May 2017

Gillette

Long Range Transportation Plan Update

Final Report

Prepared For:

201 E. 5th Street
Gillette, Wyoming 82716

Prepared By:

DOWL

1901 Energy Court, Suite 170
Gillette, Wyoming 82718

Gillette

Long Range Transportation Plan Update

Final Report

May 16, 2017

Prepared By:

Jeffrey Rosenlund, P.E., PTP

Professional Engineer (Civil)
JEFFREY ROSENLUND
10,098
Date 16 MAY 2017
WYOMING

DOWL

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1.0 Introduction and Background

1.1 Background

In 2004, the City of Gillette completed a *2004 Transportation Planning Study*. The 2004 study served as a foundation for transportation planning in Gillette. It established an effective transportation network, standardized transportation corridors, and identified needs for new corridors to accommodate future traffic.

The 2004 study was updated in 2009. The *2009 Transportation Plan Update* built upon the foundation laid in the 2004 study and incorporated information from studies and projects completed since 2004. The main objectives of the 2009 update were to update the transportation model, evaluate the transportation network, and develop a priority list of transportation projects.

This **2017 Long Range Transportation Plan Update** builds on the previous studies. Primary objectives of this transportation plan update include:

1. Update the transportation model;
2. Evaluate the future transportation network; and
3. Develop a priority list of transportation projects, including signal projects.

1.2 Process

The study was guided through interaction and collaboration with a core project team composed of City of Gillette, Campbell County, WYDOT, and Campbell County School District staff. Minutes of these workshops are contained in Appendix A. Two public open houses were held and public comment on the update was solicited.

2.0 Existing Data Since 2009

2.1 Recent Studies

The following studies are relevant and were reviewed in the 2017 Long Range Transportation Plan update:

- *2004 Transportation Planning Study,*
- *2009 Transportation Plan Update,*
- 2008 *Railroad Crossing Alternatives Evaluation*,
- 2009 *Parks and Pathways Master Plan ,*
- *2010 Gillette Express Transportation Study*
- 2006 *The "Gillette Plan" Comprehensive Plan,* and

- *RTi Technical Memorandum on Population Growth Projections for the Gillette Regional Master Plan WWDC Level I Study*.

Additional studies recommended in the *2009 Transportation Plan Update* that have been performed since 2009 are:

- 6th Street Improvement Reconnaissance Study – a preliminary evaluation of converting 6th Street from a local-through street with parking and direct access to a minor arterial was performed shortly after the 2009 Transportation Plan Update. This preliminary design identified improvements to the grade and slopes as well as opportunities to manage accesses along this street.
- Boxelder Road – Highway 59 to 4J Road Widening and Access Management Reconnaissance Study/Preliminary Design – this study evaluated options for widening Boxelder Road from Highway 59 to 4J Road, and access management of the many accesses along this arterial.
- Western Drive Corridor Study – this study evaluated options for building Western Drive from Highway 50 to Highway 14/16 and an interchange feasibility/justification study for the intersection of I-90 and Western Drive. This study identifies the R.O.W. requirements, potential interchange and roadway locations, and costs for the various options.

2.2 Recent Projects

The City of Gillette has constructed some of the priority projects identified in the *2009 Transportation Plan Update*. Campbell County and the WYDOT have also assisted in funding and building some projects. Recently completed projects (since 2009), and projects that are “committed” to be built (currently in design or construction) are shown in Figure 2.1. This update incorporates these recent projects in the transportation network analysis.

2.3 Safety Analysis

Recent crash data was also reviewed to identify roadways or locations that might require improvements to enhance travel safety within the comprehensive planning area. Intersections with high crash counts were evaluated with respect to signal prioritization.

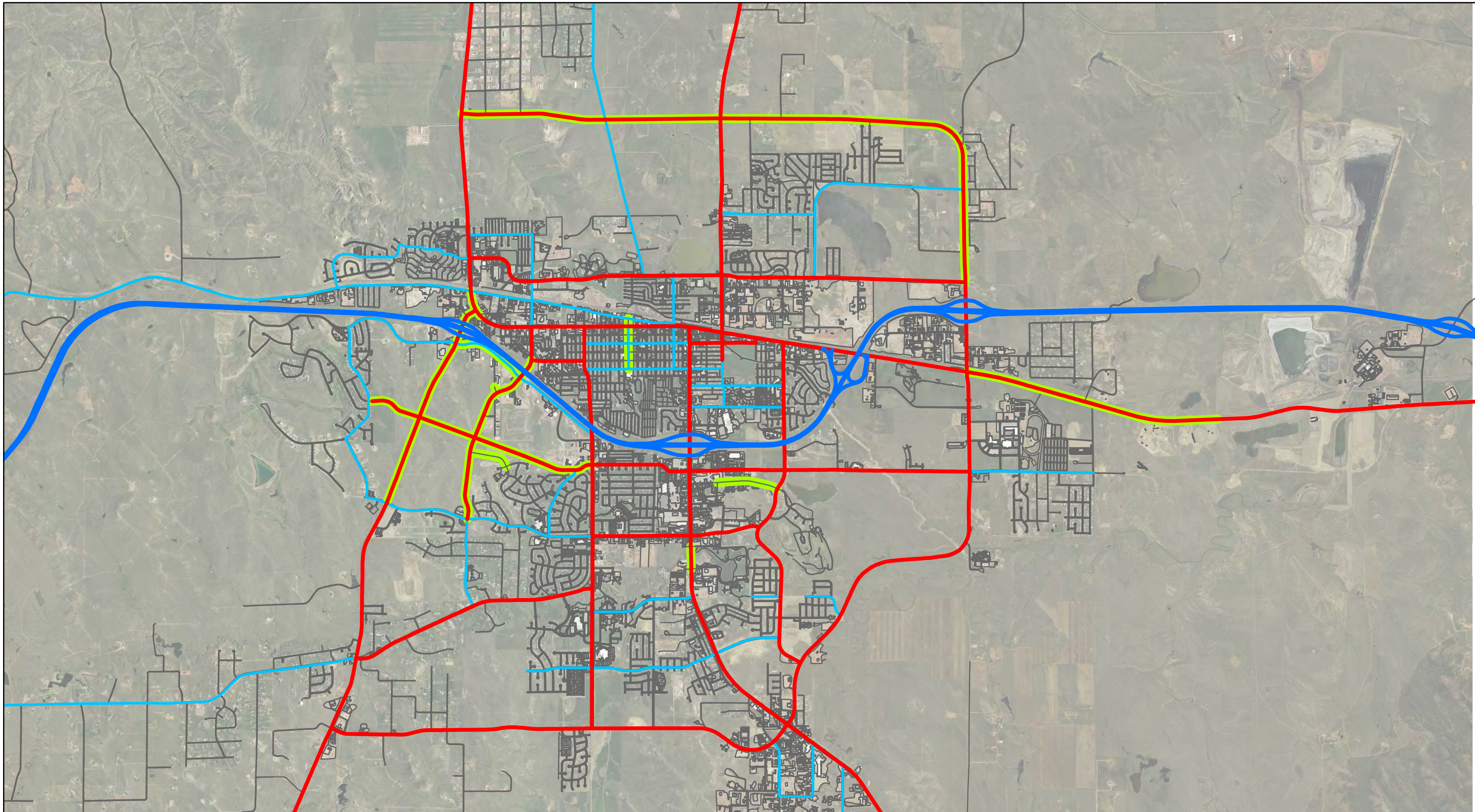
2.3.1 Summary of Crash Data Analysis

Crashes within the City of Gillette were reviewed to identify areas in the city where traffic safety may be a concern. Crash data from January 1, 2010 through December 31, 2015 was received and reviewed. The data was placed in GIS format to identify areas of concern.

In summary, the higher crash density coincides with the higher traffic areas of the city, as well as some residential areas. A few of the areas with high crash volumes are:

- Highway 59 corridor from 2nd Street to Garner Lake Road,
- Downtown Gillette,
- 2nd Street/Skyline Drive intersection and Highway 14/Echeta Road intersection and this area of Highway 14/16,
- the residential area northwest of S Four J Road and W Four J Road, and
- the residential area northeast of Highway 59 and I-90.

There were a total of 5,804 crashes over the six-year period. Figure 2.2 shows a density map of all reported crashes within the City of Gillette from 2010 to 2015 and Figure 2.3 shows density maps of various crash types.



Legend

- Interstate
- Arterial
- Collector
- Local Street
- 2010 to 2017 Projects

N

0 2,000 4,000
Feet

RECENT PROJECTS MAP

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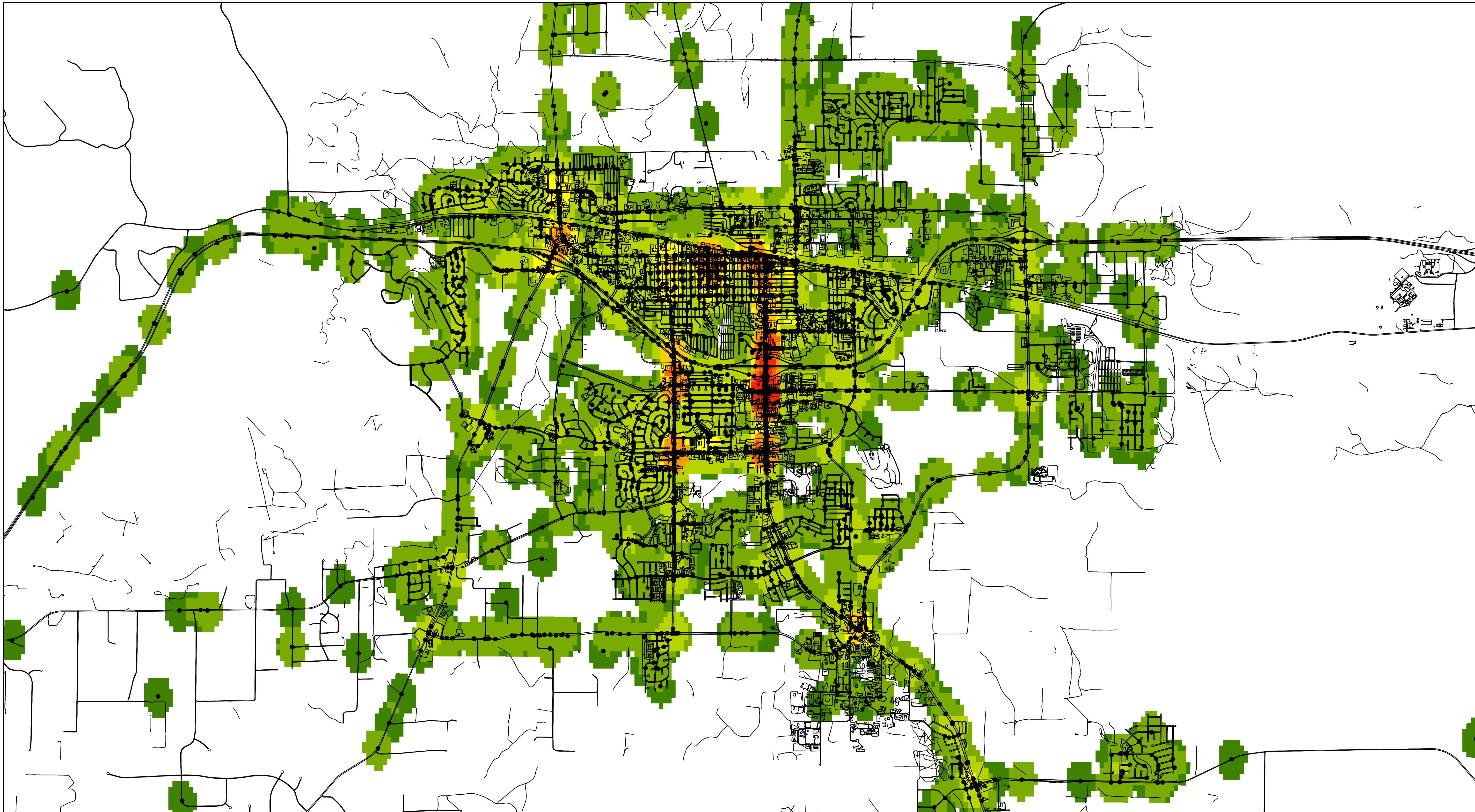
Figure 2.1



Legend

- CRASH LOCATIONS

CRASH DENSITY

<VALUE>

0 CRASHES	11-50 CRASHES	101-150 CRASHES
1 CRASH	51-75 CRASHES	151-200 CRASHES
2-10 CRASHES	76-100 CRASHES	200-1000 CRASHES

N

0 1,250 2,500
Feet

CITY OF GILLETTE 2010-2015 CRASH DENSITY MAP

GILLETTE 2017 LRTP UPDATE

Date: March 16, 2017

DOWL

Figure 2.2

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig2.2 City of Gillette 2010-2015 Crash Density Map.mxd Mar 16, 2017 11:47:52 AM User: dhomola

Legend

Crash Density Map <VALUE>

- 0 CRASHES
- 1 CRASH
- 2-5 CRASHES
- 6-10 CRASHES
- 11-20 CRASHES
- 21-40 CRASHES
- 41-60 CRASHES
- 61-80 CRASHES
- 81-100 CRASHES

N

0 3,000 6,000
Feet

CITY OF GILLETTE 2010-2015 CRASH DENSITY MAPS

GILLETTE 2017 LRTP UPDATE

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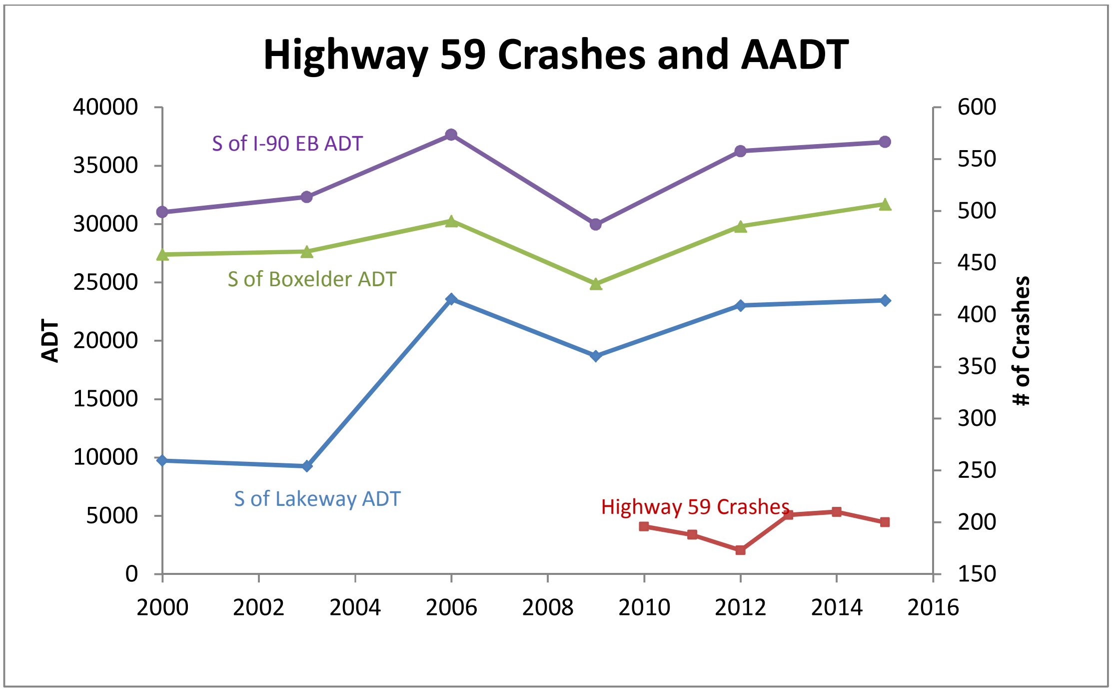
Figure 2.3

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig2.3 City of Gillette 2010-2015 Crash Density Map.mxd Mar 16, 2017 11:50:21 AM User: dhomola

The highest density of crashes was on Highway 59, especially the red-shaded area to the south of I-90. This is a commercial area with retail stores, restaurants, and hotels that attract high traffic volumes. It is also a state highway that connects the southern part of Campbell County to I-90. Highway 59 segments in this area carry as much as 30,000 vehicles per day. A high density of head-on, angle, rear-end, sideswipe crashes were shown in this area.
Figure 2.4 shows the yearly trends of crashes and vehicle traffic on Highway 59. From 2011 to 2015, while traffic volumes are increasing slightly, the crashes are kept at similar numbers.

Figure 2.4 Highway 59 Traffic Volume and Number of Crashes



In the downtown area, Gillette Avenue had the highest crash density. As shown in Table 2.1, the crashes on Gillette Avenue consisted mostly of backing-up crashes. This is likely due to the high number of vehicles on the angled street parking stalls that are unable to see the upstream traffic while backing into the lane. However, it should be noted that the crashes seem to have drop ped off in recent years after the reconstruction of Gillette Avenue, indicating that some traffic calming measures implemented on Gillette Avenue have been beneficial.

Table 2.1: Crashes on Gillette Avenue

Impact Type	2010	2011	2012	2013	2014	2015	Total
Angle	1	4	4	3	2	0	14
Rear End	1	0	1	0	0	0	2
Backing-Up	6	10	8	3	4	5	36
Sideswipe	1	1	5	1	0	0	8
Other/Unknown	0	3	1	1	2	3	10
Total	**9**	**18**	**19**	**8**	**8**	**8**	**70**

The northwest area of Gillette has high density of crashes at 2nd Street/Skyline Drive intersection and Highway 14/Echeta Road intersection, which corresponds to a high volume of traffic at this intersection.

In the residential areas, some local street intersections had a high number of angle crashes and rear end crashes. This could be due to cut-through traffic that uses residential streets in order to bypass the congested main road. Often a characteristic of cut-through traffic is that it is observed traveling at speeds higher than the speed limit. These crashes could possibly be reduced by improved signage and traffic calming measures.

In addition to the cut-through traffic in residential areas, higher crash densities were also noticed on the streets with higher traffic volumes in the residential areas. For example, 9th and 12th Streets in the residential area northeast of Highway 59 and I-90 have higher crash volumes. Crashes in residential areas are often a result of a conflict between access and mobility, as further described in the following section.

3.0 Functional Classification Network

Streets are classified by their function. For example, local streets provide access through many driveways, alleys, curb cuts, etc. with slower speeds and less regional mobility, while major arterial roadways (interstates, freeways) have limited access, higher speeds and greater mobility. The two functions of mobility and access are used to classify streets as local, collector, or arterial roadways.

Figure 3.1 shows the current roadway functional classifications adopted by the City of Gillette and Campbell County Officials; and approved by WYDOT and the Federal Highway Administration. The adopted functional classification system categorizes existing and proposed roadways as arterials, collectors, or local streets based on the intended use for each roadway and distinguishes between existing and planned roadways.

3.1 Street Design Criteria

The recommended street designations are described below as set forth in previous studies with specific design criteria found in the *City of Gillette Design Standards*. The following descriptions and Table 3.1 generally describe the various roadway designations and corresponding functions.

- Arterial – Arterials move traffic at higher speeds and are intended to connect points of major destinations to provide for regional traffic movement. Limited access improves the arterial's mobility and safety. Target speeds on the arterial segments are in the range of 35 to 50 mph with slower speeds appropriate in the urbanized core of the city and higher speeds appropriate to outlying areas and areas where access control has been established. Within Gillette, arterials tend to be four-lane streets, but can be wider as volumes dictate. Parking is generally not allowed along arterials and access spacing is controlled appropriate with target speed.

- Collector – Collectors service neighborhoods and districts by connecting traffic movement between arterials and local streets. This function commonly provides for some direct access to abutting property. These are moderate speed streets, with target speeds in the range of 30 to

40 mph. Although generally two lanes wide, collectors can be four lanes in width. Lower target speeds are appropriate in residential and mixed-use areas, while higher target speeds can be used in commercial and industrial areas. Access frequency is reduced and the type of access design is affected by higher target speeds. Parking may be allowed along collectors, particularly those with lower target speeds.

- Local-through – these streets are local streets (see below) that provide limited connectivity between residential subdivisions. As such, they have a limited collector function, but are essentially residential in character. Target speeds on local-through streets are 25 to 30 mph and are dependent upon width and activity.

- Local – A local street provides circulation, parking, access to adjoining property and parking facilities. These streets provide the greatest degree of access, have lower speeds, and yield the right of way to all other street classes. Street architecture and traffic calming on local streets may be used to discourage through traffic and higher speeds. Target speeds on local streets are 20 to 25 mph or less and are dependent upon width and activity.

Table 3.1: General Design Criteria by Classification

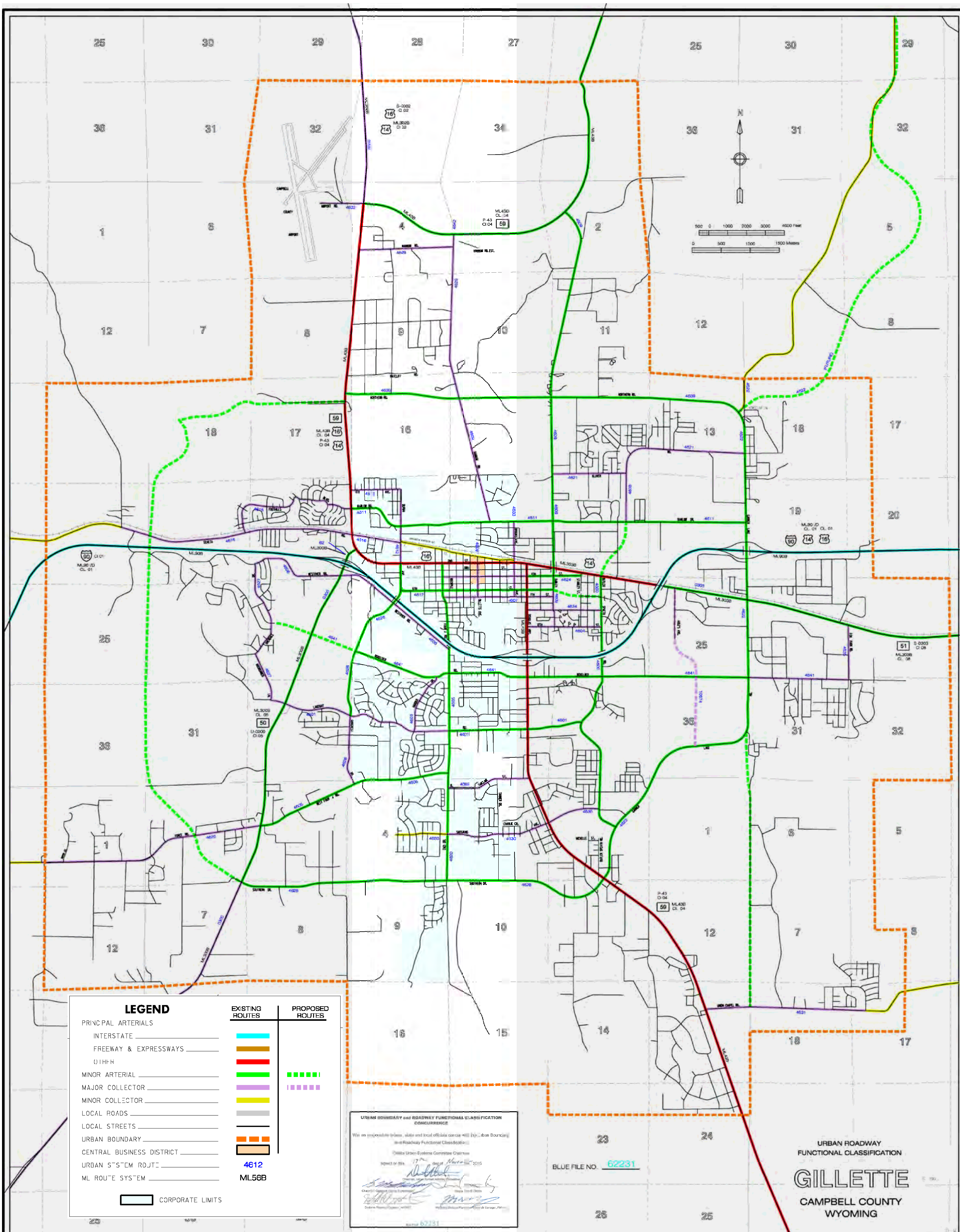
Street Classification	Target Speed (mph)	Access Spacing (ft)	Parking	Street Width (ft)	Right of Way Width (ft)
Arterial	35-50	250-600	None	50-98	100-120
Minor Arterial	30-45	100-400	None	38-72	90
Collector	30-40	100-350	Parallel	36-56	66-80
Local-through	25-30	50-100	Parallel	36-50	50-70
Local	20-25	50	Diagonal or parallel	36-50	50-70

Note: For more specificity, see The City of Gillette Design Standards.

Network Connectivity Criteria
The ability of a street to function as an arterial or collector is also influenced by connectivity in the street network. Adequate connectivity in the network is important for individual streets to function according to their classification. Without sufficient connections and parallel routes of similar function, traffic of all types (local and regional) will be focused on the streets that connect across the network.

Criteria for spacing of arterials and collectors should be used to establish potential future network needs. Arterial roadways should be established on an expansion of the City's grid system with an approximate spacing of one-eighth (1/8) to one-quarter (1/4) mile in business districts and the urban core and one-half (1/2) to one (1) mile in suburban areas. Collector streets, in order to get traffic to the arterial roadways should be spaced uniformly between parallel arterials. Topography, present and future land use, sight distance, safety, connectivity, and existing street geometry are all considered when evaluating the street network.

The existing Gillette transportation network has, for the most part, been planned and constructed based on the criteria above. Future development within the Gillette area should continue to be guided by the criteria stated above and the future network map provided in Chapter 5 of this report. Existing corridors may require modification (i.e. removing access, adding/removing parking, etc.) to enable the roadway network to function as intended. The proposed improvements and future network are discussed further in this report.



0 0.5
Miles

WYDOT Existing Network Functional Classification Map

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Figure 3.1

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig3.1 Existing Functional Classification Map.mxd Mar 16, 2017 5:26:36 PM User: dhomola

4.0 Travel Forecasting Modeling

Gillette's travel forecasting model was used to evaluate future growth. This section highlights the characteristics of Gillette's travel forecasting model.

The primary components of travel forecasting applications are a network, traffic analysis zones (TAZs), and a four-step modeling process that includes trip generation, trip distribution, mode split, and traffic assignment. Following are characteristics common to the forecasting process:

- Network - The network is representative and mainly includes major links in the roadway system. Not all roadways are modeled.
- Traffic Analysis Zones - TAZs divide the study area into discrete areas within the network. Land use and socioeconomic data are associated with each TAZ and are used to calculate trips between zones. Figure 4.1 shows the TAZs used for Gillette.
- Trip Generation – Trips were generated based on the number of dwelling units per traffic analysis zone. For this study, generated trips were separated into the following trip types:
  - Home Based Work (HBW)
  - Home Based Shopping (HBS)
  - Home Based Recreational (HBR)
  - Home Based Other (HBO)
  - Non Home Based (NHB)

  Attractions for each zone were based on land use and separated into the same trip types mentioned above.

  Special generators were also used for the schools, airport, and hospital.

  A portion of the traffic on the transportation network within the study area is generated by sources outside of the planning boundary. These types of trips are called external trips. Significant sources of external demand in the Gillette area are traffic associated with coal mines, power plants, and other energy development work in Campbell County. Also, county subdivisions and towns such as Rozet and Moorcroft contribute traffic to Gillette.

- Trip Distribution – Trips were distributed around the model from TAZ to TAZ, based on the productions and attractions in each TAZ, and the distance to other zones.

- Traffic Assignment – The final step of the modeling process is trip assignment, which is the step in which the model determines how much traffic will be on each road. This is determined by the origin and destination of trips and the roadway network. The model accounts for roadway speed or travel time between zones and capacity of the roadways when assigning trips to the network.

WYDOT has provided the socioeconomic data, trip generation and trip distribution for past studies. However, WYDOT has stopped performing modeling for communities in Wyoming. Therefore, DOWL used existing land use and socioeconomic data and the TransCAD model to perform the travel forecasting for this study. Additional travel forecasting model data such as productions and attractions for each TAZ can be found in Appendix B.

4.1 Transportation Model Calibration
Travel forecasting for the 2017 Long Range Transportation Plan Update started with modeling 2015 or existing (base year) land use and socioeconomic data on a network representing the existing system. This 2015 base year model was calibrated and validated using observed conditions (2015 traffic counts) to ensure the model was representing the existing conditions adequately and functioning correctly.

4.2 Future Growth Scenarios

Once calibrated, the model was used to evaluate future conditions, which was accomplished by entering expected changes in land use and changes in the street network. The future conditions were evaluated by first loading future traffic over the existing plus committed network, and then loading future traffic over the proposed future network. Results from iterations of the model (termed a model run) were then compared with each other.

