.58
4.50	323.09	0.06	2496.07	4.21	1.36	82.69

Hydrologic Soil Groups



Legend

- Parcels
- Hydrologic Soils Group
  - Soil Group: A 100%
  - Soil Group: B 100%
  - Soil Group: C 100%
  - Soil Group: D 100%
  - Soil Group: Mixed



Notes:

5/16/2022

800.0 0 400.00

Feet

Pima County GIS

This map is static output from an internet mapping site and no warranty is expressed or implied as to the accuracy, reliability, currency or completeness of the data, and is for reference only

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	Baker and Associates Engineering, Inc.	Prepared by:	LKR
Project Name:	W-1	Date:	05/11/2022
Concentration Point:	W-1	Job #	
Watershed Area:	7 Acres	Watershed Type	Medium Density Urbanized

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	15	1270	0.0118	0.04

Length of Watercourse (Lc):	1270	feet	Mean Slope:	0.0118	
Length to Cen. of Gravity (Lca):	635	feet	Weighted Basin Fac:	0.04	
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30	

RETURN PERIOD: 100-years NOAA Data Obtained: 2022-05-11 09:09:25 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.385 Longitude: -111.0428

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.85	1.29	1.6	2.15	2.66	2.96	3.11	3.38	3.62	4.55

Soil Type	Percent	Curve # (CN)	Runoff Coef. (C)
B	-	-	-
C	50	87.3	0.552
D	50	90.3	0.639
Imp.	55	99	0.956

Weighted Runoff Coef. (Cw):	0.79	
Time of Concentration:	7.8	min
Rainfall Intensity (i) @ Tc:	8.41	in/hr
Runoff Supply Rate (q) @ Tc:	6.68	in/hr
PEAK DISCHARGE:	47.1	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	Baker and Associates Engineering, Inc.	Prepared by:	LKR
Project Name:	W-2	Date:	05/11/2022
Concentration Point:	W-2	Job #	
Watershed Area:	14.8 Acres	Watershed Type	Medium Density Urbanized

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	20	1272	0.0157	0.04

Length of Watercourse (Lc):	1272	feet	Mean Slope:	0.0157	
Length to Cen. of Gravity (Lca):	636	feet	Weighted Basin Fac:	0.04	
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30	

RETURN PERIOD: 100-years NOAA Data Obtained: 2022-05-11 09:09:25 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.385 Longitude: -111.0428

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.85	1.29	1.6	2.15	2.66	2.96	3.11	3.38	3.62	4.55

Soil Type	Percent	Curve # (CN)	Runoff Coef. (C)
B	-	-	-
C	50	87.3	0.552
D	50	90.3	0.639
Imp.	55	99	0.956

Weighted Runoff Coef. (Cw):	0.79	
Time of Concentration:	6.9	min
Rainfall Intensity (i) @ Tc:	8.87	in/hr
Runoff Supply Rate (q) @ Tc:	7.04	in/hr
PEAK DISCHARGE:	105	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	Baker and Associates Engineering, Inc.	Prepared by:	LKR
Project Name:	W-3 local	Date:	05/11/2022
Concentration Point:	W-3-local	Job #	
Watershed Area:	8 Acres	Watershed Type	Undeveloped-Valley

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	12	732	0.0164	0.035

Length of Watercourse (Lc):	732	feet	Mean Slope:	0.0164	
Length to Cen. of Gravity (Lca):	366	feet	Weighted Basin Fac:	0.035	
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30	

RETURN PERIOD: 100-years NOAA Data Obtained: 2022-05-11 09:09:25 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.385 Longitude: -111.0428

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.85	1.29	1.6	2.15	2.66	2.96	3.11	3.38	3.62	4.55

Soil Type	Percent	Curve # (CN)	Runoff Coef. (C)
B	-	-	-
C	50	87.3	0.552
D	50	90.3	0.639
Imp.	0	99	0.956

Weighted Runoff Coef. (Cw):	0.6	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.2	in/hr
Runoff Supply Rate (q) @ Tc:	6.07	in/hr
PEAK DISCHARGE:	48.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	Baker and Associates Engineering, Inc.	Prepared by:	LKR
Project Name:	E1	Date:	05/11/2022
Concentration Point:	E-1	Job #	
Watershed Area:	9.6 Acres	Watershed Type	Medium Density Urbanized

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	14	950	0.0147	0.04

Length of Watercourse (Lc):	950	feet	Mean Slope:	0.0147	
Length to Cen. of Gravity (Lca):	475	feet	Weighted Basin Fac:	0.04	
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30	

RETURN PERIOD: 100-years NOAA Data Obtained: 2022-05-11 09:09:25 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.385 Longitude: -111.0428

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.85	1.29	1.6	2.15	2.66	2.96	3.11	3.38	3.62	4.55

Soil Type	Percent	Curve # (CN)	Runoff Coef. (C)
B	-	-	-
C	50	87.3	0.552
D	50	90.3	0.639
Imp.	55	99	0.956

Weighted Runoff Coef. (Cw):	0.79	
Time of Concentration:	5.7	min
Rainfall Intensity (i) @ Tc:	9.57	in/hr
Runoff Supply Rate (q) @ Tc:	7.6	in/hr
PEAK DISCHARGE:	73.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	Baker and Associates Engineering, Inc.	Prepared by:	LKR
Project Name:	NR-E1 local	Date:	05/11/2022
Concentration Point:	NR-E1 local	Job #	
Watershed Area:	7 Acres	Watershed Type	Low Density Urbanized

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	24	1520	0.0158	0.035

Length of Watercourse (Lc):	1520	feet	Mean Slope:	0.0158	
Length to Cen. of Gravity (Lca):	760	feet	Weighted Basin Fac:	0.035	
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30	

RETURN PERIOD: 100-years NOAA Data Obtained: 2022-05-11 09:09:25 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.385 Longitude: -111.0428

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.85	1.29	1.6	2.15	2.66	2.96	3.11	3.38	3.62	4.55

Soil Type	Percent	Curve # (CN)	Runoff Coef. (C)
B	-	-	-
C	50	87.3	0.552
D	50	90.3	0.639
Imp.	5	99	0.956

Weighted Runoff Coef. (Cw):	0.61	
Time of Concentration:	7.5	min
Rainfall Intensity (i) @ Tc:	8.56	in/hr
Runoff Supply Rate (q) @ Tc:	5.25	in/hr
PEAK DISCHARGE:	37	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	Baker and Associates Engineering, Inc.	Prepared by:	LKR
Project Name:	NR-E3 local	Date:	05/11/2022
Concentration Point:	NR-E3 local	Job #	
Watershed Area:	4.1 Acres	Watershed Type	Low Density Urbanized

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	16	1168	0.0137	0.035

Length of Watercourse (Lc):	1168	feet	Mean Slope:	0.0137	
Length to Cen. of Gravity (Lca):	584	feet	Weighted Basin Fac:	0.035	
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30	

RETURN PERIOD: 100-years NOAA Data Obtained: 2022-05-11 09:09:25 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.385 Longitude: -111.0428

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.85	1.29	1.6	2.15	2.66	2.96	3.11	3.38	3.62	4.55

Soil Type	Percent	Curve # (CN)	Runoff Coef. (C)
B	-	-	-
C	50	87.3	0.552
D	50	90.3	0.639
Imp.	1	99	0.956

Weighted Runoff Coef. (Cw):	0.6	
Time of Concentration:	6.7	min
Rainfall Intensity (i) @ Tc:	8.94	in/hr
Runoff Supply Rate (q) @ Tc:	5.35	in/hr
PEAK DISCHARGE:	22.1	cfs

North Ranch Wash - West Branch Additive Hydrographs

Concentration Point		W-1	NR-W			W-2			W-3 local	
Return Period		100-Yr	100-Yr			100-Yr			100-Yr	
Time of Concentration (min)		7.84				6.86			5	
Time to Peak (hr		0.27	3.37			0.25			0.23	
					1	= Lag (min)		2	= Lag (min)	
					418	= Distance (ft)		733	= Distance (ft)	
					5	= velocity (ft/s)		5	= velocity (ft/s)	
Concentration Poin		W-1	NR-W	NR-W1	NR-W1	W-2	NR-W2	NR-W2	W-3 local	NR-W3
Q_{100} peak		46	303	303	303	104	303	303	48	303
		(A)	(B)	(A+B)	(A)	(B)	(A+B)	(A)	(B)	(A+B)
Time (min	Time (hr)	Discharge (cfs)			Discharge (cfs)			Discharge (cfs)		
0	0.00	0	0	0		0	0		0	0
1	0.02	1		1	0	2	2		1	1
2	0.03	2		2	1	5	6	0	3	3
3	0.05	4		4	2	9	11	2	5	7
4	0.07	6		6	4	14	18	6	8	13
5	0.08	8		8	6	20	26	11	11	22
6	0.10	11		11	8	26	34	18	14	32
7	0.12	14		14	11	33	44	26	18	44
8	0.13	17		17	14	40	54	34	21	56
9	0.15	20		20	17	48	65	44	26	70
10	0.17	23		23	20	57	77	54	31	85
11	0.18	27		27	23	67	91	65	37	101
12	0.20	32		32	27	78	106	77	42	119
13	0.22	37		37	32	89	121	91	46	137
14	0.23	41		41	37	98	135	106	48	154
15	0.25	45		45	41	104	146	121	45	166
16	0.27	46		46	45	99	144	135	42	177
17	0.28	44		44	46	93	140	146	39	185
18	0.30	42		42	44	87	131	144	36	180
19	0.32	39		39	42	81	123	140	33	173
20	0.33	37		37	39	76	115	131	31	162
21	0.35	34		34	37	70	107	123	28	151
22	0.37	32		32	34	65	99	115	26	141
23	0.38	30		30	32	61	92	107	24	131
24	0.40	28		28	30	56	86	99	22	121
25	0.42	26		26	28	52	80	92	20	112
26	0.43	24		24	26	48	74	86	18	104
27	0.45	22		22	24	44	68	80	16	96
28	0.47	20		20	22	40	62	74	15	88
29	0.48	19		19	20	37	57	68	13	81
30	0.50	17	0	17	19	33	52	62	12	74
31	0.52	16		16	17	30	48	57	11	68
32	0.53	14		14	16	27	43	52	9	61
33	0.55	13		13	14	25	39	48	8	56
34	0.57	12		12	13	23	36	43	8	51
35	0.58	11		11	12	20	32	39	7	46
36	0.60	10		10	11	18	29	36	6	42
37	0.62	9		9	10	17	27	32	6	38
38	0.63	8		8	9	15	24	29	5	34
39	0.65	8		8	8	14	22	27	5	31
40	0.67	7		7	8	13	20	24	4	29
41	0.68	6		6	7	12	18	22	4	26
42	0.70	6		6	6	10	17	20	4	24
43	0.72	5		5	6	10	15	18	3	22
44	0.73	5		5	5	9	14	17	3	20
45	0.75	4		4	5	8	13	15	3	18
46	0.77	4		4	4	8	12	14	2	16
47	0.78	4		4	4	7	11	13	2	15
48	0.80	3		3	4	6	10	12	2	14
49	0.82	3		3	3	6	9	11	2	13
50	0.83	3		3	3	5	9	10	2	12
51	0.85	3		3	3	5	8	9	2	11
52	0.87	3		3	3	5	7	9	1	10
53	0.88	2		2	3	4	7	8	1	9
54	0.90	2		2	2	4	6	7	1	9
55	0.92	2		2	2	4	6	7	1	8
56	0.93	2		2	2	3	5	6	1	7
57	0.95	2		2	2	3	5	6	1	7
58	0.97	2		2	2	3	5	5	1	6
59	0.98	1		1	2	3	4	5	1	6
60	1.00	1	0	1	1	3	4	5	1	5
90	1.50	0	101	101	0	0	0	1	0	1
91	1.52	0		0	101	0	102	1	0	1
92	1.53	0		0	0	0	1	0	0	0
93	1.55	0		0	0	0	1	102	0	102
	2		74	74	74		74	74		74
	2.5		45	45	45		45	45		45
	3		72	72	72		72	72		72
	3.37		303	303	303		303	303		303
	3.5		283	283	283		283	283		283
	4		152	152	152		152	152		152
	4.5		83	83	83		83	83		83

North Ranch Wash - East Branch Additive Hydrographs

Concentration Point		NR-E1 local	NR-E			E-1			NR-E3 local	
Return Period		100-Yr	100-Yr			100-Yr			100-Yr	
Time of Concentration (min)		7.49				5.73			6.72	
Time to Peak (hr		0.25	3.28			0.23			0.25	
								3	= Lag (min)	
								877	= Distance (ft)	
								5	= velocity (ft/s)	
Concentration Poin		NR-E1 local	NR-E	NR-E1	NR-E1	E-1	NR-E2	NR-E2	NR-E3 local	NR-E3
Q_{100} peak		36	531	531	531	73	531	531	22	531
		(A)	(B)	(A+B)	(A)	(B)	(A+B)	(A)	(B)	(A+B)
Time (min	Time (hr)	Discharge (cfs)			Discharge (cfs)			Discharge (cfs)		
0	0.00	0	0	0	0	0	0		0	0
1	0.02	1		1	1	1	2		0	0
2	0.03	2		2	2	4	5		1	1
3	0.05	3		3	3	7	10	0	2	2
4	0.07	5		5	5	11	16	2	3	5
5	0.08	7		7	7	15	22	5	4	10
6	0.10	9		9	9	20	29	10	6	16
7	0.12	11		11	11	25	36	16	7	23
8	0.13	14		14	14	31	44	22	9	30
9	0.15	16		16	16	37	53	29	10	39
10	0.17	19		19	19	44	63	36	12	48
11	0.18	22		22	22	52	74	44	14	59
12	0.20	26		26	26	60	86	53	17	70
13	0.22	30		30	30	67	97	63	19	82
14	0.23	33		33	33	73	106	74	21	95
15	0.25	36		36	36	70	106	86	22	108
16	0.27	36		36	36	65	101	97	21	118
17	0.28	34		34	34	61	95	106	19	126
18	0.30	32		32	32	57	89	106	18	124
19	0.32	30		30	30	53	82	101	17	118
20	0.33	28		28	28	48	76	95	16	111
21	0.35	26		26	26	45	71	89	15	103
22	0.37	24		24	24	41	66	82	14	96
23	0.38	23		23	23	38	61	76	13	89
24	0.40	21		21	21	35	56	71	12	82
25	0.42	20		20	20	32	52	66	11	77
26	0.43	18		18	18	29	47	61	10	71
27	0.45	17		17	17	27	43	56	9	65
28	0.47	15		15	15	24	39	52	8	60
29	0.48	14		14	14	22	36	47	8	55
30	0.50	13	0	13	13	20	32	43	7	50
31	0.52	12		12	12	18	29	39	6	46
32	0.53	11		11	11	16	27	36	6	41
33	0.55	10		10	10	14	24	32	5	38
34	0.57	9		9	9	13	22	29	5	34
35	0.58	8		8	8	12	20	27	4	31
36	0.60	7		7	7	11	18	24	4	28
37	0.62	7		7	7	10	16	22	3	25
38	0.63	6		6	6	9	15	20	3	23
39	0.65	6		6	6	8	13	18	3	21
40	0.67	5		5	5	7	12	16	3	19
41	0.68	5		5	5	6	11	15	2	17
42	0.70	4		4	4	6	10	13	2	15
43	0.72	4		4	4	5	9	12	2	14
44	0.73	4		4	4	5	9	11	2	13
45	0.75	3		3	3	5	8	10	2	12
46	0.77	3		3	3	4	7	9	2	11
47	0.78	3		3	3	4	7	9	1	10
48	0.80	3		3	3	4	6	8	1	9
49	0.82	2		2	2	3	6	7	1	8
50	0.83	2		2	2	3	5	7	1	8
51	0.85	2		2	2	3	5	6	1	7
52	0.87	2		2	2	3	4	6	1	7
53	0.88	2		2	2	2	4	5	1	6
54	0.90	2		2	2	2	4	5	1	6
55	0.92	2		2	2	2	3	4	1	5
56	0.93	1		1	1	2	3	4	1	5
57	0.95	1		1	1	2	3	4	1	4
58	0.97	1		1	1	2	3	3	1	4
59	0.98	1		1	1	1	3	3	1	4
60	1.00	1	0	1	1	1	2	3	1	4
90	1.50	0	25	25	25	0	25	0	0	1
91	1.52	0		0	0	0	0	0	0	0
92	1.53	0		0	0	0	0	0	0	0
93	1.55	0		0	0	0	0	25	0	25
	2		106	106	106		106	106		106
	2.5		99	99	99		99	99		99
	3		256	256	256		256	256		256
	3.28		531	531	531		531	531		531
	3.5		486	486	486		486	486		486
	4		332	332	332		332	332		332
	4.5		227	227	227		227	227		227

Appendix C. Hydraulics

HEC-RAS Profile: PF 1

River	Reach	River Sta	Plan	Q Total	W.S. Elev
				(cfs)	(ft)
West Branch	2	3	existing	303	2469.1
West Branch	2	3	developed	303	2469.1
West Branch	2	2	existing	303	2465.4
West Branch	2	2	developed	303	2465.6
West Branch	2	1	existing	303	2460.7
West Branch	2	1	developed	303	2461.2
West Branch	2	0.44	existing	303	2457.1
West Branch	2	0.44	developed	303	2457.1
West Branch	2	0.33	existing	303	2453.1
West Branch	2	0.33	developed	303	2453.1
North Ranch Wash	1	2	existing	834	2450.6
North Ranch Wash	1	2	developed	834	2450.6
North Ranch Wash	1	1	existing	834	2447.3
North Ranch Wash	1	1	developed	834	2447.3
East trib	5	63	existing	74	2481.5
East trib	5	63	developed	74	2481.5
East trib	5	62	existing	74	2479.2
East trib	5	62	developed	74	2479.2
East trib	5	61	existing	74	2478.9
East trib	5	61	developed	74	2478.9
East Branch	4	8	existing	531	2482.9
East Branch	4	8	developed	531	2482.9
East Branch	4	7	existing	531	2480.0
East Branch	4	7	developed	531	2480.0
East Branch	3	6	existing	531	2477.2
East Branch	3	6	developed	531	2477.2
East Branch	3	5	existing	531	2474.7
East Branch	3	5	developed	531	2474.7

HEC-RAS Profile: PF 1 (Continued)

River	Reach	River Sta	Plan	Q Total	W.S. Elev
				(cfs)	(ft)
East Branch	3	4	existing	531	2471.0
East Branch	3	4	developed	531	2471.0
East Branch	3	3	existing	531	2468.6
East Branch	3	3	developed	531	2468.6
East Branch	3	2	existing	531	2466.4
East Branch	3	2	developed	531	2466.4
East Branch	3	1	existing	531	2462.4
East Branch	3	1	developed	531	2462.4
East Branch	3	0.4	existing	531	2457.5
East Branch	3	0.4	developed	531	2457.5
East Branch	3	0.3	existing	531	2454.0
East Branch	3	0.3	developed	531	2454.0

HEC-RAS Profile: PF 1

River	Reach	River Sta	Plan	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Max Chl Dpth	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft/s)	(ft)	(sq ft)	(ft)	
West Branch	2	3	existing	303	2468.0	2469.1	4.7	1.1	68	108	1.0
West Branch	2	3	developed	303	2468.0	2469.1	4.8	1.1	63	85	1.0
West Branch	2	2	existing	303	2463.8	2465.4	3.1	1.6	116	192	0.6
West Branch	2	2	developed	303	2463.8	2465.6	3.6	1.9	84	85	0.6
West Branch	2	1	existing	303	2459.4	2460.7	4.2	1.4	79	180	1.0
West Branch	2	1	developed	303	2459.4	2461.2	5.0	1.9	61	76	1.0
West Branch	2	0.44	existing	303	2456.4	2457.1	0.4	1.6	169	437	0.1
West Branch	2	0.44	developed	303	2456.4	2457.1	3.0	1.6	101	349	1.0
West Branch	2	0.33	existing	303	2452.0	2453.1	3.4	1.1	91	182	0.9
West Branch	2	0.33	developed	303	2452.0	2453.1	3.8	1.1	83	172	0.9
North Ranch Wash	1	2	existing	834	2448.6	2450.6	3.9	1.9	274	450	0.8
North Ranch Wash	1	2	developed	834	2448.6	2450.6	3.9	1.9	274	450	0.8
North Ranch Wash	1	1	existing	834	2445.1	2447.3	6.3	2.1	189	291	1.1
North Ranch Wash	1	1	developed	834	2445.1	2447.3	6.3	2.1	189	291	1.1
East trib	5	63	existing	74	2480.8	2481.5	3.6	0.7	21	53	1.0
East trib	5	63	developed	74	2480.8	2481.5	3.6	0.7	21	53	1.0
East trib	5	62	existing	74	2478.5	2479.2	3.8	0.8	19	43	1.0
East trib	5	62	developed	74	2478.5	2479.2	3.8	0.8	19	43	1.0
East trib	5	61	existing	74	2477.4	2478.9	1.4	1.5	54	71	0.3
East trib	5	61	developed	74	2477.4	2478.9	1.4	1.5	54	71	0.3
East Branch	4	8	existing	531	2481.2	2482.9	6.4	1.7	83	67	1.0
East Branch	4	8	developed	531	2481.2	2482.9	6.4	1.7	83	67	1.0
East Branch	4	7	existing	531	2478.8	2480.0	5.6	1.3	95	101	1.0
East Branch	4	7	developed	531	2478.8	2480.0	5.6	1.3	95	101	1.0
East Branch	3	6	existing	531	2474.7	2477.2	5.6	2.5	107	113	1.0
East Branch	3	6	developed	531	2474.7	2477.2	5.6	2.5	107	113	1.0
East Branch	3	5	existing	531	2471.3	2474.7	6.8	3.4	111	125	1.0
East Branch	3	5	developed	531	2471.3	2474.7	6.8	3.4	111	125	1.0
East Branch	3	4	existing	531	2468.7	2471.0	6.3	2.3	84	67	1.0
East Branch	3	4	developed	531	2468.7	2471.0	6.3	2.3	84	67	1.0
East Branch	3	3	existing	531	2466.0	2468.6	4.8	2.6	121	151	0.8
East Branch	3	3	developed	531	2466.0	2468.6	4.8	2.6	121	151	0.8
East Branch	3	2	existing	531	2463.7	2466.4	5.8	2.7	102	100	0.9
East Branch	3	2	developed	531	2463.7	2466.4	5.8	2.7	102	100	0.9
East Branch	3	1	existing	531	2459.0	2462.4	6.5	3.4	82	61	1.0
East Branch	3	1	developed	531	2459.0	2462.4	6.5	3.4	82	61	1.0
East Branch	3	0.4	existing	531	2454.8	2457.5	5.5	2.7	97	89	0.9
East Branch	3	0.4	developed	531	2454.8	2457.5	5.5	2.7	97	89	0.9
East Branch	3	0.3	existing	531	2451.3	2454.0	6.3	2.7	84	68	1.0
East Branch	3	0.3	developed	531	2451.3	2454.0	6.3	2.7	84	69	1.0

Appendix D

Biological Impact Report

Biological Impact Report
Thornydale and Sumter
NE#22037

Prepared for:
Mr. Zach Channing
ZDC Properties, LLC
18381 Long Lake Drive
Boca Raton, FL 33496

Prepared by:
Novak Environmental, Inc.
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BIOLOGICAL IMPACT REPORT
Thornydale and Sumter Rezoning

August 17, 2022

I. INTRODUCTION

This Biological Impact Report is for an approximately 17.88-acre site on the northeast corner of N. Thornydale Road and W Sumter Drive in Pima County, Arizona, including parcels 224-44-0570 and 224-44-058A. The owner is seeking to rezone the property through a Specific Plan. The property is in Sections 17, T12S, R13E, G. & S.R.M., Pima County, Arizona (see Figure 1).