To determine the amount of future traffic demand, estimates of the amount of growth expected to occur in the urbanized area are needed on a zone (TAZ) by zone (TAZ) basis. DOWL met with City of Gillette Engineering and Planning Staff to identify probable growth areas and future land use. This growth and land use was then assigned to each TAZ in the model. A target population for Gillette of 50,000 was used as the main growth scenario for this study update. To evaluate roadway improvements and prioritize signals, other scenarios were also evaluated. The three population scenarios evaluated were:

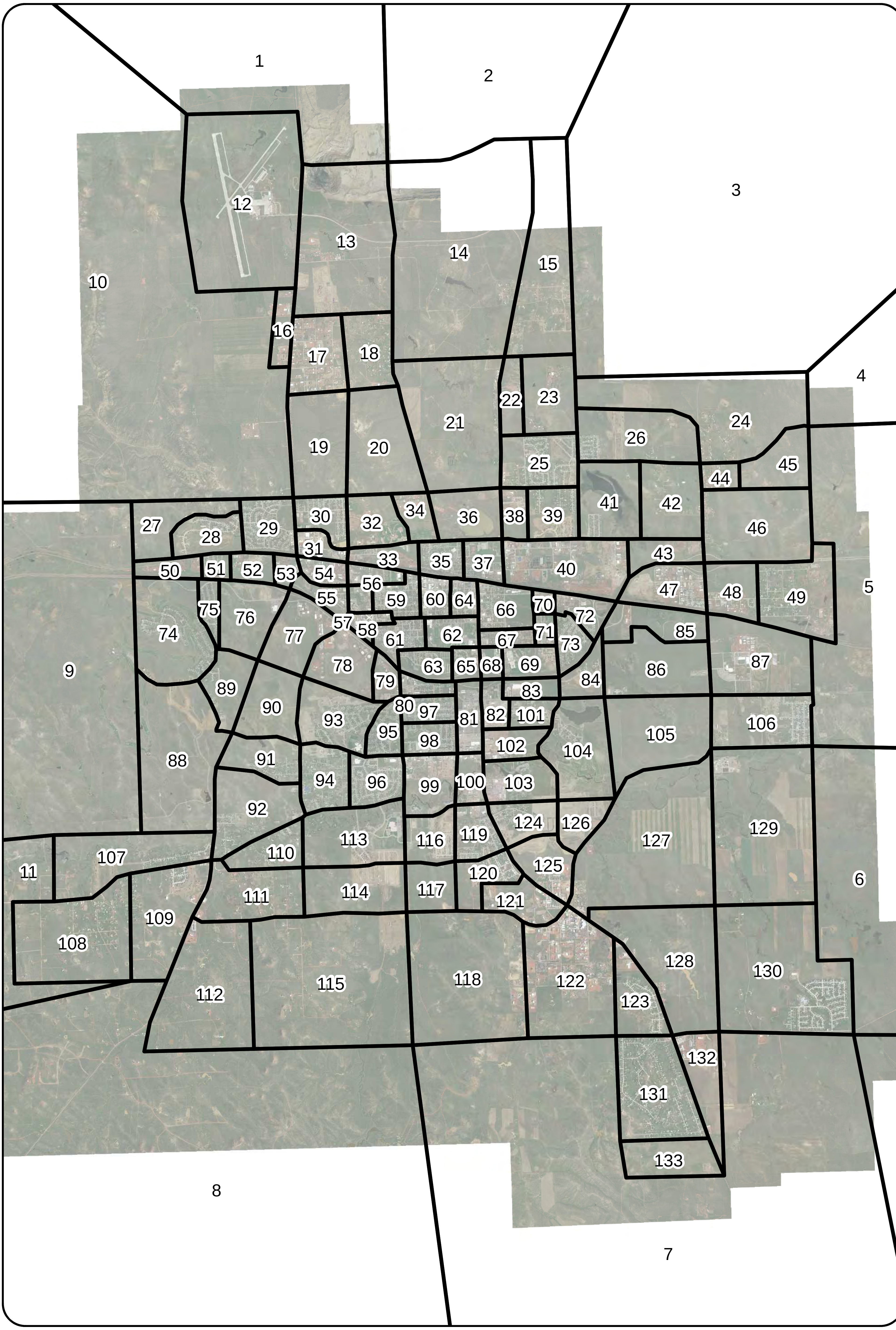
- Existing 2015 (Population = 31,500)
- Interim scenario (Population = 38,000)
- Main planning scenario (Population = 50,000)

For each of these growth scenarios, probable land use was developed and used in the trip production and attraction process.

Figure 4.2 shows the occupied land for the three growth scenarios. Figure 4.3 shows the growth in dwelling units by TAZ for the three growth scenarios identified above. Figures 4.4, 4.5 and 4.6 show the occupied parcels and the zoning of those parcels for each of the growth scenarios.

Each of the growth scenarios shown above were used to assign traffic to roadways in the transportation network. For travel forecast modeling, three networks were used. They are:

- Existing 2015 network
- Committed Network – the existing network plus “committed” projects (projects in the design phase, or are currently being constructed). Figure 4.7 shows the committed network for Gillette showing functional classification and number of lanes.
- Proposed Network - proposed roadway network to accommodate the traffic for a City of Gillette population of 50,000. Figure 4.8 shows the future network for Gillette with functional classification and number of lanes shown. More detailed discussion on this network is covered in other sections of this report.



Legend

TRAFFIC ANALYSIS ZONE

N

0 0.5 1
Miles

TRAFFIC ANALYSIS ZONES

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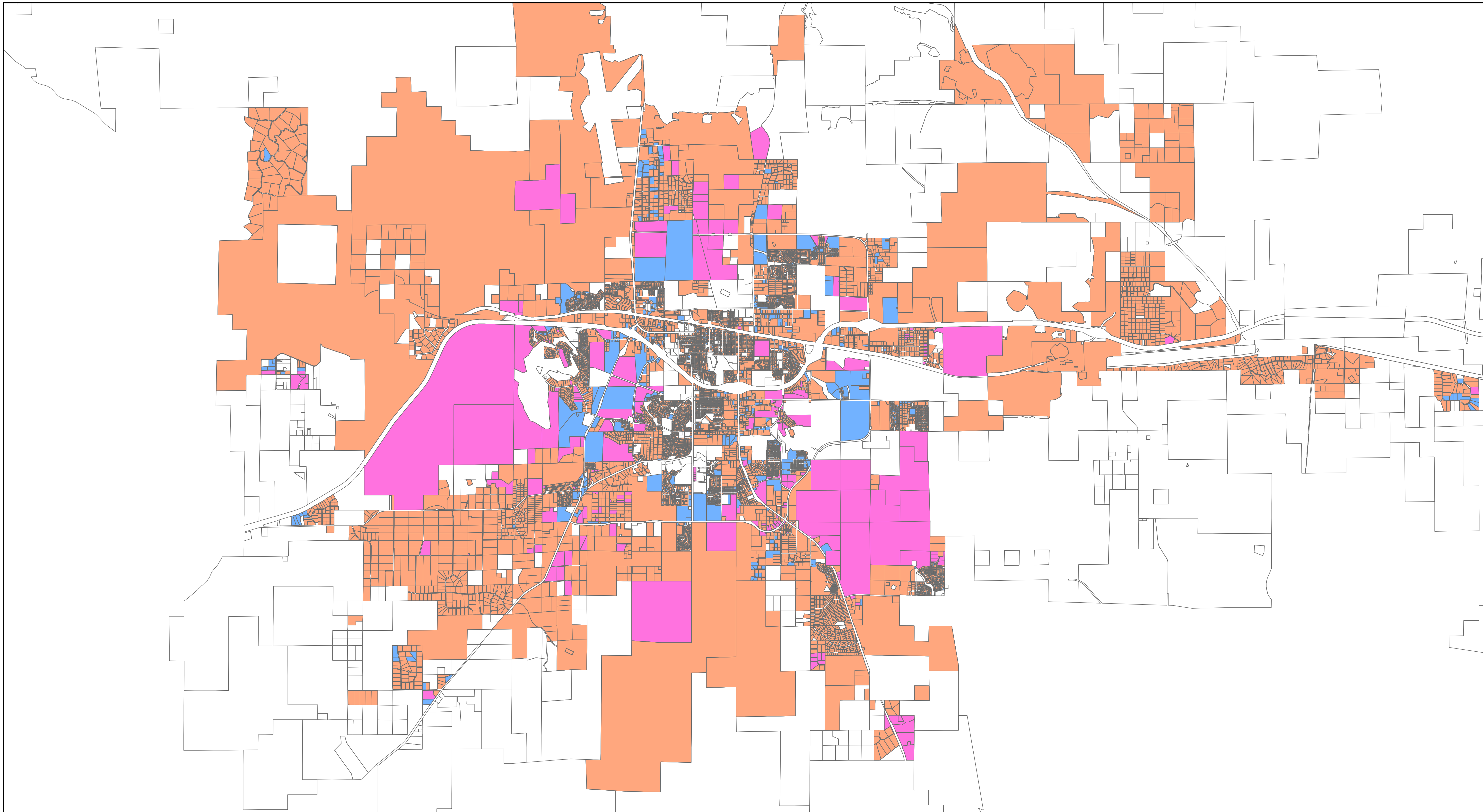
Figure 4.1

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig4.1 Traffic Analysis Zones.mxd Mar 16, 2017 11:55:59 AM User: dhomola



Legend

Occupied Parcels | Population 38K Growth | Population 50K Growth

0 0.5 1
Miles

N

OCCUPIED PARCELS FOR VARIOUS GROWTH SCENARIOS

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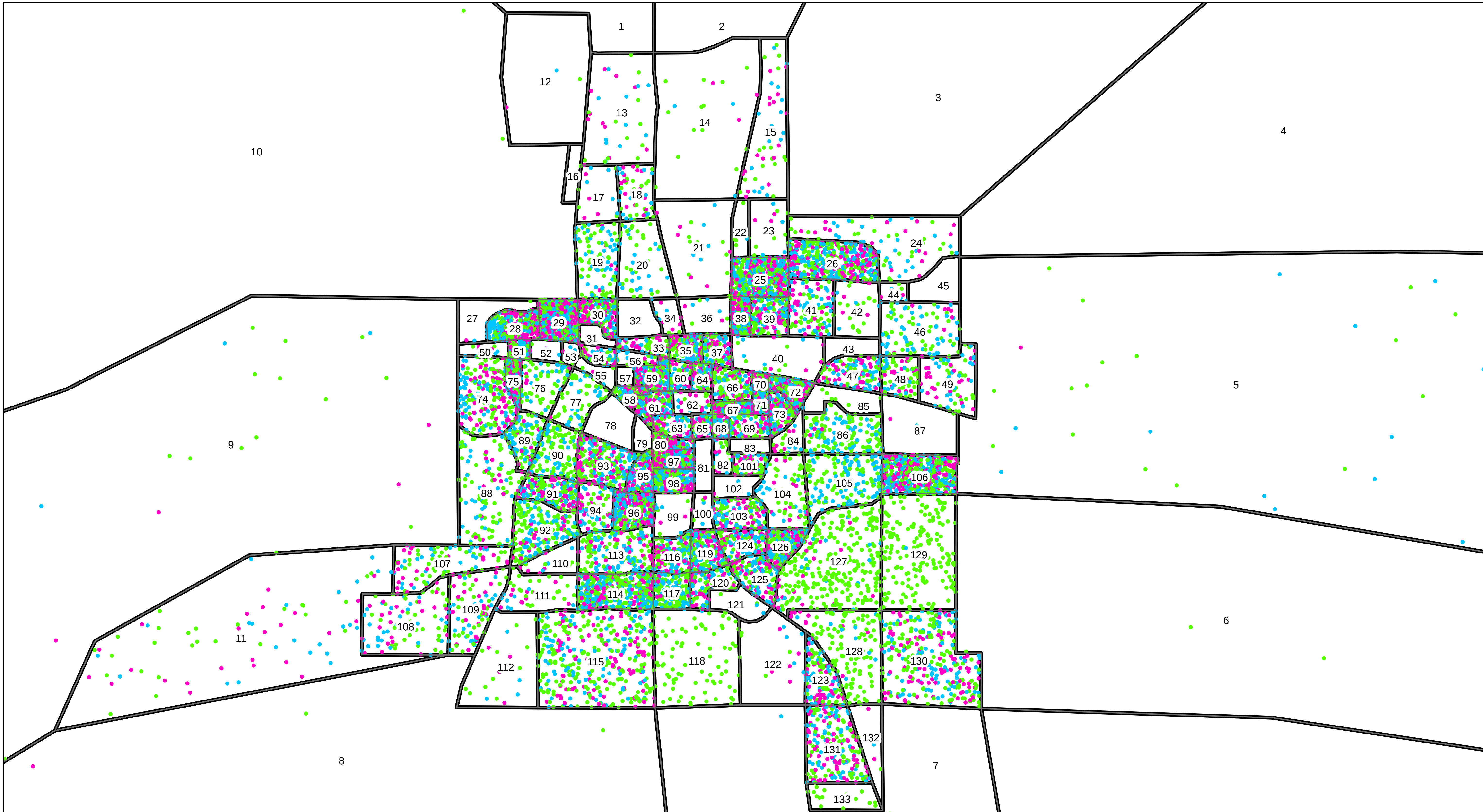
Figure 4.2



Legend

1 Dot = 5 Dwelling Units · Existing · 38K · 50K

DWELLING UNIT GROWTH

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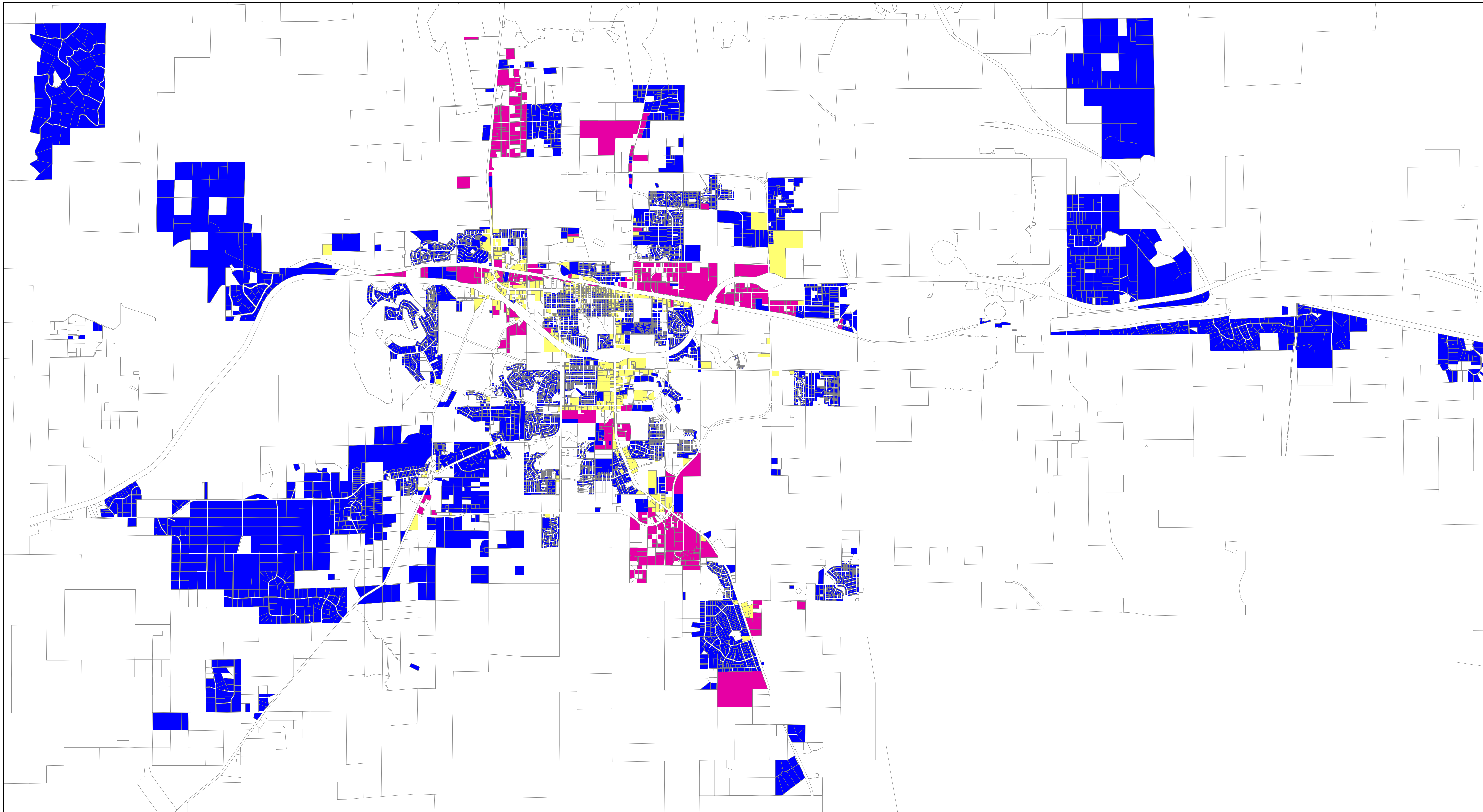
Figure 4.3

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig4.3 Dwelling Unit Growth.mxd Mar 16, 2017 12:01:39 PM User: dhomola



Legend

- Commercial
- Industrial
- Residential

0 0.5 1
Miles

N

Existing Occupied Parcels

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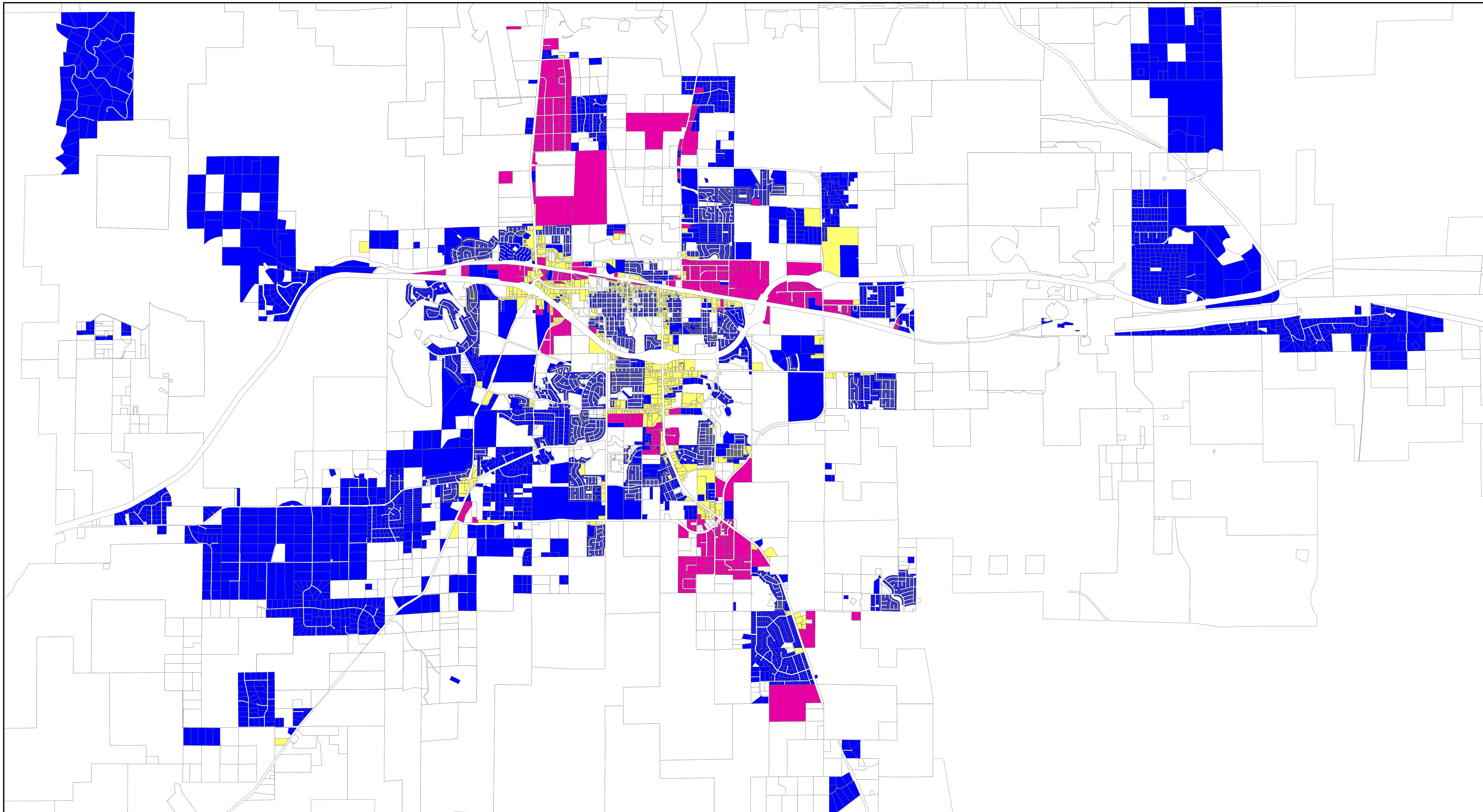
Figure 4.4

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig4.4 Existing Occupied Parcels.mxd Mar 16, 2017 12:03:37 PM User: dhomola



Legend

Commercial
Industrial
Residential

Pop. 38,000 Occupied Parcels

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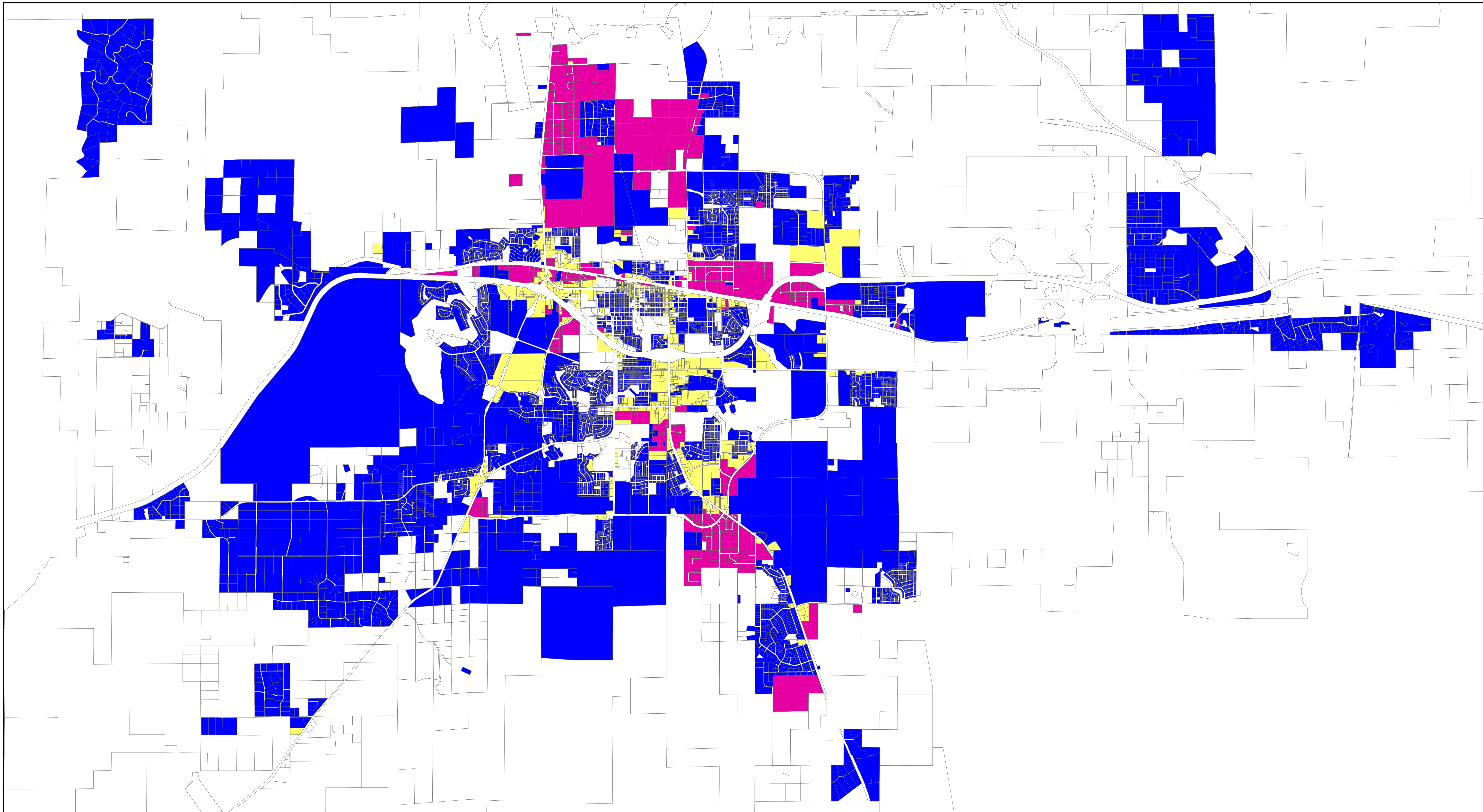
Figure 4.5



Legend

Commercial Industrial Residential

0 0.5 1
Miles

N

Pop. 50,000 Occupied Parcels

Gillette 2017 LRTP Update

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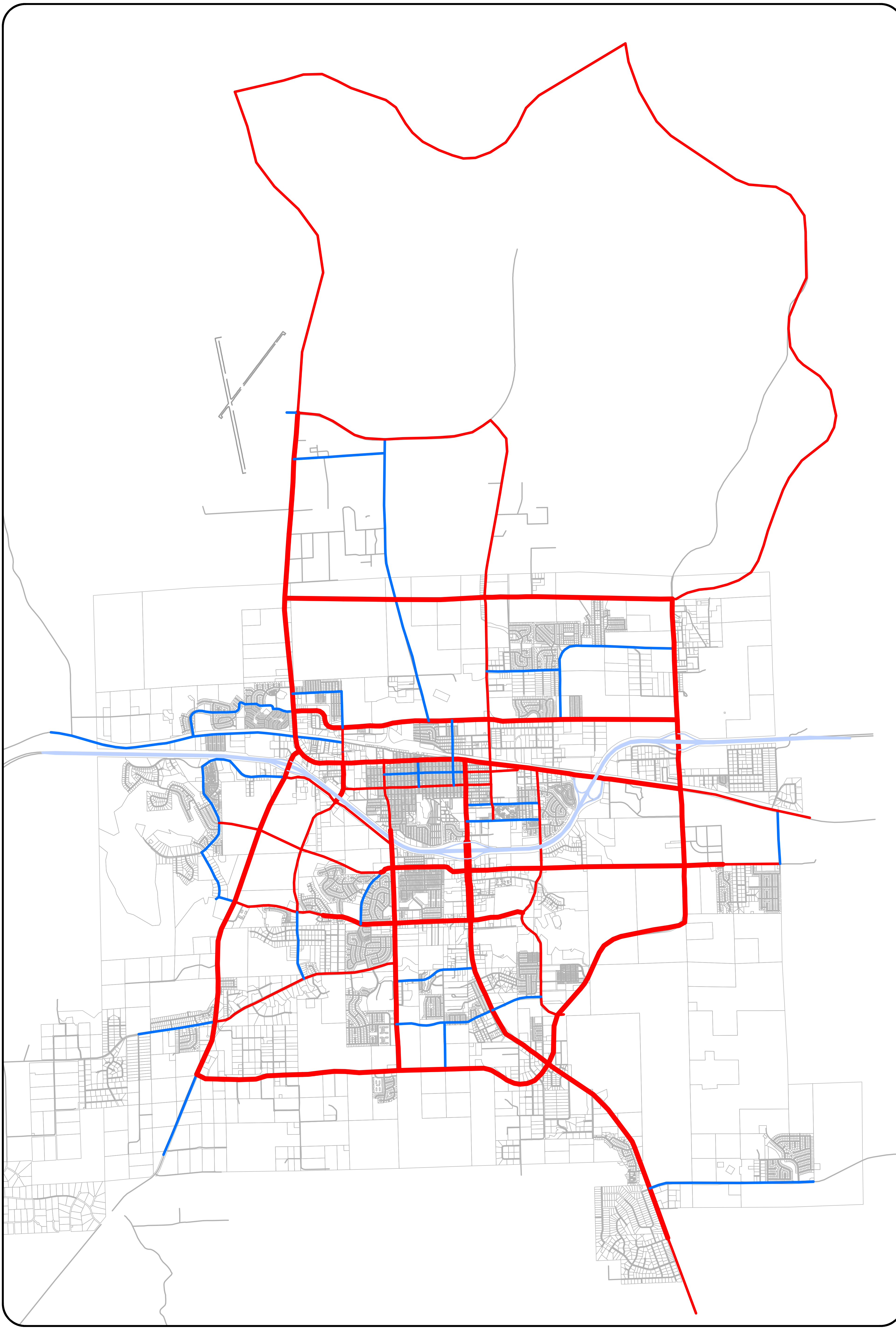
Figure 4.6

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig4.6 Pop. 50000 Occupied Parcels.mxd Mar 16, 2017 12:09:49 PM User: dhomola



Legend

Lanes, Functional Class

- Interstate
- Interstate Ramps
- 6 Lane Arterial
- 4 Lane Arterial
- 2 Lane Arterial
- 4 Lane Collector
- 2 Lane Collector
- Streets

0 0.5 1
Miles

N

Committed Network - Lanes and Functional Class

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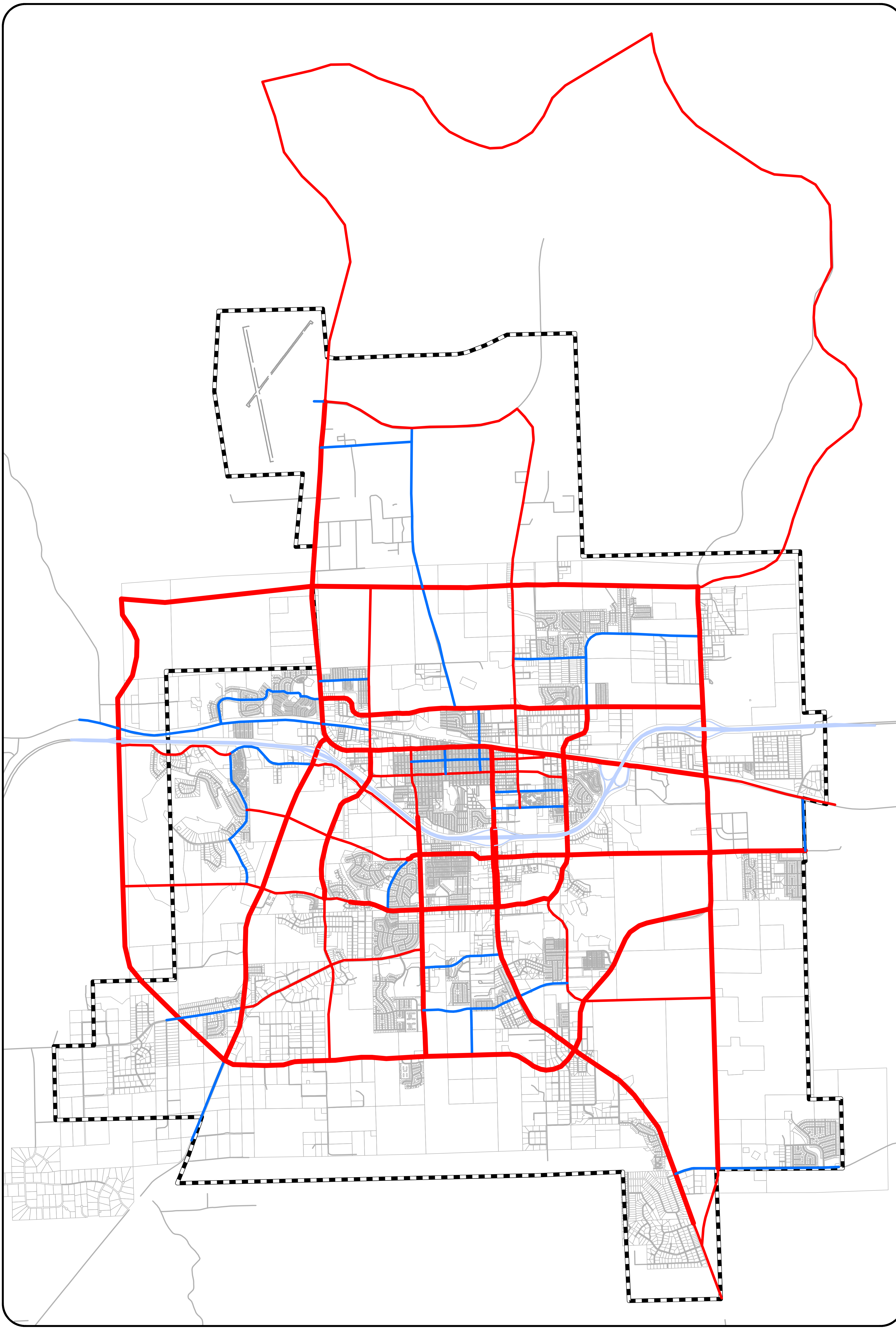
Figure 4.7

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig4.7 Committed Network - Lanes and Functional Class.mxd Mar 16, 2017 12:21:34 PM User: dhomola



Legend

Lanes, Functional Class

- Interstate
- Interstate Ramps
- 6 Lane Arterial
- 4 Lane Arterial
- 2 Lane Arterial
- 4 Lane Collector
- 2 Lane Collector
- Model Boundary
- Streets

N

0 0.5 1
Miles

Proposed Network - Lanes and Functional Class

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Figure 4.8

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig4.8 Proposed Network - Lanes and Functional Class.mxd Mar 16, 2017 12:41:58 PM User: dhomola

5.0 Level of Service Analysis

Level of service (LOS) is a quality measure describing operational conditions within a traffic stream. Operational conditions affecting the LOS include speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. LOS is determined by the ratio of a roadway's volume to its capacity. A level of service analysis was performed for the purpose of relating each roadway's volume and capacity. Table 5.1 shows each LOS, its corresponding volume-to-capacity ratio (v/c), and a general description of the traffic conditions to be expected within the LOS.

Table 5.5.1: Level of Service Relationships.

Level of Service	V/C Ratio	Description
A	0.00 to 0.65	Below capacity. Free-flow conditions with unimpeded maneuverability. Delay at signalized intersections is minimal.
B	0.66 to 0.75	Below capacity. Reasonably unimpeded traffic flow with slightly restricted maneuverability. Intersection delays are still minimal.
C	0.76 to 0.85	Below capacity. Speeds and maneuverability controlled due to increased traffic volumes.
D	0.86 to 0.95	Approaching capacity. Restriction of maneuverability and controlled-intersection delays become substantial.
E	0.96 to 1.00	At capacity. Conditions maintain low speeds and increased intersection congestion.
F	above 1.00	Over capacity. Very low speeds, long delays, and low degree of maneuverability.

Table 5-2 is a service volume table calculated from the LOS relationships. The service volume table relates the number of lanes for a given urban roadway to the average daily traffic (ADT) threshold within each LOS. For example, the maximum ADT a major arterial, such as Highway 14/16, can handle and still maintain a LOS C is 33,660 vehicles. The corridor will operate at an unacceptable LOS (D, E, or F) with an ADT greater than 33,660 vehicles.

The assumptions made in the Table 5-2 are general and may not apply to all roadways in the Gillette network. Roadway intersections play a significant role in the determination of LOS. Effective green ratio is a relationship between the effective green time of a traffic signal to the entire time period of the signal cycle. For example, an effective green ratio for major arterials of 0.55 assumes the signal is green at all intersections for the traffic on the arterial roadway 55 percent of the time. This is a reasonable assumption for intersections with minor arterials, collectors, and locals. However, in the event of an intersection with another major arterial, such as the intersection of HWY 59 and Boxelder Road, the green time for each roadway may be reduced.

Despite the affect intersections have on traffic flow and congestion, the LOS analysis based on roadway capacity provides a good indication of how well the proposed network will handle future traffic. The following results show how the existing, committed, and proposed networks accommodate the various levels of traffic.

Table 5.5.2: Service Volume Table.

Level of Service Threshold Volumes						
Total Daily Vehicles (ADT)						
	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F
Interstate						
4 Lanes	49920	57600	65280	72960	76800	> 76800
Major Arterial						
4 Lanes	25740	29700	33660	37620	39600	> 39600
2 Lanes	12870	14850	16830	18810	19800	> 19800
Minor Arterial						
4 Lanes	20475	23625	26775	29925	31500	> 31500
2 Lanes	10238	11813	13388	14963	15750	> 15750
Collector/Local						
4 Lanes	15470	17850	20230	22610	23800	> 23800
2 Lanes	7735	8925	10115	11305	11900	> 11900

Note: The table above is based on the Highway Capacity Manual and the following assumptions.

	Interstate	Major Art.	Minor Art.	Collector/Local
Effective Green Ratio	0.8	0.55	0.45	0.35
Adj. Sat. Flow	2400	1800	1750	1700
Signal Density (sig/mi)		0.8	3	5

Table 5.2 was used to analyze the existing traffic conditions based on daily traffic counts from 2015 for the Gillette area, as well as the predicted future conditions for the following scenarios.

- Figure 5.1 Existing Network LOS (Population: 31,500)
- Figure 5.2 Committed Network LOS (Population: 31,500)
- Figure 5.3 Committed Network LOS (Population: 38,000)
- Figure 5.4 Committed Network LOS (Population: 50,000)
- Figure 5.5 Proposed Network LOS (Population: 38,000)
- Figure 5.6 Proposed Network LOS (Population: 50,000)
- Figure 5.7 Proposed Network LOS Gurley Avenue Connection (Population: 50,000)

A review of the model results compared to the 2015 traffic counts show the model is calibrated well, and the main travel patterns exhibited by the model reflect the tendencies of traffic in Gillette.

The following section gives a brief discussion of each model run and the corresponding LOS figure for those runs.

Figure 5.1: Existing Network LOS (Population: 31,500)

The existing Gillette network shows a few areas of congestion using the analysis criteria described above. The main areas are Brooks Avenue, Burma Avenue and Gurley Avenue crossings of the railroad tracks.

Figure 5.2: Committed Network LOS (Population: 31,500)

Figure 5.2 shows a model run with the committed network and the existing population. The committed network consists of roadways in the existing network, plus roadways currently in construction or design, and includes the additions of Boxelder Road from Highway 50 to Overdale Drive, reconstruction of Boxelder from Highway 59 to 4J as four lanes, a new extension of Garner Lake Road northeast of Gillette to connect to the Highway 59 relocation project. With these roads, and a population of 31,500, the following points were noted:

- The crossings of the railroad tracks is congested, as in the existing model run, although some of the committed projects "pull" some of the traffic off of the existing railroad crossings.

Figure 5.3: Committed Network LOS (Population: 38,000)

Figure 5.3 shows a model run with the committed network and a 38,000 population. With these roads, and a population of 38,000, the following points were noted:

- Growth on the southern side of Gillette continues to increase traffic on the north-south roadways such as 4J, Highway 59 and Butler-Spaeth Road.
- The Gurley Avenue and Burma Avenue crossings of the railroad tracks become more congested.

Figure 5.4: Committed Network LOS (Population: 50,000)

Figure 5.4 shows the results of the 50,000 population growth scenario modeled on the committed network. This model scenario illustrates the need for network improvements beyond what is currently committed. There is a significant increase in roadway miles demonstrating undesirable congestion. Some noticeable areas are:

- Most north-south railroad crossings show congestion.
- Butler-Spaeth Road shows congestion from Lakeway Road north towards 12th Street.
- Highway 59 south of Southern Drive shows congestion.
- Garner Lake Road shows congestion between I-90 and Highway 59.

Figure 5.5: Proposed Network LOS (Population: 38,000)

Figure 5.5 shows the results of the 38,000 population growth scenario modeled on the proposed network. The proposed network provides additional mobility and connectivity through the addition of the corridors described in the "Proposed Network" section of this report. Some noticeable points about this model run are:

- A large amount of traffic is shifted to the new crossings of the railroad at Butler-Spaeth Road and Burma Avenue, improving the LOS on Gurley Avenue and Brooks Avenue. However, the Burma Avenue crossing is still overloaded.
- Highway 59 also shows relief due to Garner Lake Road South.
- Additional lanes on Boxelder are utilized by the increased traffic volume.

Overall, the proposed network handles the 38,000 population traffic well.

Figure 5.6: Proposed Network LOS (Population: 50,000)

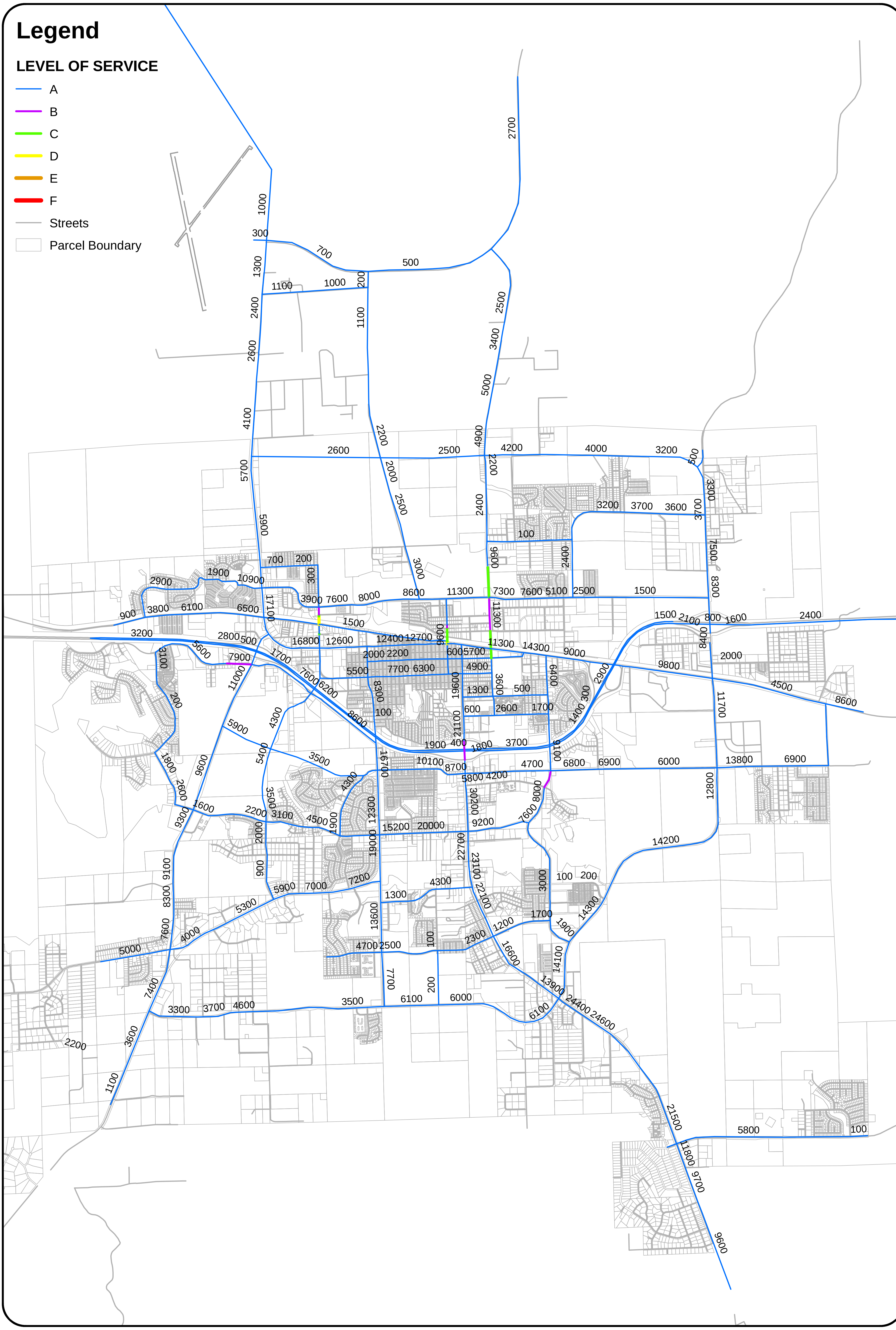
Figure 5.6 shows the results of the 50,000 population growth scenario modeled on the proposed network. Comparing Figure 5.6 to Figure 5.4 shows the ability of the proposed network to handle future traffic and alleviate congestion resulting from future development. Noticeable areas are:

- The proposed arterial network in the southeast portion of Gillette appears to be well utilized, and includes Garner Lake Road South, Axel's Avenue, Boxelder Road, and East Lakeway Road.

- The Butler-Spaeth Road overpass of the railroad appears to offload the north-south traffic from the other railroad crossings. However, there is still large demand on the Burma Avenue crossing.
- The extension of Boxelder Road to Pioneer Avenue helps offload traffic from the residential developments west of Highway 50 and shows a potential need for future improvements to Boxelder between Highway 50 and Burma Avenue.

Figure 5.7: Proposed Network LOS Gurley Avenue Connection (Population: 50,000)

Figure 5.7 shows the results of the 50,000 population growth scenario modeled on the proposed network. This proposed network is the same as in Figure 5.6, except the Butler-Spaeth Road overpass is not part of the network. Instead, this network includes the Gurley Avenue overpass as upgraded to 5 lanes, and also has a railroad overpass on 4J Road, from 2nd Street to Warlow Drive. This network also appears to be well utilized, and the 4J Road overpass does offload some of the traffic on the Burma Avenue railroad crossing. Also, increasing the number of lanes on the Gurley Avenue overpass improves the LOS of Gurley Avenue.



Existing Network LOS (Pop. 31,500)

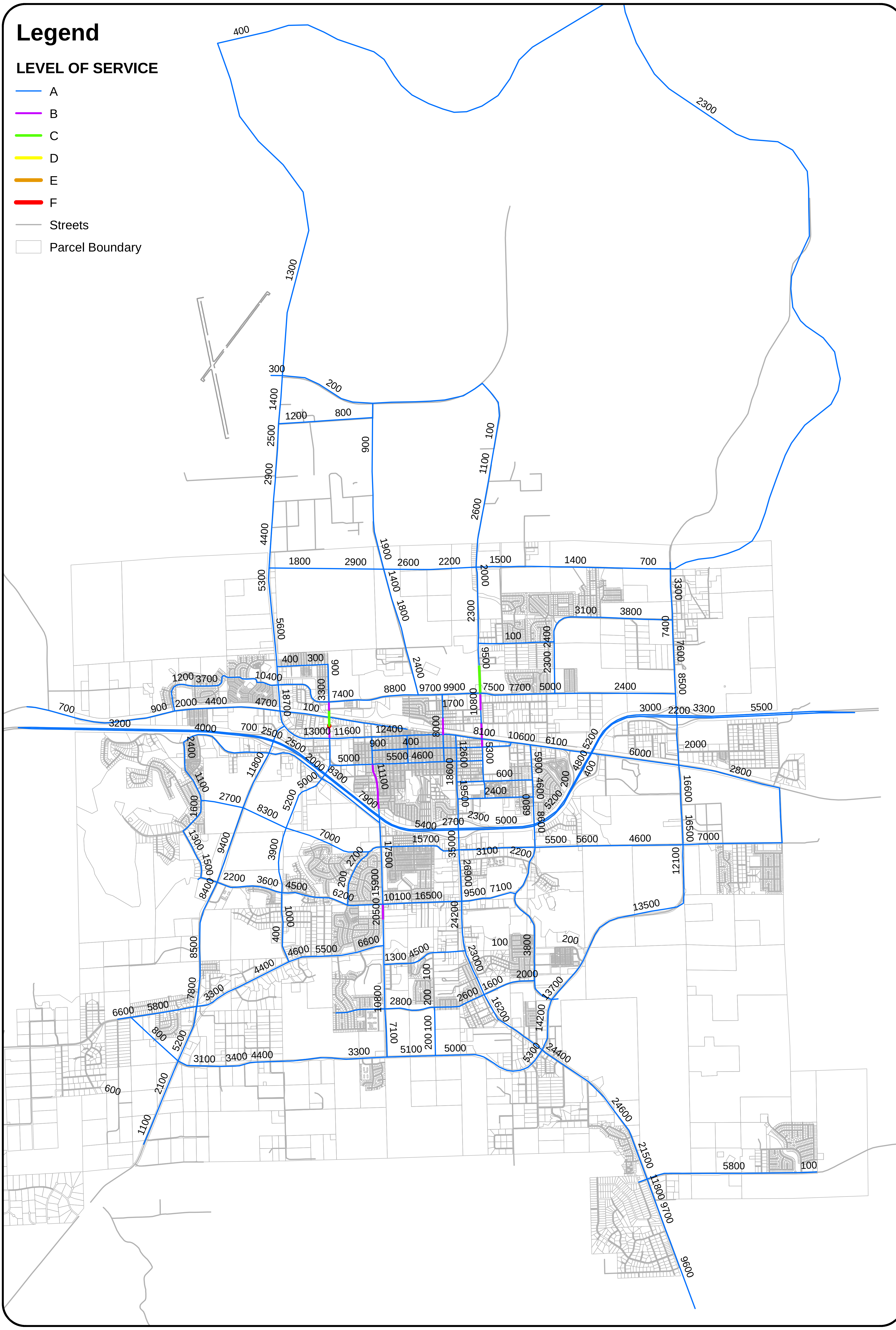
Gillette 2017 LRTP Update

Date: March 16, 2017

Figure 5.1

DOWL

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig5.1 Existing Network LOS Pop. 31500.mxd Mar 16, 2017 1:48:12 PM User: dhomola



0 0.5 1
Miles

Commited Network LOS (Pop. 31,500)

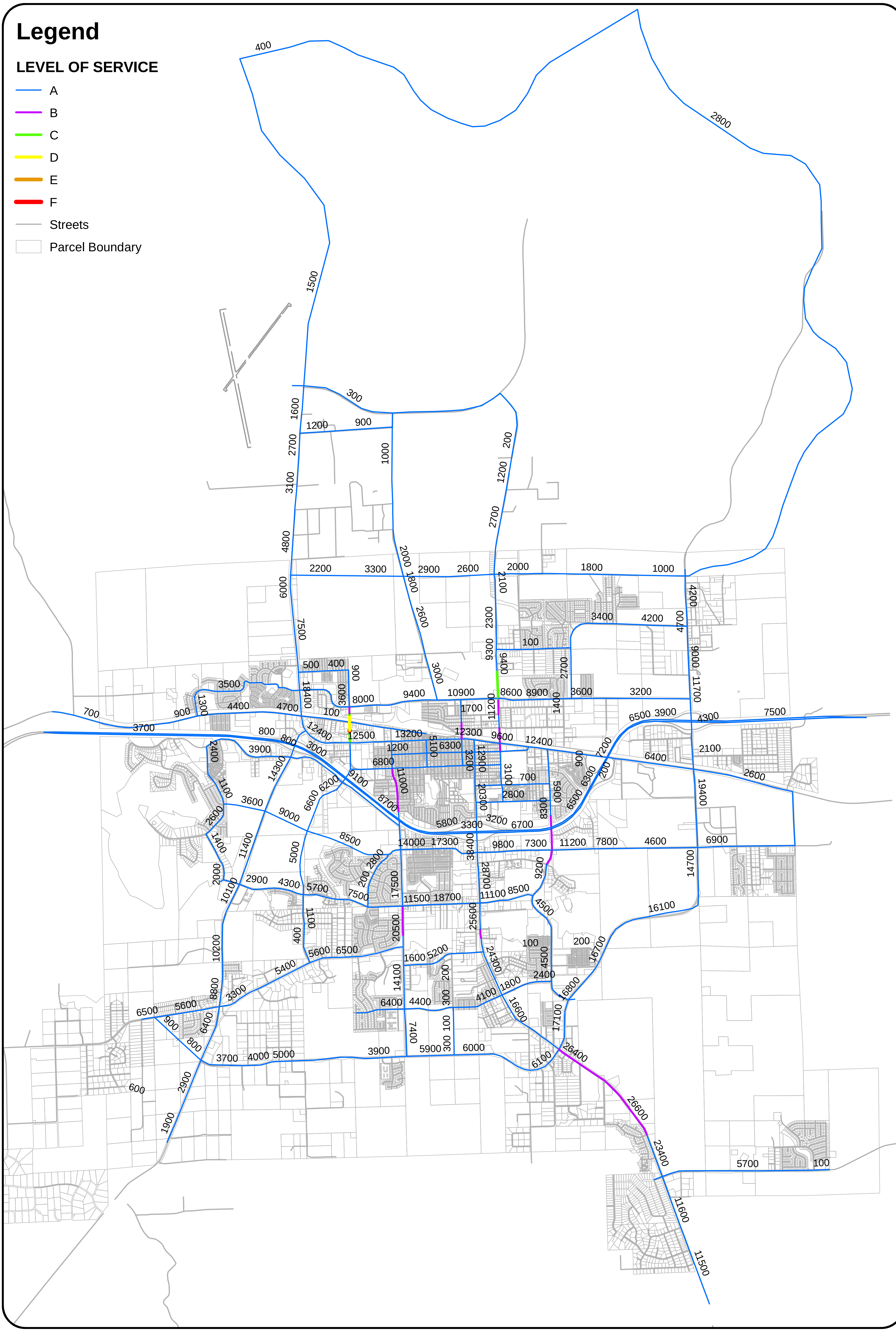
Gillette 2017 LRTP Update

DOWL

Date: March 30, 2017

Figure 5.2

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig5.2 Commited Network LOS Pop. 31500.mxd Mar 30, 2017 8:22:53 AM User: jrosenlund



Commited Network LOS (Pop. 38,000)

Gillette 2017 LRTP Update

Date: March 30, 2017

Figure 5.3

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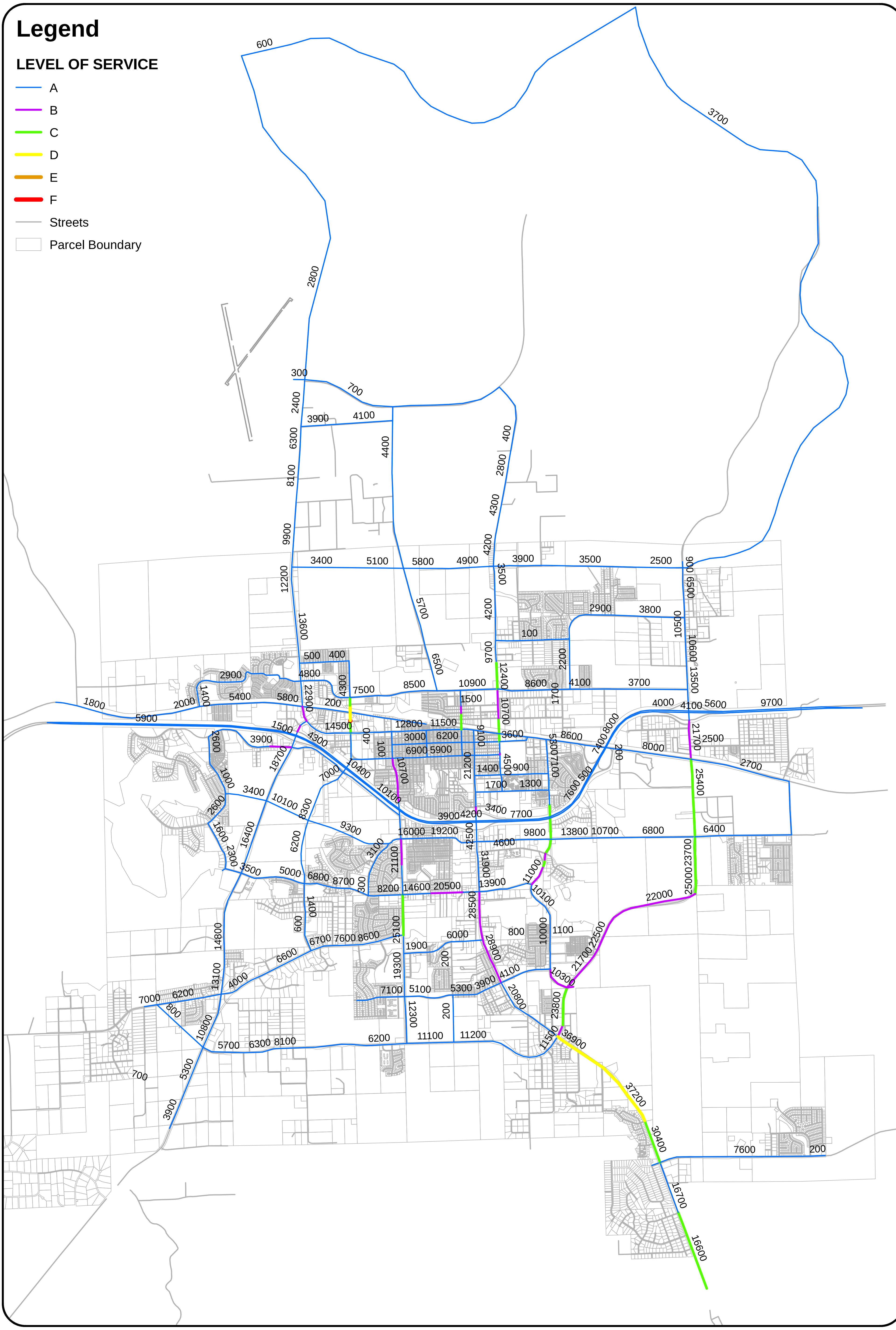
Miles

DOWL

Q:\24\26682-01\60GIS\Figures\Fig5.3 Commited Network LOS Pop. 38000.mxd Mar 30, 2017 8:26:18 AM User: jrosenlund



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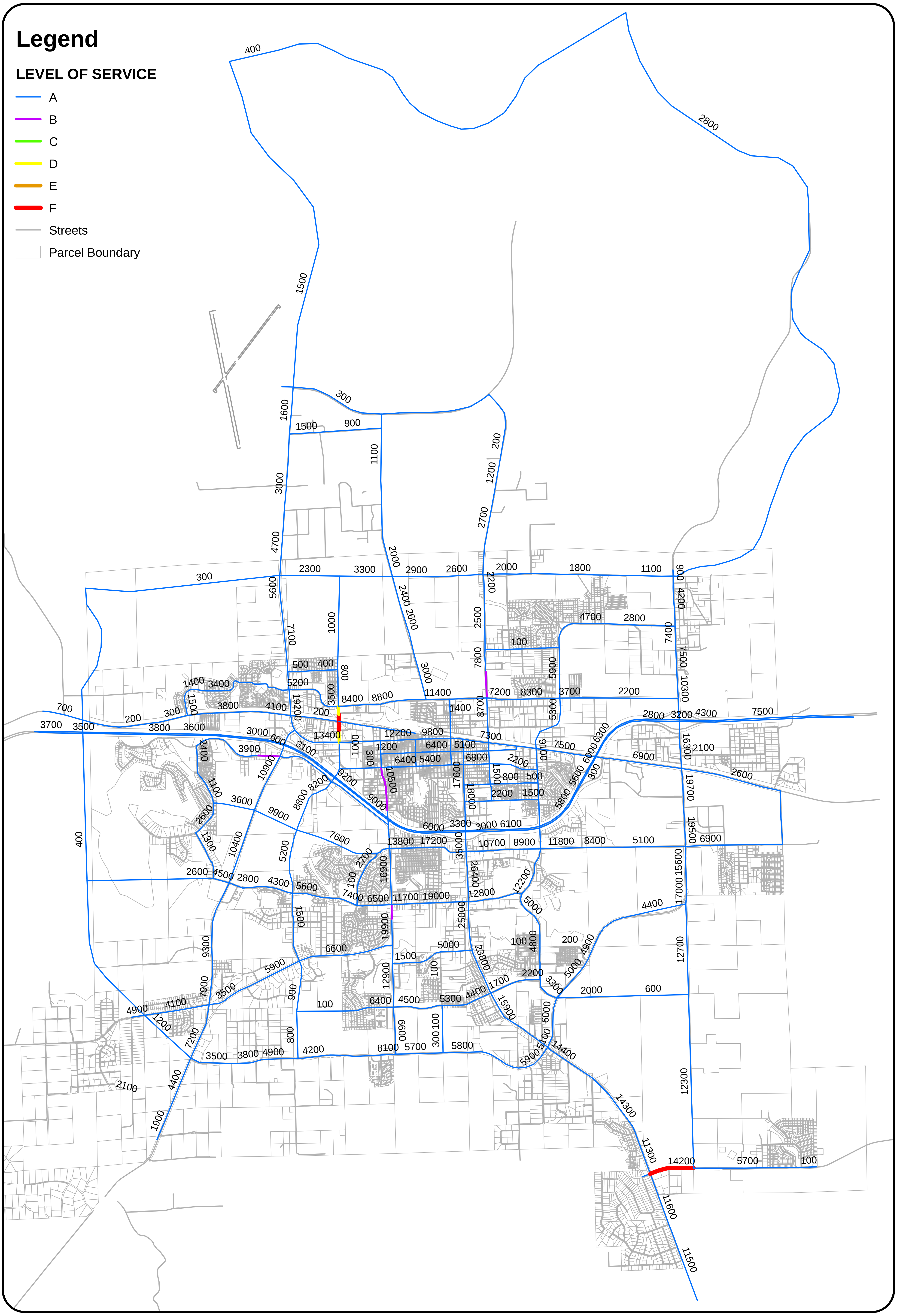
Commited Network LOS (Pop. 50,000)

Gillette 2017 LRTP Update

DOWL

Date: March 30, 2017

Figure 5.4



0 0.5 1
Miles

Proposed Network LOS (Pop. 38,000)