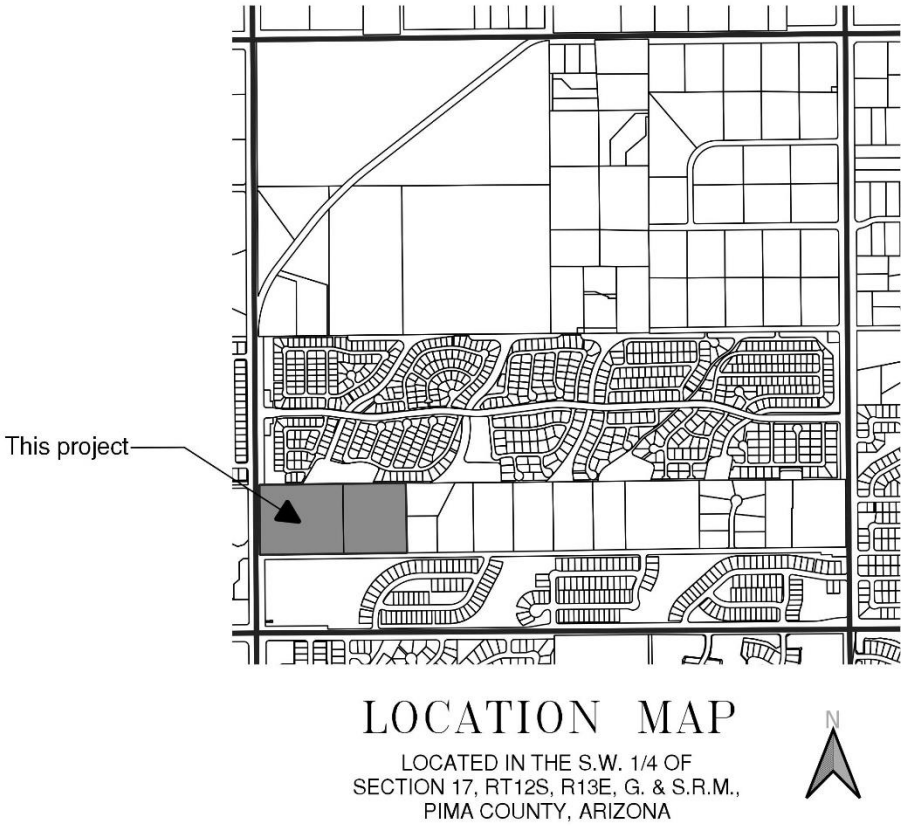

Figure 1. Location Map
2 Parcels (224-44-0570 and 224-44-058A)
Section 17, T12S, R13E, G. & S.R.M., Pima County, Arizona

This required Biological Impact Report will present responses, as they pertain to the subject property, to all questions set forth in the Pima County Development Services Biological Impact Report Guidelines, March 2010.

II. LANDSCAPE RESOURCES

1. Identify whether the proposed site occurs wholly or partially within any Maeveen Marie Behan Conservation Lands System Category including Important Riparian Areas and Special Species Management Areas.

Yes, the site is located in CLS Category Special Species Management Area, Multiple Use Management Area, and portions of the site are within the CLS Category Important Riparian Area Xeroriparian C.

2. Identify whether the proposed project occurs in the vicinity of any of the six general areas identified as Critical Landscape Linkages.

This project occurs to the southwest of Critical Landscape Linkage area number 1, and southeast of Critical Landscape Linkage area number 2.

3. If the property is a Habitat Protection or Community Open Space priority acquisition property, as displayed on SDCP MapGuide, identify which designation applies to the site and comment on the status of communications, if any, between the owner and Pima County regarding the County's potential acquisition of the property.

This site is included as a priority acquisition for either Habitat Protection. There have been no communications between the owner and Pima County regarding acquisition and none are planned.

III. SPECIES-SPECIFIC INFORMATION (including Pertinent Federally-Threatened and Endangered Species)

Cactus Ferruginous Pygmy-owl:

1. Does the proposed project site occur within Survey Zone 1 for the cactus ferruginous pygmy-owl?

Yes, it is within the Pygmy-Owl Survey Zone 1.

2. Has the proposed project site been surveyed for pygmy-owls?

a. If yes, disclose the dates when surveys were done and provide a summary of the results.

b. If no, are surveys planned in the future?

No. The project site has not been surveyed for pygmy-owls; there are no surveys planned in the future. The site has been mostly cleared of vegetation.

Western Burrowing Owl:

1. ***Does the proposed project site occur within the Priority Conservation Area for the Western Burrowing Owl?***

   No.

2. Has the proposed project site been surveyed for burrowing owls?

a. If yes, disclose the dates when surveys were done and provide a summary of the results.

b. If no, are surveys planned in the future?

No. The project site has not been surveyed for Western Burrowing Owls; there are no surveys planned in the future.

Pima Pineapple Cactus

1. Does the proposed project site occur within the Priority Conservation Area for the Pima pineapple cactus?

No.

2. Have Pima pineapple cactus been found on the proposed project site?

No. No Pima pineapple cacti have been found on the project site.

3. Has the proposed project site been surveyed for Pima pineapple cactus?

a. If yes, disclose the date when surveys were done and provide a summary of the results.

b. If no, are surveys planned in the future?

No. The project site has not been surveyed for Pima pineapple cactus; no surveys are planned in the future.

<u>Needle-Spined Pineapple Cactus:</u>

1. Does the proposed project site occur within the Priority Conservation Area for the needle-spined pineapple cactus?

No.

2. Have needle-spined pineapple cactus been found on the proposed project site?

No needle-spined pineapple cactus have been found on the project site.

3. Has the proposed project site been surveyed for needle-spined pineapple cactus?

a. If yes, disclose the date when surveys were done and provide a summary of the results.

b. If no, are surveys planned in the future?

No. The project site has not been surveyed for needle-spined pineapple cactus; no surveys are planned in the future.

IV. SAGUAROS AND IRONWOODS

Portions of the property have been disturbed for a single family residence with equestrian facilities. The undisturbed portions contain both saguaros and ironwoods. See site analysis information for details.

V. SUMMARY

This report presents a Biological Impact Report for the Thornydale and Sumter Rezoning, an approximately 17.88-acre parcel located in Pima County. This Biological Impact Report, required as part of the Specific Plan request, presents responses to all questions set forth in the Pima County Development Services Biological Impact Report Guidelines, March 2010. The findings indicate that this site is within areas of concern included in the report guidelines. The developer is aware of the CLS Guidelines for conservation and is working with the County to present a plan, including off-site mitigation, that is in compliance with these guidelines.

Appendix E

Traffic Impact Study

NEC Thornydale-Sumter Residential

Traffic Impact Study

Prepared for submittal to:

Pima County, AZ

Prepared by:

M Esparza Engineering, LLC
2934 W. Salvia Drive
Tucson, AZ 85745

August 23, 2022
Updated October 18, 2022
Updated May 9, 2023
Updated June 26, 2023
Updated July 20, 2023

NEC Thornydale-Sumter Residential
Traffic Impact Study

Prepared for:

Pima County, Arizona

Prepared by:
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Phone: (520) 207-3358
Project No. 2022.12
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August 23, 2022
Updated October 18, 2022
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Updated June 26, 2023
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1. Introduction and Summary

Purpose of Report and Study Objectives

This updated traffic impact study (TIS) addresses traffic operations and roadway design for a proposed residential development east of Thornydale Road and north of Sumter Drive. The project is in unincorporated Pima County. The current zoning is SR (Suburban Ranch). This TIS is provided to support a rezoning application to revise the zoning to Specific Plan.

Exhibit 1 shows the preliminary development plan (also provided in the appendix). Exhibit 2 shows the site location.

The project has been updated to reduce the number of multifamily residential units from 340 units to 270 units. The updated preliminary development plan shows seven three-story apartment buildings with thirty units in each building and three two-story buildings with twenty units in each building. The preliminary development plan also shows a two-story "clubhouse/retail" 8,000 square foot building on the east side of the project that, in addition to being the offices for the apartments, will include 3,000 square feet of amenity-commercial space (likely a beauty salon or personal trainer). There are regulated riparian habitat areas that separate one of the apartment buildings and the office building from the remaining buildings.

The objectives of this study are to determine the traffic impacts of the proposed development on the adjacent roadway system and to recommend any needed improvements to maintain efficient and safe traffic operations. The specific study objectives are as follows:

- Evaluate the intersections of Thornydale Road/Linda Vista Boulevard, Thornydale Road/Sumter Drive, Thornydale Road/Le Mirage Apartments Driveway, and Shannon Road/Sumter Drive with and without the project and recommend any needed improvements.
- Evaluate the roadways Linda Vista Boulevard, Sumter Drive, Thornydale Road and Shannon Road adjacent to the project, and recommend any needed improvements.
- Evaluate the appropriateness of the proposed driveway locations.

The project will generate an estimated 1,860 daily trips with 112 AM peak hour trips and 143 PM peak hour trips. Based on the projected trip generation, this report includes the required analysis for a Category 1 Traffic Impact Study. This report analyzes existing, future "without project" and future "with project" conditions at the site access drives and at adjacent signalized intersections and/or major unsignalized street intersections. For the purposes of this study, the analysis for the future year conditions estimates buildout in 2025.

Executive Summary

Development Description

The preliminary development plan of the proposed development includes 270 multi-family residential units. There is an 8,000 square foot building on the east side of the project that, in addition to being the offices for the apartments, will include 3,000 square feet of amenity-commercial space (likely a beauty salon or personal trainer). Access to the site is proposed from Thornydale Road and Sumter Drive.

Based on trip rates for multi-family residential units and the anticipated commercial use (Hair Salon) from the Institute of Transportation Engineering (ITE) *Trip Generation Manual 11th Edition*, the project will add approximately 1,860 daily trips with 112 AM peak hour trips and 143 PM peak hour trips to the roadway system.

The west driveway on Thornydale Road would be located opposite the driveway to the Le Mirage Apartments. The south driveway is shown on the preliminary development plan to be approximately 771 feet from Thornydale Road.

The spacing of project driveways will meet Pima County driveway spacing and corner clearance guidelines as defined in the Pima County Subdivision and Development Street Standards.

Existing traffic volumes near the project show that all study area intersections operate at acceptable levels of service (LOS D or better).

Exhibit 1 Preliminary Development Plan

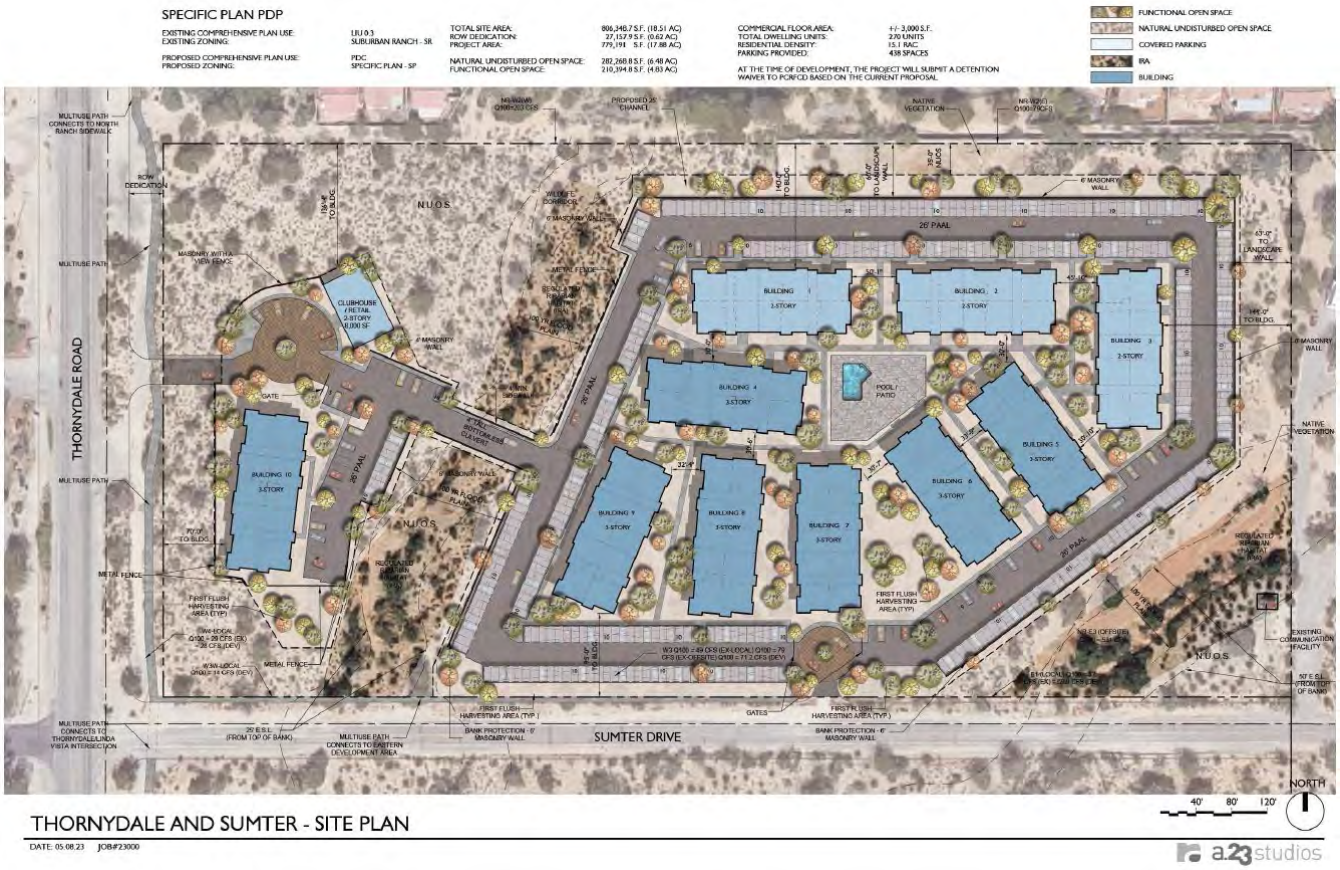
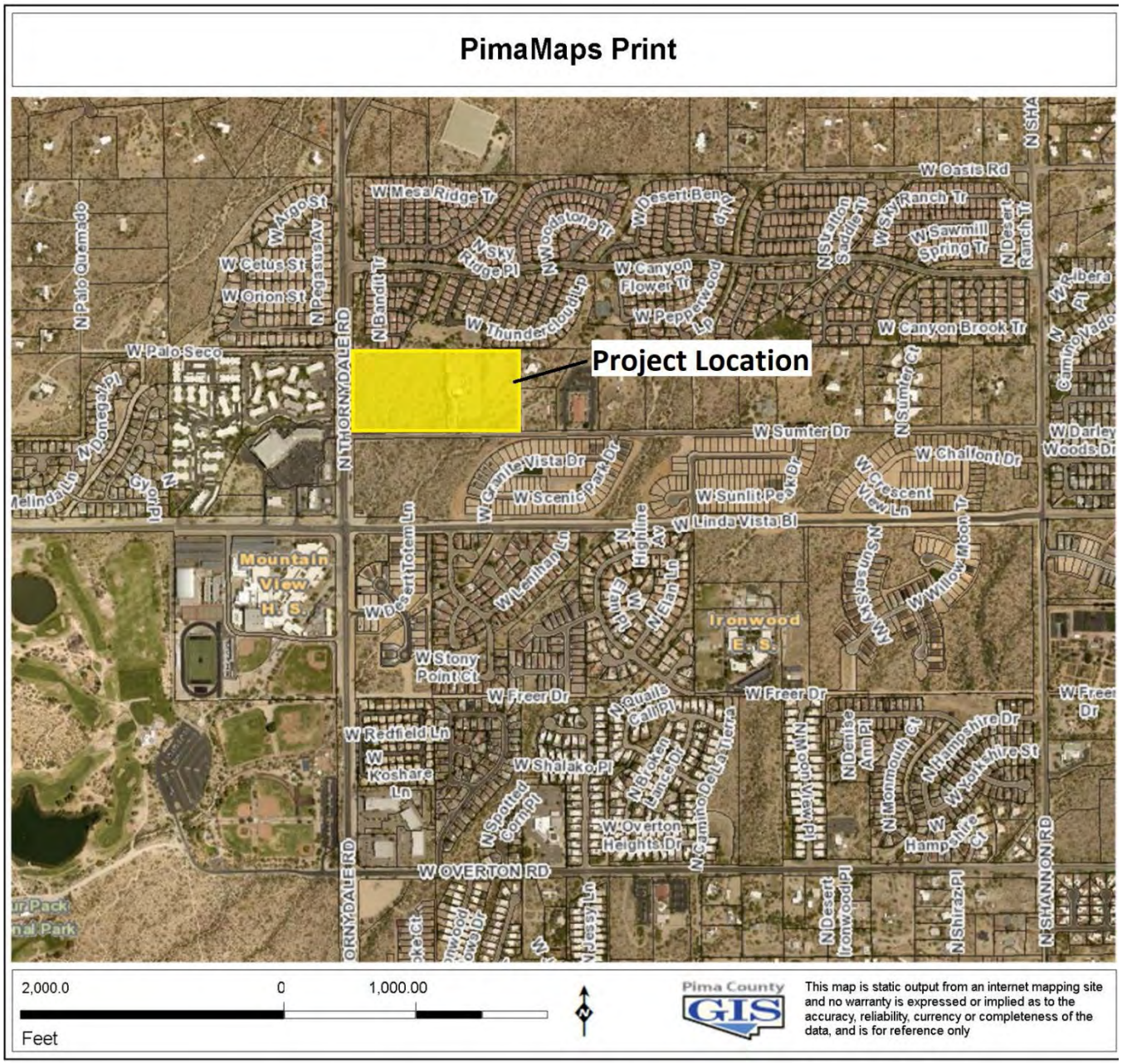


Exhibit 2 Site Location



Summary of Conclusions and Recommendations

The following is a summary of conclusions and recommendations for the roadways within and surrounding the project site.

Conclusions

1. Turn lanes on Thornydale Road and on Sumter Drive at the project driveways are not warranted based on Pima County turn lane warrant criteria. However, although the northbound turn lane on Thornydale Road is not warranted, the developer will construct a northbound turn lane into the project driveway to address concurrency issues related to the over-capacity concerns on Thornydale Road.
2. The westbound left turn movement and eastbound approach at Thornydale Road/Sumter may experience LOS E during the PM peak hour. It is not unusual for drivers entering major roadways like Thornydale Road to experience moderate to high delays during peak periods. The eastbound and westbound approaches on Sumter Road at Thornydale Road will likely operate with less delay during the non-peak hours. No mitigation is recommended for these movements. All other movements at the other project intersections will operate at LOS D or better through the year 2025 with the project.
3. The project will generate an estimated 1,860 daily trips with 112 AM peak hour trips and 143 PM peak hour trips. These trips will be distributed to and from the project site at two driveways, one on Thornydale Road and one on Sumter Drive.
4. The driveway spacings and corner clearances will meet Pima County minimum spacing standards.
5. The developer is providing off-site improvements for the project to address the County's transportation concurrency concerns.