Gillette 2017 LRTP Update

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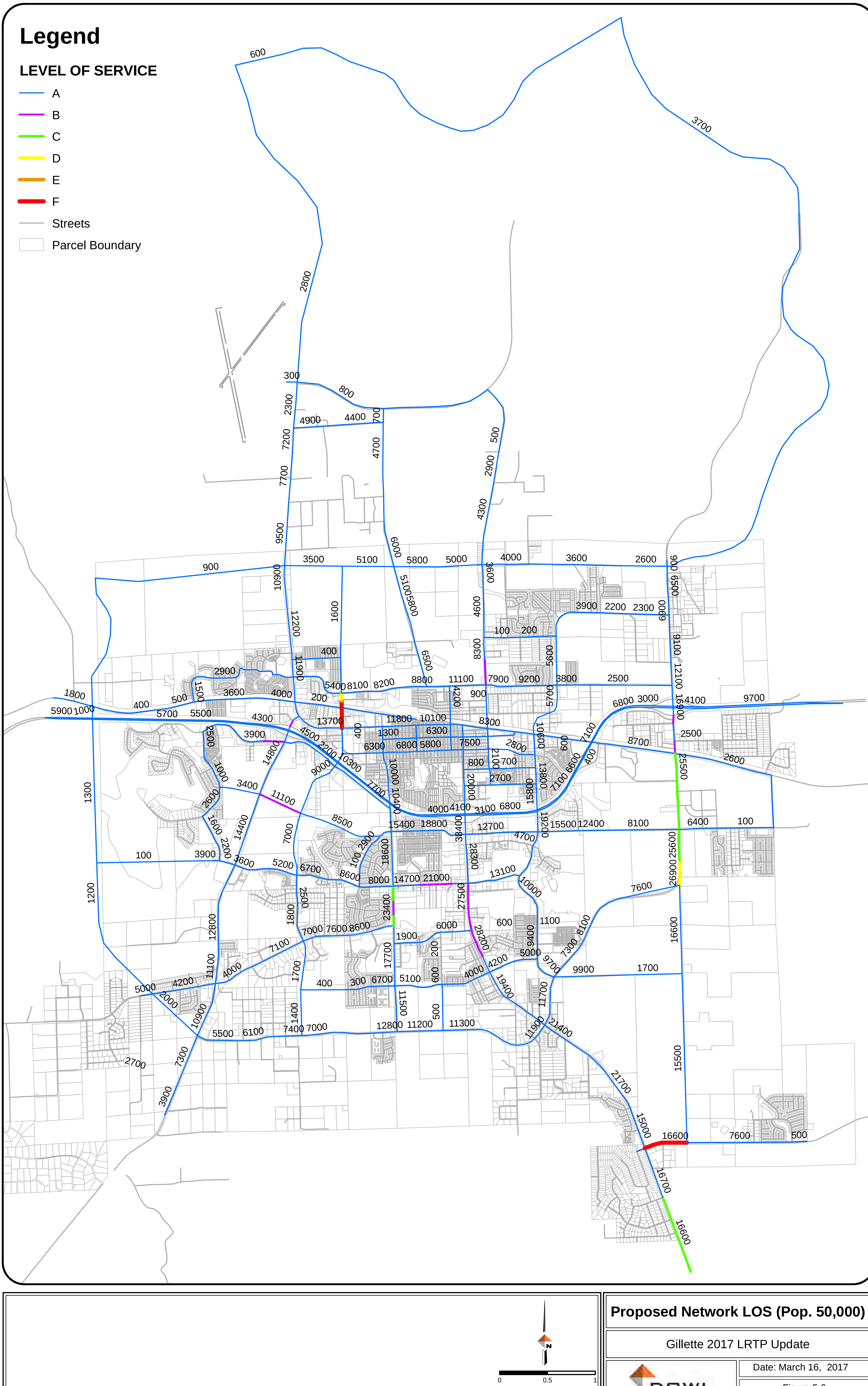
Figure 5.5

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig5.5 Proposed Network LOS Pop. 38000.mxd Mar 16, 2017 2:22:35 PM User: dhomola



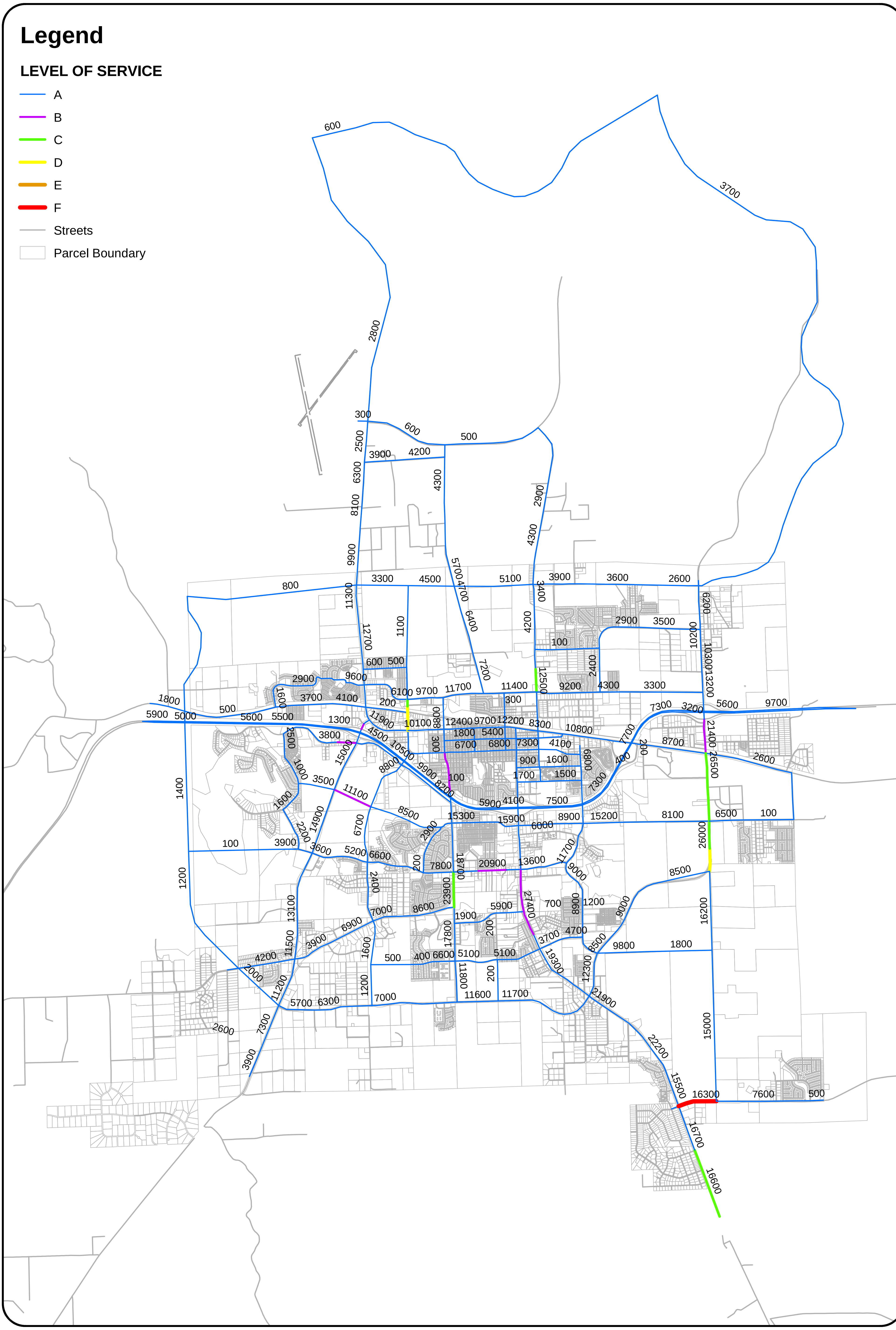
Proposed Network LOS (Pop. 50,000)

Gillette 2017 LRTP Update

Date: March 16, 2017

Figure 5.6

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig5.6 Proposed Network LOS Pop. 50000.mxd Mar 16, 2017 2:25:42 PM User: dhomola



Miles 0 0.5 1

Proposed Network LOS
Gurley Connection

Gillette 2017 LRTP Update

DOWL

Date: March 30, 2017

Figure 5.7

Q:\24\26682-01\60GIS\Figures\Fig5.7 Proposed Network LOS Gurley Option.mxd Mar 30, 2017 8:36:52 AM User: jrosenlund

6.0 *Transportation Improvement Plan*

6.1 Proposed Network

To accommodate the growth patterns for Gillette described previously, a proposed future network is shown in Figure 6.1. Roadways are illustrated by functional classification and include both modifications to existing roadways and new roadways to support new development. The proposed network is a framework for guiding development of the recommended roadway network, and a tool for preserving roadway corridors.

In addition to the planning criteria used to develop the proposed roadway network, the performance of the network in efficiently accommodating future traffic was evaluated. Accordingly, the results of a series of model runs were used to evaluate the effectiveness of the proposed network, as described in Chapter 6 of this report. The extension of the existing network is also shown on Figure 7.1 outside of the City of Gillette. The roadway arterial and collector network should be extended as this land is developed using the network and roadway classification criteria discussed in this report.

Physical improvements for the Gillette transportation network are categorized as follows:

a. Roadway capacity improvements
b. Intersection capacity improvements
c. Roadway network expansion/extension
d. Pedestrian network expansion/extension

In addition to new roads, several roadways may need expanded from 3 to 5 lanes. This is shown by comparing Figures 4.7 and 4.8.

6.2 Roadway Capacity Improvements

6.2.1 Railroad Crossings

The BNSF railroad continues to be a physical barrier to traffic movement in Gillette as identified in the LOS analysis. Currently Gillette has three grade separated crossings of the railroad, which are Highway 14/16, Gurley Avenue, and I-90. In addition to the grade separated crossings, there are five at-grade crossings: Foothills Boulevard, Burma Avenue, Brooks Avenue, Garner Lake Road, and Potter Avenue. The at-grade crossings function well, when a train isn't present. However, when a train is present, then the traffic must wait, or be directed to one of the grade separated crossings. Table 6.1 shows a comparison of these grade separated crossings and the existing and projected traffic volumes.

Table 6.6.1: Railroad Crossing Volumes for E+C Network.

Railroad Crossings	Traffic Volume (ADT)		
	Pop 31,500	Pop 38,000	Pop 50,000
Highway 14/16	18700	19900	22900
Gurley Avenue	11400	11800	12300
I-90	10000	15000	15400
Foothills Blvd.	1200	1300	1400
Burma Avenue	12800	13600	14600
Brooks Avenue	8000	8500	9700
Garner Lake Road	14600	17500	22000

Table 6.1 shows how the existing railroad crossing's traffic volumes will continue to increase in the future. Also it should be noted that during times when a train is blocking the crossing, the traffic from the at-grade crossings is directed to a grade separated crossing. This is especially the case with traffic from Brooks Avenue being directed to the Gurley Avenue overpass, since the activity in the BNSF switching yard can block the Brooks Avenue crossing for longer periods of time. Table 6.1 also illustrates the projected high future traffic volume on Garner Lake Road.

A few options for increasing the capacity of the railroad crossings were modeled. They were:
The "proposed network" includes a new crossing from Butler-Spaeth Road to Warlow Drive.
The "proposed network with Gurley Avenue option" is the proposed network with Butler-Spaeth Road connected to Gurley Avenue, and the Gurley Avenue overpass with four lanes of traffic. This network also has a grade separated crossing from 4J Road to Warlow Drive. Table 6.2 shows the results of these modeling runs.

Table 6.6.2: Railroad Crossing Volumes for Proposed Network.

	E+C network	Proposed network	Gurley Option
Railroad Crossings	**Pop 50,000**	**Pop 50,000**	**Pop 50,000**
Highway 14/16	22900	21600	19700
Gurley Avenue	12300	9200	16200
I-90	15400	13900	15000
Foothills Blvd.	1400	1500	1600
Burma Avenue	14600	13600	11300
Brooks Avenue	9700	6800	3700
Garner Lake Road	22000	20700	21800
Western Drive	NA	900	800
Butler-Spaeth Road	NA	10600	NA
4J Road	NA	NA	8800

Table 6.2 shows that the proposed network with the Butler-Spaeth Road crossing of the railroad will offload some traffic from the existing crossings, especially the Gurley Avenue crossing. However, the Burma Avenue crossing still has a high amount of traffic.

Increasing the capacity of the Gurley Avenue crossing also accommodates the north-south traffic on the east side of Gillette. Adding a crossing at 4J Road also offloads the Burma Avenue crossing.

The recommendations for the future roadway network railroad crossings are as follows:

1. Increase the capacity of the Burma Avenue at-grade crossing to four lanes between 2nd Street and Warlow Drive.
2. Increase the capacity of the Gurley Avenue Overpass crossing to four lanes from 6th Street to Kluver Road.
3. If possible (may be difficult to get from BNSF), add an at-grade crossing on Butler-Spaeth Road from Highway 51 to Warlow Drive.

4. As train traffic increases, the at-grade crossing at Garner Lake Road should be improved to a grade separated crossing. Based on the large traffic volume on this roadway, a grade separated crossing here may become high priority.
5. A grade separated crossing at Burma Avenue or 4J Road may be needed in the future, especially if the train traffic increases.

6.2.2 I-90 Crossings

Similar to the railroad, Interstate 90 is a physical barrier to the north-south traffic movement in Gillette, and this can be observed in the LOS analysis on the roads that cross I-90. Table 6.3 shows the crossings of I-90 and the projected traffic volume for the E+C network.

Table 6.6.3: I-90 Crossing Volumes for E+C Networks

I-90 Crossings	Traffic Volume (ADT)		
	Pop 31,500	Pop 38,000	Pop 50,000
Highway 50	18400	19900	23100
Burma Avenue	12100	15400	19300
4J Road	11300	11300	11000
Highway 59	28100	30800	34000
Butler-Spaeth	8600	10500	13000
Garner Lake Road	12500	15400	18800

Table 6.3 shows that most of the I-90 crossings will increase as the population of Gillette increases. The one exception to this is 4J Road. It appears that the Burma Avenue crossing of I-90 traffic volumes will continue to grow, and the Boxelder Road and Westover Road segments between 4J Road and Burma Avenue will help offload traffic from 4J Road.

Since traffic is funneled to these major roadways to get across the interstate, a few improvements to these roadways will be needed in the upcoming years. In addition to the improvements noted in section 6.2.1, the following improvements should be built:

1. Widen Butler-Spaeth Road to 4 lanes from Lakeway Road to 12th Street.
2. Although the traffic projections show 4J Road volumes remaining flat, 4J Road may benefit from an increase to 5 lanes from Westover Road to 6th Street.

6.2.3 Roadway Capacity improvements

The two sections above cover most of the roadway network capacity improvements. However, the following roadways would benefit from capacity improvements in the future. These roadways are as follows:

1. Widen Boxelder Road to 5 lanes from Highway 59 to 4J Road.
2. Widen Burma Avenue to 5 lanes from Westover Road to Lakeway Road.
3. Widen Boxelder Road to 5 lanes from 4J Road to Highway 50.
4. Widen Butler-Spaeth to 5 lanes from Garner Lake Road to Lakeway Road.

6.3 Intersection Capacity Improvements
6.3.1 Signal Prioritization Study

As traffic increases on the roadway network and roadways are enlarged to increase their capacity, eventually the capacity of the roadway is controlled by the delay at intersections. Therefore, an important part of the roadway network is the capacity at intersections. The current transportation network has several signalized intersections, with many of these traffic signals owned and operated by the WYDOT. The City of Gillette also owns and operates several traffic signals. This study evaluated a list of intersections with higher traffic volumes and attempted to prioritize the intersections that will require signals in the future. The signal prioritization work can be found in Appendix C.

The signal prioritization analysis showed that none of the unsignalized intersections currently warrant a signal. However several intersections may warrant a signal in the near future and the intersection operations will definitely benefit from intersection improvements. Intersection improvements recommended include the following:

1. Install traffic signals at the following intersections in the near future (as traffic volumes warrant):
    a. Garner Lake Road and Boxelder Road
    b. Lakeway Road and Dogwood Avenue
    c. Burma Avenue and Boxelder Road
    d. Highway 50 and Boxelder Road
    e. Highway 59 and 6th Street

2. Evaluate installation of roundabouts at the following locations.
    a. Brooks Avenue and Warlow Drive
    b. Lakeway Road and Butler-Spaeth Road

3. Evaluate the connection of Gurley Avenue to Butler-Spaeth and 6th Street. The 4th Street and Gurley Avenue intersection has high traffic volumes, but this intersection is not ideal for a signal. It would be better to direct this traffic to the vicinity of 6th Street and Gurley Avenue and place a signal or roundabout here. The configuration of the connection of Gurley Avenue to Butler-Spaeth Road also plays a part in what makes the most sense for this area.

As the signal prioritization proceeds, the City of Gillette should consider implementation of roundabouts as an alternative to signals at some locations. For some situations, roundabouts have the potential to provide the following benefits:

- *Improve safety - A study by the Insurance Institute for Highway Safety indicates roundabouts reduce crashes by 75 percent at intersections where stop signs or signals were previously used for traffic control. Reasons for this improved safety include:*
    - Less potential for serious crashes – since vehicles all travel around the center island in the same direction, head-on and left-hand turn (T-bone) collisions are eliminated.

    - Low travel speeds – because drivers must yield to traffic before entering a roundabout, they naturally slow down. The few collisions that occur in roundabouts are typically minor with few injuries, since they occur at low speeds of 15 – 20 miles per hour.

- No red lights to run – roundabouts are designed to keep traffic flowing without requiring vehicles to stop, so the incentive for drivers to speed up to make it through a yellow or red light is eliminated.
- Reduce delay and improve traffic flow - Contrary to the perception of many, roundabouts actually move traffic through an intersection faster and with less congestion on approaching roads. Roundabouts promote a continuous flow of traffic. Unlike intersections with traffic signals, traffic doesn't have to wait for a green light at a roundabout to get through the intersection. Traffic is not required to stop – only yield – so the intersection can handle more traffic in the same amount of time. However, a two lane roundabout is typically effective up to about 50,000 average daily traffic (ADT) volumes. Most intersections in Gillette have less traffic than 50,000 ADT.
- Studies by Kansas State University http://www.ksu.edu/roundabouts/ have measured traffic flow at intersections before and after conversion to roundabouts. In each case, installing a roundabout led to a 20 percent reduction in delays. The proportion of vehicles that had to stop – just long enough for a gap in traffic – was also reduced.
- Cost - The cost to build a roundabout and a traffic signal is comparable. A roundabout may need more property within the actual intersection, but takes up less space on the streets approaching the roundabout. Roundabouts usually require less overall property to build than a signal with turn lanes because traffic doesn't have to line up and wait for a green light. In addition to reducing congestion and increasing safety, roundabouts eliminate hardware, maintenance and electrical costs associated with traffic signals, which can amount to approximately $5,000 per year. In addition, many communities are favorable to the aesthetics of a well-designed and landscaped roundabout.

Roundabouts are safe and efficient, but they are not the ideal solution for every intersection. Several factors must be considered when deciding to build a roundabout at a specific intersection.

- **Accident history** – data about the number of accidents, type of crash, speeds, and other contributing factors are analyzed.
- **Intersection operation** – the level of current and projected travel delay being experienced, and backups on each leg of the intersection.
- **Types of vehicles using the intersection** – we look at the different kinds of vehicles that use the intersection. This is especially important for intersections frequently used by large trucks.
- **Cost** – this includes the societal cost of accidents, right-of-way (land purchase) requirements, and long-term maintenance needs.

Roundabout information taken in part from
http://www.wsdot.wa.gov/Projects/roundabouts/benefits.htm , Washington State DOT.

Some of the potential roundabout locations in Gillette are as follows:

- Burma Avenue and Boxelder Road
- Brooks Avenue and Warlow Drive
- Gurley Avenue and Kluver Road
- Lakeway Road and Butler-Spaeth Road
- Additional locations where traffic on both intersecting streets is approximately equal and where topography and R.O.W. allow.

6.3.2 Highway 14/16 - 2nd Street Road Diet

Also related to intersection capacity is the ability for roadways with high turning movements at intersections to function. Sometimes, an intersection and roadway's capacity and safety can be improved by adding turn lanes to intersections without turn lanes. To do this, the number of through lanes on a roadway is reduced to provide the turning lanes at intersections. This reduction in lanes has commonly been called a "road diet". A road diet analysis was performed for 2nd Street to evaluate the impacts of reducing the number of lanes from four to three in the area near Gillette's downtown. The full analysis can be found in Appendix D.

This analysis concluded that 2nd street would operate acceptably as a three lane roadway, and the safety of this roadway section (from Four J Road to Brooks Avenue) would be improved.

Therefore, this analysis recommends that 2nd Street be striped as a 3 lane roadway (one lane each direction with a continuous center turn lane) from 4J Road to Brooks Avenue.

6.4 Roadway Network Expansion/Extension

Although Gillette has made significant improvements in the roadway network over the past several years, some improvements to the network could be made. The following network improvements are categorized based on functional classification:

6.4.1 Arterial Network Expansion/Extension Improvements

The arterial network should continue to be extended and expanded, as the City of Gillette grows and development occurs outside of the City of Gillette. The following main network improvements are recommended:

1. Extend Burma Avenue north from Warlow Drive to Northern Drive.
2. Build Western Drive interchange west of Gillette. This could be built in the following pieces:
    a. Build new interchange at I-90. Connect Westover Road to the Interchange and across to Echeta Road.
    b. Build Western Drive from I-90 to Force Road.
    c. Build Western Drive from Force Road to Southern Drive/Highway 50.
    d. Build Western Drive from I-90 to Northern Drive.
3. Extend Lakeway Road from Highway 50 to Western Drive.
4. Extend Oakcrest Drive south to Southern Drive to connect at the intersection of Southern Drive and Antelope Valley Street.
5. Extend Axels Avenue from Highway 51 to Garner Lake Road. Although this was not included in the future network modeling runs, it appears that another north-south roadway parallel to Garner Lake Road will be needed in the future.
6. Connect Sinclair Street from Highway 59 to Sinclair Street at Hoback Avenue.
7. Convert 6th Street to an arterial from Burma Avenue to Gurley Avenue. A corridor study should be performed to evaluate alternatives for mobility between Burma Avenue and Butler Spaeth Road in the downtown area. A concept for a one-way couplet with 6th Street running west bound and 7th Street running east bound has also been proposed and warrants consideration.
8. Extend 6th Street from Gurley Avenue to Butler-Spaeth Road. This improvement depends on the railroad crossing improvements and also the improvements to 6th Street (and possibly 7th Street) from Burma Avenue to Gurley Avenue.

One option includes connecting Butler-Spaeth Road to Gurley Avenue along the 6th to 7th Street area with a roundabout at 6th Street.

6.4.2 Collector Network Expansion/Extension Improvements

The collector network should continue to be developed to subdivide the arterial grid. Most of these projects should be built as the land is developed. Some examples of these street extensions include:

1. Extend Destination Drive to future Powder Basin Avenue extension.
2. Extend Powder Basin Avenue to future Destination Drive extension.
3. Extend KG Avenue to Madison Street from Menards to existing end of Madison Street.
4. Extend Madison Street to KG Avenue
5. Extend Shoshone Avenue west to connect to the Oakcrest Drive extension.
6. Extend Overdale Road to connect to future Western Drive.
7. Extend Dogwood Avenue south to the STEM Center Development.

6.5 Pedestrian Network Expansion/Extension

As a general rule, the extensions of arterials should include provisions for a pathway on at least one side of the roadway. The recently constructed Boxelder Road project is an example of this. If this is done for all future arterial projects, the pathway network will continue to expand with the roadway network.

Figure 6.2 shows the Park and Pathway Map and identifies future recommended projects. They are:

1. Perform a Pathways Master Plan.
2. Update the Parks Master Plan (separate from the Pathways Master Plan).
3. Extend a Pathway from the Rec Center to College Park Circle along the existing drainage.
4. Extend Donkey Creek Pathway from N. College Park Ct. to Dalbey Park. This would include a grade separated underpass at Hwy 59.
5. Extend the Donkey Creek Pathway from Dalbey Park to Energy Capital Sports Complex. This would include a grade separated pedestrian underpass at Butler-Spaeth Road and would also require a pedestrian bridge over Donkey Creek at the SW corner of the Energy Capital Sports complex.
6. Build a new Stonepile Creek Pathway along the floodway from Highway 14/16 to Bicentennial Park. This would include grade separated pedestrian crossings at Commercial Drive, Warlow Drive, and Burma Avenue.
7. Build a new pathway from Bicentennial Park to Kluver/Spruce via Kluver Road and Mcmanamen Park. This includes a grade separated pedestrian crossing of Gurley Avenue near Kluver Road.
8. Build a new Stonepile Creek Pathway along floodway and Railroad Avenue from Bicentennial Park to Church Ave.
9. Build a new Stonepile Creek Pathway from City parcel at the end of O’hara Drive to Energy Capital Sports Complex. This includes a grade separated overpass at I-90 and a grade separated underpass at Boxelder Road.
10. Build a new Highway 50/Southern Drive Pathway from Lakeway Road to Glock Avenue.
11. Build pathway within the Energy Capital Sports Complex.
12. Build a new pathway from Camplex Park to the Energy Capital Sports Complex.
13. Build a new pathway along the railroad from Axels Avenue to Brooks Avenue.
14. Build a new pathway along Warlow Drive from Moose Street to Garner Lake Road, including a connection on Garner Lake.
15. Build a new pathway in the “Boxelder alley” from 4J Road to Emerson Avenue.
16. Build a Foothills pathway from Foothills Blvd to Highway 14/16.
17. Build a new pathway from Fox Park to Garner Lake Road.
18. Build a new pathway from College to Oakcrest Drive along College Drive/West 4J Road.
19. Build a new pathway along I-90 from Hwy 59 to Sierra Glen Park.

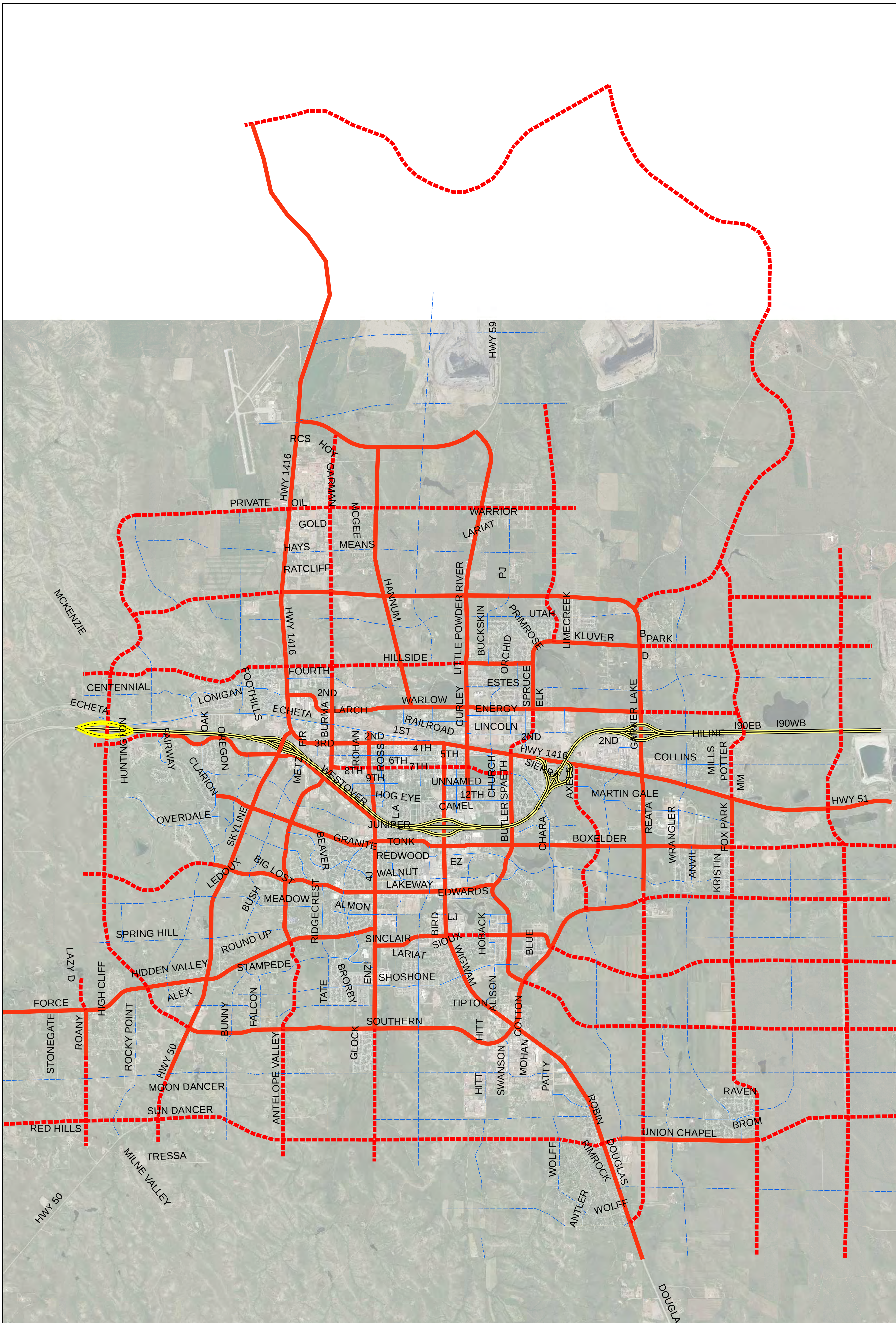
In addition to the pathways, the following bike routes should be established to improve the bike network:

1. Harder Ave. from Belle Fourche Drive to Boxelder Road.
2. 9th Street from Highway 59 to Butler Spaeth Road.
3. Butler Spaeth Road from 9th Street to O'hara Drive.
4. 3rd Street from 2nd Street to Rohan Avenue.
5. 1st Street/Echeta Road from Highway 14/16 to Rohan.
6. Warren Avenue from 7th Street to 2nd Street.
7. Rohan Avenue from Echeta Road to 4J Road.
8. West Westover Road from Huntington Drive to Prairie Wind School.
9. Kluver Road from Gurley Avenue to Spruce Avenue.
10. 10th Street from 4J Road to 8th Street.
11. Shoshone Avenue from Tanner Drive to Highway 59.

6.6 Roadway Project Prioritization

Figure 6.1 shows the location of transportation improvements for roadways. The transportation improvement projects were prioritized primarily based on impact (improving LOS) to the transportation network. Transportation improvements were identified in three categories, for prioritization. These categories were City projects, Non-city or joint projects, and signal projects. Table 6.4 shows the "order of magnitude" cost estimates for these groups of projects.