Recommendations

1. Construct the project driveways to Pima County standards, with one ingress and one egress lane at both driveway access locations.
2. The northbound right turn lane on Thornydale Road at the west project driveway will be constructed to the Pima County minimum length (110 feet) with the gap and taper designed to Pima County turn lane design standards.
3. Ensure that there is acceptable sight distance to and from the project entrances.
4. Provide stop signs for traffic exiting the project driveways.
5. The developer will construct a shared-use path from an existing sidewalk along the North Ranch development to Linda Vista Boulevard along the east side of Thornydale Road. A shared use path will also be constructed by the developer along Sumter Drive. The path on Sumter Drive shall be constructed from the west side of the access location on Sumter Drive to its intersection with the shared-use path along Thornydale Road, as shown on the preliminary development plan. This off-site improvement is to be constructed to address concurrency concerns. The shared-use paths will be designed and built to Pima County standards.
6. Subdivision design should conform to current Pima County standards.
7. All new traffic signs and markings must comply with the current *Manual on Uniform Traffic Control Devices* and local requirements.

2. Proposed Development

Site Location

The project is a multi-family residential development east of Thornydale Road and north of Sumter Drive. The project is in unincorporated Pima County. The site location is shown in Exhibit 2.

Land Use and Intensity

The project includes two hundred and seventy multi-family residential units. There is also an 8,000 square foot building on the east side of the project that, in addition to being the offices for the apartments, will include 3,000 square feet of amenity-commercial space (likely a beauty salon or personal trainer).

Site Plan

The updated preliminary development plan shows seven three-story apartment buildings with thirty units in each building and three two-story buildings with twenty units in each building. There is also an 8,000 square foot building on the east side of the project that, in addition to being the offices for the apartments, will include 3,000 square feet of amenity-commercial space (likely a beauty salon or personal trainer). There are regulated riparian habitat areas that separate one of the apartment buildings and the office building from the remaining buildings.

Access Geometrics

The driveways should be constructed to Pima County standards. The project will have full access with one ingress and one egress lane at both driveways.

Development Phasing and Timing

For the purpose of this study, we have assumed a horizon buildout year of 2025 to better prepare for potential mitigation recommendations.

3. Study Area Conditions

Study Area

The study area includes Thornydale Road, Sumter Drive and Shannon Road A Category I TIS is required for this project, and the study area for a Category I TIS includes site access driveways and adjacent signalized intersections and/or major unsignalized street intersections within a quarter mile. For this project, the intersections within this area are Thornydale Road/Linda Vista Boulevard, Thornydale Road/Sumter Drive, and Shannon Road/Sumter Drive. A driveway on Thornydale Road will be located opposite the driveway to the Le Mirage Apartments and the driveway on Sumter Drive will be approximately 771 feet from Thornydale Road.

Area of Significant Traffic Impact

The significant impact from the project will be along the roadways adjacent to the project site.

Influence Area

The influence area includes the area in the vicinity of the project.

Existing Land Use

The project site is mostly vacant with one single family residential horse property, and zoned SR (Suburban Ranch). Mountain View High School is on the southwest corner of Thornydale Road/Linda Vista Boulevard. The Le Mirage Apartments are on the west side of Thornydale immediately west of the project. The Thornydale Plaza shopping center is southwest of the project. There are residential subdivisions to the north, south and west of the project site. Other major uses in the area include the Ironwood Elementary School south of the project area and The Church of Jesus Christ of Latter-Day Saints on Sumter Drive, east of Thornydale Road.

Site Accessibility

Access to the project will be via one ingress/egress driveway on Thornydale Road and one ingress/egress driveway on Sumter Drive.

Existing and Future Area Roadway System

Thornydale Road, Linda Vista Boulevard, Sumter Drive and Shannon Road will provide the primary regional access to the project site. They are all two-lane roadways, with Thornydale Road having a two-way, left turn lane along the frontage of the property. Linda Vista Boulevard, from a quarter mile west of Thornydale Road to Thornydale Road, also has a two-way, left turn lane along the frontage of Mountain View High School. It continues with the center turn lane east of Thornydale Road to Shannon Road. The Mountain Vista Ridge residential project (two-hundred single family residential lots) is near buildout on the south side of Sumter Drive, which is a two-lane undivided collector road from Thornydale Road to Shannon Road. Shannon Road also is a two-lane undivided collector road in the vicinity of the project.

The Pima Association of Governments (PAG) FY 2022-2026 Transportation Improvement Program (TIP) does not have any projects that are approved for funding in its project list.

Site Circulation

The preliminary development plan shows a roadway connecting the western area of the site to the eastern area. This road will be constructed with a bridge over the riparian area on-site.

4. Analysis of Existing Conditions

Physical Characteristics

Roadway Characteristics

Exhibit 3 is an inventory of the physical features of the project area roads. The following describes the roadway features of the study area roads.

Thornydale Road – is a nine-mile north/south paved roadway from its northern paved terminus north of Moore Road to its southern terminus at River Road. It is a two-lane arterial road with a two-way left turn lane in the vicinity of the project. It is classified as a medium volume arterial with a 150-foot right of way in the Pima County Major Streets Plan and as a Scenic, Major Route in the Pima County Scenic Routes Plan. It is also classified as an urban minor arterial on the Federal Functional Classification System map.

Near the project, Thornydale Road has a 40-mph speed limit. It has paved shoulders along the project frontage. It is classified as a minor arterial. There are some sidewalks on the east side between Pecos Drive and Linda Vista Boulevard. There are no bike routes along the frontage of the project site.

Sun Shuttle Route 412 (Thornydale/River) runs along Thornydale Road with a stop at Thornydale/Linda Vista.

Shannon Road - is a two-lane arterial road with a two-way left turn lane in the vicinity of the project. It is classified as a low volume arterial with a 90-foot right of way in the Pima County Major Streets Plan and as a Scenic, Major Route in the Pima County Scenic Routes Plan. It is also classified as an urban minor arterial on the Federal Functional Classification System map.

Its speed limit is 40 mph. There are no sidewalks, bike lanes or bus routes along the project frontage.

Linda Vista Boulevard – Linda Vista Boulevard is a two-lane east-west paved roadway. It is classified as a medium volume arterial with a 150-foot right of way in the Pima County Major Streets Plan west of Shannon Road and as a low volume arterial with a 90-foot right of way east of Shannon Road. Between Thornydale Road and Shannon Road, it is also classified as a Scenic, Major Route in the Pima County Scenic Routes Plan. It is also classified as an urban minor collector on the Federal Functional Classification System map.

West of Thornydale Road, Linda Vista Boulevard has a two-way left turn lane. East of Thornydale Road, the road continues with a two-way left turn lane to Shannon Road. It continues as a local road at Shannon Road to the east. West of Thornydale Road, the posted speed limit is 25 mph and east of Thornydale Road, the posted speed limit is 35 mph.

There are sidewalks and bike lanes along Linda Vista Boulevard within the study area.

Sumter Drive - is a two-lane east-west undivided road between Thornydale Road and Shannon Road. It is classified as an urban minor arterial on the Federal Functional Classification System map. Its speed limit is 35 mph. There are no sidewalks, bike lanes or bus routes along the project frontage. It provides local access to residential uses and a church on the north side of Sumter Drive.

Existing Intersections

This study analyses conditions at the existing intersections of Thornydale Road/Linda Vista Boulevard, Thornydale Road/Sumter Drive, and Shannon Road/Sumter Drive.

Thornydale Road/Linda Vista Boulevard is a four-leg signalized intersection. There is a lagging left turn phase for the north and south movements. Each approach has a left turn lane. The northbound, southbound, and eastbound approaches have a through lane and a right turn lane; the westbound approach has a shared through/right turn lane. There are crosswalks on each leg of the intersection.

Thornydale Road/Sumter Drive is a four-leg unsignalized intersection. Each approach has one through lane. The west leg is an entrance to the Thornydale Plaza Shopping Center. The west leg has a shared left/through/right lane. The east and north legs have a left turn lane and a shared through/right turn lane. The north and south legs turn left from the two-way left turn lane on Thornydale Road. The south leg has an exclusive right turn lane.

Shannon Road/Sumter Drive is a four-leg unsignalized intersection with stop control on both legs of Sumter Drive. The east and west legs are stop sign controlled. The west leg has a 100-foot left turn lane and a shared through/right turn lane. The two-way left turn lane on Shannon Road provides for a separate turn lane on the Shannon Road approaches.

Exhibits 4-5 are aerial photographs of the closest intersections to the project on Thornydale Road.

Exhibit 3 Roadway Inventory

Street	*Weekday Daily Volume*	*Data Year*	*Source*	*ROW Width (ft)*	*No. Thru Lanes*	*Speed Limit*	*Sidewalks*	*Bike Route*	*Daily Capacity at LOS D**
Thornydale Road									
Pecos Drive to Linda Vista	15,213	2022	FDS	100-145	2	40	Some, East Side	No	16,730
Linda Vista to Overton	19,514	2021	PAG	150	2	40	No	No	16,730
Shannon Road									
Lambert to Linda Vista	3,890	2021	PAG	100-160	2	40	No	No	12,740
Linda Vista to Overton	7,699	2021	PAG	110	2	40	No	No	12,740
Sumter Road									
Thornydale Road to Shannon Road	679	2022	PAG	45	2	35	No	No	10,660
Linda Vista Boulevard									
Camino de Oeste to Thornydale Road	10,976	2021	PAG	120-150	2	25-35	South Side by MV High Sch	Yes	13,990
Thornydale Road to Shannon Road	2,935	2021	PAG	105-135	2	35	Yes	Yes	13,990

*Generalized Annual Average Daily Volumes for Florida's Urbanized Areas, *from 2020 FDOT Quality/Level of Service Handbook Tables.*

Transit Service

Sun Shuttle Route 412 runs along Thornydale Road and Linda Vista Boulevard with a stop at the southwest corner of Thornydale/Linda Vista with ninety-minute headways. Besides this shuttle service, there is no fixed route service within the study area.

Pedestrian/Bicycle Facilities

With few exceptions, the roadways within the study area have shoulders with no sidewalks or bike lanes. There is a separated walking path along the north side of Mountain View High School on Linda Vista Boulevard. There are sidewalks along Linda Vista Boulevard between Thornydale Road and Shannon Road.

Exhibit 4 Thornydale/Linda Vista

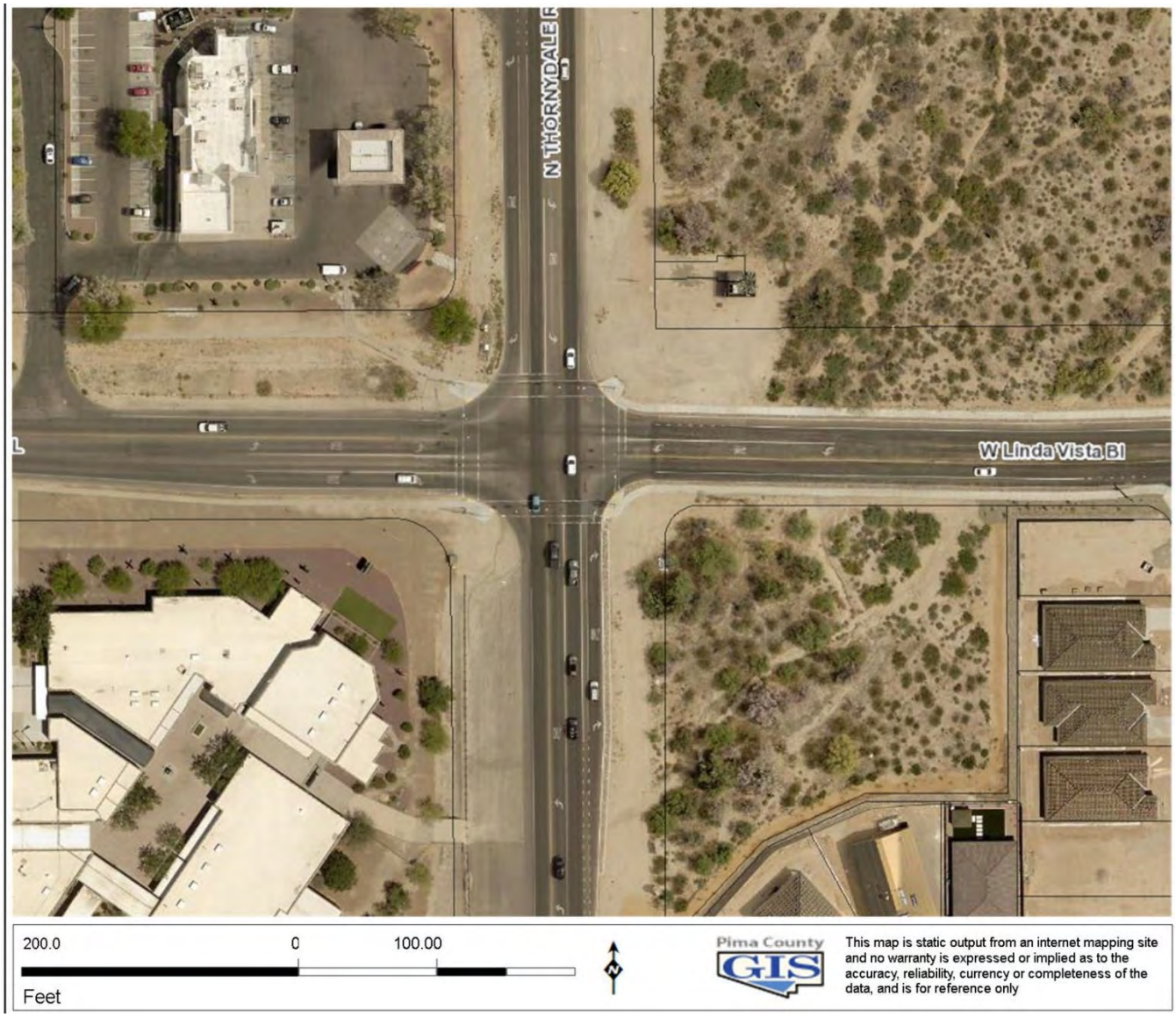
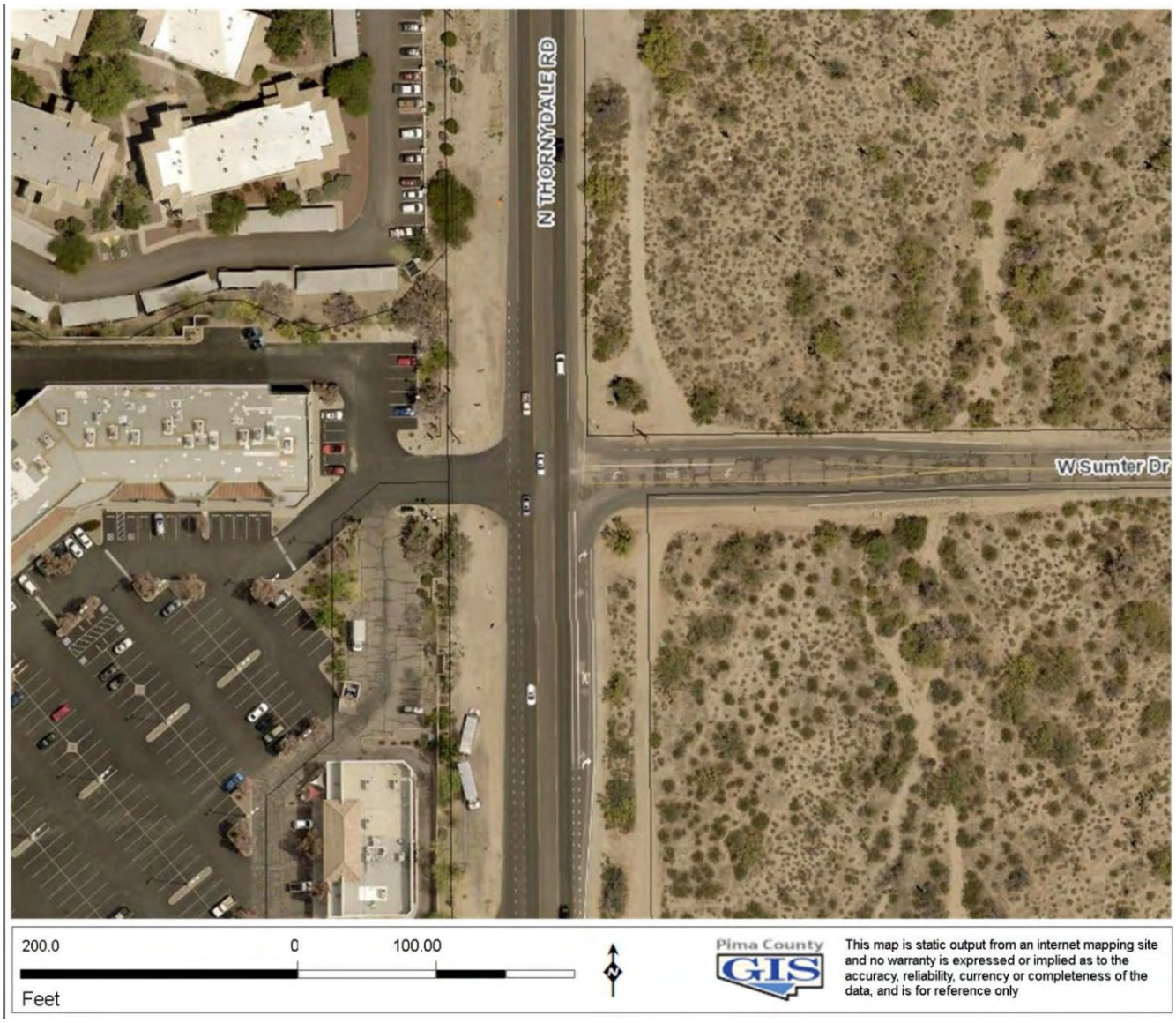


Exhibit 5 Thornydale/Sumter



Traffic Volumes

Daily traffic volumes from 2021 and 2022 for several of the roadway segments are available on Pima Association of Governments' website. A weekday count on Thornydale Road north of Sumter Drive was recorded by Field Data Services (FDS) of Arizona in March 2022.

Peak period turning movement counts were collected by FDS at Thornydale Road/Sumter Drive, Thornydale Road/Le Mirage Apartments intersection and at Shannon Road/Sumter Drive in March 2022. Year 2021 turning movement counts at Thornydale/Linda Vista are available on PAG's website. The peak hour intersection volumes are shown in Exhibit 6.

Level of Service

Level of service is a qualitative description of how well a roadway or intersection operates under prevailing traffic conditions based on traffic volumes and capacity. A grading system of A through F, like academic grades, is utilized. LOS A is free-flowing traffic, whereas LOS F is forced flow and extreme congestion. LOS D is generally accepted as the standard in urbanized areas although LOS E is sometimes accepted in more congested areas. Segment performance has been estimated using the planning methods contained in the Florida Department of Transportation (FDOT) Level of Service Handbook. Current performance of the intersections was analyzed using the Synchro analysis software.

It should also be noted that for projects in urban or suburban areas, performance is more dependent on peak hour intersection operations than daily roadway segment volumes.

Roadway Performance

Two lane roadways have a LOS D daily volume threshold of between 10,660 and 16,730 vehicles per day, depending on speed limit and the presence of turn lanes. Based on the recorded traffic volumes shown in Exhibit 3, the daily volumes on Thornydale Road north of Linda Vista approach the LOS D daily volume threshold, and the daily volumes on Thornydale Road south of Linda Vista exceed the LOS D daily threshold volumes. All other project area roadways operate below their LOS D daily volume thresholds.

Intersection Performance

The project area intersections were analyzed for both the AM and PM peak hour conditions and the results are provided in Exhibit 7. All study area intersections currently operate at acceptable levels of service (LOS D or better).

Crash History

Collision data for the project intersections and adjacent roadway segments were provided by ADOT. Recorded collision data from 2017 through 2021 are shown in a summary in Exhibit 8 and 9. Only intersections or roadway segments with three or more crashes during the five-year period are shown.