Although projects were mainly prioritized based on need for improving traffic, some project priorities were adjusted based on funding or projects scheduled in other capital improvement plans. It should be noted the priorities shown are approximate, and may be adjusted due to funding or growth patterns. Table 6.5 shows the prioritization matrix used to develop the project priority. Figure 6.3 shows the proposed 15-year improvement plan.



Legend

Network

Fun_Class

- Arterial
- Collector
- Interstate
- P_Arterial
- P_Collector
- P_Interstate

N

0 0.5 1
Miles

PROPOSED FUTURE NETWORK

Gillette 2017 LRTP Update

DOWL

Date: March 30, 2017

Figure 6.1

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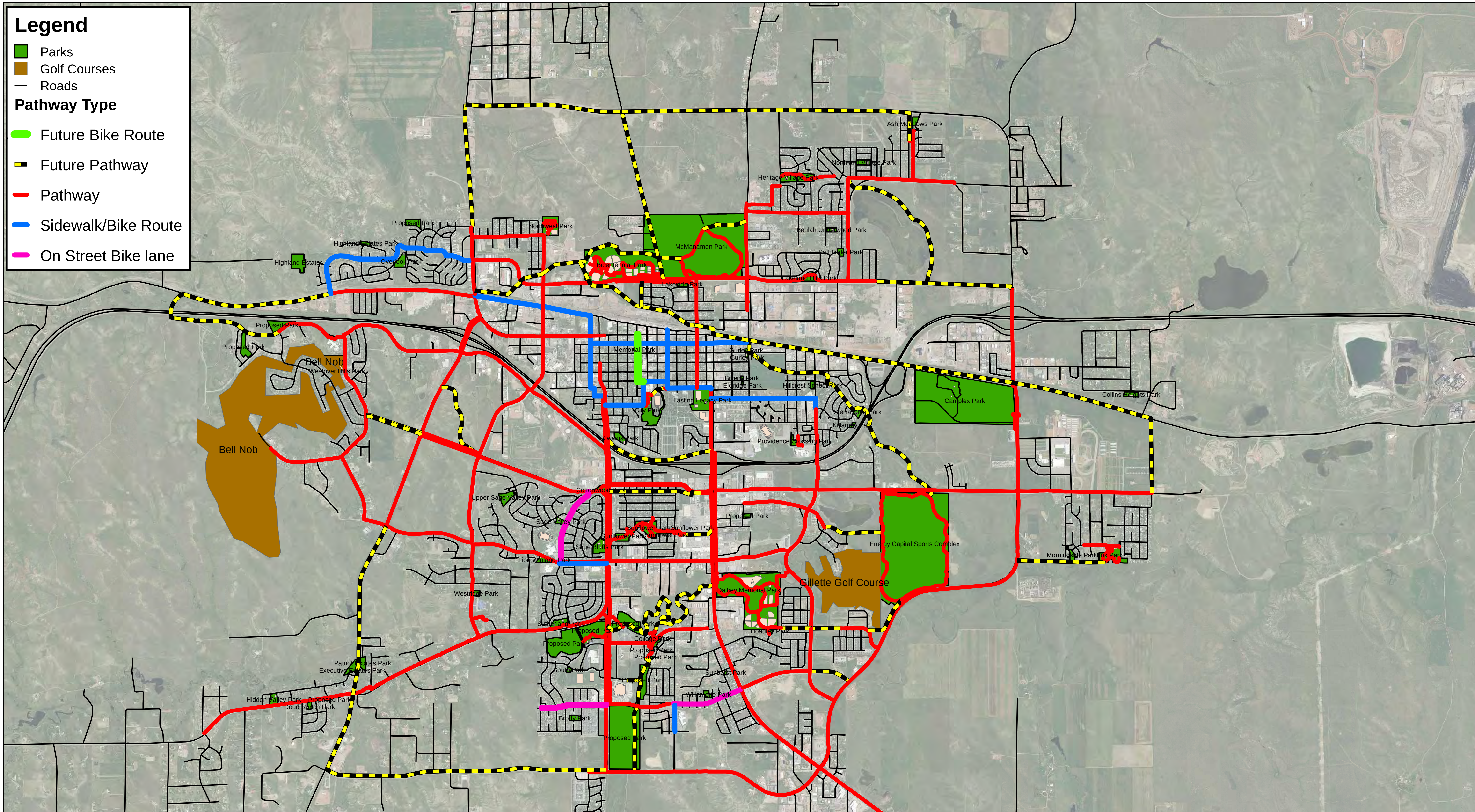


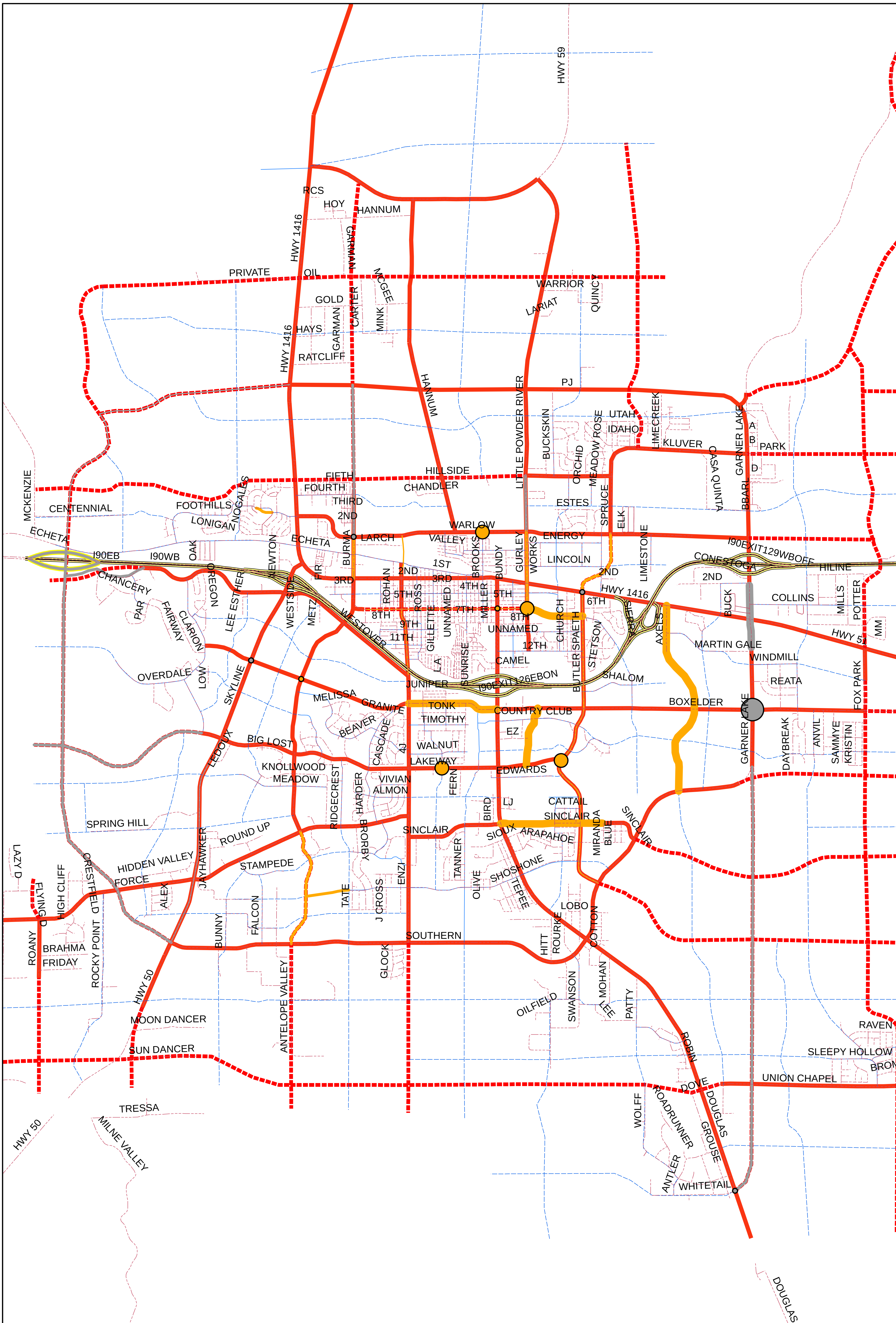
PARK AND PATHWAY MAP

GILLETTE 2017 LRTP UPDATE

Date: March 16, 2017

Figure 6.2

\\SHR-FS\Shr-projects\24\26682-01\60GIS\Figures\Fig6.2 Parks and Pathway Map.mxd Mar 16, 2017 2:37:48 PM User: dhomola



Legend

Signal Priority

Non-City / Joint	City
High	High
Medium	Medium
Low	Low

Priority

Non-City / Joint	City
High	High
Medium	Medium
Low	Low

PROPOSED TRANSPORTATION IMPROVEMENT PLAN

Gillette 2017 LRTP Update

DOWL

Date: May 16, 2017

Figure 6.3

Q:\24\26682-01\60GIS\Figures\Fig6.3 Proposed Transportation Improvement Plan.mxd May 16, 2017 12:29:26 PM User: jrosenlund

2017 GILLETTE LRTP UPDATE
TABLE 6-4
TRANSPORTATION PLAN UPDATE
RECOMMENDED ROADWAY IMPROVEMENTS

Priority	PROJECT	PROPOSED FUNCTIONAL CLASSIFICATION	LENGTH (MILES)	EST.CONSTRUCTION COSTS		ANTICIPATED R/W AND EASEMENT ACQUISITION COSTS	ESTIMATED TOTAL COSTS 2017 DOLLARS (MILLIONS)
				UNIT COST 2017 DOLLARS (MILLIONS/MILE)	EXTENDED COST 2017 DOLLARS (MILLIONS)		
HIGH	Rebuild Boxelder from 4-J to Highway 59, expand to 5 Lanes	Arterial	0.8	4.41	3.53	$ 340,000.00	4.9
HIGH	Expand Gurley Overpass	Arterial	0.7	12.00	8.04		10.4
HIGH	Extend 6th Street to Stanley/7th Street	Minor Arterial	0.3	3.30	0.99	$ 800,000.00	2.1
HIGH	Extend Sinclair Street to Miranda Avenue	Minor Arterial	0.2	2.49	0.40	-NA- Acquired through development	0.5
HIGH	New Garner Lake Rd RR Overpass	Arterial	0.6	16.00	10.24		13.3
HIGH	Construct Gurley-South Road from Boxelder to Edwards	Collector	0.5	2.49	1.32	-NA- Acquired through development	1.6
HIGH	Axels Avenue Extension	Arterial	1.8	2.26	3.98	-NA- Acquired through development	5.2
HIGH	Extend Sinclair Street to Hoback Avenue	Arterial	0.7	2.49	1.74	$ 880,000.00	3.1
MEDIUM	Extend Westover to Western Drive Interchange / Echeta	Arterial	0.9	4.41	3.97	$ 1,140,000.00	6.4
MEDIUM	Expand Gurley Road to 5 lanes north of Warlow	Arterial	1.3	4.41	5.68	$ 320,000.00	7.7
MEDIUM	Extend Garner Lake South to Highway 59 at Union Chapel	Arterial	3.8	3.09	11.74	$ 2,010,000.00	17.3
MEDIUM	Extend Oakcrest from 4J to Southern Drive	Arterial	1.1	2.49	2.61	$ 1,340,000.00	4.8
MEDIUM	Extend Lakeway Road West to connect to Western Drive	Arterial	1.6	2.49	3.98	-NA- Acquired through development	5.2
MEDIUM	New Butler-Spaeth Railroad Overpass	Arterial	0.6	16.00	10.24	$ 820,000.00	14.1
MEDIUM	Extend Burma to Northern Drive	Arterial	1.0	4.41	4.23	$ 610,000.00	6.1
MEDIUM	New Interchange at Western Drive and Interstate 90	Arterial	-	12.00	12.00	-NA- Provided by WYDOT	14.4
MEDIUM	Widen Burma to 5 lanes from 2nd Street to Warlow	Arterial	0.4	4.41	1.76	-NA- City Owned	2.4
MEDIUM	New Western Drive from Highway 50 to Interstate 90	Arterial	3.8	2.49	9.36	2,380,000.00	14.7
MEDIUM	Shoshone Avenue West Extension to the Oakcrest Extension	Arterial	0.4	2.49	0.95	-NA- Acquired through development	1.2
LOW	Widen Highway 50 from Lakeway to Southern Drive	Arterial	1.9	4.41	8.38	-NA- Provided by WYDOT	11.9
LOW	New Western Drive from Interstate 90 to Northern Drive and Highway 14/16	Arterial	3.2	2.49	7.84	2,000,000.00	12.2
LOW	New 4-J Railroad Overpass	Arterial	0.4	16.00	6.88	$ 540,000.00	9.5
LOW	Convert 6th Street to an arterial from Burma Avenue to Gurley Avenue	Arterial	1.4	2.49	3.51	$ 750,000.00	5.3
LOW	Widen Butler Spaeth to 5 lanes from Boxelder to 12th Street	Arterial	0.5	4.41	2.21	$ 150,000.00	3.0
LOW	Widen Butler Spaeth from Lakeway to Boxelder	Arterial	0.5	1.60	0.80	-NA- City Owned	1.0
LOW	Expand 4-J from 6th Street to I-90	Arterial	0.6	4.41	2.65	$ 950,000.00	4.4

2017 GILLETTE LRTP UPDATE
TABLE 6-4 (Continued)

RECOMMENDED INTERSECTION IMPROVEMENTS

Priority	PROJECT	PROPOSED FUNCTIONAL CLASSIFICATION	EXTENDED COST 2017 DOLLARS (MILLIONS)	ANTICIPATED R/W AND EASEMENT ACQUISITION COSTS (2009 DOLLARS)	ESTIMATED TOTAL COSTS 2009 DOLLARS (MILLIONS)	PROJECT DESCRIPTION
High	Boxelder Road and Garner Lake Road Intersection Traffic Signal	Traffic Signal	0.35	-NA- City Owned	0.5	Install a Traffic Signal at the Intersection of Boxelder Road and Garner Lake Road.
Medium	Warlow Drive and Brooks Avenue Roundabout	Roundabout	0.30	-NA- City Owned	0.4	Install a roundabout (or signal) at Brooks Ave. and Warlow Drive intersection
Medium	Lakeway and Dogwood	Traffic Signal	0.30	-NA- City Owned	0.4	Install a Traffic Signal at the intersection of 6th Street and Hwy 59. Move signal from 7th Street and Highway 59.
Medium	6th Street and Gurley Ave. Intersection Traffic Signal	Traffic Signal	0.30	-NA- City Owned	0.4	Install a Traffic Signal or roundabout at the intersection of 6th Street and Gurley Ave. Plan for 4 legged intersection.
Medium	Lakeway and Butler Spaeth Roundabout	Roundabout	0.30	-NA- City Owned	0.4	Install a roundabout (or signal) at Butler Spaeth and Lakeway intersection
Low	6th Street and Hwy 59 Intersection Traffic Signal	Traffic Signal	0.40	-NA- Provided by WYDOT	0.5	Install a Traffic Signal at the intersection of 6th Street and Hwy 59.

Table 6.5 - 2017 GILLETTE LRTP

PROJECT PRIORITIZATION MATRIX

PRIORITY	PROJECT	PROPOSED FUNCTIONAL CLASSIFICATION	LENGTH (MILES)	Project Priority Weighting Criteria								
				Addresses Current traffic congestion.	Addresses Population 38,000 Traffic Issues	Addresses 50,000 population traffic issues	Addresses current growth area	Addresses 38,000 Pop growth areas	Addresses 50,000 Pop. Growth Areas	Addresses Network Connectivity	Has Pathway Component	Total
HIGH	Rebuild Boxelder from 4-J to Highway 59, expand to 5 Lanes	Arterial	0.8	1	1	1	1	1	1		1	7
HIGH	Expand Gurley Overpass	Arterial	0.7	1	1	1	1	1	1		1	7
MEDIUM	Extend Burma to Northern Drive	Arterial	1.0					1	1	1	1	4
HIGH	Extend Sinclair Street to Miranda Avenue	Minor Arterial	0.2			1	1	1	1	1	1	6
HIGH	Extend 6th Street to Stanley/7th Street	Minor Arterial	0.3	1	1	1	1		1	1	1	7
LOW	Widen Highway 50 from Lakeway to Southern Drive	Arterial	1.9		1	1					1	3
MEDIUM	New Interchange at Western Drive and Interstate 90	Arterial	-			1			1	1	1	4
MEDIUM	Extend Westover to Western Drive Interchange / Echeta	Arterial	0.9				1	1	1	1	1	5
LOW	Convert 6th Street to an arterial from Burma Avenue to Gurley Avenue	Arterial	1.4						1	1		2
MEDIUM	Widen Gurley Road to 5 lanes north of Warlow to Kluver	Arterial	1.3		1	1		1	1		1	5
LOW	Widen Butler Spaeth to 5 lanes from Boxelder to 12th Street	Arterial	0.5		1	1						2
LOW	Widen Butler Spaeth from Lakeway to Boxelder	Arterial	0.5		1	1						2
MEDIUM	Extend Garner Lake South to Highway 59 at Union Chapel	Arterial	3.8			1	1		1	1	1	5
HIGH	New Garner Lake Rd RR Overpass	Arterial	0.6	1		1	1		1	1	1	6
HIGH	Construct Gurley-South Road from Boxelder to Edwards	Collector	0.5		1	1	1	1	1	1		6
LOW	Expand 4-J from 6th Street to I-90	Arterial	0.6		1	1						2
LOW	Straighten Foothills Blvd.	Collector	0.2			1	1					2
HIGH	Axels Avenue Extension	Arterial	1.8		1	1		1	1	1	1	6
MEDIUM	Widen Burma to 5 lanes from 2nd Street to Warlow	Arterial	0.4	1	1	1					1	4
MEDIUM	Extend Oakcrest from 4J to Southern Drive	Arterial	1.1			1		1	1	1	1	5
HIGH	Extend Sinclair Street to Hoback Avenue	Arterial	0.7			1	1	1	1	1	1	6
LOW	Widen Butler Spaeth from Garner Lake Road to Lakeway	Arterial	1.2			1						1
MEDIUM	New Western Drive from Highway 50 to Interstate 90	Arterial	3.8					1	1	1	1	4
MEDIUM	Extend Lakeway Road West to connect to Western Drive	Arterial	1.6				1	1	1	1	1	5
MEDIUM	Shoshone Avenue West Extension to the Oakcrest Extension	Arterial	0.4					1	1	1	1	4
LOW	New Western Drive from Interstate 90 to Northern Drive and Highway 14/16	Arterial	3.2						1	1	1	3
MEDIUM	New Butler-Spaeth Railroad Overpass	Arterial	0.6	1	1	1				1	1	5
LOW	New 4-J Railroad Overpass	Arterial	0.4			1				1	1	3
LOW	Widen Enzi Drive to 5 lanes from Shoshone to Southern Drive	Arterial	0.5			1						1

7.0 Transportation Improvement Plan Implementation

The City of Gillette, Campbell County and the WYDOT have been very proactive in implementation of the recommendations of the **2009 Transportation Planning Study**. Similar to the previous plans, funding sources will play a big role in implementing this plan.

Additional studies may be warranted prior to design and construction of some of the projects identified in the transportation improvement plan. A few examples of these additional studies are:

- Railroad crossing alternative analysis – This study identifies the need for new railroad crossings. The previously completed *Railroad Crossing Alternatives Evaluation* prioritized the railroad crossings based on a cost / benefit analysis. Some additional study and consideration may be needed to identify and prioritize the potential railroad crossing improvements from a traffic standpoint.
- Corridor study of mobility in the downtown area from Burma Avenue to Butler-Spaeth Road. As noted in this report, several options exist for this area, including one way couplets, signalized or roundabout intersections with Gurley Avenue, and street improvements needed on 6th Street. A more detailed study of this area with options would be appropriate.

The studies noted above could likely be funded by a FHWA planning grant, through the WYDOT planning department.

Also, updating this transportation plan is important as Gillette grows and new roadways are built. A review of the current federal transportation bill indicates an emphasis will be placed on having a transportation plan with specific performance standards. This bill requires new road projects to be comprehensive and multi-modal, so all new road projects should incorporate comprehensive street design principles, which take into account the needs of all users. This is usually done already in Gillette, but may need to be emphasized or publicized more in future designs.

8.0 Other Transportation Recommendations

In addition to capital improvements to increase capacity, the City of Gillette should consider various traffic management techniques and technology applications to ease congestion while improving safety. Many of the following recommendations were noted in the 2004 and 2009 Transportation Planning Studies, and should continue to be considered as the City of Gillette grows.

- Alternate transportation modes. The current park master plan addresses parks and a pathway network. New road designs should consider a “complete street” design and allow for extension of this pathway network, as well as opportunities to incorporate bike lanes on the road network.
- Transit. At some point, a transit system may begin to be feasible and attractive. Employing a transit system has the ability to relieve vehicle pressure on the network. Federal funding is available for studying as well as implementing transit projects. One suggestion is to have a publicly funded shuttle bus transit service from the airport to the college, Cam-plex, high schools, major hotels, and shopping.
- Land use concepts. Some land use concepts are able to reduce vehicular travel by mixed use residential and commercial zoning. Some of this is already being done in Gillette.
- Intelligent Transportation Systems applies technologies (electronics, communications, traffic monitoring, advanced control strategies / software, and traveler information) to assist in the

proactive management of traffic. These applications have proven very effective across the country to reduce congestion, improve safety, manage incidents, and better inform the traveling public. Such a plan should determine which of these techniques could be applied, their approximate cost, estimated benefits of implementation, and a preliminary schedule of deployment. The following is offered to begin to think about such approaches. Some elements that require further investigation include:

- ***Traffic Monitoring.*** A better understanding of near real-time traffic demand and incident detection can be used by traffic managers to respond more quickly to traffic congestion and emergency response. Collection of this type of information, usually speed and volume at a minimum, is essential to the successful implementation of other ITS elements. The use of loops or video detection is the common approach to collect this important data. Such devices would be placed at key locations in the region, both on the interstate and state highways, as well as major arterials and other key locations, allowing this information to be collected and reviewed at a central location.

- ***Traffic Signal Improvements.*** Various levels of signal improvements ranging from improved timing, to coordinating several signals together, to central management of the signal system (state and city together), to signal adapting to weather/pavement conditions can help to relieve congestion and provide for more proactive traffic management during incidents or special events. Also emergency vehicle signal preemption is a desired improvement on many signals in Gillette.

- ***Freeway Management.*** Another aspect of traffic management that, although is not within the City's jurisdiction, can affect the traffic within the City boundaries, is freeway management. Through the use of traffic monitoring, video detection, and traveler information, the freeway traffic and its impact on the City arterials, can be better managed.

- ***Traveler Information.*** One critical element of ITS is providing information to motorists and commercial vehicles so that they can make more informed decisions regarding their travel. This can be achieved through such dissemination techniques as websites, radio and television broadcasts, advisory radio, and Dynamic Message Signs (DMS). DMS are the large and small illuminated message boards that provide limited information to travelers during their route and can provide warnings, detours, or general traffic information. These are also being used in other states to provide mechanisms for the national Amber Alert Program (abducted child information).

- ***Communications Infrastructure.*** One of the primary enabling technologies that allows much of these applications is a communications network to allow for data to be transmitted from device to a central location and then disseminated to the public. A review of the communications infrastructure should be included in the ITS planning process and recommendations made to identify approaches that are appropriate for the region surrounding the City of Gillette.

- ***Management Center.*** A central location (or multiple locations) to collect, view, and analyze information to support traffic management decisions and disseminate traveler information can be in many forms and usually begins small with a single computer work station. Such a center provides the place where integrated traffic management can occur and has proven very successful in other cities across the country. The size and extent of this kind of center depends on the specific needs of the region. The planning process being recommended will determine what is appropriate for the City of Gillette and the surrounding region.

9.0 References

A Parks and Pathways Master Plan for the City of Gillette DRAFT (Chapter 4 – Trail and Pathway Standards and Plan). By RDG Planning and Design. September 2008.

A Policy on Geometric Design of Highways and Streets, 2004. Published by American Association of State Highway and Transportation Officials. Washington, D.C.. 2005.

City of Gillette Development Summary Fourth Quarter 2009. Prepared by the City of Gillette Planning Department, January 2, 2009

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The Gillette Plan – A Comprehensive Plan for the City of Gillette, Wyoming. By RDG Planning & Design and Worthington, Lenhart and Carpenter. June 2006.

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Major Street and Highway System Report: Travel Forecasting Process. Prepared by the Wyoming Department of Transportation, Planning Program, Systems Planning. Wyoming. 1997.

Manual on Uniform Traffic Control Devices: Part 4, Highway Traffic Signals. Prepared by U.S. Department of Transportation. 2000.

Railroad Crossing Alternatives Evaluation for the BNSF Railroad Powder River Division Black Hills Subdivision, Gillette, WY. Final Report. Prepared by HWS Consulting Group, Omaha, Nebraska and HDR, Inc., Rapid City, South Dakota. October 2008.

RTi Technical Memorandum Re: Gillette Regional Master Plan, Level I Study – Population Growth Projections. Prepared by Riverside Technology, Inc., December 12, 2008.

The Surface Trasnportation Authorization Act of 2009 – A Blueprint for Investment and Reform Executive Summary. By the Committee on Transportation and Infrastructure U.S. House of Representatives. Presented by Chairman James L. Oberstar, Ranking Member John L. Mica, Chairman Peter A. DeFazio, and Ranking Member John J. Duncan Jr. June 18, 2009

Trip Generation, 6th Edition. Prepared by Institute of Transportation Engineers. Washington, D.C.. 1997.

City of Gillette

2017 Long Range Transportation Plan

APPENDICES

Contents:

APPENDIX A

PUBLIC INVOLVEMENT

Gillette Long Range Transportation Plan Update

Kick Off Meeting Agenda

2:30 P.M.

November 17, 2015

City Hall

1. Introductions
2. Scope of Work (see attachment)
    - Task 1. Project Management
    - Task 2. Review Study Boundary
    - Task 3. Data Acquisition
        - i. Collect Data (see list in scope)
        - ii. Public Open House I
    - Task 4. Travel Demand Modeling
        - a. Model Update
        - b. Future Year Socioeconomic data
        - c. Modeling Alternatives
        - d. Signal prioritization
    - Task 5. Bikeway Trails Component
    - Task 6. Safety Component
    - Task 7. Project Prioritization
    - Task 8. Public Participation
        - i. Website
        - ii. Project Team meetings (need to develop project team)
        - iii. 2 public open houses
    - Task 9. Report
3. Schedule (see attachment)
4. Action Items

DOWL

Gillette Long Range Transportation Plan Update

Kick Off Meeting Discussion

2:30 P.M.

November 17, 2015

City Hall

1. Attendees: *Jeff Rosenlund (DOWL), Kurt Siebenaler, Josh Richardson, Heath Voneye, Dustin Hamilton (City of Gillette)*
2. Scope of Work (see attachment)

Task 1. Project Management – *One of the tasks is to identify a project team. The following project team was selected:*

- i. *Heath Voneye – City of Gillette*
- ii. *Dustin Hamilton – City of Gillette*
- iii. *Kurt Siebenaler – City of Gillette*
- iv. *Josh Richardson – City of Gillette*
- v. *Mike Cole – City of Gillette*
- vi. Josh Jundt – WYDOT (We discussed that we would leave it up to Josh Jundt whether Kevin McKoy and Jim Evenson would need to be on the project team).
- vii. *Kevin King – Campbell County*

Other stakeholders that can be met with individually were identified. They are:

- i. Emergency Medical Services
- ii. City Police Department
- iii. Fire Department
- iv. School District Transportation
- v. City Council

Task 2. Review Study Boundary – *The Gillette Urban Systems boundary will be used.*

Task 3. Data Acquisition

- i. Collect Data (see list in scope) – *In addition to this list, the following items were noted:*
  - *i. City Comprehensive Plan*
  - *ii. County Plan*
  - *iii. The development summary put together by the City Planning office has good information on growth.*
  - *iv. BLM and other growth modeling studies used for planning the Madison pipeline – Mike Cole has this information and knowledge of these studies.*
- ii. Public Open House I - *this open house will be used to gather input from the public.*

Task 4. Travel Demand Modeling

i. Model Update – *The plan is to take the 2010 socioeconomic data and update it to current 2015 year for base model runs and calibration. Airsage (cell phone data mining company) will most likely be used for information on the origin-destination matrix and trip generation information.*

ii. Future Year Socioeconomic data – *This will be determined through discussions with the project team and planners.*

iii. Modeling Alternatives – *some of the alternatives that will need to be modeled are:*

   a. Possible road diet on 2nd Street from Brooks to 4J, which will be a SYNCRO L.O.S. analysis modeling task.

   b. The "Centennial Section" development may impact the network based on how it develops, and what is done with the transfer station and waste collection.

   c. The Highway 59 bypass is happening and should be included.

iv. Signal prioritization – *this will be part of the transportation plan update. It includes counting and performing a warrant analysis on 5 intersections. Two of the intersections could be counted soon. Boxelder and Garner Lake Road could be counted once the FCA store is open. Also Brooks and Warlow could be counted. Both of these intersections were close to the top of the list when the last signal prioritization plan was performed.*

Task 5. Bikeway Trails Component – *The "keep Gillette beautiful" committee has also been working on the pathways. Jeff will verify that he has a copy of the pathway master plan.*

Task 6. Safety Component – *crash history will be obtained from the WYDOT safety division.*

Task 7. Project Prioritization

Task 8. Public Participation

i. Website

ii. Project Team meetings – *first project team meeting could be the day of the first open house.*

iii. 2 public open houses – *first public open house can wait until we have some modeling information.*

Task 9. Report

3. Schedule (see attachment) – *main items needed are the signal prioritization for planning for the next budget cycle and the road diet analysis of 2nd street is needed for the next Gillette Urban Systems Committee Meeting.*
4. Action Items

Gillette Transportation Master Plan
OPEN HOUSE

Thursday, May 19, 2016
5:30 p.m. to 7:00 p.m.
City Hall, 201 E 5th Street, 2nd Floor
Community Conference Room

The City of Gillette is hosting an open house to gain public input on the City of Gillette Long Range Transportation Plan (LRTP). The objective of this plan is to update the transportation model, evaluate the future transportation network, and revise the priority list of transportation projects.