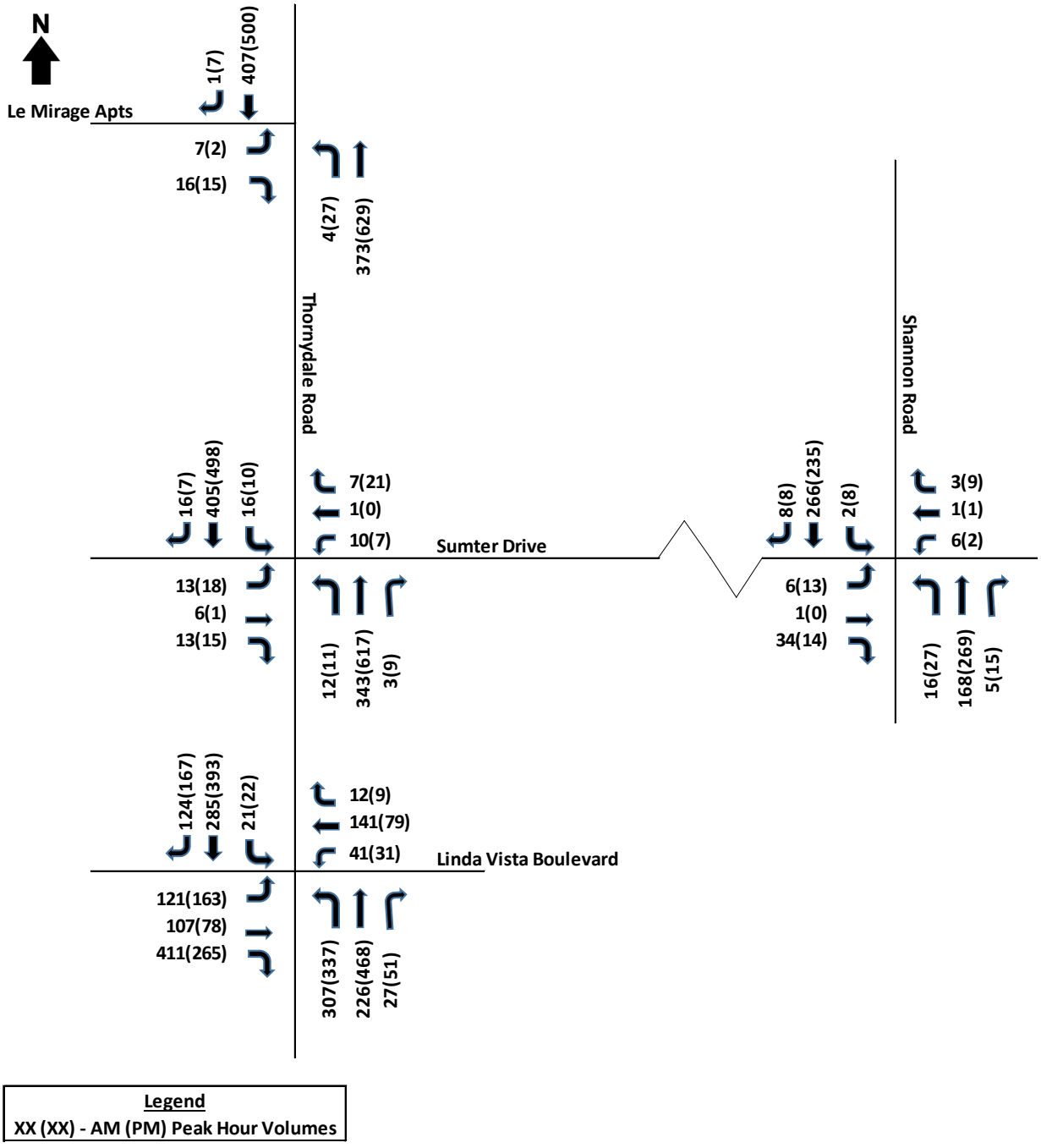
Crash rates over 1.0 crash per million entering-vehicles (MEV) for intersections, or per million vehicle-miles (MVM) for roadways usually indicate a need to review mitigating measures to reduce the rate.

All intersections and roadway segments are below the 1.0 MEV or 1.0 MVM crash rate over the five-year period.

The predominant crash types at the Thornydale/Linda Vista intersection were left turn (ten) and rear end (five. Most (fourteen) of the crashes were non-injury crashes. There were only three crashes at the Thornydale/Sumter crashes during the five-year period.

The Thornydale Road segment south of Linda Vista Road had the highest number (fifteen) of crashes during the five-year period, with the majority being rear-end crashes (ten). Thirteen of these crashes were non-injury crashes.

Exhibit 6 Existing Project Area Traffic Volumes



Legend
XX (XX) - AM (PM) Peak Hour Volumes

Exhibit 7 Current Intersection Performance

	Thornydale/Linda Vista			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	17.4	C	16.9	B
Through	12.8	B	13.2	B
Right	14.7	B	11.8	B
Approach	*14.9*	*B*	*13.7*	*B*
Westbound				
Left	14.6	B	14.3	B
Through/Right	13.8	B	13.4	B
Approach	*13.9*	*B*	*13.6*	*B*
Northbound				
Left	22.6	C	21.8	C
Through	14.6	B	14.9	B
Right	12.4	B	9.9	A
Approach	*18.9*	*B*	*17.3*	*B*
Southbound				
Left	11.4	B	15.8	B
Through/Right*	14.7	B	15.1	B
Right	12.7	B	12.1	B
Approach	*13.9*	*B*	*14.3*	*B*
Intersection	***15.7***	***B***	***15.3***	***B***

	Thornydale/Sumter			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left/Through/Right	17.2	C	29	D
Westound				
Left	21	C	32.7	D
Through/Right	11.5	B	13.3	B
Northbound				
Left	8.3	A	8.5	A
Southbound				
Left	8.1	A	8.9	A

	Shannon/Sumter			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	13.4	B	15.5	C
Through/Right	10.3	B	9.8	A
Westbound				
Left/Through/Right	12.7	B	11.3	B
Northbound				
Left	7.9	A	7.9	A
Southbound				
Left	7.6	A	7.9	A

	Thornydale/Le Mirage Apts			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left/Right	13.5	B	14.5	B
Northbound				
Left	8.2	A	8.7	A

Exhibit 8 Collision History - Intersections

Thornydale/Sumter							
Crash Type	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**	**%**
Angle	1					1	**33%**
Rear End	1					1	**33%**
Sideswipe	1					1	**33%**
Total	**3**	**0**	**0**	**0**	**0**	**3**	
Crash Rate (per MEV)	**0.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	
Severity						**Total**	**%**
Bodily Injury	1					**1**	**33%**
Property Damage	2					**2**	**67%**

Thornydale/Linda Vista							
Crash Type	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**	**%**
Angle					1	1	**5%**
Left Turn	1	3		3	3	10	**48%**
Rear End	2	3				5	**24%**
Sideswipe		2			1	3	**14%**
Other			1		1	2	**10%**
Total	**3**	**8**	**1**	**3**	**6**	**21**	
Crash Rate (per MEV)	**0.34**	**0.90**	**0.11**	**0.34**	**0.68**	**0.47**	
Severity						**Total**	**%**
Bodily Injury	1	2		1	3	**7**	**33%**
Property Damage	2	6	1	2	3	**14**	**67%**
Note: MEV = Million Entering Vehicles							

Exhibit 9 Collision History - Roadways

Thornydale Road: Linda Vista to 1/2 Mile North							
Crash Type	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**	**%**
Angle		1			1	2	**25%**
Rear End		1	1	1		3	**38%**
Sideswipe				1		1	**13%**
Other					1	1	**13%**
Rear to Rear		1				1	**13%**
Total	**0**	**3**	**1**	**2**	**2**	**8**	
Crash Rate (per MVM)	**0.00**	**1.08**	**0.36**	**0.72**	**0.72**	**0.58**	
Severity						**Total**	**%**
Bodily Injury		3	1	2	1	**7**	**88%**
Property Damage					1	**1**	**13%**

Thornydale Road: Linda Vista to 1/2 Mile South

Crash Type	2017	2018	2019	2020	2021	Total	%
Angle				1		1	**7%**
Left Turn				1	1	2	**13%**
Rear End	2	3	2		3	10	**67%**
Head On	1					1	**7%**
Sideswipe					1	1	**7%**
Rear to Rear						0	**0%**
Total	**3**	**3**	**2**	**2**	**5**	**15**	
Crash Rate (per MVM)	**0.84**	**0.84**	**0.56**	**0.56**	**1.40**	**0.84**	
Severity						**Total**	**%**
Bodily Injury		1	1			**2**	**13%**
Property Damage	3	2	1	2	5	**13**	**87%**
Note: MVM = Million Vehicle Miles							

5. Projected Traffic

Site Traffic Forecasting

The future traffic from the project is estimated using the trip rates contained in the Institute of Traffic Engineers' *Trip Generation Manual, 11th Edition* for the various land uses. Trip generation is the mathematical product of land use intensity (building square footage, number of units, etc.) and the trip generation rate. The result is the total number of one-way trips expected to be generated by the project. These trips represent the number of vehicles estimated to enter and leave the project site.

Trip Generation

Exhibit 10 provides the ITE average trip rates and trip generation for the proposed uses during the average weekday. The exhibit shows the number of trips generated by the project for the three-time periods (weekday, weekday AM peak hour, and weekday PM peak hour) at build out of the project. The lane use "Hair Salon" does not have rates for the average weekday. We assumed that the "personal trainer space" would have a similar trip generation rate as the hair salon as trips to personal trainer services will likely require reservations similar to hair salons. We estimated the daily trips for this lane use by multiplying the average peak hour trips (4 trips) by ten.[1]

Exhibit 10 Trip Generation

				Trip Generation Average Rates					
				Weekday AM		Weekday PM		Avg Weekday	
Land Use	*Unit*	*No. Units*	*ITE Categ.*	*In*	*Out*	*In*	*Out*	*In*	*Out*
Multi Family Detached Unit	Units	270	220	0.4		0.51		6.74	
Low Rise				24%	76%	63%	37%	50%	50%
Hair Salon	Units	3	918	1.21		1.45		No Weekday Rates	
				50%	50%	17%	83%		

				Trip Generation					
				Weekday AM		Weekday PM		Avg Weekday	
Land Use	*Unit*	*No. Units*	*ITE Categ.*	*In*	*Out*	*In*	*Out*	*In*	*Out*
Multi Family Detached Unit	1000 SF	270	220	108		138		1,820	
Low Rise				26	82	87	51	910	910
Hair Salon	1000 SF	3	918	4		4		40	
				2	2	1	4	20	20
Total Trip Generation				112		143		1,860	
				28	84	88	55	930	930

Note: AM, PM Rates based on Peak Hour of Adjacent Street Traffic (7-9 AM; 4-6 PM)
There are no weekday rates for the lane use "Hair Salon" in the ITE Trip Generation Manual. We estimated that the number of weekday trips by multiplying the peak hour trips by 10.

[1] The most recent Pima County review of the previous updated TIS requested that we apply the most conservative land use listed in the specific plan document for the 3,000 square foot space in the 8,000 square foot building. Of those land uses listed, only "hair salon" and "small office building" are provided in the ITE Trip Generation Manual. The estimated trip generation for a 3,000 square foot "small office building" results in an estimated 5 AM peak hour trips, 6 PM peak hour trips and 43 weekday trips. The difference in trips between the two land uses is inconsequential, and the developer is expecting the land use to be more like a personal trainer/hair salon. Therefore we did not revise the report and the impact of the changes in trips would be trivial.

Pass-By Trips

No pass-by trips were assumed for the trip generation.

Trip Distribution and Assignment

Trips generated by this project have been distributed to the surrounding roadway network and the project intersections as shown in Exhibit 11.

Trips were distributed 60% toward Thornydale Road and 40% to Shannon. These trips were then distributed 60% to the south and 40% to the north.

Non-Site Traffic Forecasting

Background traffic volumes were estimated for the project area intersections and roadways. We assumed a 2% per year growth rate for existing volumes at the project area intersection based on historical traffic data available on Pima County's and Pima Association of Governments' websites.

The background, or "No Project," volumes for the year 2025 are shown in Exhibit 12.

Total Traffic

The total traffic volumes are the site traffic volumes added to the projected traffic volumes for the year 2025. The total traffic volumes are shown in Exhibit 13.

Exhibit 11 Site Trips

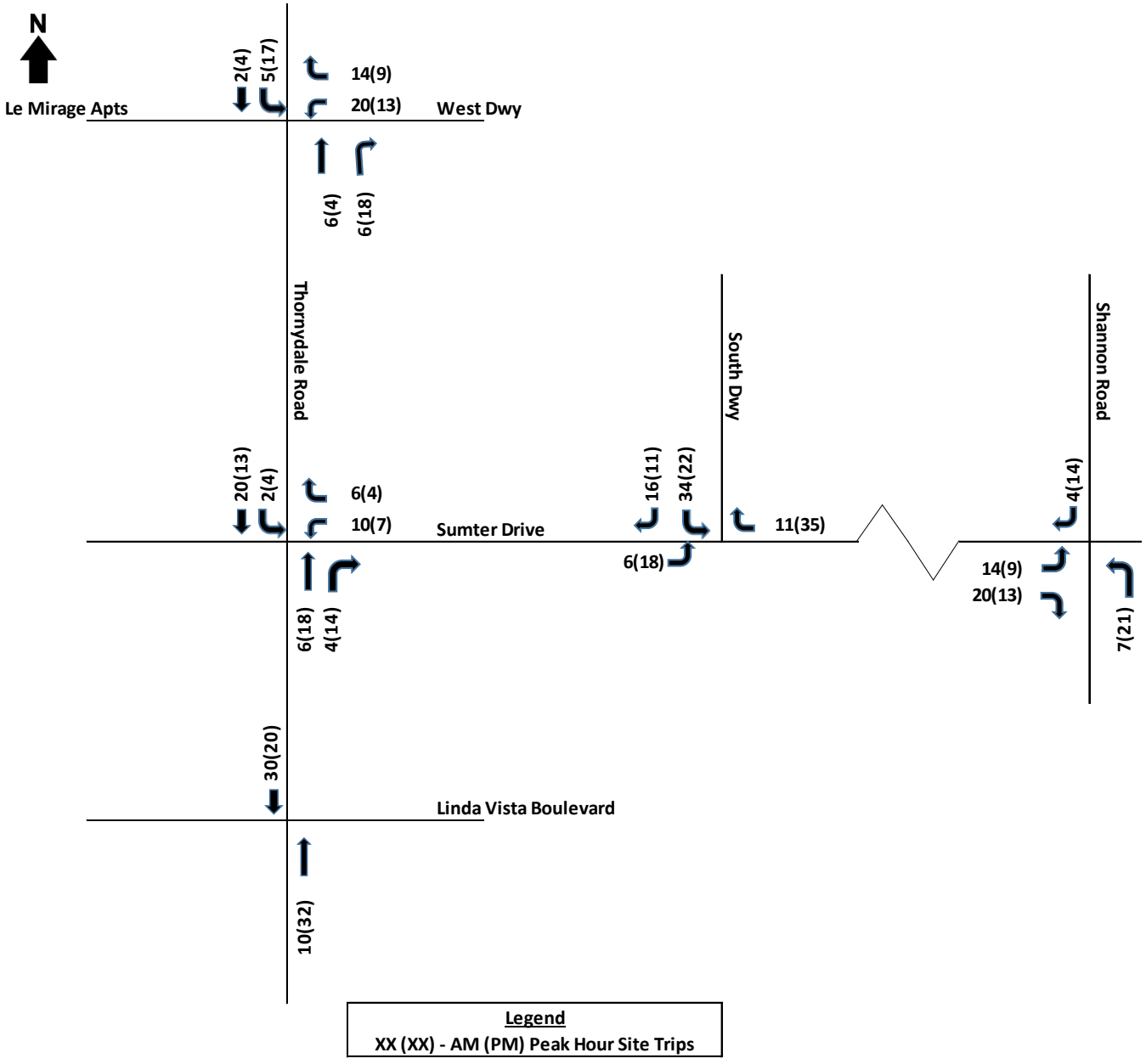
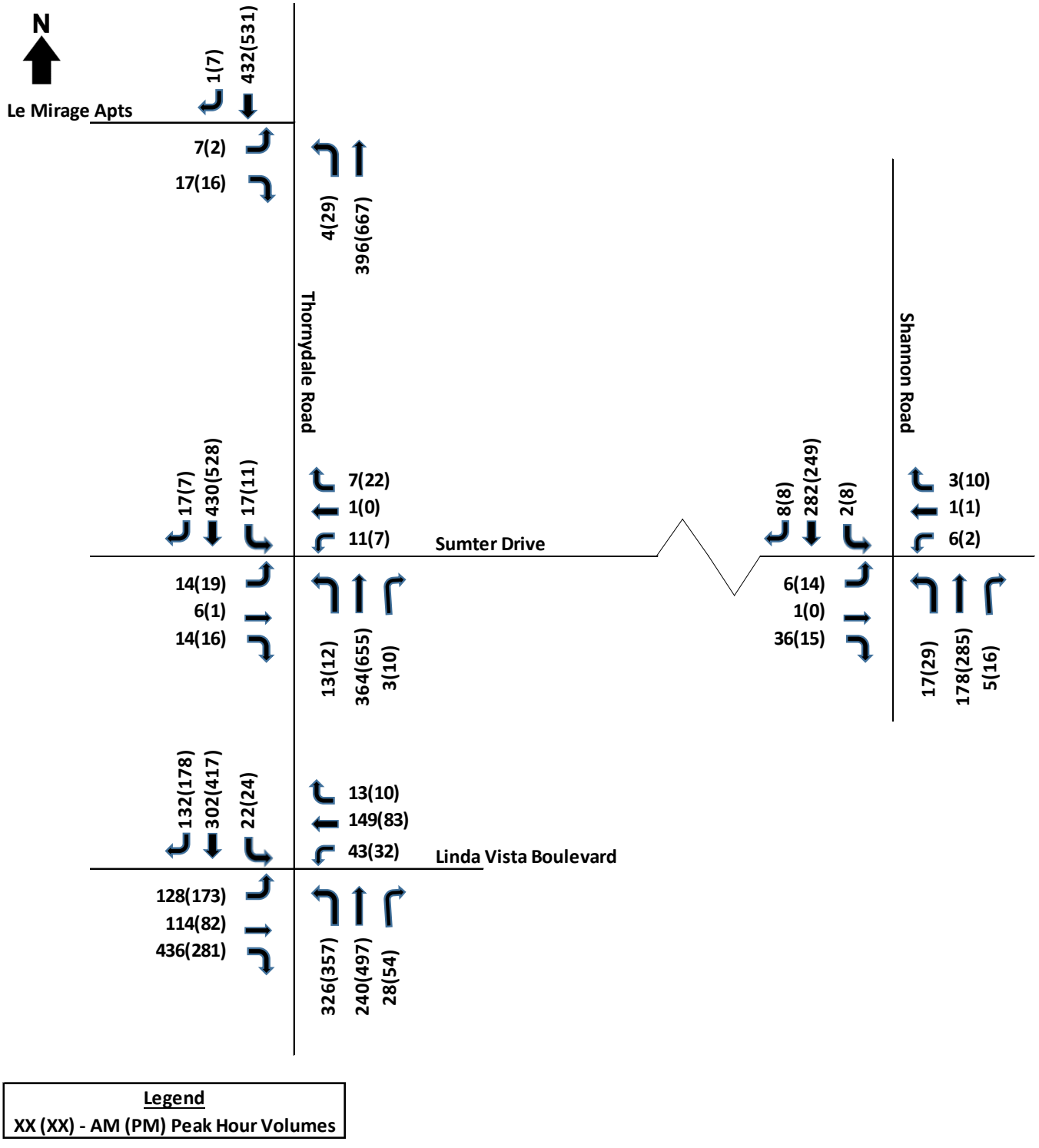
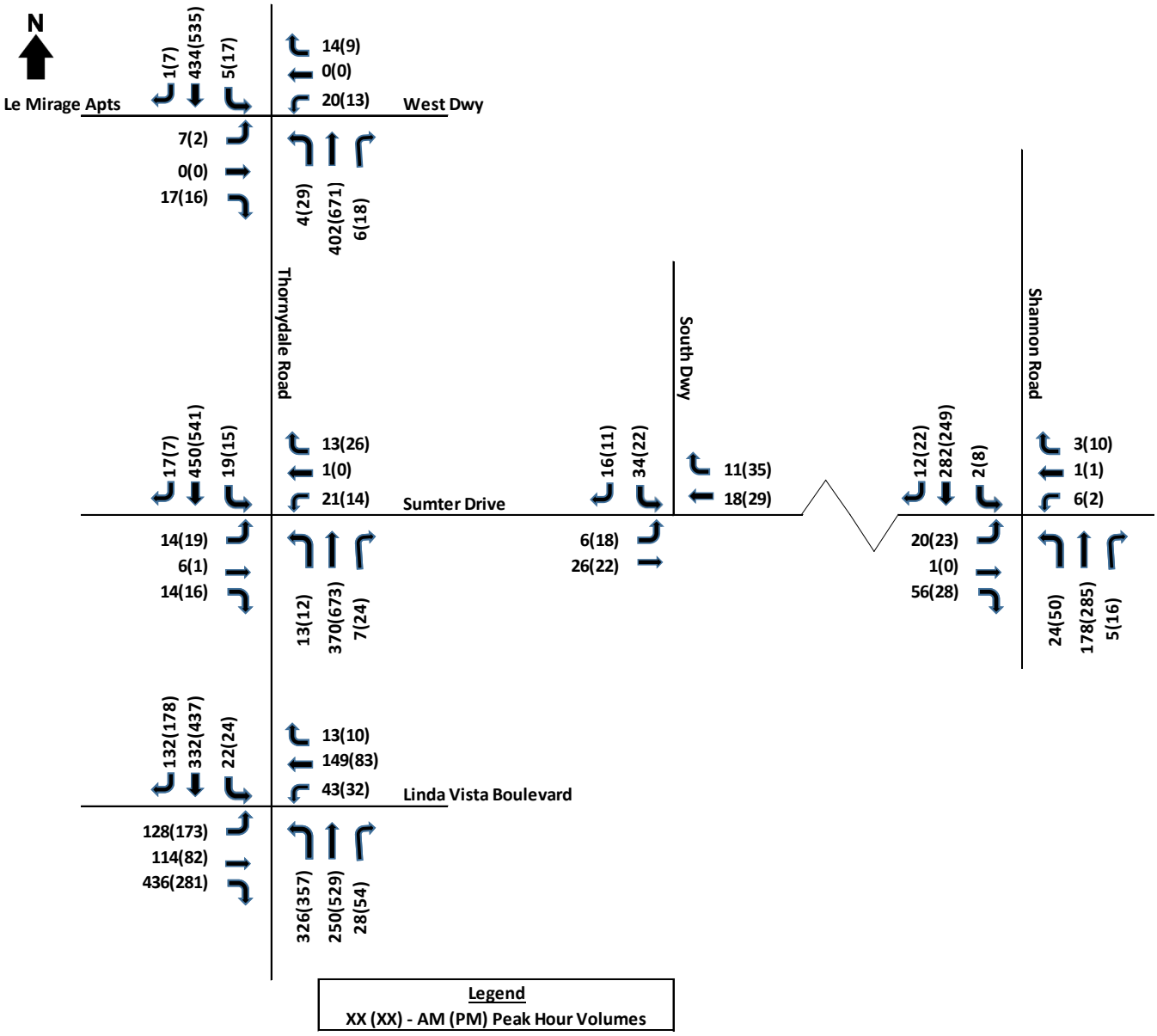


Exhibit 12 Peak Hour Background Traffic at 2025



Legend
XX (XX) - AM (PM) Peak Hour Volumes

Exhibit 13 Total Peak Hour Traffic at 2025



6. Traffic and Improvement Analysis

Site Access

The driveways should be constructed to Pima County standards. It is recommended that both driveways provide one entering lane and one exit lane. Both driveways should be controlled by a stop sign.