There will be an opportunity to provide your comments and ask questions at the meeting. You can also email comments/questions anytime by contacting:

Mail to: Jeffrey Rosenlund, DOWL
16 W 8th Street • Sheridan, Wyoming 82801

Phone: 307-672-9006 • Fax 800-865-98547
jrosenlund@dowl.com

People can weigh in on city's long-range transportation plan

City residents will have an opportunity to ask questions and make comments about the city of Gillette Long Range Transportation Plan during an open house on Thursday.

The objectives of the Long Range Transportation Plan include:

- Updating the transportation model
- Evaluating the future transportation network, and
- Revising the priority list of transportation projects

The open house will be from 5:30-7:30 p.m. Thursday in the second floor community room at City Hall.

Anyone wishing to comment but is unable to attend the open house can contact Jeffrey Rosenlund at DOWL by phone at 307-672-9006 or email at jrosenlund@dowl.com.

Gillette
Long Range Transportation Plan Update

Please Sign In

May 19, 2016
Open House

PRINT NAME	ORGANIZATION	TELEPHONE	E-MAIL
JEFFREY ROSENLUND	DOWL	307-751-6235	jrosenlund@dowl.com
Heath VonEye	City	686-5265	heathv@gillettewy.gov
Tad Rosenlund	DOWL	(307) 461-0565	trosenlund@dowl.com
Katie Alo	Chamber of Commerce	(307) 682-3673	Katiea@gillettechamber.com
Kurt Siebenaler	City	686-5265	Kurt@gillettewy.gov
Brent Albrecht	City		
Kevin King	County	685-8061	kck08@ccgov.net
Scott Chan		660-7141	ScottChan@live.com
MIKE COLE	City	299-2653	mikec@gillettewy.gov
JOSH RICHARDSON	City	686-5317	josh@gillettewy.gov
Mark Hines	DOWL		

Gillette Long Range Transportation Plan Update

Open House – May 19, 2016
Comment Sheet

DOWL

We welcome your feedback!

We are interested in your thoughts, concerns, and suggestions regarding issues with the transportation network in and around the City of Gillette. Please provide your comments below.

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Please provide (please print):

Name (required): ______________________________

Address: ______________________________

City: ______________ State: ______ Zip: __________

E-Mail: ______________________________

I want to get project updates:

- ☐ Please add my name to your project mailing list.
- ☐ Please add my name to your project e-mail list.

If you need more time to fill out your comments please send them via email, website, or mail to:
Jeffrey Rosenlund, P.E., PTP ■ Email: *jrosenlund@dowl.com* ■ Website: www.gillettelrtp.com
DOWL ■ P.O. Box 7010 ■ Sheridan, Wyoming 82801 ■ Phone: 307-672-9006

Gillette Long Range Transportation Plan Update

Team Meeting #2 Agenda

10:00 A.M.

October 27, 2016

City Hall – EN Conference Room

1. Purpose of meeting – update team on progress, get input on travel forecasting modeling results, identify other intersections for signal prioritization study.
2. Review and discuss draft modeling results/figures.
    a. Land Use figures
    b. Committed and Future networks
    c. Level of Service maps – modeling results
3. Signal Prioritization
    a. Boxelder and Garner Lake
    b. Brooks and Warlow
    c. Other locations to count and analyze (need 3 more).
4. Road Diet Analysis – crash analysis added
5. Other discussion points
    a. Transportation/Traffic issues
    b. Network improvements/Changes
6. Schedule (see attachment)
7. Action Items

Gillette Long Range Transportation Plan Update

Team Meeting #2 Agenda

10:00 A.M.

October 27, 2016

City Hall – EN Conference Room

Attendees: Dustin Hamilton, Kurt Siebenaler, Josh Richardson, Heath Voneye – City of Gillette Megan, Kevin King, Adrienne Hahn – Campbell County; Jeff Rosenlund – DOWL

1. Purpose of meeting – update team on progress, get input on travel forecasting modeling results, identify other intersections for signal prioritization study.
2. Review and discuss draft modeling results/figures.
    a. Land Use figures – *a few changes were noted. These figures will be updated. Jeff discussed modeling and how the model is now based on land use, with trip generation based on dwelling units and attractions based on land use, as opposed to employment (previous models used employment for trip attractions).*
    b. Committed and Future networks –*it was noted that the Burma extension from Warlow north to Northern drive shouldn't be on the committed network.*
    c. Level of Service maps – modeling results – *results were reviewed, no major issues noticed.*
3. Signal Prioritization
    a. Boxelder and Garner Lake
    b. Brooks and Warlow
    c. Other locations to count and analyze (need 3 more). – *The following three locations will be counted:*
        i. *Butler-Spaeth and Lakeway*
        ii. *Lakeway and Dogwood*
        iii. *Burma and Boxelder – the City would like to wait until the Highway 50 to Overdale section of Boxelder is open to perform the traffic counts.*
4. Road Diet Analysis – crash analysis added – *This was reviewed briefly and in more detail at the GUSAC meeting. The City will put together a striping plan and present this to WYDOT. It was noted that the road diet may help simplify WYDOT's improvements for 4J and 2nd Street. Jim Evensen will review the road diet analysis and let the City know if WYDOT needs additional information.*
5. Other discussion points
    a. Transportation/Traffic issues
    b. Network improvements/Changes
6. Schedule (see attachment) – *Schedule was discussed. We will shoot for having a final report ready for review in January. We will shoot for a final team meeting and public open house mid-January - February.*
7. Action Items


Gillette LRTP
HOME
DOCUMENTS
MEETINGS
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Gillette Long Range Transportation Plan Update
The City of Gillette is conducting an update to the Long Range Transportation Plan for Gillette. The objective of this plan is to update the transportation travel forecasting model, evaluate the future transportation network, and revise the priority list of transportation projects.
Gillette
Long Range Transportation Plan Update
Gillette LRTP
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WHAT'S NEW

OPEN HOUSE | THURSDAY, MAY 19, 2016
5:30 p.m. to 7:00 p.m.

City Hall, 201 E 5th Street, 2nd Floor
Community Conference Room

The City of Gillette is hosting an open house to gain public input on the City of Gillette Long Range Transportation Plan (LRTP)

Gillette LRTP

HOME DOCUMENTS MEETINGS COMMENTS CONTACT

DOCUMENTS

Project documents can be found here and are updated as needed. Please check back for updates.

- Project Schedule
- Transportation Network with recent projects
- 2009 Gillette Transportation Plan Update
- 2009 Transportation Plan Appendix
- 2013 City of Gillette Traffic Signal Priority Report

KICKOFF MEETING 11/17/15	PROJECT TEAM MEETING 03/16/16	OPEN HOUSE 05/19/16
AGENDA	AGENDA	AGENDA
MATERIAL	MATERIALS	MATERIALS
ADDITIONAL DOCUMENTS	ADDITIONAL DOCUMENTS	ADDITIONAL DOCUMENTS
COMMENT	COMMENT	COMMENT

Gillette LRTP

HOME DOCUMENTS MEETINGS COMMENTS CONTACT

COMMENTS

The purpose of inviting the public to comment is to inform the project team about issues that are important. It also allows the public to help shape the development and outcome of the project. Each comment received is reviewed by the project team members and become part of the project's official public record. However, the project team is not soliciting public comment as a means to measure the degree of public support for the project; your comment is not a ballot. For your comment to be of value to the project team, please be sure it contains ideas, suggestions, recommendations, or experiences that relate to the outcome of this project.

Gillette LRTP

HOME DOCUMENTS MEETINGS COMMENTS CONTACT

CONTACT US

Jeffrey Rosenlund, P.E., PTP

DOWL | P.O. Box 7010 | Sheridan, WY 82801

307-672-9006

jrosenlund@dowl.com

Name

Email

Subject

Message

SEND

Gillette Long Range Transportation Plan Update

Team Meeting #3 Meeting Minutes

3:00 P.M.

March 8, 2017

City Hall – EN Conference Room

Attendees: see attached list

1. Purpose of meeting – gather input on draft report.
2. Overview of report
    a. Land Use figures- *The City requested clarification about how the population growth was weighted due to varying increases in population densities around the city. DOWL will add a table with the potential growth for each section.*
    b. Committed network
    c. Level of Service maps – *modeling results*
    d. Signal Prioritization- *Discussion included the benefit of signals at the following intersections: Garner Lake Road/Boxelder, Hwy 59/6th Street, signals along Hwy 50, and options for Boxelder/Burma. The City asked if any signals will warrant removal after new signals are in place.*
    e. Road Diet Analysis
    f. Pathway network- *The City requested a separate pathway study be recommended in the report. DOWL will remove construction dates from the pathway priority, show joint City/County pathway projects, and rank the roadway based on a three-tier system (low, medium, or high).*
    g. Future network / project prioritization- *The report will be edited to reflect the project prioritization with a ranking system based on the benefit of each project. Assumed construction dates will be removed.*

3. Other Input
    a. *Update road names to reflect the new "Little Powder River Road"*
    b. *Remove population displayed in the State section west of the city*
    c. *Update the cost estimate for the S-curves by Taco John's (~$1.7M) and assign a higher priority*
    d. *Bold, or adjust the text in the "Total Cost" column in the construction estimate table*
    e. *Questions concerning crash volume on 12th Street were voiced*
    f. *Revisit Foothills projected volumes (may be high?)*

4. Schedule for public meeting – *The next public meeting is tentatively scheduled for late March or early April. The City will inform DOWL of the specific date once it is decided.*

5. Final report – *DOWL will review the entire report and get edits back to DOWL. The name of the report will be changed to the "2017" Long Range Transportation plan update.*

Gillette
Long Range Transportation Plan Update

March 8, 2017
Team Meeting #3

NAME	ORGANIZATION	E-MAIL
JEFF ROSENLUND	DOWL	jrosenlund@dowl.com
Adrienne Hahn	Campbell County	ahahn@ccgov.net
JORDAN ROBERTS	DOWL	jroberts@dowl.com
JOSH RICHARDSON	COG	josh@gillettewy.gov
MIKE COLE	COG	mikec@gillettewy.gov
JOSH JUNDT	WYDOT	Josh.jundt@wyo.gov
Mark Hines	DOWL	mhines@dowl.com
Kurt Siebenaler	C.O.G.	Kurt@gillettewy.gov
Kevin King	COUNTY	kck08@ccgov.net
Todd Merchen	COG	Todd@gillettewy.gov
Heath VanEye	COG	heathv@gillettewy.gov
Dustin Hamilton	COG	dustinh@gillettewy.gov

Gillette Transportation Master Plan
OPEN HOUSE

Thursday, March 30, 2017
5:30 p.m. to 7:00 p.m.
City Hall, 201 E 5th Street, 2nd Floor
Community Conference Room

The City of Gillette is hosting an open house to gain public input on the City of Gillette Long Range Transportation Plan (LRTP) draft report. The objective of this plan was to update the transportation model, evaluate the future transportation network, and revise the priority list of transportation projects.

The Draft report is available online at gillettelrtp.com.

There will be an opportunity to provide your comments and ask questions at the open house. You can also email comments/questions anytime by contacting:

Mail to: Jeffrey Rosenlund, DOWL
16 W 8th Street • Sheridan, Wyoming 82801

Phone: 307-672-9006 • Fax 800-865-98547
jrosenlund@dowl.com

Gillette
Long Range Transportation Plan Update

Please Sign In

March 30, 2017
Open House

PRINT NAME	ORGANIZATION	TELEPHONE	E-MAIL
JEFFREY ROSENLUND	DOWL	307-672-2006	jrosenlund@dowl.com
Heath VonEye	City	686-5265	
JOSH RICHARDSON	CITY	686-5317	josh@gillettewy.gov
Kevin Geis	CCR+B	682-4411	kfg14@ccgov.net
MARK HINES	Dowl	686 4181	mhines@dowl.com
MIKE COLE	CITY	686-5281	mikec@gillettewy.gov

Gillette Long Range Transportation Plan Update

Open House – March 30, 2017

Comment Sheet

We welcome your feedback!

We are interested in your thoughts, concerns, and suggestions regarding issues with the transportation network in and around the City of Gillette. Please provide your comments below.

____

Please provide (please print):

Name (required): ____

Address: ____

City: ______________________ State: ______ Zip: __________

E-Mail: ____

I want to get project updates:

- ☐ Please add my name to your project mailing list.
- ☐ Please add my name to your project e-mail list.

If you need more time to fill out your comments please send them via email, website, or mail to:

Jeffrey Rosenlund, P.E., PTP ■ Email: *jrosenlund@dowl.com* ■ Website: www.gillettelrtp.com

DOWL ■ P.O. Box 7010 ■ Sheridan, Wyoming 82801 ■ Phone: 307-672-9006

APPENDIX B

TRAVEL FORECASTING MODEL DATA

2017 Gillette LRTP

Trip Generation Rates

LAND USE	Area Type	Zone Category	UNITS	TRIP RATE	PRODUCTION RATES					ATTRACTION RATES				
					HBW	HBS	HBR	HBO	NHB	HBW	HBS	HBR	HBO	NHB
SINGLE FAMILY	Agricultural	A	DU	9.57	1.06	1.67	1.12	2.42	3.33					
SINGLE FAMILY	Agricultural	A-L	DU	9.57	1.06	1.67	1.12	2.42	3.33					
SINGLE FAMILY	Enhanced Manufactured Home	E-MH	DU	9.57	1.06	1.67	1.12	2.42	3.33					
SINGLE FAMILY	Enhanced Manufactured Home Suburban	E-MH RS	DU	13.58	1.90	2.39	1.51	3.38	4.41					
SINGLE FAMILY	Mobile Home Park	M-H	DU	4.99	0.55	0.87	0.58	1.26	1.74					
SINGLE FAMILY	Mobile Home Park	M-P	DU	4.99	0.55	0.87	0.58	1.26	1.74					
SINGLE FAMILY	Not Zoned	Zoned	DU	9.57	1.06	1.67	1.12	2.42	3.33					
SINGLE FAMILY	Planned Unit Development	PUD	DU	7.5	0.83	1.31	0.88	1.90	2.61					
SINGLE FAMILY	Single Family	R-1	DU	9.57	1.06	1.67	1.12	2.42	3.33					
SINGLE AND TWO F	Single and Two Family	R-2	DU	5.81	0.64	1.16	0.58	1.32	2.12					
SINGLE AND MULTI	Single and Multi Family	R-3	DU	5.81	0.64	1.49	0.65	0.84	2.19					
MULTI FAMILY	Multi Family	R-4	DU	6.65	0.86	1.49	0.78	1.09	2.43					
SINGLE FAMILY	Single Family	R-L	DU	9.57	1.06	1.67	1.12	2.42	3.33					
SINGLE FAMILY	Single Family Rural	R-R	DU	18.08	2.53	3.27	2.39	4.48	5.46					
SINGLE FAMILY	Single Family Suburban	R-S	DU	13.58	1.90	2.39	1.51	3.38	4.41					

GENERAL RETAIL	General Commercial District	C-1	SQF	50						2.75	22.70	11.05	5.00	8.50
GENERAL RETAIL	Central Business District	C-2	SQF	55						2.04	28.76	10.45	3.85	9.90
SERVICE	Business/Services	C-3	SQF	16.5						2.60	0.00	0.00	7.30	6.60
OFFICE	Office and Institution District	C-O	SQF	11.5						2.30	0.00	0.00	2.29	6.91
GENERAL RETAIL		C-P	SQF	50						2.75	22.70	11.05	5.00	8.50
LIGHT INDUSTRIAL		I-1	ACRE	51.8						38.86	0.00	0.00	0.00	12.95
HEAVY INDUSTRIAL		I-2	ACRE	6.75						6.33	0.00	0.00	0.00	2.11
AIRPORT		-	SQF	40.6						6.09	0.00	28.42	0.00	6.09
MEDICAL CENTER			SQF	4.43						2.66	0.00	0.00	0.44	1.33
ELEMENTARY		-	ENROLLM	1.29						0.13	0.00	0.00	0.52	0.65
Middle			ENROLLM	1.62						0.16	0.00	0.00	0.65	0.81
High		-	ENROLLM	1.71						0.17	0.00	0.00	0.69	0.86
COLLEGE		-	ENROLLM	2.38						0.28	0.00	0.00	0.94	1.16

2017 Gillette LRTP

Trip Generation Rates

Productions Zoning	Description	Trip Rate	Unit	Source
A	Agricultural	9.57	DU	ITE Trip Generation Report Single Family Detached Housing
A-L	Agricultural	9.57	DU	ITE Trip Generation Report Single Family Detached Housing
E-MH	Enhanced Manufactured Home District	9.57	DU	ITE Trip Generation Report Single Family Detached Housing
E-MH RS	Enhanced Manufactured Home Suburban R	13.58	DU	City of Lincoln Trip Generation Suburban Single Family
M-H	Mobile Home District	4.99	DU	ITE Trip Generation Report Mobile Home Park
M-P	Mobile Home Park	4.99	DU	ITE Trip Generation Report Mobile Home Park
Not Zoned	Not Zoned by City or County	9.57	DU	ITE Trip Generation Report Single Family Detached Housing
PUD	Planned Unit Development	7.5	DU	ITE Trip Generation Report Residential Planned Unit Development
R-1	Single Family Residential District	9.57	DU	ITE Trip Generation Report Single Family Detached Housing
R-2	Single and Two Family Residential District	5.81	DU	ITE Trip Generation Report Residential Condominium/Townhouse
R-3	Single and Multiple Family Residential Distr	5.81	DU	ITE Trip Generation Report Residential Condominium/Townhouse
R-4	Multi Family Residential District	6.65	DU	ITE Trip Generation Report Apartment
R-L	Single Family Residential District	9.57	DU	ITE Trip Generation Report Single Family Detached Housing
R-R	Rural Residential	18.08	DU	City of Lincoln Trip Generation Rural Single Family
R-S	Suburban Residential	13.58	DU	City of Lincoln Trip Generation Suburban Single Family

Attractions Zoning	Description	Trip Rate	Unit	Source
C-1	General Commercial District	50	1000 SF	City of Lincoln Trip Generation Report
C-2	Central Business District	55	1000 SF	City of Lincoln Trip Generation
C-3	Business/Services District	16.5	1000 SF	City of Lincoln Trip Generation
C-O	Office and Institution District	11.5	1000 SF	City of Lincoln Trip Generation
C-P	Planned Neighborhood Business District	50	1000 SF	City of Lincoln Trip Generation
I-1	Light Industrial	51.8	Acre	ITE Trip Generation Report Light Industrial
I-2	Heavy Industrial	6.75	Acre	ITE Trip Generation Report heavy Indusrial

Attractions Special	Description	Trip Rate	Unit	Source
Elementary School	Elementary School	1.29	Enrollmen	ITE Trip Generation Report Elementary School
Middle School	Middle School	1.62	Enrollmen	ITE Trip Generation Report Middle School
High School	High School	1.71	Enrollmen	ITE Trip Generation Report High School
College	College	2.38	Enrollmen	ITE Trip Generation Report College
Hospital	Hospital	4.43	1000 SF	City of Lincoln Trip Generation Medical Center
Airport	Airport	1.97	Flights/Da	Assumed 50 Trips per commercial flight, 4 flights per day.

2017 Gillette LRTP
Trip Productions by TAZ

Trip Rate Table- Trip Rates can be adjusted											
Zone	A	A-L	E-MH	E-MH RS	M-H	M-P	Not Zoned	PUD	R-1	R-2	R-3
Trip Rate	10.4	10.4	10.4	14.79337	5.44	5.44	10.42508	8.17	10.4	6.33	6.33
Units	Dwelling Units										
HBW	1.155	1.155	1.155	2.071	0.602	0.602	1.155	0.905	1.155	0.696	0.697
HBS	1.824	1.824	1.824	2.604	0.951	0.951	1.824	1.430	1.824	1.266	1.627
HBR	1.219	1.219	1.219	1.642	0.636	0.636	1.219	0.956	1.219	0.633	0.709
HBO	2.637	2.637	2.637	3.683	1.375	1.375	2.637	2.067	2.637	1.437	0.913
NHB	3.628	3.628	3.628	4.808	1.892	1.892	3.628	2.843	3.628	2.310	2.386

	Dwelling Units										
TAZ_NUMBER	A-1	A-L	E-MH	E-MH RS	M-H	M-P	Not Zoned	PUD	R-1	R-2	R-3
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	2	0	0	0	0
5	0	0	0	0	20	0	24	0	0	0	0
6	0	0	0	0	0	0	2	0	0	0	0
7	0	3	0	0	0	0	7	0	6	0	0
8	0	7	0	0	0	0	25	0	0	0	0
9	0	5	0	0	0	0	71	0	0	8	0
10	0	6	0	0	0	4	38	0	0	0	0
11	0	1	0	0	0	0	12	0	0	0	0
12	0	0	0	0	0	0	3	0	0	0	0
13	0	0	0	0	0	0	56	0	0	0	0
14	0	0	0	0	0	0	2	0	0	0	0
15	0	0	0	0	0	0	9	0	0	0	0
16	0	0	0	0	0	0	2	0	0	0	0
17	0	0	0	0	0	0	22	0	0	0	0
18	0	0	0	0	0	0	52	0	0	0	0
19	0	0	0	0	0	10	13	200	0	0	0
20	0	0	0	0	0	0	0	100	0	0	0
21	0	1	0	0	0	0	25	0	0	0	0
22	0	0	0	0	0	0	2	0	1	0	0
23	0	6	0	0	1	0	6	0	0	0	0
24	0	0	0	0	0	0	82	0	50	0	0
25	0	0	97	0	169	0	262	0	211	50	0
26	0	4	0	0	353	0	318	0	100	0	0
27	0	2	1	0	0	0	0	0	2	0	0
28	0	0	50	0	0	0	41	0	292	27	0
29	0	0	0	0	284	0	284	0	114	27	34
30	0	0	0	0	38	0	38	0	8	185	0
31	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	1	1	1	0	0	0	0
33	0	0	0	0	31	0	76	0	0	0	0
34	0	0	0	0	0	16	0	0	0	3	0
35	0	0	0	0	63	0	61	0	30	106	0
36	0	0	0	0	0	0	15	0	0	0	0
37	0	0	0	0	46	0	46	0	0	37	0

2017 Gillette LRTP
Trip Productions by TAZ

38	0	0	0	0	65	0	65	0	50	0	0
39	0	0	0	0	13	0	13	0	127	63	23
40	0	0	0	0	10	0	24	0	0	0	0
41	0	0	0	0	77	0	77	0	50	0	0
42	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	15	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	16	0	15	0	200	0	0
47	0	0	0	0	101	0	101	0	0	0	0
48	0	1	0	0	43	0	56	0	0	0	0
49	0	0	0	0	0	0	14	0	0	0	0
50	0	7	0	0	0	0	2	0	0	0	0
51	0	0	0	0	130	2	132	0	0	0	0
52	0	0	0	0	0	4	7	0	0	0	0
53	0	0	0	0	0	0	8	0	0	0	0
54	0	0	0	0	45	0	50	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	30	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	152	0	0	0	0
59	0	0	0	0	0	0	1	0	0	200	0
60	0	0	0	0	0	0	2	0	0	66	0
61	0	0	0	0	0	0	6	0	0	224	0
62	0	0	0	0	0	0	0	0	0	42	0
63	0	0	0	0	0	0	0	0	1	127	0
64	0	0	0	0	0	0	14	0	0	114	0
65	0	0	0	0	0	0	0	0	36	49	0
66	0	0	0	0	0	0	0	1	0	118	0
67	0	0	0	0	54	0	54	0	0	24	186
68	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	62	0	62	0	0	3	0
71	0	0	0	0	0	0	0	0	0	27	0
72	0	0	0	0	201	0	201	0	0	6	0
73	0	0	0	0	10	0	10	0	0	222	0
74	0	0	0	0	0	0	0	0	272	7	26
75	0	0	0	0	0	0	0	0	13	36	73
76	0	0	0	0	8	0	8	0	100	0	0
77	0	0	0	0	0	0	2	0	100	0	0
78	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	47	0
81	0	0	0	0	0	0	0	1	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0
85	1	0	0	0	0	0	1	0	0	0	0
86	0	1	0	0	0	0	0	0	288	0	0
87	0	0	0	0	2	0	2	0	0	0	0

2017 Gillette LRTP

Trip Productions by TAZ

88	0	0	0	0	0	0	0	0	118	0	0
89	0	0	0	0	0	0	0	0	52	200	0
90	0	0	0	0	0	0	0	0	200	0	0
91	0	0	0	0	0	0	0	0	60	15	0
92	1	14	46	0	0	0	46	0	200	0	0
93	0	0	0	0	0	0	0	0	336	15	28
94	0	0	0	0	0	0	0	0	46	0	0
95	0	0	0	0	0	0	0	0	117	163	0
96	0	0	0	0	0	0	0	0	378	32	0
97	0	0	0	0	0	0	0	0	0	419	0
98	0	0	0	0	0	0	0	1	0	196	0
99	0	1	0	0	0	0	7	0	7	6	0
100	0	1	0	0	0	0	4	0	1	0	0
101	0	2	0	0	0	0	0	0	0	1	0
102	0	5	0	0	0	0	0	4	0	0	0
103	0	0	0	0	0	0	0	0	48	80	0
104	0	0	0	0	0	0	0	0	0	0	14
105	0	1	0	0	0	0	0	0	400	0	0
106	1	0	0	46	435	0	426	0	0	0	0
107	0	0	0	0	0	0	0	0	32	0	0
108	0	18	0	0	0	0	1	0	0	0	0
109	0	24	0	0	0	0	0	0	79	0	0
110	0	23	0	0	0	0	0	0	0	0	0
111	0	2	0	0	0	0	0	0	0	0	0
112	0	6	0	0	0	0	0	0	0	0	0
113	0	8	0	0	0	0	1	10	156	0	100
114	0	1	0	0	0	0	0	337	111	200	100
115	0	16	0	0	0	0	0	0	123	103	0
116	0	0	0	0	0	1	21	38	153	11	0
117	0	0	0	0	0	0	0	0	104	200	100
118	0	1	0	0	0	0	0	0	0	0	0
119	0	0	0	0	102	12	110	0	7	53	0
120	0	0	0	0	71	0	70	0	11	22	0
121	0	0	0	0	0	0	0	0	0	8	0
122	0	2	0	0	0	0	20	0	0	0	0
123	0	0	0	0	0	0	0	0	62	5	0
124	0	0	0	0	0	0	0	1	205	28	0
125	1	0	0	0	96	0	96	0	100	0	0
126	0	0	0	0	0	0	0	0	0	0	100
127	0	1	0	0	0	48	48	0	0	0	0
128	0	1	0	0	26	0	26	0	0	0	0
129	0	5	0	0	0	0	0	0	0	0	0
130	0	19	0	0	0	0	0	0	445	0	0
131	0	0	0	0	0	0	0	0	299	8	0
132	0	0	0	0	0	0	9	0	0	0	0
133	0	0	0	0	0	0	0	0	0	0	0
	4	197	194	46	2573	98	3607	693	5901	3583	784

2017 Gillette LRTP
Trip Productions by TAZ

R-4	R-L	R-S	R-R
7.24	10.4	14.79	19.7
0.942	1.155	2.071	2.757
1.623	1.824	2.604	3.564
0.847	1.219	1.642	2.602
1.189	2.637	3.683	4.885
2.644	3.628	4.808	5.943

R-4	R-L	R-R	R-S
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	125	0
0	0	0	1
0	0	13	1
0	2	54	14
0	0	37	47
0	0	3	0
0	0	43	70
0	0	0	0
0	0	2	1
0	0	12	0
0	0	71	0
0	0	0	0
0	0	4	0
0	0	24	4
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	3	3	0
0	0	0	0
97	0	0	15
0	0	0	0
0	0	0	0
53	0	0	0
243	0	0	0
86	0	0	0
0	0	0	0
0	0	0	0
0	0	0	1
0	0	0	0
0	0	0	0
0	0	0	0
69	0	0	0

	Trips					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB	Total
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	1	1	0	1	1	4
4	2	4	3	5	8	22
5	299	388	247	551	726	2211
6	5	7	5	9	12	38
7	47	65	42	93	123	370
8	190	253	167	357	467	1433
9	300	413	281	578	751	2323
10	59	92	61	132	181	526
11	298	386	269	536	673	2163
12	4	6	4	9	12	35
13	71	110	74	159	218	633
14	28	35	23	50	66	202
15	158	201	128	285	374	1146
16	2	3	2	5	7	20
17	33	50	33	72	98	288
18	121	172	114	246	329	982
19	202	319	213	461	634	1828
20	91	143	96	207	285	821
21	31	48	32	70	96	277
22	4	7	4	10	13	38
23	24	36	24	52	71	208
24	152	241	161	348	479	1381
25	928	1475	956	1997	2850	8205
26	700	1105	739	1598	2198	6340
27	6	9	6	13	18	52
28	511	819	529	1113	1593	4566
29	903	1481	914	1801	2769	7867
30	286	494	270	542	894	2485
31	0	0	0	0	0	0
32	2	3	2	4	6	16
33	109	172	115	248	340	983
34	12	19	12	27	38	108
35	217	361	219	480	695	1972
36	18	28	19	40	56	160
37	172	287	167	320	522	1467

2017 Gillette LRTP

Trip Productions by TAZ

201	0	0	0
1	0	38	26
0	0	0	0
0	0	0	1
0	0	20	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	117
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
11	0	0	0
6	0	0	0
0	0	0	0
0	0	0	0
121	0	0	0
45	0	0	0
15	0	0	0
9	0	0	0
0	0	0	0
34	0	0	0
42	0	0	0
52	0	0	0
106	0	0	0
144	0	0	0
144	0	0	0
0	0	0	0
227	0	0	0
0	0	0	0
0	0	0	0
0	0	1	40
231	0	1	0
0	0	2	0
0	0	0	0
0	0	0	0
0	0	0	0
159	0	0	7
0	0	0	0
40	0	0	0
0	0	0	0
0	0	3	32
0	0	0	0
0	0	1	4
0	0	0	0

38	361	597	351	631	1070	3010
39	380	577	365	766	1071	3159
40	34	53	36	77	106	306
41	194	306	205	442	607	1754
42	43	55	35	77	101	311
43	0	0	0	0	0	0
44	18	28	19	40	56	161
45	1	1	1	1	2	5
46	258	407	272	589	810	2336
47	177	280	187	405	557	1608
48	93	146	98	211	290	838
49	338	441	320	606	743	2448
50	11	17	11	24	34	97
51	232	366	245	529	727	2098
52	11	17	11	24	34	97
53	9	14	10	21	29	83
54	85	134	90	194	267	769
55	10	18	9	13	29	80
56	40	64	42	86	125	357
57	0	0	0	0	0	0
58	176	277	185	401	551	1591
59	254	451	230	434	786	2156
60	91	160	82	154	279	766
61	177	319	162	356	580	1595
62	38	69	35	72	122	336
63	89	161	81	183	295	809
64	127	225	118	241	404	1115
65	115	196	111	215	355	992
66	132	235	120	233	413	1133
67	341	655	337	547	1078	2958
68	136	234	122	171	381	1043
69	136	234	122	171	381	1043
70	111	176	117	253	349	1006
71	233	403	209	309	663	1816
72	358	567	378	817	1126	3246
73	171	307	158	357	565	1559
74	451	694	461	952	1310	3869
75	311	566	288	432	921	2518
76	133	209	140	302	415	1199
77	118	186	124	269	370	1067
78	0	0	0	0	0	1
79	0	0	0	0	0	0
80	202	342	183	291	571	1588
81	1	2	1	3	3	10
82	38	65	34	48	106	291
83	0	0	0	0	0	0
84	96	124	90	171	209	690
85	2	3	2	5	7	19
86	345	542	363	783	1074	3108
87	4	7	4	10	13	38

2017 Gillette LRTP

Trip Productions by TAZ

0	0	0	60
0	0	0	9
0	0	0	0
174	0	45	0
0	0	4	16
0	0	0	42
0	0	83	5
0	0	0	0
103	0	0	0
14	0	0	0
153	0	0	0
0	0	1	0
0	0	2	0
112	0	0	0
1	0	0	0
129	0	0	0
45	0	0	33
0	0	0	0
0	0	2	0
0	0	6	108
0	0	48	57
0	0	2	30
0	0	0	4
0	0	0	48
0	0	0	13
31	0	0	0
30	0	0	0
216	0	11	2
73	0	0	0
0	0	0	0
1	0	0	0
64	0	0	0
6	0	0	0
0	0	0	0
1	0	0	0
194	0	0	0
0	0	0	0
0	0	0	0
343	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	1
44	0	0	5
0	0	0	0
0	0	0	2

88	303	430	301	606	787	2426
89	224	380	213	468	704	1989
90	231	365	244	527	726	2093
91	337	528	304	553	929	2651
92	408	629	423	904	1230	3595
93	533	826	548	1137	1569	4613
94	239	318	206	452	597	1813
95	248	419	246	542	800	2255
96	557	898	569	1167	1720	4911
97	305	553	277	619	1006	2761
98	281	497	254	465	859	2356
99	23	37	23	51	72	206
100	12	17	11	24	33	97
101	108	186	98	140	305	836
102	10	16	11	22	32	91
103	233	399	219	396	701	1947
104	143	214	134	228	349	1068
105	463	731	488	1056	1453	4191
106	854	1317	875	1900	2601	7546
107	348	459	330	635	787	2559
108	277	361	249	503	636	2027
109	207	301	208	428	564	1708
110	38	57	39	81	108	322
111	134	174	127	239	292	968
112	45	61	44	84	105	339
113	298	528	308	584	947	2665
114	671	1150	681	1406	2144	6052
115	465	771	442	823	1379	3880
116	313	506	318	642	961	2740
117	329	606	324	653	1078	2990
118	3	4	3	5	8	23
119	300	492	302	617	930	2642
120	157	253	163	350	495	1417
121	6	10	5	12	19	52
122	26	42	28	59	83	238
123	257	434	243	401	748	2083
124	257	411	269	583	811	2331
125	285	451	301	652	896	2585
126	393	720	362	500	1146	3120
127	85	134	90	194	267	771
128	47	75	50	108	149	429
129	6	10	7	14	20	56
130	540	852	569	1231	1692	4883
131	408	647	422	880	1254	3611
132	11	17	11	24	33	96
133	5	7	5	9	11	37

3870 5 663 818 23036 24086 38461 23838 48310 71621 206318

2017 Gillette LRTP

Trip Attractions by TAZ

Trips Land Use					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	380	214	104	47	198
8	0	0	0	0	0
9	38	245	119	54	95
10	182	0	0	0	61
11	0	0	0	0	0
12	197	0	0	0	66
13	2368	0	0	0	790
14	1098	0	0	0	366
15	580	0	0	0	193
16	0	0	0	0	0
17	1887	0	0	0	629
18	0	0	0	0	0
19	266	0	0	25	108
20	0	0	0	1	1
21	782	0	0	102	534
22	93	0	0	0	31
23	0	0	0	0	0
24	0	0	0	0	0
25	34	284	138	62	106
26	264	0	0	1	89
27	0	0	0	0	0
28	0	0	0	0	0

Trips Special					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
1	40	0	0	164	204
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	54	0	0	222	276
6	0	0	0	0	0
7	0	0	0	0	0
8	5	0	0	21	26
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	30	0	140	0	30
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0

Trips Combined						
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB	Total
1	40	0	0	164	204	408
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	54	0	0	222	276	552
6	0	0	0	0	0	0
7	380	214	104	47	198	945
8	5	0	0	21	26	53
9	38	245	119	54	95	552
10	182	0	0	0	61	242
11	0	0	0	0	0	0
12	227	0	140	0	96	463
13	2368	0	0	0	790	3158
14	1098	0	0	0	366	1464
15	580	0	0	0	193	773
16	0	0	0	0	0	0
17	1887	0	0	0	629	2516
18	0	0	0	0	0	0
19	266	0	0	25	108	399
20	0	0	0	1	1	2
21	782	0	0	102	534	1418
22	93	0	0	0	31	124
23	0	0	0	0	0	0
24	0	0	0	0	0	0
25	34	284	138	62	106	625
26	264	0	0	1	89	354
27	0	0	0	0	0	0
28	0	0	0	0	0	0

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Trip Attractions by TAZ

Trips Land Use					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
29	158	1306	636	288	489
30	444	1941	945	924	1279
31	1079	1656	806	1944	2154
32	136	0	0	378	342
33	1034	0	0	213	672
34	186	0	0	82	127
35	136	0	0	174	182
36	66	0	0	66	199
37	759	115	56	25	292
38	198	230	112	51	143
39	0	0	0	0	0
40	1981	368	179	81	783
41	0	0	0	0	0
42	34	0	0	97	88
43	318	0	0	0	106
44	0	0	0	0	0
45	0	0	0	0	0
46	0	0	0	0	0
47	2998	0	0	0	999
48	1463	50	24	31	558
49	165	0	0	0	55
50	139	0	0	0	46
51	6	0	0	0	2
52	387	0	0	0	129
53	791	2436	1186	537	1078
54	1283	2703	1316	595	1331
55	591	3977	1936	985	1817
56	727	1270	616	483	1216
57	637	973	474	732	1925
58	580	0	0	578	1743
59	381	2770	1115	596	1330

Trips Special					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
29	0	0	0	0	0
30	61	0	0	251	312
31	0	0	0	0	0
32	0	0	0	0	0
33	0	0	0	0	0
34	0	0	0	0	0
35	0	0	0	0	0
36	7	0	0	29	36
37	0	0	0	0	0
38	76	0	0	312	388
39	0	0	0	0	0
40	0	0	0	0	0
41	0	0	0	0	0
42	0	0	0	0	0
43	0	0	0	0	0
44	0	0	0	0	0
45	0	0	0	0	0
46	0	0	0	0	0
47	0	0	0	0	0
48	0	0	0	0	0
49	0	0	0	0	0
50	0	0	0	0	0
51	0	0	0	0	0
52	0	0	0	0	0
53	0	0	0	0	0
54	0	0	0	0	0
55	418	0	0	70	209
56	0	0	0	0	0
57	0	0	0	0	0
58	0	0	0	0	0
59	0	0	0	0	0

Trips Combined						
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB	Total
29	158	1306	636	288	489	2877
30	505	1941	945	1176	1591	6157
31	1079	1656	806	1944	2154	7639
32	136	0	0	378	342	855
33	1034	0	0	213	672	1920
34	186	0	0	82	127	395
35	136	0	0	174	182	492
36	73	0	0	94	234	402
37	759	115	56	25	292	1248
38	273	230	112	362	530	1508
39	0	0	0	0	0	0
40	1981	368	179	81	783	3392
41	0	0	0	0	0	0
42	34	0	0	97	88	219
43	318	0	0	0	106	424
44	0	0	0	0	0	0
45	0	0	0	0	0	0
46	0	0	0	0	0	0
47	2998	0	0	0	999	3998
48	1463	50	24	31	558	2125
49	165	0	0	0	55	220
50	139	0	0	0	46	185
51	6	0	0	0	2	8
52	387	0	0	0	129	515
53	791	2436	1186	537	1078	6027
54	1283	2703	1316	595	1331	7227
55	1009	3977	1936	1054	2026	10002
56	727	1270	616	483	1216	4312
57	637	973	474	732	1925	4741
58	580	0	0	578	1743	2900
59	381	2770	1115	596	1330	6191

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Trip Attractions by TAZ

Trips Land Use					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
60	1036	12264	4586	1841	4570
61	295	91	44	162	509
62	264	708	345	333	800
63	12	95	46	21	36
64	534	3463	1686	876	1639
65	81	520	253	132	247
66	734	6055	2948	1334	2267
67	143	1176	573	259	441
68	378	3121	1519	688	1169
69	0	0	0	0	0
70	153	1262	615	278	473
71	0	0	0	0	0
72	412	2033	990	448	817
73	0	0	0	0	0
74	0	0	0	0	0
75	0	0	0	0	0
76	274	2264	1102	499	848
77	712	788	384	537	786
78	906	2	1	1	303
79	310	283	138	337	936
80	342	1862	907	526	1048
81	1772	14626	7120	3221	5477
82	619	5111	2488	1126	1914
83	507	4184	2036	921	1567
84	2	14	7	3	5
85	323	0	0	0	108
86	205	717	349	491	569
87	5	45	22	10	17
88	2	20	10	4	7
89	13	108	53	24	40
90	0	0	0	0	0

Trips Special					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
60	0	0	0	0	0
61	0	0	0	0	0
62	169	0	0	685	853
63	0	0	0	0	0
64	0	0	0	0	0
65	0	0	0	0	0
66	43	0	0	176	219
67	0	0	0	0	0
68	0	0	0	0	0
69	389	0	0	1584	1973
70	0	0	0	0	0
71	0	0	0	0	0
72	0	0	0	0	0
73	0	0	0	0	0
74	74	0	0	306	381
75	0	0	0	0	0
76	0	0	0	0	0
77	0	0	0	0	0
78	0	0	0	0	0
79	0	0	0	0	0
80	0	0	0	0	0
81	0	0	0	0	0
82	0	0	0	0	0
83	0	0	0	0	0
84	0	0	0	0	0
85	0	0	0	0	0
86	0	0	0	0	0
87	0	0	0	0	0
88	0	0	0	0	0
89	0	0	0	0	0
90	0	0	0	0	0

Trips Combined						
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB	Total
60	1036	12264	4586	1841	4570	24298
61	295	91	44	162	509	1102
62	432	708	345	1018	1653	4156
63	12	95	46	21	36	210
64	534	3463	1686	876	1639	8196
65	81	520	253	132	247	1233
66	776	6055	2948	1510	2486	13775
67	143	1176	573	259	441	2591
68	378	3121	1519	688	1169	6875
69	389	0	0	1584	1973	3947
70	153	1262	615	278	473	2781
71	0	0	0	0	0	0
72	412	2033	990	448	817	4699
73	0	0	0	0	0	0
74	74	0	0	306	381	761
75	0	0	0	0	0	0
76	274	2264	1102	499	848	4988
77	712	788	384	537	786	3207
78	906	2	1	1	303	1213
79	310	283	138	337	936	2004
80	342	1862	907	526	1048	4685
81	1772	14626	7120	3221	5477	32215
82	619	5111	2488	1126	1914	11258
83	507	4184	2036	921	1567	9215
84	2	14	7	3	5	31
85	323	0	0	0	108	431
86	205	717	349	491	569	2331
87	5	45	22	10	17	98
88	2	20	10	4	7	43
89	13	108	53	24	40	238
90	0	0	0	0	0	0

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Trip Attractions by TAZ

Trips Land Use					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
91	22	181	88	40	68
92	17	140	68	31	52
93	14	0	0	14	41
94	0	0	0	0	0
95	0	0	0	0	1
96	24	189	92	42	71
97	165	985	480	262	506
98	423	2960	1441	716	1302
99	2732	4229	2058	1324	3375
100	1346	1762	858	388	1037
101	177	1462	712	322	547
102	1307	8034	3911	1770	3120
103	364	0	0	0	121
104	7	58	28	13	22
105	0	0	0	0	0
106	51	424	207	93	159
107	5	38	19	8	14
108	0	0	0	0	0
109	127	876	426	193	335
110	0	0	0	0	0
111	577	113	55	25	230
112	66	0	0	185	167
113	23	187	91	41	70
114	17	144	70	32	54
115	115	951	463	210	356
116	608	20	10	591	1783
117	0	0	0	0	0
118	679	0	0	0	226
119	772	2252	1096	496	1010
120	13	109	53	24	41
121	1073	1038	505	622	1014

Trips Special					
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB
91	0	0	0	0	0
92	0	0	0	0	0
93	199	0	0	813	1012
94	70	0	0	286	356
95	0	0	0	0	0
96	66	0	0	273	340
97	0	0	0	0	0
98	65	0	0	269	335
99	441	0	0	1483	1842
100	0	0	0	0	0
101	0	0	0	0	0
102	0	0	0	0	0
103	0	0	0	0	0
104	0	0	0	0	0
105	0	0	0	0	0
106	0	0	0	0	0
107	0	0	0	0	0
108	0	0	0	0	0
109	0	0	0	0	0
110	0	0	0	0	0
111	0	0	0	0	0
112	0	0	0	0	0
113	0	0	0	0	0
114	0	0	0	0	0
115	0	0	0	0	0
116	0	0	0	0	0
117	0	0	0	0	0
118	0	0	0	0	0
119	0	0	0	0	0
120	73	0	0	298	371
121	0	0	0	0	0

Trips Combined						
TAZ_NUMBER	HBW	HBS	HBR	HBO	NHB	Total
91	22	181	88	40	68	398
92	17	140	68	31	52	307
93	213	0	0	826	1053	2092
94	70	0	0	286	356	712
95	0	0	0	0	1	2
96	91	189	92	315	411	1098
97	165	985	480	262	506	2398
98	488	2960	1441	985	1636	7511
99	3173	4229	2058	2807	5217	17484
100	1346	1762	858	388	1037	5392
101	177	1462	712	322	547	3220
102	1307	8034	3911	1770	3120	18141
103	364	0	0	0	121	485
104	7	58	28	13	22	127
105	0	0	0	0	0	0
106	51	424	207	93	159	934
107	5	38	19	8	14	84
108	0	0	0	0	0	0
109	127	876	426	193	335	1957
110	0	0	0	0	0	0
111	577	113	55	25	230	1000
112	66	0	0	185	167	418
113	23	187	91	41	70	411
114	17	144	70	32	54	317
115	115	951	463	210	356	2096
116	608	20	10	591	1783	3013
117	0	0	0	0	0	0
118	679	0	0	0	226	905
119	772	2252	1096	496	1010	5626
120	86	109	53	322	412	981
121	1073	1038	505	622	1014	4252

2017 Gillette LRTP

Trip Attractions by TAZ

Trips Land Use					
TAZ_NUMBER	**HBW**	**HBS**	**HBR**	**HBO**	**NHB**
122	3167	18	9	4	1062
123	227	486	237	107	238
124	282	2238	1089	502	865
125	1000	951	463	730	1060
126	49	259	126	107	142
127	2386	32	16	7	806
128	0	0	0	0	0
129	0	0	0	0	0
130	0	0	0	0	0
131	74	613	298	135	229
132	1948	7	4	590	1114
133	8	63	31	14	24

Trips Special					
TAZ_NUMBER	**HBW**	**HBS**	**HBR**	**HBO**	**NHB**
122	0	0	0	0	0
123	0	0	0	0	0
124	0	0	0	0	0
125	0	0	0	0	0
126	0	0	0	0	0
127	0	0	0	0	0
128	0	0	0	0	0
129	0	0	0	0	0
130	63	0	0	257	320
131	0	0	0	0	0
132	0	0	0	0	0
133	0	0	0	0	0

Trips Combined						
TAZ_NUMBER	**HBW**	**HBS**	**HBR**	**HBO**	**NHB**	**Total**
122	3167	18	9	4	1062	4259
123	227	486	237	107	238	1295
124	282	2238	1089	502	865	4975
125	1000	951	463	730	1060	4203
126	49	259	126	107	142	682
127	2386	32	16	7	806	3248
128	0	0	0	0	0	0
129	0	0	0	0	0	0
130	63	0	0	257	320	640
131	74	613	298	135	229	1350
132	1948	7	4	590	1114	3663
133	8	63	31	14	24	139
	57087	112168	53122	40360	79683	######

Pop. 35,000 - Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
1	0.03	0.05	0.03	0.07	0.13	11.55	0.00	0.00	135.34	168.99
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.55	0.72	0.46	1.02	1.81	0.00	0.00	0.00	0.00	0.00
4	2.40	3.79	2.53	5.47	10.12	0.00	0.00	0.00	0.00	0.00
5	39.34	62.14	41.53	89.83	166.13	15.66	0.00	0.00	183.39	228.98
6	2.35	3.71	2.48	5.36	9.91	0.00	0.00	0.00	0.00	0.00
7	28.24	41.41	27.44	59.37	107.70	132.95	59.08	37.64	47.01	198.40
8	80.80	115.50	79.74	163.29	287.55	1.50	0.00	0.00	17.56	21.93
9	256.43	356.43	245.44	499.88	871.85	13.43	67.61	43.08	53.80	94.76
10	51.05	80.65	53.90	116.58	215.60	63.46	0.00	0.00	0.02	60.53
11	279.76	363.09	252.66	504.31	851.13	0.00	0.00	0.00	0.00	0.00
12	3.86	6.09	4.07	8.81	16.29	79.34	0.00	50.51	0.00	95.67
13	71.41	111.49	74.63	160.86	296.26	827.87	0.00	0.00	0.00	789.51
14	27.56	35.50	22.54	50.35	88.93	383.76	0.00	0.00	0.00	365.96
15	155.49	198.74	125.92	281.64	496.47	202.71	0.00	0.00	0.00	193.31
16	2.16	3.42	2.29	4.94	9.14	0.00	0.00	0.00	0.00	0.00
17	33.45	50.25	33.20	72.33	132.41	659.70	0.00	0.00	0.00	629.12
18	121.33	172.25	113.65	245.96	442.17	0.00	0.00	0.00	0.00	0.00
19	20.75	32.77	21.91	47.38	87.62	92.98	0.00	0.00	24.70	108.16
20	0.15	0.24	0.16	0.35	0.64	0.09	0.00	0.00	0.71	0.64
21	37.48	59.20	39.57	85.58	158.27	273.45	0.00	0.00	101.35	533.70
22	3.47	5.17	3.41	7.44	13.60	32.38	0.00	0.00	0.00	30.88
23	23.42	34.28	22.51	49.23	89.64	0.00	0.00	0.00	0.00	0.00
24	94.65	149.52	99.94	216.14	399.73	0.00	0.00	0.00	0.00	0.00
25	886.63	1401.32	917.87	1914.16	3650.34	12.01	78.15	49.79	62.18	106.18
26	562.62	888.78	594.07	1284.83	2376.14	92.12	0.00	0.00	1.31	88.88
27	3.81	6.02	4.02	8.70	16.08	0.00	0.00	0.00	0.00	0.00
28	482.10	773.11	498.65	1046.85	2018.56	0.00	0.00	0.00	0.00	0.00
29	901.53	1479.40	912.52	1798.01	3718.15	59.54	387.46	246.87	308.30	526.41
30	284.12	490.94	268.74	539.08	1194.64	172.76	534.97	340.86	1127.54	1537.31
31	0.05	0.08	0.05	0.12	0.21	384.77	506.21	322.53	1975.10	2221.15
32	2.16	3.41	2.28	4.93	9.12	47.36	0.00	0.00	375.99	341.84
33	106.77	168.66	112.74	243.82	450.92	361.42	0.00	0.00	212.54	672.10
34	32.50	51.84	34.01	73.75	137.75	64.97	0.00	0.00	81.96	126.63
35	215.64	358.29	216.89	476.30	928.41	47.65	0.00	0.00	172.78	181.77
36	18.75	29.62	19.80	42.82	79.19	25.10	0.00	0.00	88.88	227.72
37	169.21	282.21	165.28	317.47	692.68	263.54	20.60	13.12	16.39	276.30
38	321.07	534.40	309.40	539.74	1270.79	91.05	63.37	40.37	307.68	463.91
39	360.73	544.23	346.16	723.76	1355.96	0.00	0.00	0.00	0.00	0.00
40	33.74	53.30	35.63	77.05	142.49	692.29	101.43	64.62	80.70	783.12
41	136.13	214.60	143.56	310.07	572.83	0.00	0.00	0.00	0.00	0.00
42	43.21	54.56	34.59	77.15	135.28	12.03	0.00	0.00	96.38	87.52
43	0.00	0.00	0.00	0.00	0.00	111.15	0.00	0.00	0.00	106.00
44	17.72	27.99	18.71	40.46	74.83	0.00	0.00	0.00	0.00	0.00
45	0.50	0.79	0.53	1.15	2.12	0.00	0.00	0.00	0.00	0.00

Pop. 35,000 - Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
46	44.72	70.64	47.22	102.12	188.86	0.00	0.00	0.00	0.00	0.00
47	177.46	280.34	187.38	405.27	749.49	1048.07	0.00	0.00	0.00	999.49
48	92.73	146.19	97.80	211.24	390.29	511.25	13.66	8.70	30.83	557.86
49	337.53	440.92	320.38	606.14	999.30	57.59	0.00	0.00	0.00	54.92
50	10.69	16.89	11.29	24.41	45.15	48.60	0.00	0.00	0.00	46.35
51	231.57	365.82	244.52	528.83	978.01	2.06	0.00	0.00	0.00	1.96
52	10.68	16.87	11.28	24.39	45.10	135.12	0.00	0.00	0.00	128.85
53	9.14	14.44	9.65	20.88	38.61	276.54	671.47	427.83	534.28	1077.59
54	84.84	134.03	89.59	193.75	358.32	448.34	745.01	474.68	592.79	1330.56
55	5.65	9.74	5.08	7.14	21.33	359.55	1140.61	726.74	1085.08	2086.21
56	40.30	64.47	41.67	86.26	167.65	271.25	461.96	293.40	569.98	1368.27
57	0.00	0.00	0.00	0.00	0.00	235.79	352.81	224.80	796.14	2040.46
58	256.54	416.88	258.23	503.17	1047.05	202.70	0.00	0.00	575.36	1742.71
59	248.70	441.44	225.25	424.63	1033.07	145.52	844.17	453.72	657.44	1439.84
60	86.02	152.03	78.17	145.64	355.44	361.97	3380.28	1654.55	1833.46	4570.39
61	165.41	297.84	151.30	331.69	726.79	103.09	25.11	16.00	161.32	509.38
62	35.62	63.97	32.31	66.74	153.12	141.03	195.14	124.33	896.61	1506.83
63	87.41	158.98	79.49	180.46	390.09	4.03	26.25	16.72	20.88	35.66
64	122.10	215.34	113.12	231.48	520.29	186.51	954.37	608.08	872.25	1638.58
65	115.23	195.87	110.50	215.31	477.06	28.14	143.30	91.30	131.41	247.35
66	129.93	231.08	118.02	229.50	545.56	268.84	1668.97	1063.38	1473.13	2448.72
67	337.71	649.09	334.14	541.77	1435.37	49.82	324.24	206.59	257.99	440.52
68	135.66	233.77	122.05	171.37	511.98	132.20	860.32	548.15	684.54	1168.84
69	137.89	237.30	124.41	176.47	521.42	111.72	0.00	0.00	1294.53	1619.79
70	111.03	175.89	116.93	253.09	469.40	53.47	347.95	221.70	276.86	472.73
71	229.76	397.73	206.89	305.23	880.03	0.00	0.00	0.00	0.00	0.00
72	358.21	566.87	377.63	817.12	1513.85	149.68	597.43	380.65	475.36	866.87
73	165.65	297.29	153.09	345.66	735.26	0.00	0.00	0.00	0.00	0.00
74	433.62	666.60	444.63	915.54	1690.32	21.57	0.00	0.00	252.61	315.41
75	296.76	537.61	274.57	412.35	1178.23	0.00	0.00	0.00	0.00	0.00
76	18.73	28.45	18.85	40.99	75.21	92.26	600.44	382.57	477.76	815.76
77	4.62	7.30	4.88	10.55	19.51	240.75	163.65	104.27	492.42	713.75
78	0.00	0.00	0.00	0.00	0.00	316.67	0.65	0.41	0.51	302.77
79	0.00	0.00	0.00	0.00	0.00	147.16	329.44	209.90	536.16	1277.60
80	199.42	338.35	180.57	286.79	757.28	125.82	553.58	352.71	556.16	1102.50
81	0.00	0.00	0.00	0.00	0.00	619.41	4031.07	2568.40	3207.46	5476.65
82	32.38	55.79	29.13	40.89	122.19	216.45	1408.68	897.54	1120.86	1913.84
83	0.01	0.01	0.01	0.01	0.03	177.18	1153.06	734.67	917.47	1566.56
84	90.44	116.76	84.59	160.30	263.36	0.60	3.89	2.48	3.09	5.28
85	1.15	1.82	1.22	2.64	4.88	113.01	0.00	0.00	0.00	107.77
86	24.74	36.29	24.89	51.60	92.01	71.70	197.60	125.90	488.42	569.22
87	4.20	6.53	4.34	9.42	17.36	1.14	7.43	4.73	5.91	10.09
88	185.63	245.61	177.41	338.92	563.99	0.83	5.42	3.45	4.31	7.36
89	77.37	115.26	78.98	164.27	294.62	4.57	29.74	18.95	23.67	40.41
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pop. 35,000 - Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
91	315.23	494.07	282.96	506.33	1160.74	7.66	49.82	31.74	39.64	67.69
92	172.49	258.30	175.61	369.10	665.76	5.91	38.47	24.51	30.61	52.27
93	508.88	785.53	523.24	1083.89	2003.54	62.40	0.00	0.00	684.12	879.42
94	234.94	312.22	201.68	443.38	786.18	20.20	0.00	0.00	236.59	295.41
95	248.26	419.30	245.52	542.09	1075.65	0.15	0.00	0.00	0.42	1.26
96	554.26	894.71	566.74	1161.67	2302.19	78.92	384.99	245.29	532.07	805.38
97	303.61	550.94	275.97	616.24	1345.84	57.62	271.61	173.06	261.19	505.55
98	275.39	487.39	249.07	455.34	1131.72	166.81	815.73	519.74	935.06	1579.04
99	16.71	26.73	17.44	37.85	70.90	1066.45	1059.90	675.31	2457.70	4758.31
100	14.27	21.20	13.98	30.49	55.70	470.46	485.71	309.47	386.47	1037.38
101	111.38	190.89	101.35	148.13	423.64	55.06	358.32	228.30	285.11	486.81
102	6.60	10.57	6.80	13.99	27.39	456.91	2214.24	1410.81	1761.84	3119.56
103	176.07	305.38	162.60	290.88	713.35	127.10	0.00	0.00	0.00	121.21
104	131.87	193.91	123.98	214.31	426.54	2.45	15.93	10.15	12.68	21.65
105	0.65	1.03	0.69	1.49	2.76	0.00	0.00	0.00	0.00	0.00
106	820.14	1264.31	840.46	1823.92	3356.86	12.01	78.18	49.81	62.20	106.21
107	336.61	444.32	319.59	613.58	1022.66	1.61	10.48	6.68	8.34	14.24
108	270.12	351.32	242.43	489.16	830.29	0.00	0.00	0.00	0.00	0.00
109	198.48	289.80	200.03	411.04	729.40	32.27	162.31	103.42	129.15	227.51
110	37.78	56.55	38.67	80.69	145.10	0.00	0.00	0.00	0.00	0.00
111	131.67	170.91	124.55	234.50	384.77	201.85	31.01	19.76	24.68	230.09
112	44.42	59.59	42.76	82.57	138.79	22.98	0.00	0.00	184.12	167.20
113	192.28	307.66	198.76	411.22	799.78	42.01	273.43	174.22	217.56	371.49
114	451.95	718.01	472.80	1003.26	1896.05	6.10	39.70	25.29	31.59	53.93
115	459.46	763.21	436.57	812.43	1834.90	46.11	300.08	191.19	238.77	407.69
116	282.50	457.35	286.88	574.65	1163.94	211.71	0.00	0.00	584.44	1775.74
117	65.83	103.99	69.51	150.33	278.02	0.00	0.00	0.00	0.00	0.00
118	1.76	2.79	1.86	4.03	7.45	237.28	0.00	0.00	0.00	226.29
119	300.82	491.19	304.11	623.78	1254.08	244.07	452.50	288.31	360.05	781.22
120	154.78	248.71	160.60	346.27	655.68	40.52	126.77	80.77	347.28	479.90
121	7.19	11.35	7.59	16.41	30.34	375.12	285.99	182.22	619.55	1013.68
122	26.22	41.42	27.68	59.87	110.73	1107.10	4.85	3.09	3.86	1061.66
123	243.31	410.20	229.18	377.03	950.11	79.42	133.95	85.35	106.58	238.09
124	250.46	400.32	261.61	567.70	1062.45	98.40	616.74	392.95	499.51	865.01
125	168.68	266.46	178.11	385.20	712.38	349.41	262.08	166.98	726.88	1059.88
126	320.43	552.02	288.46	405.87	1209.80	13.60	48.40	30.84	87.88	110.59
127	85.06	134.37	89.81	194.24	359.23	834.04	8.95	5.70	7.12	806.23
128	46.25	73.06	48.83	105.61	195.32	0.00	0.00	0.00	0.00	0.00
129	5.06	7.99	5.34	11.55	21.36	0.00	0.00	0.00	0.00	0.00
130	526.47	830.88	555.59	1200.86	2219.80	18.13	0.00	0.00	212.31	265.10
131	405.60	643.69	419.30	875.02	1675.73	25.95	168.87	107.60	134.37	229.43
132	10.55	16.67	11.14	24.10	44.57	680.97	1.99	1.27	587.36	1114.03
133	5.14	6.65	4.85	9.11	14.90	2.68	17.45	11.12	13.88	23.70