Level of Service Analysis

By the year 2025, the operational impacts of the project at the project intersections are projected to be minor. Roadway daily volumes and intersection levels of service are provided for the future years in this section.

Roadway Performance

The regional growth estimate of 2% per year was applied to the existing roadway segment volumes along with the estimated site traffic to analyze future segment performance at 2025 using the FDOT generalized tables. The future daily volumes are shown in Exhibit 14.

As a two-lane roadway, Thornydale road south of Linda Vista Road will continue to be over its LOS D capacity based on its daily volumes without and with the project. The addition of weekday site trips on Thornydale Road between Pecos Drive to Linda Vista will increase daily traffic volumes to just above the LOS D threshold. All other segments will operate at LOS D or better based on daily volumes even with the project.

Exhibit 14 Future Roadway Performance at 2025

Street	*Daily Capacity at LOS D**	*2025 ADT No Project*	*Site Trips*	*2025 ADT With Project*	*Over LOS D Capacity (No Project)*	*Over LOS D Capacity (With Project)*
Thornydale Road						
Pecos Drive to Linda Vista	16,730	16,140	670	16,810	No	Yes
Linda Vista to Overton	16,730	21,120	670	21,790	Yes	Yes
Shannon Road						
Lambert to Linda Vista	12,740	4,210	446	4,656	No	No
Linda Vista to Overton	12,740	8,330	446	8,776	No	No
Sumter Road						
Thornydale Road to Shannon Road	10,660	720	1,302	2,022	No	No
Linda Vista Boulevard						
Camino de Oeste to Thornydale Road	13,990	11,880	0	11,880	No	No
Thornydale Road to Shannon Road	13,990	3,180	0	3,180	No	No

*Generalized Annual Average Daily Volumes for Florida's Urbanized Areas, *from 2020 FDOT Quality/Level of Service Handbook Tables.*

Intersection Performance

The project intersections were analyzed without and with the project site trips for the year 2025. Results for the "with project" and "without project" scenarios are shown in Exhibits 15 and 16.

Without the project in 2025, the westbound left turn lane movement at the Sumter/Thornydale intersection will operate at LOS E during the PM peak hour and will continue to do so with the project trips added.

The westbound left and the eastbound approach at the Thornydale access is projected to operate at LOS E.

It is not unusual for drivers entering major roadways like Thornydale Road to experience moderate to high delays during peak periods. The eastbound and westbound approaches on Sumter Road at Thornydale Road will likely operate with less delay during the non-peak hours. No mitigation is recommended for these movements.

All movements at the other study area intersections will operate at LOS D or better through the year 2025.

Exhibit 15 Peak Hour LOS Results – No Project, Year 2025

	Thornydale/Linda Vista			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	18.6	B	17.9	B
Through	13.3	B	13.7	B
Right	15.4	B	12	B
Approach	*15.7*	*B*	*14.1*	*B*
Westbound				
Left	15.3	B	14.9	B
Through/Right	14.4	B	13.9	B
Approach	*14.6*	*B*	*14.2*	*B*
Northbound				
Left	27.4	C	27	C
Through	15.7	B	17.4	B
Right	13.1	B	10.5	B
Approach	*22*	*C*	*20.8*	*C*
Southbound				
Left	12	B	17.2	B
Through/Right*	16.3	B	17.3	B
Right	13.6	B	13	B
Approach	*15.3*	*B*	*16*	*B*
Intersection	***17.3***	***B***	***17.4***	***B***

	Thornydale/Sumter			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left/Through/Right	18.3	C	33.8	D
Westound				
Left	22.9	C	37.1	E
Through/Right	11.8	B	13.8	B
Northbound				
Left	8.4	A	8.6	A
Southbound				
Left	8.2	A	9.1	A

	Shannon/Sumter			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	13.9	B	16.3	C
Through/Right	10.5	B	10	B
Westbound				
Left/Through/Right	13.1	B	11.5	B
Northbound				
Left	8	A	7.9	A
Southbound				
Left	7.7	A	7.9	A

	Thornydale/Le Mirage Apts			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left/Right	14	B	15.2	C
Northbound				
Left	8.3	A	8.8	A

Exhibit 16 Peak Hour LOS Results – With Project, Year 2025

	Thornydale/Linda Vista			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	19.6	B	18.4	B
Through	14.1	B	14	B
Right	15.3	B	12.1	B
Approach	*15.9*	*B*	*14.4*	*B*
Westbound				
Left	16.2	B	15.3	B
Through/Right	15.2	B	14.3	B
Approach	*15.4*	*B*	*14.5*	*B*
Northbound				
Left	29.7	C	29.8	C
Through	16.7	B	19.5	B
Right	13.8	B	10.5	A
Approach	*23.6*	*C*	*22.9*	*C*
Southbound				
Left	12.2	B	18.2	B
Through/Right*	19	B	18.2	B
Right	14	B	13	B
Approach	*17.3*	*B*	*16.7*	*B*
Intersection	***18.5***	***B***	***18.6***	***B***

	Thornydale/Sumter			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left/Through/Right	19.3	C	37.9	E
Westound				
Left	25.9	D	43.2	E
Through/Right	11.6	B	14.2	B
Northbound				
Left	8.5	A	8.7	A
Southbound				
Left	8.2	A	9.2	A

	Shannon/Sumter			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	14.7	B	18	C
Through/Right	10.7	B	10.1	B
Westbound				
Left/Through/Right	13.8	B	11.8	B
Northbound				
Left	8	A	8	A
Southbound				
Left	7.7	A	7.9	A

	Thornydale/Le Mirage Apts/West Dwy			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left/Through/Right	14.4	B	15.8	C
Westbound				
Left/Through/Right	18	C	33.1	D
Northbound				
Left	8.3	A	8.8	A
Southbound				
Left	8.2	A	9.2	A

	Sumter/South Dwy			
	AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	7.3	A	7.4	A
Southbound				
Left/Right	8.9	A	9.1	A

Turn Lane Warrants

We applied turn lane warrants from the *Pima County Subdivision and Development Street Standards*. They are based on the daily volume of the street where a potential turn lane may be and the peak hour turning volumes. The warrants for turn lanes also consider the posted speed limit on the street from which the turn would originate.

The Pima County left turn lane warrant criteria and right turn lane warrant criteria are shown in Exhibits 17 and 18.

Based on the volumes shown in the exhibits, neither an eastbound left turn on Sumter Drive nor a northbound right turn lane will be warranted on Sumter Drive or on Thornydale Road at the project driveways. However, although the northbound turn lane on Thornydale Road is not warranted, the developer will construct a northbound turn lane into the project driveway to address concurrency issues related to the over-capacity concerns on Thornydale Road. For this right turn lane, it be constructed to the Pima County minimum length (110 feet) with the gap and taper designed to Pima County turn lane design standards.

Exhibit 17 Pima County Left Turn Warrants

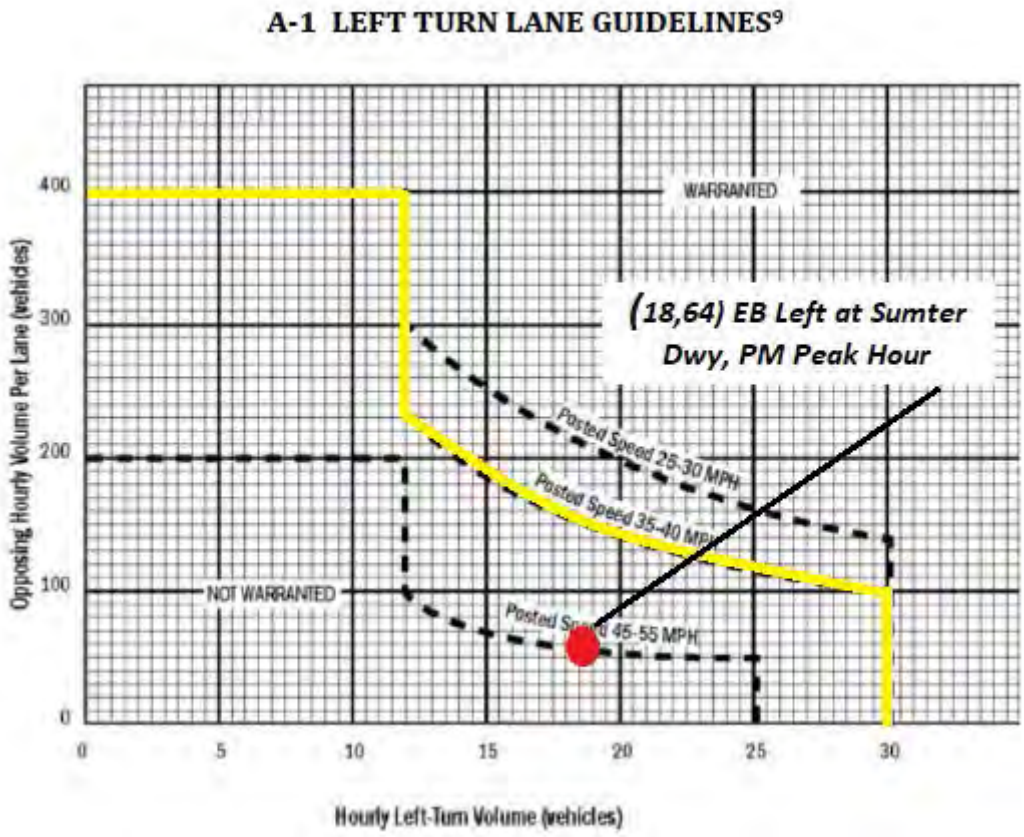
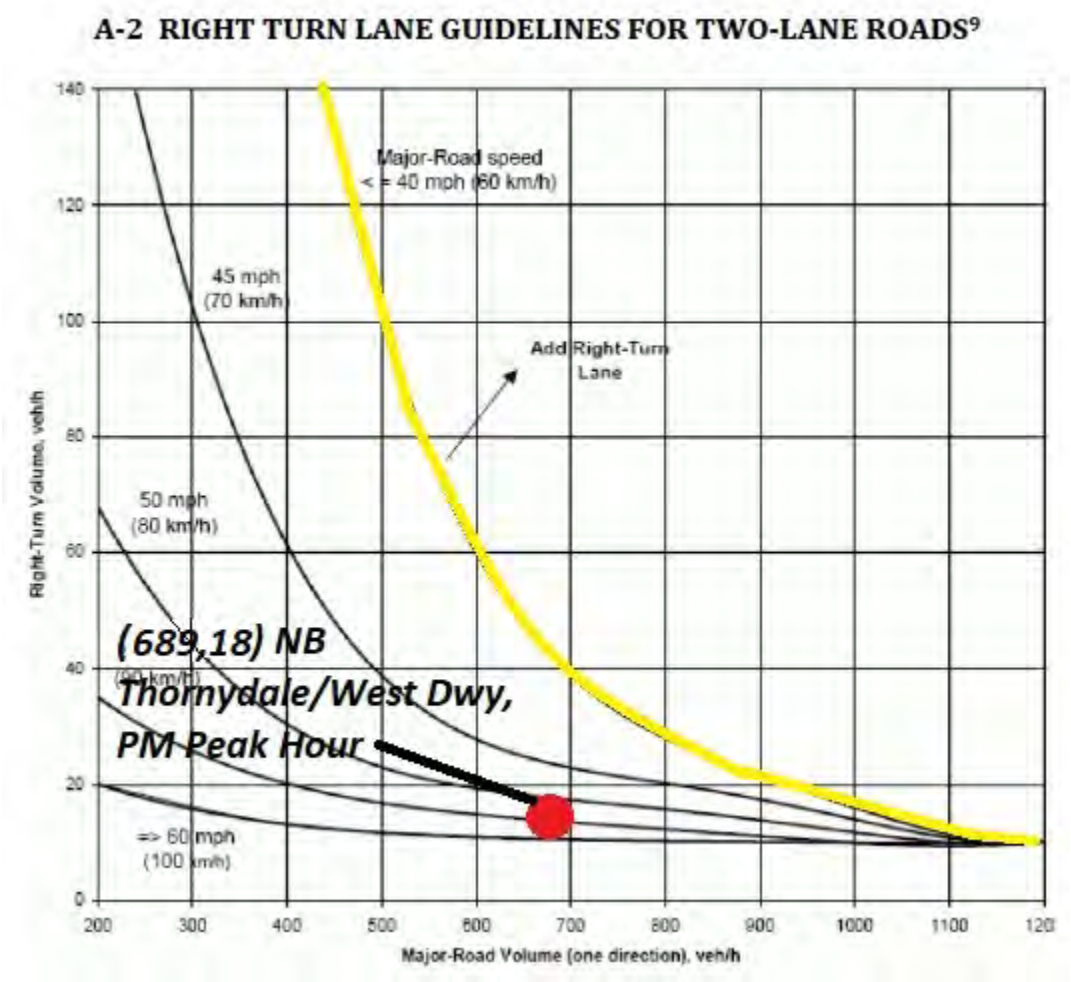


Exhibit 18 Pima County Right Turn Warrants on Two-Lane Roads



Turn Lane Storage Lengths

The Synchro intersection analysis results include projected queue lengths (95th percentile) based on the projected traffic volumes at the intersections. The calculated queue lengths for existing turn lanes and the warranted turn lanes for the 2025 With Project condition are shown in Exhibit 19. The existing storage lengths will serve the projected traffic queues through the year 2025.

Exhibit 19 Turn Lane Storage Length Recommendations

Existing Turn Lanes

		95th Percentile Queue Length (ft)		
Intersection	**Lane**	**AM Peak Hour**	**PM Peak Hour**	**Existing Storage Length (ft.)**
Thornydale/Linda Vista	EB Left	89	112	150
	EB Right	142	79	150
	WB Left	32	27	125
	NB Left	145	174	280
	NB Right	0	6	150
	SB Left	11	13	125
	SB Right	18	37	325
Thornydale/Sumter	WB Left	<25	<25	110
	NB Left	<25	<25	TWLTL
	NB Right	<25	<25	180
	SB Left	<25	<25	TWLTL
Shannon/Sumter	EB Left	<25	<25	100
	NB Left	<25	<25	TWLTL
	SB Left	<25	<25	TWLTL

Sight Distance

The project driveways and intersections should be designed to allow for acceptable sight distance. Sight distance is typically shown on the development plan and improvement drawings. The guidelines for sight distance are provided in Pima County's Roadway Design Manual.

Adequacy of Location and Design of Driveway Access

The preliminary development plan shows that the corner clearances and driveway spacings for the driveways on Thornydale Road and on Sumter Drive will meet the County minimum standards. The spacing for the driveway on Sumter Drive is more than 150 feet (minimum spacing for the 35 mph roads) and the driveway spacing on Thornydale Road is more than 230 feet.

The development will have gated access. Pima County includes guidance on the placement of gates at the entrances to residential developments in their *Subdivision and Development Street Standards*:

> "Gated entrances shall be allowed for commercial/industrial developments such as apartments where on-site parking areas are privately maintained and for residential subdivisions with private streets. Gated entries shall meet the following requirements:
>
> - Stopping locations (keypads, card-readers, guard shacks, etc.) shall be set back from the right-of-way of the cross street to avoid interfering with through traffic and to provide protection for entering vehicles.
> - The gate may not encroach into the travel lane when open.

- Each side of a median-divided roadway/driveway shall be at least 16 feet wide to provide accessibility of emergency vehicles.
- Any equipment or obstructions such as keypads or card-readers shall be installed in a median island.
- The design of the entrance shall allow vehicles that do not go past the gate to turn around without interfering with other traffic.
- The turnaround area shall be located within the development boundary outside of the collector or arterial right-of-way.

Gate Queuing Analysis

Using a basic Poisson distribution methodology, it is possible to estimate the average queue at a gate. The entering volume of 53 entering volumes per hour at the Sumter Road driveway was applied to this analysis. Based on the number of entering vehicles, it is likely that the entry will remain open during the highest peak and allow two to three vehicles in per entry "call." This would allow the second (or third) vehicle to enter without activating the gate. Given this assumption, the entering volume applied in this analysis is 27 vehicles (half of the projected entering vehicles). We also assume that it takes an average of 30 seconds for a driver to activate the gate and to enter. The following queue equation is applied:

$$E(n) = \rho/(1-\rho) = \lambda/(\mu - \lambda),$$

Where:

λ = arrival rate, in this case 27 vehicles/hour, or 0.45/minute,
μ = service rate, in this case 30 seconds per vehicle/hour, or 2 vehicles/minute,
$\rho = \lambda/\mu = 0.23$. This is the traffic intensity, or utilization factor.

This equation estimates the average number of queued vehicles plus the vehicle entering the gate.

The average number of vehicles in the queue is then:

$0.23/(1-0.23) = 0.30$ vehicle on average at the gate.

The probability that there will be three vehicles at the gate is:

$P(3) = \rho^3 \text{ X } P(0)$, where P(0) is the probability of no queue, and $P(0) = 1-\rho = 0.77$,

$= 0.23^3 \text{ X } 0.77 = 0.01$, or a 1% probability of a queue of 3 vehicles.

The probability of four or more vehicles queued decreases rapidly, so it can be estimated that there is a 99% probability that entering vehicles will not back up to the street if storage for at least four vehicles is provided between the gate and the street. For this reason, it is recommended that there be enough space for three to four vehicles to queue before the gate keypad. Because there are fewer vehicles entering at the Thornydale entrance, this analysis would apply to that location also.

Alternative Modes Considerations

The internal streets will contain sidewalks, accommodating pedestrian needs.

The developer is providing off-site improvements for the project to address the County's transportation concurrency concerns. The developer has agreed to provide a separated shared-use path on the east side of Thornydale Road that will begin at the existing sidewalk along the frontage of the North Ranch development and continue to Linda Vista Boulevard. A shared use path will also be constructed by the developer along Sumter Drive. The path on Sumter Drive shall be constructed from the west side of the access location on Sumter Drive to its intersection with the shared-use path along Thornydale Road, as shown on the preliminary development plan.

Traffic Control Needs

Stop signs are recommended for traffic control at the project driveways at their entrances to Thornydale Road and Sumter Drive. Sign construction and placement should comply with the MUTCD and local policies.

Traffic Signal Warrants

Traffic volumes at the project driveways are not expected to warrant traffic signals.

7. Conclusions and Recommendations

Conclusions

1. Turn lanes on Thornydale Road and on Sumter Drive at the project driveways are not warranted based on Pima County turn lane warrant criteria. However, although the northbound turn lane on Thornydale Road is not warranted, the developer will construct a northbound turn lane into the project driveway to address concurrency issues related to the over-capacity concerns on Thornydale Road.
2. The westbound left turn movement and eastbound approach at Thornydale Road/Sumter may experience LOS E during the PM peak hour. It is not unusual for drivers entering major roadways like Thornydale Road to experience moderate to high delays during peak periods. The eastbound and westbound approaches on Sumter Road at Thornydale Road will likely operate with less delay during the non-peak hours. No mitigation is recommended for these movements. All other movements at the other project intersections will operate at LOS D or better through the year 2025 with the project.
3. The project will generate an estimated 1,860 daily trips with 112 AM peak hour trips and 143 PM peak hour trips. These trips will be distributed to and from the project site at two driveways, one on Thornydale Road and one on Sumter Drive.
4. The driveway spacings and corner clearances will meet Pima County minimum spacing standards.
5. The developer is providing off-site improvements for the project to address the County's transportation concurrency concerns.

Recommendations

1. Construct the project driveways to Pima County standards, with one ingress and one egress lane at both driveway access locations.
2. The northbound right turn lane on Thornydale Road at the west project driveway will be constructed to the Pima County minimum length (110 feet) with the gap and taper designed to Pima County turn lane design standards.
3. Ensure that there is acceptable sight distance to and from the project entrances.
4. Provide stop signs for traffic exiting the project driveways.
5. The developer will construct a shared-use path from an existing sidewalk along the North Ranch development to Linda Vista Boulevard along the east side of Thornydale Road. A shared use path will also be constructed by the developer along Sumter Drive. The path on Sumter Drive shall be constructed from the west side of the access location on Sumter Drive to its intersection with the shared-use path along Thornydale Road, as shown on the preliminary development plan. This off-site improvement is to be constructed to address concurrency concerns. The shared-use paths will be designed and built to Pima County standards.
6. Subdivision design should conform to current Pima County standards.
7. All new traffic signs and markings must comply with the current *Manual on Uniform Traffic Control Devices* and local requirements.

Appendix

- Preliminary Development Plan
- Traffic Counts
- Capacity Analysis Worksheets

SPECIFIC PLAN PDP

EXISTING COMPREHENSIVE PLAN USE:	LIU 0.3	TOTAL SITE AREA:	806,348.7 S.F. (18.51 AC)	COMMERCIAL FLOOR AREA:	+/- 3,000 S.F.
EXISTING ZONING:	SUBURBAN RANCH - SR	ROW DEDICATION:	27,157.9 S.F. (0.62 AC)	TOTAL DWELLING UNITS:	270 UNITS
		PROJECT AREA:	779,191 S.F. (17.88 AC)	RESIDENTIAL DENSITY:	15.1 RAC
PROPOSED COMPREHENSIVE PLAN USE:	PDC			PARKING PROVIDED:	438 SPACES
PROPOSED ZONING:	SPECIFIC PLAN - SP	NATURAL UNDISTURBED OPEN SPACE:	282,268.8 S.F. (6.48 AC)		
		FUNCTIONAL OPEN SPACE:	210,394.8 S.F. (4.83 AC)		

AT THE TIME OF DEVELOPMENT, THE PROJECT WILL SUBMIT A DETENTION WAIVER TO PCRFCD BASED ON THE CURRENT PROPOSAL

- FUNCTIONAL OPEN SPACE
- NATURAL UNDISTURBED OPEN SPACE
- COVERED PARKING
- IRA
- BUILDING

THORNYDALE AND SUMTER - SITE PLAN

DATE: 05.08.23 JOB#23000

a.23 studios

Project: **Thornydale/Linda Vista**

Date: **Thursday, September 23, 2021**

Count | 0:15

Count Starts at

	7:00 AM	NB Thornydale			SB Thornydale			EB Linda Vista			WB Linda Vista									
	END	Left			Left		Right	Left		Right	Left		Right	TOTALS					END	
	Time	Turn	THRU	Right	Turn	THRU	Turn	Turn	THRU	Turn	Turn	THRU	Turn	NB	SB	EB	WB	Total	Time	
	7:15 AM	58	69	8	6	86	36	44	23	76	17	25	3	135	128	143	45	451	7:15 AM	
	7:30 AM	37	65	4	12	110	30	42	26	82	12	32	5	106	152	150	49	457	7:30 AM	
	7:45 AM	57	102	6	10	122	33	58	36	102	11	47	9	165	165	196	67	593	7:45 AM	
	8:00 AM	93	99	7	5	118	43	55	21	89	5	39	6	199	166	165	50	580	8:00 AM	
	8:15 AM	91	92	9	9	123	86	46	21	126	9	28	3	192	218	193	40	643	8:15 AM	
	8:30 AM	60	88	4	8	80	31	45	27	86	15	24	3	152	119	158	42	471	8:30 AM	
	8:45 AM	35	84	5	9	118	13	35	12	59	10	19	6	124	140	106	35	405	8:45 AM	
	9:00 AM	39	84	9	5	108	26	37	12	40	4	15	2	132	139	89	21	381	9:00 AM	
7:00 AM	8:00 AM	245	335	25	33	436	142	199	106	349	45	143	23	605	611	654	211	2081	7:00 AM	8:00 AM
7:15 AM	8:15 AM	278	358	26	36	473	192	201	104	399	37	146	23	662	701	704	206	2273	7:15 AM	8:15 AM
7:30 AM	8:30 AM	301	381	26	32	443	193	204	105	403	40	138	21	708	668	712	199	2287	7:30 AM	8:30 AM
7:45 AM	8:45 AM	279	363	25	31	439	173	181	81	360	39	110	18	667	643	622	167	2099	7:45 AM	8:45 AM
8:00 AM	9:00 AM	225	348	27	31	429	156	163	72	311	38	86	14	600	616	546	138	1900	8:00 AM	9:00 AM
7:00 AM	9:00 AM	470	683	52	64	865	298	362	178	660	83	229	37	1205	1227	1200	349	3981	7:00 AM	9:00 AM
														0.89	0.77	0.91	0.74			
2022		307	389	27	33	452	197	208	107	411	41	141	21							
Adjusted 2022		307	226	27	21	285	124	121	107	411	41	141	12							
2025 NP		326	240	28	22	302	132	128	114	436	43	149	13							
Site Trips			10			30														
2025 WP		326	250	28	22	332	132	128	114	436	43	149	13							

Count Starts at

	4:00 PM	NB Thornydale			SB Thornydale			EB Linda Vista			WB Linda Vista									
	END	Left			Left		Right	Left		Right	Left		Right	TOTALS					END	
	Time	Turn	THRU	Right	Turn	THRU	Turn	Turn	THRU	Turn	Turn	THRU	Turn	NB	SB	EB	WB	Total	Time	
	4:15 PM	69	100	10	5	115	28	37	15	64	5	17	5	179	148	116	27	470	4:15 PM	
	4:30 PM	80	132	14	4	123	37	42	9	51	4	25	4	226	164	102	33	525	4:30 PM	
	4:45 PM	88	102	14	5	97	38	47	16	42	6	18	3	204	140	105	27	476	4:45 PM	
	5:00 PM	68	107	7	4	91	37	30	17	48	9	14	5	182	132	95	28	437	5:00 PM	
	5:15 PM	76	111	11	7	90	43	30	17	60	8	15	2	198	140	107	25	470	5:15 PM	
	5:30 PM	83	114	9	5	110	40	42	18	71	6	20	2	206	155	131	28	520	5:30 PM	
	5:45 PM	101	110	12	5	104	37	45	16	79	5	26	3	223	146	140	34	543	5:45 PM	
	6:00 PM	70	124	18	5	81	44	43	25	50	11	16	2	212	130	118	29	489	6:00 PM	
4:00 PM	5:00 PM	305	441	45	18	426	140	156	57	205	24	74	17	791	584	418	115	1908	4:00 PM	5:00 PM
4:15 PM	5:15 PM	312	452	46	20	401	155	149	59	201	27	72	14	810	576	409	113	1908	4:15 PM	5:15 PM
4:30 PM	5:30 PM	315	434	41	21	388	158	149	68	221	29	67	12	790	567	438	108	1903	4:30 PM	5:30 PM
4:45 PM	5:45 PM	328	442	39	21	395	157	147	68	258	28	75	12	809	573	473	115	1970	4:45 PM	5:45 PM
5:00 PM	6:00 PM	330	459	50	22	385	164	160	76	260	30	77	9	839	571	496	116	2022	5:00 PM	6:00 PM
4:00 PM	6:00 PM	635	900	95	40	811	304	316	133	465	54	151	26	1630	1155	914	231	3930	4:00 PM	6:00 PM
														0.94	0.92	0.89	0.85			
2022		337	468	51	22	393	167	163	78	265	31	79	9							
2025 NP		357	497	54	24	417	178	173	82	281	32	83	10							
Site Trips			32			20														
2025 WP		357	529	54	24	437	178	173	82	281	32	83	10							

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Thornydale Rd	DATE:	03/24/22	LOCATION:	Tucson
E-W STREET:	Sumter Dr	DAY:	THURSDAY	PROJECT#	22-1178-001

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	1	0	1	0	0	1	0	1	1	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	0	54	1	4	54	2	3	2	2	0	1	1	124
7:15 AM	3	77	1	5	84	2	3	1	2	4	0	2	184
7:30 AM	3	101	0	6	100	0	2	0	0	4	0	3	219
7:45 AM	3	94	1	4	86	1	4	1	3	4	0	3	204
8:00 AM	6	79	1	7	100	2	3	1	4	4	1	2	210
8:15 AM	1	78	0	2	110	4	4	1	4	1	0	1	206
8:30 AM	2	92	1	3	109	9	2	3	2	1	0	1	225
8:45 AM	1	108	3	1	73	3	2	1	3	0	1	5	201
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	19	683	8	32	716	23	23	10	20	18	3	18	1573
Approach %	2.68	96.20	1.13	4.15	92.87	2.98	43.40	18.87	37.74	46.15	7.69	46.15	
App/Depart	710	/	724	771	/	754	53	/	50	39	/	45	

AM Peak Hr Begins at: 745 AM

PEAK													
Volumes	12	343	3	16	405	16	13	6	13	10	1	7	845
2025 NP	13	364	3	17	430	17	14	6	14	11	1	7	
Site Trips		6	4	2	20					10		6	
2025 WP	13	370	7	19	450	17	14	6	14	21	1	13	
Approach %	3.35	95.81	0.84	3.66	92.68	3.66	40.63	18.75	40.63	55.56	5.56	38.89	
PEAK HR. FACTOR:		0.913			0.903			0.889			0.643		0.939

CONTROL: 2-Way Stop (EB & WB)
COMMENT 1:
GPS: 32.382641, -111.046921

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Thornydale Rd 0	DATE:	03/24/22	LOCATION:	Tucson
E-W STREET:	Sumter Dr	DAY:	THURSDAY	PROJECT#	22-1178-001

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	1	0	1	0	0	1	0	1	1	0	
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	2	149	4	1	130	2	7	1	8	3	0	4	311
4:15 PM	2	137	2	0	131	1	7	1	4	0	0	2	287
4:30 PM	3	147	5	3	131	1	5	0	2	2	0	3	302
4:45 PM	3	162	4	2	133	2	1	0	1	0	0	5	313
5:00 PM	4	147	0	4	107	1	7	0	7	2	0	6	285
5:15 PM	1	161	0	1	127	3	5	1	5	3	0	7	314
5:30 PM	0	159	0	2	111	4	8	0	3	5	0	5	297
5:45 PM	1	152	5	4	127	0	2	0	2	1	0	2	296
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	16	1214	20	17	997	14	42	3	32	16	0	34	2405
Approach %	1.28	97.12	1.60	1.65	96.98	1.36	54.55	3.90	41.56	32.00	0.00	68.00	
App/Depart	1250	/	1290	1028	/	1045	77	/	40	50	/	30	

PM Peak Hr Begins at: 430 PM

PEAK													
Volumes	11	617	9	10	498	7	18	1	15	7	0	21	1214
2025 NP	12	655	10	11	528	7	19	1	16	7	0	22	
Site Trips		18	14	4	13					7		4	
2025 WP	12	673	24	15	541	7	19	1	16	14	0	26	
Approach %	1.73	96.86	1.41	1.94	96.70	1.36	52.94	2.94	44.12	25.00	0.00	75.00	

PEAK HR. FACTOR:	0.942	0.940	0.607	0.700	0.967

CONTROL: 2-Way Stop (EB & WB)
COMMENT 1: 0
GPS: 32.382641, -111.046921

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Thornydale Rd	DATE:	03/24/22	LOCATION:	Tucson
E-W STREET:	Le Mirage Apt. Driveway	DAY:	THURSDAY	PROJECT#	22-1178-002

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	1	0	0	0	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	2	56	0	0	59	0	3	0	1	0	0	0	121
7:15 AM	1	81	0	0	85	0	1	0	6	0	0	0	174
7:30 AM	3	103	0	0	96	1	1	0	10	0	0	0	214
7:45 AM	2	99	0	0	83	1	1	0	8	0	0	0	194
8:00 AM	2	82	0	0	105	1	0	0	4	0	0	0	194
8:15 AM	1	82	0	0	109	0	2	0	7	0	0	0	201
8:30 AM	0	95	0	0	117	0	3	0	4	0	0	0	219
8:45 AM	1	114	0	0	76	0	2	0	1	0	0	0	194
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	12	712	0	0	730	3	13	0	41	0	0	0	1511
Approach %	1.66	98.34	0.00	0.00	99.59	0.41	24.07	0.00	75.93	####	####	####	
App/Depart	724	/	725	733	/	771	54	/	0	0	/	15	

AM Peak Hr Begins at: 800 AM

PEAK													
Volumes	4	373	0	0	407	1	7	0	16	0	0	0	808
2025 NP	4	396	0	0	432	1	7	0	17	0	0	0	
Site Trips		6	6	5	2					20		14	
2025 WP	4	402	6	5	434	1	7	0	17	20	0	14	
Approach %	1.06	98.94	0.00	0.00	99.75	0.25	30.43	0.00	69.57	####	####	####	
PEAK HR. FACTOR:		0.820			0.872			0.639			0.000		0.922

CONTROL:	1-Way Stop (EB)
COMMENT 1:	
GPS:	32.383737, -111.046926

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Thornydale Rd 0	DATE:	03/24/22	LOCATION:	Tucson
E-W STREET:	Le Mirage Apt. Driveway	DAY:	THURSDAY	PROJECT#	22-1178-002

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	1	0	0	0	0	
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	6	154	0	0	128	1	1	0	5	0	0	0	295
4:15 PM	3	143	0	0	130	2	1	0	2	0	0	0	281
4:30 PM	5	150	0	0	130	2	1	0	5	0	0	0	293
4:45 PM	6	162	0	0	136	3	0	0	1	0	0	0	308
5:00 PM	5	155	0	0	107	2	1	0	5	0	0	0	275
5:15 PM	11	162	0	0	127	0	0	0	4	0	0	0	304
5:30 PM	13	159	0	0	109	1	2	0	8	0	0	0	292
5:45 PM	8	148	0	0	125	1	1	0	6	0	0	0	289
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	57	1233	0	0	992	12	7	0	36	0	0	0	2337
Approach %	4.42	95.58	0.00	0.00	98.80	1.20	16.28	0.00	83.72	####	####	####	
App/Depart	1290	/	1240	1004	/	1028	43	/	0	0	/	69	

PM Peak Hr Begins at: 430 PM

PEAK													
Volumes	27	629	0	0	500	7	2	0	15	0	0	0	1180
2025 NP	29	667	0	0	531	7	2	0	16	0	0	0	
Site Trips		4	18	17	4					13		9	
2025 WP	29	671	18	17	535	7	2	0	16	13	0	9	
Approach %	4.12	95.88	0.00	0.00	98.62	1.38	11.76	0.00	88.24	####	####	####	
PEAK HR. FACTOR:		0.948			0.912			0.708			0.000		0.958

CONTROL: 1-Way Stop (EB)
COMMENT 1: 0
GPS: 32.383737, -111.046926

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Shaonnon Rd	DATE:	03/24/22	LOCATION:	Tucson
E-W STREET:	Sumter Dr	DAY:	THURSDAY	PROJECT#	22-1178-003

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	1	0	0	1	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	2	23	1	1	43	1	2	0	5	2	0	4	84
7:15 AM	3	21	0	1	51	3	3	0	9	0	0	0	91
7:30 AM	4	40	1	0	75	3	1	0	8	1	0	1	134
7:45 AM	4	52	1	0	69	1	1	1	8	2	1	0	140
8:00 AM	4	36	2	1	71	2	1	0	12	2	0	0	131
8:15 AM	4	40	1	1	51	2	3	0	6	1	0	2	111
8:30 AM	2	36	1	1	52	0	2	1	10	3	0	2	110
8:45 AM	5	48	0	2	51	1	3	0	4	0	0	2	116
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	28	296	7	7	463	13	16	2	62	11	1	11	917
Approach %	8.46	89.43	2.11	1.45	95.86	2.69	20.00	2.50	77.50	47.83	4.35	47.83	
App/Depart	331	/	323	483	/	536	80	/	16	23	/	42	

AM Peak Hr Begins at: 730 AM

PEAK													
Volumes	16	168	5	2	266	8	6	1	34	6	1	3	516
2025 NP	17	178	5	2	282	8	6	1	36	6	1	3	
Site Trips	7					4	14		20				
2025 WP	24	178	5	2	282	12	20	1	56	6	1	3	
Approach %	8.47	88.89	2.65	0.72	96.38	2.90	14.63	2.44	82.93	60.00	10.00	30.00	
PEAK HR. FACTOR:		0.829			0.885			0.788			0.833		0.921

CONTROL: 2-Way Stop (EB & WB)
COMMENT 1:
GPS: 32.382712, -111.029769

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Shaonnon Rd 0	DATE:	03/24/22	LOCATION:	Tucson
E-W STREET:	Sumter Dr	DAY:	THURSDAY	PROJECT#	22-1178-003

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	1	0	0	1	0	
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	5	51	4	0	59	2	3	0	4	1	0	1	130
4:15 PM	4	82	4	1	55	1	0	0	4	2	0	0	153
4:30 PM	7	69	4	0	61	0	2	0	3	0	0	1	147
4:45 PM	5	62	3	2	68	2	6	0	4	1	0	2	155
5:00 PM	7	66	6	2	50	1	2	0	4	0	0	3	141
5:15 PM	10	64	5	1	67	0	3	0	3	1	1	3	158
5:30 PM	5	77	1	3	50	5	2	0	3	0	0	1	147
5:45 PM	4	54	4	0	54	3	4	0	4	2	0	0	129
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	47	525	31	9	464	14	22	0	29	7	1	11	1160
Approach %	7.79	87.06	5.14	1.85	95.28	2.87	43.14	0.00	56.86	36.84	5.26	57.89	
App/Depart	603	/	558	487	/	500	51	/	40	19	/	62	

PM Peak Hr Begins at: 445 PM

PEAK													
Volumes	27	269	15	8	235	8	13	0	14	2	1	9	601
2025 NP	29	285	16	8	249	8	14	0	15	2	1	10	
Site Trips	21					14	9		13				
2025 WP	50	285	16	8	249	22	23	0	28	2	1	10	
Approach %	8.68	86.50	4.82	3.19	93.63	3.19	48.15	0.00	51.85	16.67	8.33	75.00	
PEAK HR. FACTOR:	0.937			0.872			0.675			0.600			0.951

CONTROL:	2-Way Stop (EB & WB)
COMMENT 1:	0
GPS:	32.382712, -111.029769

Prepared by: Field Data Services of Arizona/Veracity Traffic Group (520) 316-6745

Volumes for: Thursday, March 24, 2022 City: Tucson Project #: 22-1178-004

Location: Thornydale Rd north of Sumter Dr

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	13		7					12:00	135		167				
00:15	6		8					12:15	141		128				
00:30	6		5					12:30	157		120				
00:45	13	38	5	25			63	12:45	142	575	136	551			1126
01:00	3		4					13:00	132		143				
01:15	4		3					13:15	151		155				
01:30	7		6					13:30	158		151				
01:45	5	19	2	15			34	13:45	134	575	145	594			1169
02:00	1		4					14:00	128		126				
02:15	4		1					14:15	164		131				
02:30	3		4					14:30	144		140				
02:45	4	12	2	11			23	14:45	156	592	141	538			1130
03:00	5		5					15:00	148		141				
03:15	4		3					15:15	135		135				
03:30	7		4					15:30	150		137				
03:45	5	21	8	20			41	15:45	159	592	139	552			1144
04:00	12		7					16:00	160		133				
04:15	7		11					16:15	146		132				
04:30	12		10					16:30	155		135				
04:45	16	47	17	45			92	16:45	168	629	137	537			1166
05:00	15		19					17:00	160		112				
05:15	18		28					17:15	173		131				
05:30	37		36					17:30	172		117				
05:45	33	103	38	121			224	17:45	156	661	131	491			1152
06:00	42		48					18:00	147		116				
06:15	47		47					18:15	133		119				
06:30	63		63					18:30	98		92				
06:45	63	215	71	229			444	18:45	112	490	111	438			928
07:00	58		60					19:00	119		77				
07:15	82		91					19:15	98		78				
07:30	106		106					19:30	93		58				
07:45	101	347	91	348			695	19:45	83	393	52	265			658
08:00	84		109					20:00	75		65				
08:15	83		116					20:15	85		50				
08:30	95		121					20:30	80		60				
08:45	115	377	77	423			800	20:45	55	295	42	217			512
09:00	101		136					21:00	50		47				
09:15	106		129					21:15	66		44				
09:30	110		133					21:30	44		37				
09:45	104	421	140	538			959	21:45	32	192	25	153			345
10:00	127		157					22:00	36		31				
10:15	100		142					22:15	31		24				
10:30	112		151					22:30	26		22				
10:45	124	463	128	578			1041	22:45	26	119	21	98			217
11:00	145		146					23:00	10		16				
11:15	131		147					23:15	15		9				
11:30	149		139					23:30	15		15				
11:45	148	573	148	580			1153	23:45	9	49	8	48			97
Total Vol.		2636		2933			**5569**			5162		4482			**9644**

GPS Coordinates: 32.383157, -111.046931

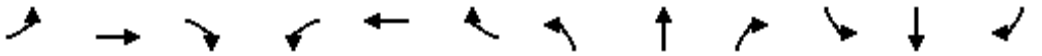
Daily Totals

NB	SB	EB	WB	Combined
7798	7415			**15213**

	AM			PM		
Split %	47.3%	52.7%	**36.6%**	53.5%	46.5%	**63.4%**
Peak Hour	11:45	11:15	**11:15**	16:45	13:00	**16:30**
Volume	581	601	**1164**	673	594	**1171**
P.H.F.	0.93	0.90	**0.96**	0.97	0.96	**0.96**

HCM 6th Signalized Intersection Summary
5: Thornydale/Thornydale Road & Linda Vista

05/04/2022



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	121	107	411	41	141	12	307	226	27	21	285	124
Future Volume (veh/h)	121	107	411	41	141	12	307	226	27	21	285	124
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	0.97		0.91	0.95		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	133	118	452	55	191	16	345	254	30	27	370	161
Peak Hour Factor	0.91	0.91	0.91	0.74	0.74	0.74	0.89	0.89	0.89	0.77	0.77	0.77
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	385	538	618	356	489	41	438	523	405	582	590	461
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.11	0.28	0.28	0.14	0.32	0.32
Sat Flow, veh/h	1165	1870	1563	837	1700	142	1781	1870	1446	1781	1870	1462
Grp Volume(v), veh/h	133	118	452	55	0	207	345	254	30	27	370	161
Grp Sat Flow(s),veh/h/ln	1165	1870	1563	837	0	1842	1781	1870	1446	1781	1870	1462
Q Serve(g_s), s	4.8	2.2	6.4	2.5	0.0	4.2	1.9	5.3	0.7	0.0	7.8	3.9
Cycle Q Clear(g_c), s	9.0	2.2	6.4	4.7	0.0	4.2	1.9	5.3	0.7	0.0	7.8	3.9
Prop In Lane	1.00		1.00	1.00		0.08	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	385	538	618	356	0	530	438	523	405	582	590	461
V/C Ratio(X)	0.35	0.22	0.73	0.15	0.00	0.39	0.79	0.49	0.07	0.05	0.63	0.35
Avail Cap(c_a), veh/h	501	725	774	439	0	714	613	946	731	582	765	598
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.9	12.6	12.0	14.4	0.0	13.3	18.0	13.9	12.3	11.4	13.6	12.2
Incr Delay (d2), s/veh	0.5	0.2	2.7	0.2	0.0	0.5	4.5	0.7	0.1	0.0	1.1	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.9	3.4	0.4	0.0	1.5	3.3	1.8	0.2	0.2	2.6	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.4	12.8	14.7	14.6	0.0	13.8	22.6	14.6	12.4	11.4	14.7	12.7
LnGrp LOS	B	B	B	B	A	B	C	B	B	B	B	B
Approach Vol, veh/h		703			262			629			558	
Approach Delay, s/veh		14.9			13.9			18.9			13.9	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.1	17.5		17.9	9.4	19.2		17.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	23.5		18.0	9.5	19.0		18.0				
Max Q Clear Time (g_c+I1), s	2.0	7.3		11.0	3.9	9.8		6.7				
Green Ext Time (p_c), s	0.0	1.2		1.8	0.5	1.8		1.0				

Intersection Summary		
HCM 6th Ctrl Delay		15.7
HCM 6th LOS		B

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	6	13	10	1	7	12	343	3	16	405	16
Future Vol, veh/h	13	6	13	10	1	7	12	343	3	16	405	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	110	-	-	100	-	180	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	64	64	64	91	91	91	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	7	15	16	2	11	13	377	3	18	450	18

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	906	901	459	909	907	377	468	0	0	380	0	0
Stage 1	495	495	-	403	403	-	-	-	-	-	-	-
Stage 2	411	406	-	506	504	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	257	278	602	256	276	670	1094	-	-	1178	-	-
Stage 1	556	546	-	624	600	-	-	-	-	-	-	-
Stage 2	618	598	-	549	541	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	246	270	602	240	269	670	1094	-	-	1178	-	-
Mov Cap-2 Maneuver	246	270	-	240	269	-	-	-	-	-	-	-
Stage 1	549	538	-	617	593	-	-	-	-	-	-	-
Stage 2	599	591	-	521	533	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.2	16.8	0.3	0.3
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1094	-	-	331	240	565	1178	-	-
HCM Lane V/C Ratio	0.012	-	-	0.109	0.065	0.022	0.015	-	-
HCM Control Delay (s)	8.3	-	-	17.2	21	11.5	8.1	-	-
HCM Lane LOS	A	-	-	C	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1	34	6	1	3	16	168	5	2	266	8
Future Vol, veh/h	6	1	34	6	1	3	16	168	5	2	266	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	83	83	83	83	83	83	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	1	43	7	1	4	19	202	6	2	299	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	554	554	304	573	555	205	308	0	0	208	0	0
Stage 1	308	308	-	243	243	-	-	-	-	-	-	-
Stage 2	246	246	-	330	312	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	443	440	736	430	440	836	1253	-	-	1363	-	-
Stage 1	702	660	-	761	705	-	-	-	-	-	-	-
Stage 2	758	703	-	683	658	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	435	433	736	399	433	836	1253	-	-	1363	-	-
Mov Cap-2 Maneuver	435	433	-	399	433	-	-	-	-	-	-	-
Stage 1	691	659	-	750	694	-	-	-	-	-	-	-
Stage 2	742	692	-	641	657	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.8	12.7	0.7	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1253	-	-	435	722	478	1363	-	-
HCM Lane V/C Ratio	0.015	-	-	0.017	0.061	0.025	0.002	-	-
HCM Control Delay (s)	7.9	-	-	13.4	10.3	12.7	7.6	-	-
HCM Lane LOS	A	-	-	B	B	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	0	16	0	0	0	4	373	0	0	407	1
Future Vol, veh/h	7	0	16	0	0	0	4	373	0	0	407	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	0	17	0	0	0	4	405	0	0	442	1

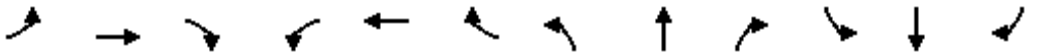
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	856	856	443	864	856	405	443	0	0	405	0	0
Stage 1	443	443	-	413	413	-	-	-	-	-	-	-
Stage 2	413	413	-	451	443	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	278	295	615	274	295	646	1117	-	-	1154	-	-
Stage 1	594	576	-	616	594	-	-	-	-	-	-	-
Stage 2	616	594	-	588	576	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	277	294	615	266	294	646	1117	-	-	1154	-	-
Mov Cap-2 Maneuver	277	294	-	266	294	-	-	-	-	-	-	-
Stage 1	592	576	-	614	592	-	-	-	-	-	-	-
Stage 2	614	592	-	571	576	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.5	0	0.1	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1117	-	-	448	-	1154	-	-
HCM Lane V/C Ratio	0.004	-	-	0.056	-	-	-	-
HCM Control Delay (s)	8.2	-	-	13.5	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	-	0	-	-

HCM 6th Signalized Intersection Summary
5: Thornydale/Thornydale Road & Linda Vista

05/04/2022



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	163	78	265	31	79	9	337	468	51	22	393	167
Future Volume (veh/h)	163	78	265	31	79	9	337	468	51	22	393	167
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.98	0.98		0.93	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	183	88	298	36	93	11	359	498	54	24	427	182
Peak Hour Factor	0.89	0.89	0.89	0.85	0.85	0.85	0.94	0.94	0.94	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	438	496	584	383	434	51	457	668	527	391	624	490
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.11	0.36	0.36	0.08	0.33	0.33
Sat Flow, veh/h	1275	1870	1561	989	1638	194	1781	1870	1476	1781	1870	1469
Grp Volume(v), veh/h	183	88	298	36	0	104	359	498	54	24	427	182
Grp Sat Flow(s),veh/h/ln	1275	1870	1561	989	0	1832	1781	1870	1476	1781	1870	1469
Q Serve(g_s), s	6.0	1.7	1.8	1.3	0.0	2.0	1.8	10.7	1.1	0.0	9.1	4.3
Cycle Q Clear(g_c), s	8.0	1.7	1.8	3.0	0.0	2.0	1.8	10.7	1.1	0.0	9.1	4.3
Prop In Lane	1.00		1.00	1.00		0.11	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	438	496	584	383	0	485	457	668	527	391	624	490
V/C Ratio(X)	0.42	0.18	0.51	0.09	0.00	0.21	0.79	0.75	0.10	0.06	0.68	0.37
Avail Cap(c_a), veh/h	599	732	782	508	0	717	641	956	755	434	765	601
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.3	13.0	11.1	14.2	0.0	13.2	17.5	13.0	9.9	15.7	13.2	11.6
Incr Delay (d2), s/veh	0.6	0.2	0.7	0.1	0.0	0.2	4.3	1.9	0.1	0.1	1.9	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.6	1.9	0.3	0.0	0.7	3.4	3.5	0.3	0.2	3.1	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.9	13.2	11.8	14.3	0.0	13.4	21.8	14.9	9.9	15.8	15.1	12.1
LnGrp LOS	B	B	B	B	A	B	C	B	A	B	B	B
Approach Vol, veh/h		569			140			911			633	
Approach Delay, s/veh		13.7			13.6			17.3			14.3	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.4	20.9		16.7	9.4	19.8		16.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	23.5		18.0	9.7	18.8		18.0				
Max Q Clear Time (g_c+I1), s	2.0	12.7		10.0	3.8	11.1		5.0				
Green Ext Time (p_c), s	0.0	2.3		1.5	0.6	1.9		0.5				

Intersection Summary												
HCM 6th Ctrl Delay			15.3									
HCM 6th LOS			B									

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	1	15	7	0	21	11	617	9	10	498	7
Future Vol, veh/h	18	1	15	7	0	21	11	617	9	10	498	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	110	-	-	100	-	180	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	61	61	61	70	70	70	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	2	25	10	0	30	12	656	10	11	530	7

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1256	1246	534	1249	1239	656	537	0	0	666	0	0
Stage 1	556	556	-	680	680	-	-	-	-	-	-	-
Stage 2	700	690	-	569	559	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	148	174	546	150	175	465	1031	-	-	923	-	-
Stage 1	515	513	-	441	451	-	-	-	-	-	-	-
Stage 2	430	446	-	507	511	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	136	170	546	140	171	465	1031	-	-	923	-	-
Mov Cap-2 Maneuver	136	170	-	140	171	-	-	-	-	-	-	-
Stage 1	509	507	-	436	446	-	-	-	-	-	-	-
Stage 2	398	441	-	477	505	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	29	18.2	0.1	0.2
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1031	-	-	205	140	465	923	-	-
HCM Lane V/C Ratio	0.011	-	-	0.272	0.071	0.065	0.012	-	-
HCM Control Delay (s)	8.5	-	-	29	32.7	13.3	8.9	-	-
HCM Lane LOS	A	-	-	D	D	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1.1	0.2	0.2	0	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	0	14	2	1	9	27	269	15	8	235	8
Future Vol, veh/h	13	0	14	2	1	9	27	269	15	8	235	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	60	60	60	94	94	94	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	0	21	3	2	15	29	286	16	9	270	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	654	653	275	655	649	294	279	0	0	302	0	0
Stage 1	293	293	-	352	352	-	-	-	-	-	-	-
Stage 2	361	360	-	303	297	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	380	387	764	379	389	745	1284	-	-	1259	-	-
Stage 1	715	670	-	665	632	-	-	-	-	-	-	-
Stage 2	657	626	-	706	668	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	363	375	764	360	377	745	1284	-	-	1259	-	-
Mov Cap-2 Maneuver	363	375	-	360	377	-	-	-	-	-	-	-
Stage 1	699	665	-	650	617	-	-	-	-	-	-	-
Stage 2	628	612	-	682	663	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.5	11.3	0.7	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1284	-	-	363	764	591	1259	-	-
HCM Lane V/C Ratio	0.022	-	-	0.053	0.027	0.034	0.007	-	-
HCM Control Delay (s)	7.9	-	-	15.5	9.8	11.3	7.9	-	-
HCM Lane LOS	A	-	-	C	A	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.1	0.1	0	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	0	15	0	0	0	27	629	0	0	500	7
Future Vol, veh/h	2	0	15	0	0	0	27	629	0	0	500	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	92	92	92	95	95	95	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	0	21	0	0	0	28	662	0	0	549	8

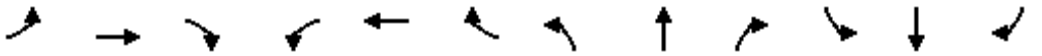
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1271	1271	553	1282	1275	662	557	0	0	662	0	0
Stage 1	553	553	-	718	718	-	-	-	-	-	-	-
Stage 2	718	718	-	564	557	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	145	168	533	142	167	462	1014	-	-	927	-	-
Stage 1	517	514	-	420	433	-	-	-	-	-	-	-
Stage 2	420	433	-	510	512	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	142	163	533	133	162	462	1014	-	-	927	-	-
Mov Cap-2 Maneuver	142	163	-	133	162	-	-	-	-	-	-	-
Stage 1	503	514	-	408	421	-	-	-	-	-	-	-
Stage 2	408	421	-	490	512	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.5	0	0.4	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1014	-	-	403	-	927	-	-
HCM Lane V/C Ratio	0.028	-	-	0.059	-	-	-	-
HCM Control Delay (s)	8.7	-	-	14.5	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	-	0	-	-

HCM 6th Signalized Intersection Summary
5: Thornydale/Thornydale Road & Linda Vista

06/23/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	128	114	436	43	149	13	326	240	28	22	302	132
Future Volume (veh/h)	128	114	436	43	149	13	326	240	28	22	302	132
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	0.97		0.91	0.95		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	141	125	479	58	201	18	366	270	31	29	392	171
Peak Hour Factor	0.91	0.91	0.91	0.74	0.74	0.74	0.89	0.89	0.89	0.77	0.77	0.77
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	375	548	645	344	495	44	436	518	401	581	585	457
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.12	0.28	0.28	0.15	0.31	0.31
Sat Flow, veh/h	1152	1870	1563	811	1689	151	1781	1870	1445	1781	1870	1461
Grp Volume(v), veh/h	141	125	479	58	0	219	366	270	31	29	392	171
Grp Sat Flow(s),veh/h/ln	1152	1870	1563	811	0	1841	1781	1870	1445	1781	1870	1461
Q Serve(g_s), s	5.5	2.5	6.8	2.9	0.0	4.7	3.4	6.0	0.8	0.0	8.9	4.5
Cycle Q Clear(g_c), s	10.1	2.5	6.8	5.3	0.0	4.7	3.4	6.0	0.8	0.0	8.9	4.5
Prop In Lane	1.00		1.00	1.00		0.08	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	375	548	645	344	0	539	436	518	401	581	585	457
V/C Ratio(X)	0.38	0.23	0.74	0.17	0.00	0.41	0.84	0.52	0.08	0.05	0.67	0.37
Avail Cap(c_a), veh/h	461	688	762	405	0	677	572	899	694	581	727	568
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.9	13.1	12.2	15.1	0.0	13.9	19.0	14.9	13.1	12.0	14.6	13.1
Incr Delay (d2), s/veh	0.6	0.2	3.3	0.2	0.0	0.5	8.5	0.8	0.1	0.0	1.7	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	1.0	3.9	0.5	0.0	1.7	4.1	2.1	0.2	0.2	3.1	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.6	13.3	15.4	15.3	0.0	14.4	27.4	15.7	13.1	12.0	16.3	13.6
LnGrp LOS	B	B	B	B	A	B	C	B	B	B	B	B
Approach Vol, veh/h		745			277			667			592	
Approach Delay, s/veh		15.7			14.6			22.0			15.3	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.0	18.1		18.8	10.3	19.8		18.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	23.5		18.0	9.5	19.0		18.0				
Max Q Clear Time (g_c+I1), s	2.0	8.0		12.1	5.4	10.9		7.3				
Green Ext Time (p_c), s	0.0	1.3		1.8	0.5	1.8		1.1				

Intersection Summary												
HCM 6th Ctrl Delay			17.3									
HCM 6th LOS			B									

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	6	14	11	1	7	13	364	3	17	430	17
Future Vol, veh/h	14	6	14	11	1	7	13	364	3	17	430	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	11	-	-	100	-	180	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	64	64	64	91	91	91	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	7	16	17	2	11	14	400	3	19	478	19

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	962	957	488	965	963	400	497	0	0	403	0	0
Stage 1	526	526	-	428	428	-	-	-	-	-	-	-
Stage 2	436	431	-	537	535	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	235	258	580	234	256	650	1067	-	-	1156	-	-
Stage 1	535	529	-	605	585	-	-	-	-	-	-	-
Stage 2	599	583	-	528	524	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	225	251	580	218	249	650	1067	-	-	1156	-	-
Mov Cap-2 Maneuver	225	251	-	218	249	-	-	-	-	-	-	-
Stage 1	528	521	-	597	577	-	-	-	-	-	-	-
Stage 2	580	575	-	499	516	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.3	18.2	0.3	0.3
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1067	-	-	308	218	541	1156	-	-
HCM Lane V/C Ratio	0.013	-	-	0.124	0.079	0.023	0.016	-	-
HCM Control Delay (s)	8.4	-	-	18.3	22.9	11.8	8.2	-	-
HCM Lane LOS	A	-	-	C	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0.3	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1	36	6	1	3	17	178	5	2	282	8
Future Vol, veh/h	6	1	36	6	1	3	17	178	5	2	282	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	83	83	83	83	83	83	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	1	46	7	1	4	20	214	6	2	317	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	586	586	322	606	587	217	326	0	0	220	0	0
Stage 1	326	326	-	257	257	-	-	-	-	-	-	-
Stage 2	260	260	-	349	330	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	422	422	719	409	422	823	1234	-	-	1349	-	-
Stage 1	687	648	-	748	695	-	-	-	-	-	-	-
Stage 2	745	693	-	667	646	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	414	415	719	377	415	823	1234	-	-	1349	-	-
Mov Cap-2 Maneuver	414	415	-	377	415	-	-	-	-	-	-	-
Stage 1	676	647	-	736	684	-	-	-	-	-	-	-
Stage 2	728	682	-	623	645	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11	13.1	0.7	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1234	-	-	414	705	455	1349	-	-
HCM Lane V/C Ratio	0.017	-	-	0.018	0.066	0.026	0.002	-	-
HCM Control Delay (s)	8	-	-	13.9	10.5	13.1	7.7	-	-
HCM Lane LOS	A	-	-	B	B	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	0	17	0	0	0	4	396	0	0	432	1
Future Vol, veh/h	7	0	17	0	0	0	4	396	0	0	432	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	0	18	0	0	0	4	430	0	0	470	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	909	909	471	918	909	430	471	0	0	430	0	0
Stage 1	471	471	-	438	438	-	-	-	-	-	-	-
Stage 2	438	438	-	480	471	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	256	275	593	252	275	625	1091	-	-	1129	-	-
Stage 1	573	560	-	597	579	-	-	-	-	-	-	-
Stage 2	597	579	-	567	560	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	255	274	593	243	274	625	1091	-	-	1129	-	-
Mov Cap-2 Maneuver	255	274	-	243	274	-	-	-	-	-	-	-
Stage 1	571	560	-	595	577	-	-	-	-	-	-	-
Stage 2	595	577	-	549	560	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14	0	0.1	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1091	-	-	428	-	1129	-	-
HCM Lane V/C Ratio	0.004	-	-	0.061	-	-	-	-
HCM Control Delay (s)	8.3	-	-	14	0	0	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	-	0	-	-

HCM 6th Signalized Intersection Summary
5: Thornydale/Thornydale Road & Linda Vista

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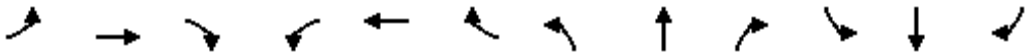

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	82	281	32	83	10	357	497	54	24	417	178
Future Volume (veh/h)	173	82	281	32	83	10	357	497	54	24	417	178
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	0.98		0.93	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	194	92	316	38	98	12	380	529	57	26	453	193
Peak Hour Factor	0.89	0.89	0.89	0.85	0.85	0.85	0.94	0.94	0.94	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	433	506	610	375	441	54	451	667	526	380	621	487
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.12	0.36	0.36	0.09	0.33	0.33
Sat Flow, veh/h	1268	1870	1562	970	1631	200	1781	1870	1476	1781	1870	1468
Grp Volume(v), veh/h	194	92	316	38	0	110	380	529	57	26	453	193
Grp Sat Flow(s),veh/h/ln	1268	1870	1562	970	0	1831	1781	1870	1476	1781	1870	1468
Q Serve(g_s), s	6.8	1.8	1.7	1.5	0.0	2.3	3.3	12.3	1.3	0.0	10.3	4.9
Cycle Q Clear(g_c), s	9.0	1.8	1.7	3.3	0.0	2.3	3.3	12.3	1.3	0.0	10.3	4.9
Prop In Lane	1.00		1.00	1.00		0.11	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	433	506	610	375	0	495	451	667	526	380	621	487
V/C Ratio(X)	0.45	0.18	0.52	0.10	0.00	0.22	0.84	0.79	0.11	0.07	0.73	0.40
Avail Cap(c_a), veh/h	562	696	769	473	0	681	590	909	717	396	735	577
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.2	13.5	11.3	14.8	0.0	13.7	18.5	14.0	10.4	17.1	14.2	12.4
Incr Delay (d2), s/veh	0.7	0.2	0.7	0.1	0.0	0.2	8.5	3.5	0.1	0.1	3.1	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.7	2.1	0.3	0.0	0.8	4.2	4.4	0.3	0.2	3.8	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.9	13.7	12.0	14.9	0.0	13.9	27.0	17.4	10.5	17.2	17.3	13.0
LnGrp LOS	B	B	B	B	A	B	C	B	B	B	B	B
Approach Vol, veh/h		602			148			966			672	
Approach Delay, s/veh		14.1			14.2			20.8			16.0	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.0	21.7		17.6	10.2	20.5		17.6				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	23.5		18.0	9.5	19.0		18.0				
Max Q Clear Time (g_c+I1), s	2.0	14.3		11.0	5.3	12.3		5.3				
Green Ext Time (p_c), s	0.0	2.2		1.5	0.5	1.8		0.5				

Intersection Summary												
HCM 6th Ctrl Delay			17.4									
HCM 6th LOS			B									

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	1	16	7	0	22	12	655	10	11	528	7
Future Vol, veh/h	19	1	16	7	0	22	12	655	10	11	528	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	110	-	-	100	-	180	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	61	61	61	70	70	70	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	31	2	26	10	0	31	13	697	11	12	562	7

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1334	1324	566	1327	1316	697	569	0	0	708	0	0
Stage 1	590	590	-	723	723	-	-	-	-	-	-	-
Stage 2	744	734	-	604	593	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	131	156	524	132	158	441	1003	-	-	891	-	-
Stage 1	494	495	-	417	431	-	-	-	-	-	-	-
Stage 2	407	426	-	485	493	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	119	152	524	122	154	441	1003	-	-	891	-	-
Mov Cap-2 Maneuver	119	152	-	122	154	-	-	-	-	-	-	-
Stage 1	488	489	-	412	425	-	-	-	-	-	-	-
Stage 2	373	420	-	453	487	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	33.8	19.4	0.2	0.2
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1003	-	-	183	122	441	891	-	-
HCM Lane V/C Ratio	0.013	-	-	0.322	0.082	0.071	0.013	-	-
HCM Control Delay (s)	8.6	-	-	33.8	37.1	13.8	9.1	-	-
HCM Lane LOS	A	-	-	D	E	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1.3	0.3	0.2	0	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	0	15	2	1	10	29	285	16	8	249	8
Future Vol, veh/h	14	0	15	2	1	10	29	285	16	8	249	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	60	60	60	94	94	94	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	0	22	3	2	17	31	303	17	9	286	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	692	691	291	694	687	312	295	0	0	320	0	0
Stage 1	309	309	-	374	374	-	-	-	-	-	-	-
Stage 2	383	382	-	320	313	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	358	368	748	357	370	728	1266	-	-	1240	-	-
Stage 1	701	660	-	647	618	-	-	-	-	-	-	-
Stage 2	640	613	-	692	657	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	340	357	748	338	359	728	1266	-	-	1240	-	-
Mov Cap-2 Maneuver	340	357	-	338	359	-	-	-	-	-	-	-
Stage 1	684	655	-	631	603	-	-	-	-	-	-	-
Stage 2	608	598	-	667	652	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13	11.5	0.7	0.2
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1266	-	-	340	748	579	1240	-	-
HCM Lane V/C Ratio	0.024	-	-	0.061	0.029	0.037	0.007	-	-
HCM Control Delay (s)	7.9	-	-	16.3	10	11.5	7.9	-	-
HCM Lane LOS	A	-	-	C	B	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.1	0.1	0	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	0	16	0	0	0	29	667	0	0	531	7
Future Vol, veh/h	2	0	16	0	0	0	29	667	0	0	531	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	92	92	92	95	95	95	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	0	23	0	0	0	31	702	0	0	584	8

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1352	1352	588	1364	1356	702	592	0	0	702	0	0
Stage 1	588	588	-	764	764	-	-	-	-	-	-	-
Stage 2	764	764	-	600	592	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	127	150	509	125	149	438	984	-	-	895	-	-
Stage 1	495	496	-	396	413	-	-	-	-	-	-	-
Stage 2	396	413	-	488	494	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	124	145	509	117	144	438	984	-	-	895	-	-
Mov Cap-2 Maneuver	124	145	-	117	144	-	-	-	-	-	-	-
Stage 1	479	496	-	383	400	-	-	-	-	-	-	-
Stage 2	384	400	-	466	494	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15.2	0	0.4	0
HCM LOS	C	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	984	-	-	378	-	895	-	-
HCM Lane V/C Ratio	0.031	-	-	0.067	-	-	-	-
HCM Control Delay (s)	8.8	-	-	15.2	0	0	-	-
HCM Lane LOS	A	-	-	C	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	-	0	-	-

HCM 6th Signalized Intersection Summary
5: Thornydale/Thornydale Road & Linda Vista

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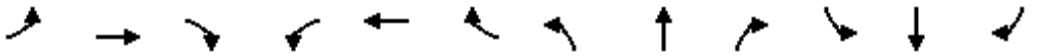


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	128	114	436	43	149	13	326	250	28	22	332	132
Future Volume (veh/h)	128	114	436	43	149	13	326	250	28	22	332	132
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	0.98		0.91	0.96		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	141	125	479	58	201	18	366	281	31	29	431	171
Peak Hour Factor	0.91	0.91	0.91	0.74	0.74	0.74	0.89	0.89	0.89	0.77	0.77	0.77
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	363	539	660	334	487	44	432	513	396	598	589	461
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.13	0.27	0.27	0.17	0.32	0.32
Sat Flow, veh/h	1152	1870	1563	811	1689	151	1781	1870	1443	1781	1870	1462
Grp Volume(v), veh/h	141	125	479	58	0	219	366	281	31	29	431	171
Grp Sat Flow(s),veh/h/ln	1152	1870	1563	811	0	1841	1781	1870	1443	1781	1870	1462
Q Serve(g_s), s	5.7	2.6	6.2	3.0	0.0	4.9	4.4	6.5	0.8	0.0	10.5	4.6
Cycle Q Clear(g_c), s	10.6	2.6	6.2	5.6	0.0	4.9	4.4	6.5	0.8	0.0	10.5	4.6
Prop In Lane	1.00		1.00	1.00		0.08	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	363	539	660	334	0	531	432	513	396	598	589	461
V/C Ratio(X)	0.39	0.23	0.73	0.17	0.00	0.41	0.85	0.55	0.08	0.05	0.73	0.37
Avail Cap(c_a), veh/h	437	660	761	386	0	650	542	862	665	598	682	533
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.0	13.8	12.3	16.0	0.0	14.7	19.7	15.8	13.7	12.2	15.5	13.6
Incr Delay (d2), s/veh	0.7	0.2	3.0	0.2	0.0	0.5	10.0	0.9	0.1	0.0	3.4	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	1.0	4.0	0.5	0.0	1.8	4.5	2.3	0.2	0.2	4.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.6	14.1	15.3	16.2	0.0	15.2	29.7	16.7	13.8	12.2	19.0	14.0
LnGrp LOS	B	B	B	B	A	B	C	B	B	B	B	B
Approach Vol, veh/h		745			277			678			631	
Approach Delay, s/veh		15.9			15.4			23.6			17.3	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.3	18.5		19.2	11.2	20.6		19.2				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	23.5		18.0	9.9	18.6		18.0				
Max Q Clear Time (g_c+I1), s	2.0	8.5		12.6	6.4	12.5		7.6				
Green Ext Time (p_c), s	0.0	1.3		1.6	0.4	1.6		1.1				

Intersection Summary			
HCM 6th Ctrl Delay		18.5	
HCM 6th LOS		B	

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	6	14	21	1	13	13	370	7	19	450	17
Future Vol, veh/h	14	6	14	21	1	13	13	370	7	19	450	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	110	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	64	64	64	91	91	91	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	7	16	33	2	20	14	407	8	21	500	19

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1002	995	510	1002	1000	411	519	0	0	415	0	0
Stage 1	552	552	-	439	439	-	-	-	-	-	-	-
Stage 2	450	443	-	563	561	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	221	245	563	221	243	641	1047	-	-	1144	-	-
Stage 1	518	515	-	597	578	-	-	-	-	-	-	-
Stage 2	589	576	-	511	510	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	208	237	563	205	235	641	1047	-	-	1144	-	-
Mov Cap-2 Maneuver	208	237	-	205	235	-	-	-	-	-	-	-
Stage 1	511	506	-	589	570	-	-	-	-	-	-	-
Stage 2	561	569	-	481	501	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.3	20.2	0.3	0.3
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1047	-	-	289	205	571	1144	-	-
HCM Lane V/C Ratio	0.014	-	-	0.132	0.16	0.038	0.018	-	-
HCM Control Delay (s)	8.5	-	-	19.3	25.9	11.6	8.2	-	-
HCM Lane LOS	A	-	-	C	D	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.5	0.6	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	1	56	6	1	3	24	178	5	2	282	12
Future Vol, veh/h	20	1	56	6	1	3	24	178	5	2	282	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	83	83	83	83	83	83	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	25	1	71	7	1	4	29	214	6	2	317	13

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	606	606	324	639	609	217	330	0	0	220	0	0
Stage 1	328	328	-	275	275	-	-	-	-	-	-	-
Stage 2	278	278	-	364	334	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	409	411	717	389	410	823	1229	-	-	1349	-	-
Stage 1	685	647	-	731	683	-	-	-	-	-	-	-
Stage 2	728	680	-	655	643	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	398	401	717	343	400	823	1229	-	-	1349	-	-
Mov Cap-2 Maneuver	398	401	-	343	400	-	-	-	-	-	-	-
Stage 1	669	646	-	713	667	-	-	-	-	-	-	-
Stage 2	706	664	-	588	642	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.7	13.8	0.9	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1229	-	-	398	707	423	1349	-	-
HCM Lane V/C Ratio	0.024	-	-	0.064	0.102	0.028	0.002	-	-
HCM Control Delay (s)	8	-	-	14.7	10.7	13.8	7.7	-	-
HCM Lane LOS	A	-	-	B	B	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.3	0.1	0	-	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	0	17	20	0	14	4	402	6	5	434	1
Future Vol, veh/h	7	0	17	20	0	14	4	402	6	5	434	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	0	18	22	0	15	4	437	7	5	472	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	939	935	473	941	932	441	473	0	0	444	0	0
Stage 1	483	483	-	449	449	-	-	-	-	-	-	-
Stage 2	456	452	-	492	483	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	244	265	591	243	266	616	1089	-	-	1116	-	-
Stage 1	565	553	-	589	572	-	-	-	-	-	-	-
Stage 2	584	570	-	558	553	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	236	263	591	234	264	616	1089	-	-	1116	-	-
Mov Cap-2 Maneuver	236	263	-	234	264	-	-	-	-	-	-	-
Stage 1	563	551	-	587	570	-	-	-	-	-	-	-
Stage 2	567	568	-	538	551	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.4	18	0.1	0.1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1089	-	-	411	314	1116	-	-
HCM Lane V/C Ratio	0.004	-	-	0.063	0.118	0.005	-	-
HCM Control Delay (s)	8.3	-	-	14.4	18	8.2	-	-
HCM Lane LOS	A	-	-	B	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.4	0	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	26	19	11	34	16
Future Vol, veh/h	6	26	19	11	34	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	50	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	28	21	12	37	17

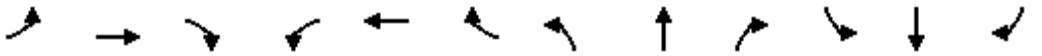
Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	33	0	-	0	69	27
Stage 1	-	-	-	-	27	-
Stage 2	-	-	-	-	42	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1579	-	-	-	936	1048
Stage 1	-	-	-	-	996	-
Stage 2	-	-	-	-	980	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1579	-	-	-	932	1048
Mov Cap-2 Maneuver	-	-	-	-	932	-
Stage 1	-	-	-	-	992	-
Stage 2	-	-	-	-	980	-

Approach	EB	WB	SB
HCM Control Delay, s	1.4	0	8.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1579	-	-	-	966
HCM Lane V/C Ratio	0.004	-	-	-	0.056
HCM Control Delay (s)	7.3	-	-	-	8.9
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2

HCM 6th Signalized Intersection Summary
5: Thornydale/Thornydale Road & Linda Vista

06/23/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	82	281	32	83	10	357	529	54	24	437	178
Future Volume (veh/h)	173	82	281	32	83	10	357	529	54	24	437	178
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	0.98		0.93	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	194	92	316	38	98	12	380	563	57	26	475	193
Peak Hour Factor	0.89	0.89	0.89	0.85	0.85	0.85	0.94	0.94	0.94	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	427	503	613	370	438	54	446	678	535	364	628	493
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.12	0.36	0.36	0.10	0.34	0.34
Sat Flow, veh/h	1268	1870	1561	970	1631	200	1781	1870	1478	1781	1870	1469
Grp Volume(v), veh/h	194	92	316	38	0	110	380	563	57	26	475	193
Grp Sat Flow(s),veh/h/ln	1268	1870	1561	970	0	1831	1781	1870	1478	1781	1870	1469
Q Serve(g_s), s	6.9	1.9	1.5	1.5	0.0	2.3	3.7	13.5	1.3	0.0	11.2	5.0
Cycle Q Clear(g_c), s	9.2	1.9	1.5	3.4	0.0	2.3	3.7	13.5	1.3	0.0	11.2	5.0
Prop In Lane	1.00		1.00	1.00		0.11	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	427	503	613	370	0	492	446	678	535	364	628	493
V/C Ratio(X)	0.45	0.18	0.52	0.10	0.00	0.22	0.85	0.83	0.11	0.07	0.76	0.39
Avail Cap(c_a), veh/h	550	683	763	463	0	668	535	891	704	375	758	596
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.6	13.9	11.4	15.2	0.0	14.0	18.9	14.3	10.4	18.2	14.6	12.5
Incr Delay (d2), s/veh	0.8	0.2	0.7	0.1	0.0	0.2	10.9	5.2	0.1	0.1	3.6	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.7	2.2	0.3	0.0	0.8	4.6	5.1	0.3	0.2	4.1	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.4	14.0	12.1	15.3	0.0	14.3	29.8	19.5	10.5	18.2	18.2	13.0
LnGrp LOS	B	B	B	B	A	B	C	B	B	B	B	B
Approach Vol, veh/h		602			148			1000			694	
Approach Delay, s/veh		14.4			14.5			22.9			16.7	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.2	22.4		17.8	10.5	21.0		17.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	23.5		18.0	8.5	20.0		18.0				
Max Q Clear Time (g_c+I1), s	2.0	15.5		11.2	5.7	13.2		5.4				
Green Ext Time (p_c), s	0.0	2.2		1.5	0.3	2.0		0.5				

Intersection Summary												
HCM 6th Ctrl Delay			18.6									
HCM 6th LOS			B									

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	1	16	14	0	26	12	673	24	15	541	7
Future Vol, veh/h	19	1	16	14	0	26	12	673	24	15	541	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	110	-	-	100	-	180	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	61	61	61	70	70	70	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	31	2	26	20	0	37	13	716	26	16	576	7

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1386	1380	580	1368	1357	716	583	0	0	742	0	0
Stage 1	612	612	-	742	742	-	-	-	-	-	-	-
Stage 2	774	768	-	626	615	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	120	144	514	124	149	430	991	-	-	865	-	-
Stage 1	480	484	-	408	422	-	-	-	-	-	-	-
Stage 2	391	411	-	472	482	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	107	140	514	114	144	430	991	-	-	865	-	-
Mov Cap-2 Maneuver	107	140	-	114	144	-	-	-	-	-	-	-
Stage 1	474	475	-	403	417	-	-	-	-	-	-	-
Stage 2	353	406	-	438	473	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	37.9	24.4	0.1	0.2
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	991	-	-	167	114	430	865	-	-
HCM Lane V/C Ratio	0.013	-	-	0.353	0.175	0.086	0.018	-	-
HCM Control Delay (s)	8.7	-	-	37.9	43.2	14.2	9.2	-	-
HCM Lane LOS	A	-	-	E	E	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1.5	0.6	0.3	0.1	-	-

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	23	0	28	2	1	10	50	285	16	8	249	22
Future Vol, veh/h	23	0	28	2	1	10	50	285	16	8	249	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	60	60	60	94	94	94	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	34	0	41	3	2	17	53	303	17	9	286	25

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	744	743	299	755	747	312	311	0	0	320	0	0
Stage 1	317	317	-	418	418	-	-	-	-	-	-	-
Stage 2	427	426	-	337	329	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	331	343	741	325	341	728	1249	-	-	1240	-	-
Stage 1	694	654	-	612	591	-	-	-	-	-	-	-
Stage 2	606	586	-	677	646	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	310	326	741	295	324	728	1249	-	-	1240	-	-
Mov Cap-2 Maneuver	310	326	-	295	324	-	-	-	-	-	-	-
Stage 1	665	649	-	586	566	-	-	-	-	-	-	-
Stage 2	565	561	-	635	641	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.7	11.8	1.1	0.2
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1249	-	-	310	741	551	1240	-	-
HCM Lane V/C Ratio	0.043	-	-	0.109	0.056	0.039	0.007	-	-
HCM Control Delay (s)	8	-	-	18	10.1	11.8	7.9	-	-
HCM Lane LOS	A	-	-	C	B	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	0	16	13	0	9	29	671	18	17	535	7
Future Vol, veh/h	2	0	16	13	0	9	29	671	18	17	535	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	92	92	92	95	95	95	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	0	23	14	0	10	31	706	19	19	588	8

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1413	1417	592	1420	1412	716	596	0	0	725	0	0
Stage 1	630	630	-	778	778	-	-	-	-	-	-	-
Stage 2	783	787	-	642	634	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	115	137	506	114	138	430	980	-	-	878	-	-
Stage 1	470	475	-	389	407	-	-	-	-	-	-	-
Stage 2	387	403	-	463	473	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	108	130	506	105	131	430	980	-	-	878	-	-
Mov Cap-2 Maneuver	108	130	-	105	131	-	-	-	-	-	-	-
Stage 1	455	465	-	377	394	-	-	-	-	-	-	-
Stage 2	366	390	-	433	463	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15.8	33.1	0.4	0.3
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	980	-	-	359	152	878	-	-
HCM Lane V/C Ratio	0.031	-	-	0.071	0.157	0.021	-	-
HCM Control Delay (s)	8.8	-	-	15.8	33.1	9.2	-	-
HCM Lane LOS	A	-	-	C	D	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.5	0.1	-	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	18	22	29	35	22	11
Future Vol, veh/h	18	22	29	35	22	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	50	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	20	24	32	38	24	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	70	0	-	0	115	51
Stage 1	-	-	-	-	51	-
Stage 2	-	-	-	-	64	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1531	-	-	-	881	1017
Stage 1	-	-	-	-	971	-
Stage 2	-	-	-	-	959	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1531	-	-	-	870	1017
Mov Cap-2 Maneuver	-	-	-	-	870	-
Stage 1	-	-	-	-	958	-
Stage 2	-	-	-	-	959	-

Approach	EB	WB	SB
HCM Control Delay, s	3.3	0	9.1
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1531	-	-	-	914
HCM Lane V/C Ratio	0.013	-	-	-	0.039
HCM Control Delay (s)	7.4	-	-	-	9.1
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Queues
5: Thornydale/Thornydale Road & Linda Vista

06/23/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	141	125	479	58	219	366	281	31	29	431	171
v/c Ratio	0.60	0.29	0.66	0.20	0.50	0.67	0.28	0.04	0.06	0.75	0.30
Control Delay	29.8	18.5	12.5	18.0	21.3	20.9	10.0	0.1	8.7	26.8	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.8	18.5	12.5	18.0	21.3	20.9	10.0	0.1	8.7	26.8	4.0
Queue Length 50th (ft)	41	34	72	15	60	49	35	0	6	116	0
Queue Length 95th (ft)	89	69	142	32	88	#145	138	0	11	185	18
Internal Link Dist (ft)		1014			1036		836			593	
Turn Bay Length (ft)	150		150	125		280		150	125		325
Base Capacity (vph)	363	671	740	453	666	572	1044	911	503	693	650
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.19	0.65	0.13	0.33	0.64	0.27	0.03	0.06	0.62	0.26

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
5: Thornydale/Thornydale Road & Linda Vista

06/23/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	194	92	316	38	110	380	563	57	26	475	193
v/c Ratio	0.59	0.19	0.47	0.12	0.24	0.68	0.51	0.06	0.07	0.73	0.31
Control Delay	26.2	17.1	8.2	16.7	16.4	22.8	14.1	1.0	7.7	24.5	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	17.1	8.2	16.7	16.4	22.8	14.1	1.0	7.7	24.5	4.3
Queue Length 50th (ft)	57	24	37	10	27	56	92	0	4	131	0
Queue Length 95th (ft)	112	53	79	27	55	#174	#322	6	13	#286	37
Internal Link Dist (ft)		1014			1036		836			593	
Turn Bay Length (ft)	150		150	125		280		150	125		325
Base Capacity (vph)	492	726	682	505	717	565	1110	962	365	806	726
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.13	0.46	0.08	0.15	0.67	0.51	0.06	0.07	0.59	0.27

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.