Pop. 38,000 Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
1	0	0	0	0	0	17	0	0	196	204
2	0	0	0	0	0	0	0	0	0	0
3	1	1	0	1	2	0	0	0	0	0
4	2	4	3	5	8	0	0	0	0	0
5	299	388	247	551	808	23	0	0	266	276
6	5	7	5	9	14	0	0	0	0	0
7	47	65	42	93	137	160	73	47	57	198
8	190	253	167	357	519	2	0	0	25	26
9	300	413	281	578	836	16	84	54	65	95
10	59	92	61	132	202	77	0	0	0	61
11	298	386	269	536	748	0	0	0	0	0
12	4	6	4	9	13	96	0	63	0	96
13	71	110	74	159	242	999	0	0	0	790
14	28	35	23	50	74	463	0	0	0	366
15	158	201	128	285	416	245	0	0	0	193
16	2	3	2	5	8	0	0	0	0	0
17	33	50	33	72	110	796	0	0	0	629
18	121	172	114	246	366	0	0	0	0	0
19	202	319	213	461	705	112	0	0	30	108
20	91	143	96	207	317	0	0	0	1	1
21	31	48	32	70	107	330	0	0	122	534
22	4	7	4	10	15	39	0	0	0	31
23	24	36	24	52	79	0	0	0	0	0
24	152	241	161	348	533	0	0	0	0	0
25	928	1475	956	1997	3170	14	97	62	75	106
26	700	1105	739	1598	2446	111	0	0	2	89
27	6	9	6	13	20	0	0	0	0	0
28	511	819	529	1113	1772	0	0	0	0	0
29	903	1481	914	1801	3081	67	448	285	344	489
30	286	494	270	542	994	213	666	424	1407	1591
31	0	0	0	0	0	455	568	362	2327	2154
32	2	3	2	4	6	57	0	0	452	342
33	109	172	115	248	378	436	0	0	256	672
34	12	19	12	27	42	78	0	0	99	127
35	217	361	219	480	774	58	0	0	208	182
36	18	28	19	40	62	31	0	0	113	234
37	172	287	167	320	581	320	40	25	30	292
38	361	597	351	631	1191	115	79	50	434	530
39	380	577	365	766	1192	0	0	0	0	0
40	34	53	36	77	118	836	126	80	97	783
41	194	306	205	442	676	0	0	0	0	0
42	43	55	35	77	112	15	0	0	116	88
43	0	0	0	0	0	134	0	0	0	106
44	18	28	19	40	62	0	0	0	0	0
45	1	1	1	1	2	0	0	0	0	0

Pop. 38,000 Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
46	258	407	272	589	901	0	0	0	0	0
47	177	280	187	405	620	1265	0	0	0	999
48	93	146	98	211	323	617	17	11	37	558
49	338	441	320	606	827	70	0	0	0	55
50	11	17	11	24	37	59	0	0	0	46
51	232	366	245	529	809	2	0	0	0	2
52	11	17	11	24	37	163	0	0	0	129
53	9	14	10	21	32	334	835	532	642	1078
54	85	134	90	194	297	541	927	590	713	1331
55	10	18	9	13	32	426	1364	869	1262	2026
56	40	64	42	86	139	307	436	276	578	1216
57	0	0	0	0	0	269	334	213	876	1925
58	176	277	185	401	614	245	0	0	692	1743
59	254	451	230	434	874	161	950	500	713	1330
60	91	160	82	154	310	437	4205	2058	2204	4570
61	177	319	162	356	645	124	31	20	194	509
62	38	69	35	72	136	182	243	155	1218	1653
63	89	161	81	183	328	5	33	21	25	36
64	127	225	118	241	449	225	1187	756	1049	1639
65	115	196	111	215	395	34	178	114	158	247
66	132	235	120	233	459	328	2076	1323	1807	2486
67	341	655	337	547	1199	60	403	257	310	441
68	136	234	122	171	424	160	1070	682	823	1169
69	136	234	122	171	424	164	0	0	1896	1973
70	111	176	117	253	388	65	433	276	333	473
71	233	403	209	309	737	0	0	0	0	0
72	358	567	378	817	1253	174	697	444	536	817
73	171	307	158	357	629	0	0	0	0	0
74	451	694	461	952	1458	31	0	0	366	381
75	311	566	288	432	1025	0	0	0	0	0
76	133	209	140	302	462	116	776	495	597	848
77	118	186	124	269	412	301	270	172	643	786
78	0	0	0	0	0	382	1	1	1	303
79	0	0	0	0	0	131	97	62	404	936
80	202	342	183	291	635	144	639	407	630	1048
81	1	2	1	3	4	748	5015	3195	3856	5477
82	38	65	34	48	118	261	1752	1116	1348	1914
83	0	0	0	0	0	214	1434	914	1103	1567
84	96	124	90	171	232	1	5	3	4	5
85	2	3	2	5	7	136	0	0	0	108
86	345	542	363	783	1195	87	246	157	587	569
87	4	7	4	10	15	2	15	10	12	17
88	303	430	301	606	875	1	7	4	5	7
89	224	380	213	468	783	6	37	24	28	40
90	231	365	244	527	807	0	0	0	0	0

Pop. 38,000 Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
91	337	528	304	553	1034	9	62	39	48	68
92	408	629	423	904	1369	7	48	30	37	52
93	533	826	548	1137	1745	90	0	0	989	1053
94	239	318	206	452	664	29	0	0	343	356
95	248	419	246	542	890	0	0	0	1	1
96	557	898	569	1167	1913	38	65	41	377	411
97	305	553	277	619	1119	70	338	215	314	506
98	281	497	254	465	956	206	1015	647	1179	1636
99	23	37	23	51	80	1339	1450	924	3360	5217
100	12	17	11	24	37	568	604	385	465	1037
101	108	186	98	140	339	75	501	319	385	547
102	10	16	11	22	35	552	2755	1755	2118	3120
103	233	399	219	396	780	153	0	0	0	121
104	143	214	134	228	388	3	20	13	15	22
105	463	731	488	1056	1617	0	0	0	0	0
106	854	1317	875	1900	2894	22	145	93	112	159
107	348	459	330	635	876	2	13	8	10	14
108	277	361	249	503	708	0	0	0	0	0
109	207	301	208	428	628	54	300	191	231	335
110	38	57	39	81	120	0	0	0	0	0
111	134	174	127	239	325	244	39	25	30	230
112	45	61	44	84	117	28	0	0	221	167
113	298	528	308	584	1054	10	64	41	49	70
114	671	1150	681	1406	2385	7	49	31	38	54
115	465	771	442	823	1535	49	326	208	251	356
116	313	506	318	642	1069	257	7	4	708	1783
117	329	606	324	653	1199	0	0	0	0	0
118	3	4	3	5	9	286	0	0	0	226
119	300	492	302	617	1035	326	772	492	594	1010
120	157	253	163	350	550	36	37	24	386	412
121	6	10	5	12	21	453	356	227	745	1014
122	26	42	28	59	92	1336	6	4	5	1062
123	257	434	243	401	833	96	167	106	128	238
124	257	411	269	583	903	119	767	489	601	865
125	285	451	301	652	997	422	326	208	874	1060
126	393	720	362	500	1275	21	89	57	128	142
127	85	134	90	194	297	1007	11	7	9	806
128	47	75	50	108	166	0	0	0	0	0
129	6	10	7	14	22	0	0	0	0	0
130	540	852	569	1231	1883	26	0	0	308	320
131	408	647	422	880	1395	31	210	134	162	229
132	11	17	11	24	37	822	2	2	706	1114
133	5	7	5	9	12	3	22	14	17	24

Pop. 50,000 Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
1.00	103.57	130.23	82.12	184.23	199.95	22.33	0.00	0.00	352.41	268.32
2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	0.55	0.72	0.46	1.02	1.12	0.00	0.00	0.00	0.00	0.00
4.00	2.40	3.79	2.53	5.47	6.26	0.00	0.00	0.00	0.00	0.00
5.00	350.36	453.29	288.20	643.19	703.36	30.27	0.00	0.00	477.78	363.78
6.00	111.96	141.74	90.29	200.28	216.88	0.00	0.00	0.00	0.00	0.00
7.00	155.04	200.92	128.34	284.86	311.00	161.80	100.04	62.12	77.09	198.40
8.00	478.86	624.80	432.91	869.53	911.80	2.90	0.00	0.00	45.75	34.83
9.00	669.37	953.40	639.64	1351.28	1491.22	16.35	114.49	71.10	88.23	94.76
10.00	233.34	310.51	198.97	441.86	486.64	77.23	0.00	0.00	0.03	60.53
11.00	309.16	401.02	280.06	556.41	579.33	0.00	0.00	0.00	0.00	0.00
12.00	3.86	6.09	4.07	8.81	10.07	96.91	0.00	83.35	0.00	95.94
13.00	71.17	110.45	73.83	159.27	181.17	5207.31	0.00	0.00	0.00	4080.51
14.00	131.02	165.57	104.56	234.36	254.71	972.20	0.00	0.00	0.00	761.80
15.00	157.56	201.34	127.56	285.32	311.01	338.53	0.00	0.00	0.00	265.28
16.00	2.16	3.42	2.29	4.94	5.65	0.60	0.00	0.00	0.00	0.47
17.00	33.45	50.25	33.20	72.33	81.88	907.76	0.00	0.00	0.00	711.31
18.00	174.76	239.43	156.01	340.99	376.57	137.38	0.00	0.00	0.00	107.65
19.00	259.51	409.95	274.01	592.62	677.74	113.70	0.00	0.00	40.50	108.58
20.00	148.40	234.43	156.69	338.89	387.56	9.05	0.00	0.00	0.00	7.09
21.00	82.36	113.41	73.34	161.93	179.83	1798.20	0.00	0.00	0.00	1409.06
22.00	44.92	57.60	36.53	81.65	89.08	122.51	0.00	0.00	0.00	95.99
23.00	59.33	80.37	51.75	114.58	126.74	0.98	0.00	0.00	0.00	0.76
24.00	152.39	240.73	160.91	348.01	397.99	0.00	0.00	0.00	0.00	0.00
25.00	928.73	1476.82	956.50	1997.89	2371.11	14.61	132.33	82.17	101.97	106.18
26.00	700.95	1107.29	740.13	1600.71	1830.61	112.11	0.00	0.00	2.15	88.88
27.00	5.77	9.11	6.09	13.17	15.06	0.00	0.00	0.00	0.00	0.00
28.00	511.48	819.65	529.52	1112.98	1324.71	0.00	0.00	0.00	0.00	0.00
29.00	902.65	1481.17	913.71	1800.57	2302.17	67.33	609.65	378.57	469.79	489.15
30.00	285.76	493.83	270.22	541.70	742.86	221.36	905.86	562.51	2032.15	1680.22
31.00	0.05	0.08	0.05	0.12	0.13	358.55	773.02	480.02	2089.95	1553.29
32.00	1.77	2.80	1.87	4.05	4.63	0.59	0.00	0.00	0.61	0.75
33.00	108.97	171.51	114.82	247.73	282.79	236.79	0.00	0.00	332.52	505.27
34.00	11.91	19.31	12.27	26.73	31.40	149.95	0.00	0.00	360.68	291.04
35.00	217.36	360.84	218.64	479.92	578.13	66.25	0.00	0.00	283.33	188.25
36.00	17.69	27.95	18.68	40.40	46.20	3.86	0.00	0.00	60.56	46.17
37.00	171.56	286.50	167.23	319.81	433.81	151.75	53.88	33.46	41.52	157.48
38.00	360.87	597.27	351.43	630.62	889.77	126.54	107.30	66.63	752.77	652.89
39.00	380.09	577.18	365.47	765.64	890.39	0.00	0.00	0.00	0.00	0.00
40.00	33.74	53.30	35.63	77.05	88.11	996.20	171.74	106.65	132.34	903.54
41.00	193.88	305.81	204.54	441.93	505.04	0.00	0.00	0.00	0.00	0.00
42.00	140.02	187.47	120.47	266.86	294.18	14.64	0.00	0.00	158.05	87.52
43.00	0.00	0.00	0.00	0.00	0.00	135.27	0.00	0.00	0.00	106.00
44.00	17.72	27.99	18.71	40.46	46.28	0.00	0.00	0.00	0.00	0.00
45.00	0.50	0.79	0.53	1.15	1.31	0.00	0.00	0.00	0.00	0.00

Pop. 50,000 Productions and Attractions

TAZ_NUMBER	HBWP	HBSP	HBRP	HBOP	NHBP	HBWA	HBSA	HBRA	HBOA	NHBA
46.00	257.76	407.19	272.17	588.64	673.18	0.00	0.00	0.00	0.00	0.00
47.00	177.46	280.34	187.38	405.27	463.47	1384.99	0.00	0.00	0.00	1085.29
48.00	152.95	241.32	161.38	348.76	398.61	613.46	23.13	14.36	17.82	497.27
49.00	373.38	487.27	354.22	669.66	682.20	75.71	0.00	0.00	0.00	59.33
50.00	10.69	16.89	11.29	24.41	27.92	59.15	0.00	0.00	0.00	46.35
51.00	231.57	365.82	244.52	528.83	604.79	2.51	0.00	0.00	0.00	1.96
52.00	10.68	16.87	11.28	24.39	27.89	164.44	0.00	0.00	0.00	128.85
53.00	9.14	14.44	9.65	20.88	23.88	338.56	1136.98	706.03	876.16	1079.17
54.00	84.84	134.03	89.59	193.75	221.58	579.68	1261.50	783.36	972.11	1357.25
55.00	10.36	17.85	9.32	13.08	24.18	429.59	1855.95	1152.49	1721.29	2025.97
56.00	40.30	64.47	41.67	86.26	103.67	236.79	592.80	366.56	483.00	657.50
57.00	0.00	0.00	0.00	0.00	0.00	50.14	454.00	281.92	349.85	364.27
58.00	175.54	277.31	185.36	400.88	458.45	41.76	0.00	0.00	159.73	295.02
59.00	254.31	451.37	230.33	433.94	653.11	127.39	1222.27	631.21	824.79	1065.86
60.00	90.69	160.34	82.40	153.77	231.88	334.11	4244.82	2045.08	2269.49	3397.77
61.00	177.23	319.31	162.07	356.13	482.04	125.47	42.51	26.40	264.55	509.38
62.00	38.21	68.61	34.72	72.18	101.80	130.90	330.43	205.19	1725.23	1387.74
63.00	88.76	161.28	80.81	183.40	244.86	4.91	44.44	27.60	34.25	35.66
64.00	127.47	224.91	117.98	241.04	335.74	226.98	1616.01	1003.49	1430.39	1638.58
65.00	115.23	195.87	110.50	215.31	295.01	33.31	242.65	150.68	211.91	240.72
66.00	248.19	418.90	242.28	498.64	646.83	336.04	2826.03	1754.88	2555.56	2555.15
67.00	340.98	654.87	337.10	547.03	895.85	60.63	549.03	340.93	423.08	440.52
68.00	135.62	233.71	122.01	171.28	316.50	160.88	1456.76	904.61	1122.58	1168.84
69.00	135.62	233.71	122.01	171.28	316.50	215.87	0.00	0.00	3370.54	2571.77
70.00	111.03	175.89	116.93	253.09	290.27	65.07	589.18	365.86	454.02	472.73
71.00	232.58	402.60	209.43	308.80	550.79	0.00	0.00	0.00	0.00	0.00
72.00	358.21	566.87	377.63	817.12	936.14	179.34	948.89	589.23	731.22	819.77
73.00	171.22	307.41	158.15	357.16	470.04	0.00	0.00	0.00	0.00	0.00
74.00	499.56	775.60	506.35	1049.06	1210.50	41.65	0.00	0.00	657.38	500.52
75.00	311.03	566.16	288.16	431.79	765.71	0.00	0.00	0.00	0.00	0.00
76.00	202.66	335.64	202.86	445.78	537.18	116.71	1056.77	656.22	814.35	847.91
77.00	189.60	315.52	189.76	416.61	503.67	302.99	367.68	228.32	877.32	786.42
78.00	0.32	0.75	0.33	0.42	0.91	525.40	1.10	0.68	0.84	412.49
79.00	0.00	0.00	0.00	0.00	0.00	14.57	131.89	81.90	101.63	105.82
80.00	201.76	342.50	182.69	290.85	474.33	95.99	869.15	539.72	669.77	697.37
81.00	1.11	1.75	1.17	2.53	2.89	753.82	6825.71	4238.57	5259.89	5476.65
82.00	37.88	65.29	34.08	47.85	88.41	263.43	2385.28	1481.19	1838.10	1913.84
83.00	0.00	0.00	0.00	0.00	0.00	215.62	1952.45	1212.41	1504.55	1566.56
84.00	101.78	131.37	95.00	180.44	183.51	0.73	6.58	4.09	5.07	5.28
85.00	36.73	58.02	38.78	83.87	95.92	154.23	0.00	0.00	0.00	120.85
86.00	486.96	799.23	492.35	1075.73	1283.18	98.79	334.59	207.77	925.46	638.15
87.00	4.26	6.61	4.40	9.54	10.87	2.30	20.86	12.95	16.08	16.74
88.00	476.30	729.72	460.68	957.34	1104.68	1.01	9.17	5.69	7.07	7.36
89.00	232.03	390.51	220.97	482.77	600.01	5.56	50.37	31.28	38.81	40.41
90.00	370.72	618.76	370.99	815.83	988.36	2.15	0.00	0.00	0.00	1.68

APPENDIX C

SIGNAL PRIORITIZATION ANALYSIS

City of Gillette 2017 Long Range Transportation Plan
SIGNAL PRIORITIZATION STUDY – APPENDIX C

Table of Contents

Introduction and Summary

The purpose of this analysis is to develop a prioritized list of intersections that warrant or are close to warranting signals in the near future. The prioritized list will be used as a guide to implement signal installation as a part of the City's Capital Improvements Plan (CIP) and will be part of the *Gillette 2017 Long Range Transportation Plan Update*.

TransCAD Model volumes and count databases were used to identify the unsignalized intersections with the highest volumes. City of Gillette crash data was also reviewed. Turning movement counts were collected at four intersections. These counts were used to analyze traffic operations at the intersections.

As a result of this study, the following priority list was identified:

Priority	Intersection
1	Garner Lake Road & Boxelder Road
2	Lakeway Road and Dogwood Ave.
3	Warlow Drive & Brooks Avenue
4	Lakeway Road and Butler-Spaeth Road

Initial Intersection List

An initial list of unsignalized intersections was developed as a starting point of the prioritization. This list includes 50 intersections with highest existing Average Daily Traffic (ADT) based on the TransCAD travel forecasting model. For these intersections, the daily volumes were converted to peak hour volumes using 12% K factor (ratio of peak hour to ADT), and plotted on the intersection control chart to determine which intersection should be considered for signalization. **Table 1** shows the 50 intersections listed in the order of traffic volumes, and Figure C-1, C-2 and C-3 show the intersection control chart for existing traffic, traffic for a population of 38,000, and traffic for 50,000 population, respectively.

Note that the existing signalized 4th Street and Highway 59 intersection is shown on the chart (red dot) as a comparison point. The intersection control charts are adapted from T*raffic Control Devices Handbook* (8, pp. 4-18).

Table 1: Top 50 Unsignalized Intersections

Intersection	Existing ADT (TransCAD)		
	Major Road	Minor Road	Major + Minor
WYO 59 & 6th Street	19634	7806	27440
Garner Lake Road & Boxelder Road	12791	13846	26637
WYO 50 & I-90 EB Ramp	18597	5913	24510
Lakeway Road & Dogwood Avenue	19991	3648	23639
2nd Street & Butler Spaeth Road	14389	4283	18672
Gurley Avenue & 4th Street	12577	5632	18209
Warlow Drive & Brooks Avenue	11298	6881	18179
2nd Street & Stanley Street	14389	3012	17401
WYO 50 & Boxelder Road	11039	5899	16938
Garner Lake Road & Butler Spaeth Road	14404	1936	16340
2nd Street & Stocktail Avenue	13444	2504	15948
WYO 51 & Fox Park Road	8637	6937	15574
Butler Spaeth Road & Lakeway Road	7576	7004	14580
Garner Lake Road & Sinclair Street	14258	192	14450
Butler Spaeth Road & Country Club Road	10285	3246	13531
Warlow Drive & Hannum Road	10092	3358	13450
Garner Lake Road & Collins Road	11213	2048	13261
Force Road & WYO 50	7632	4987	12619
Burma Road & Echeta Road	10780	1539	12319
Boxelder Road & Burma Road	5899	5427	11326
WYO 50 & Southern Drive	7371	3937	11308
Brooks Avenue & 1st Street	10179	1090	11269
Boxelder Road & Boxelder Street	6909	4326	11235
Garner Lake Road & I-90 WB Ramp	9702	1477	11179
Garner Lake Road & I-90 EB Ramp	8431	2604	11035
Garner Lake Road & Warlow Drive	9551	1444	10995
Garner Lake Road & Kluver Road	7324	3644	10968
6th Street & Brooks Avenue	7806	2991	10797
WYO 51 & I-90 EB Ramp	9796	789	10585
WYO 51 & I-90 WB Ramp	9080	693	9773
Gurley Avenue & Kluver Road	9600	116	9716
Little Powder River Road & Northern Road	5034	4190	9224
Butler Spaeth Road & 12th Street	7202	1692	8894
Four J Road & 12th Street	8203	137	8340
WYO 59 & Northern Road	5710	2599	8309
Lakeway Road & Boxelder Road	6099	1859	7958
Warlow Drive & Kluver Road Extension	4878	2394	7272
Echeta Road & Foothills Boulevard	3810	2983	6793
West Four J Road & Oakcrest Drive	5868	887	6755
Lakeway Road & Burma Road	3486	3120	6606
Garner Lake Road & Northern Road	3303	3237	6540
Butler Spaeth Road & 9th Street	5591	886	6477
Southern Drive & Tanner Road	6140	208	6348
Warlow Drive & Enterprise Avenue	5053	1161	6214
Four J Road & 4th Street	3598	2026	5624
WYO 59 & Little Powder River Road	2681	2490	5171
12th Street & Gurley Avenue	2588	2409	4997
Gurley Avenue & 9th Street	3560	1276	4836
Northern Road & Hannum Road	2629	2155	4784
4th Street & Brooks Avenue	3352	609	3961

Figure C-1: Intersection Control Chart, Existing Traffic

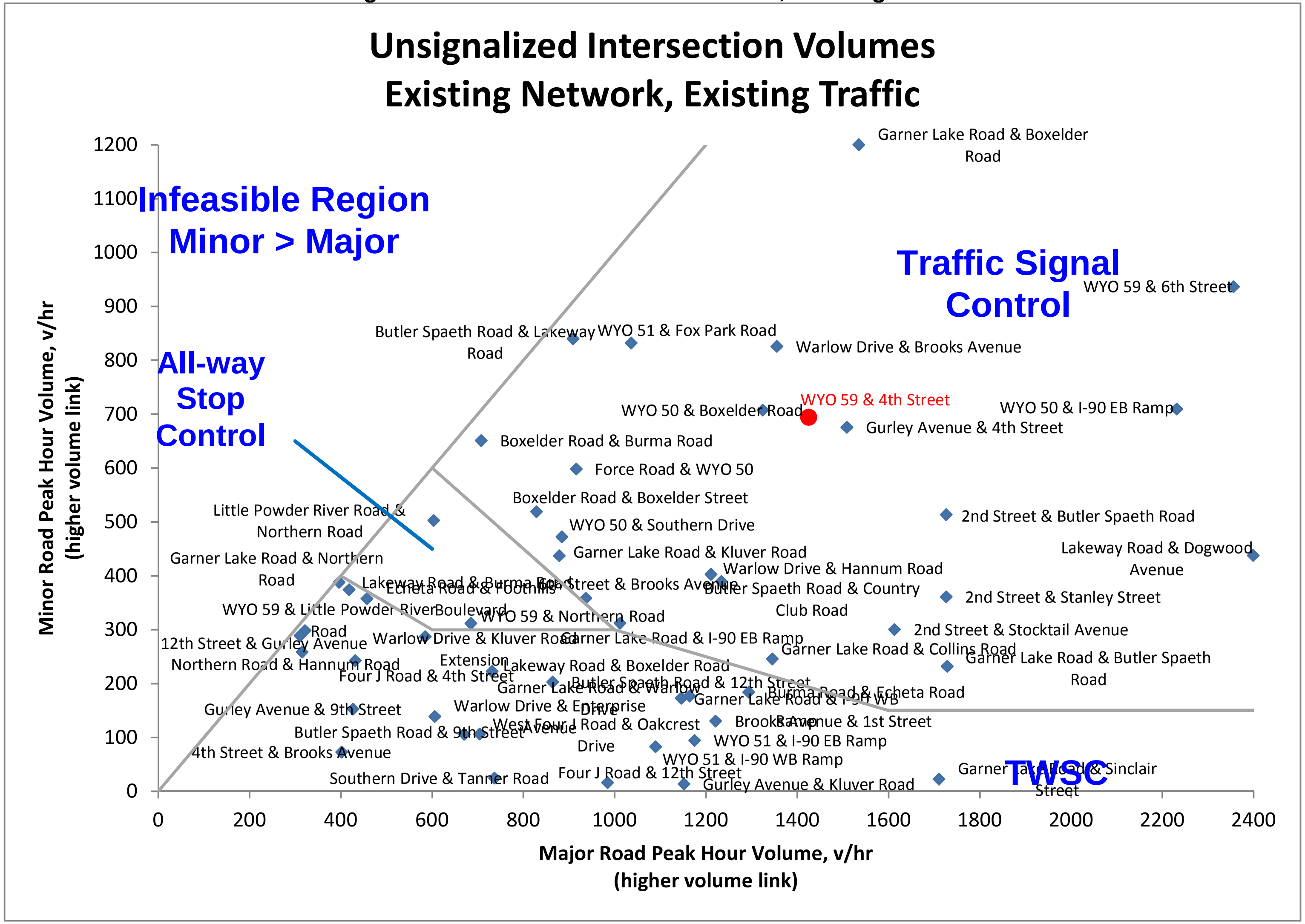


Figure C-2: Intersection Control Chart, Pop. 38,000

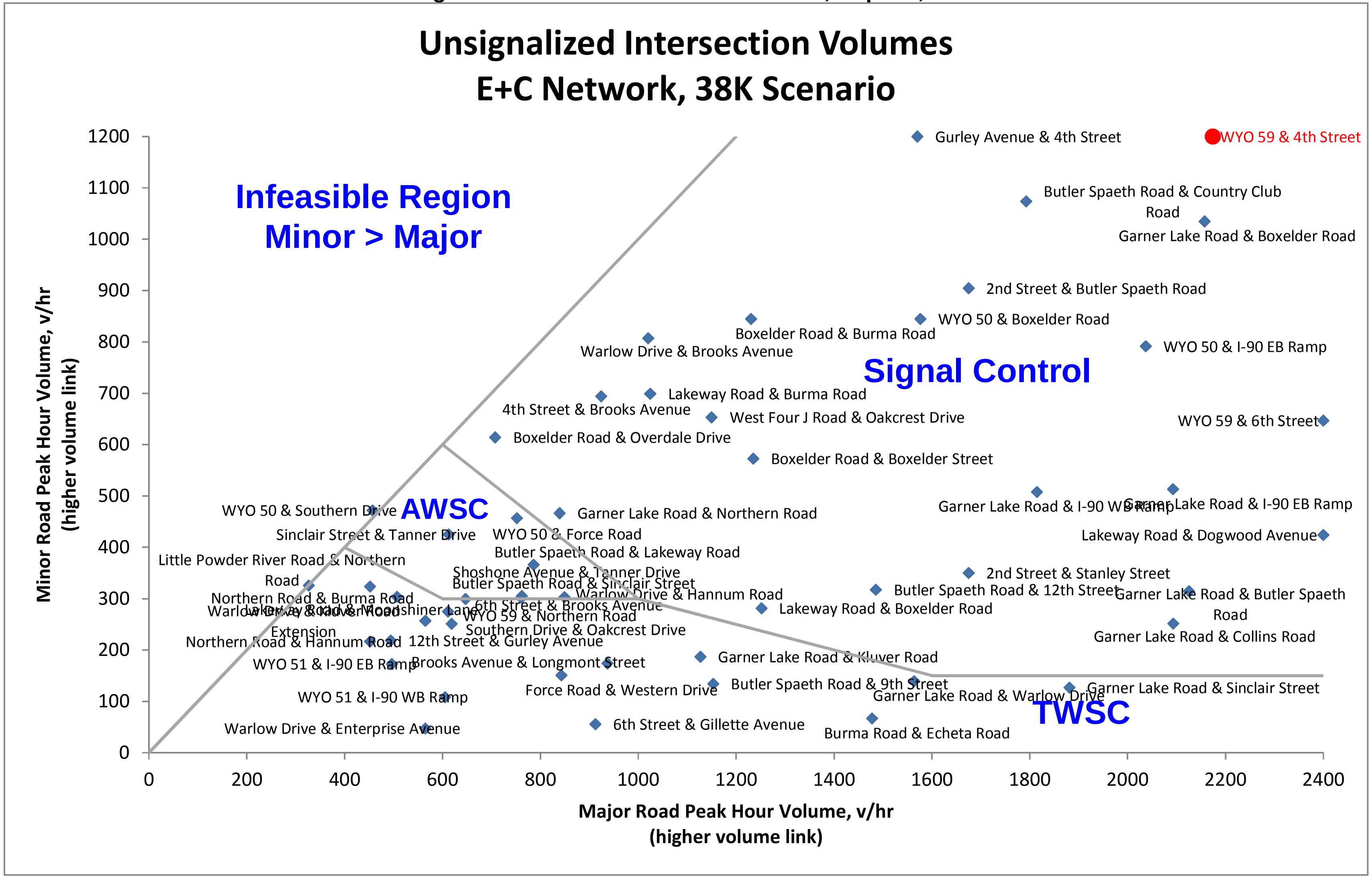
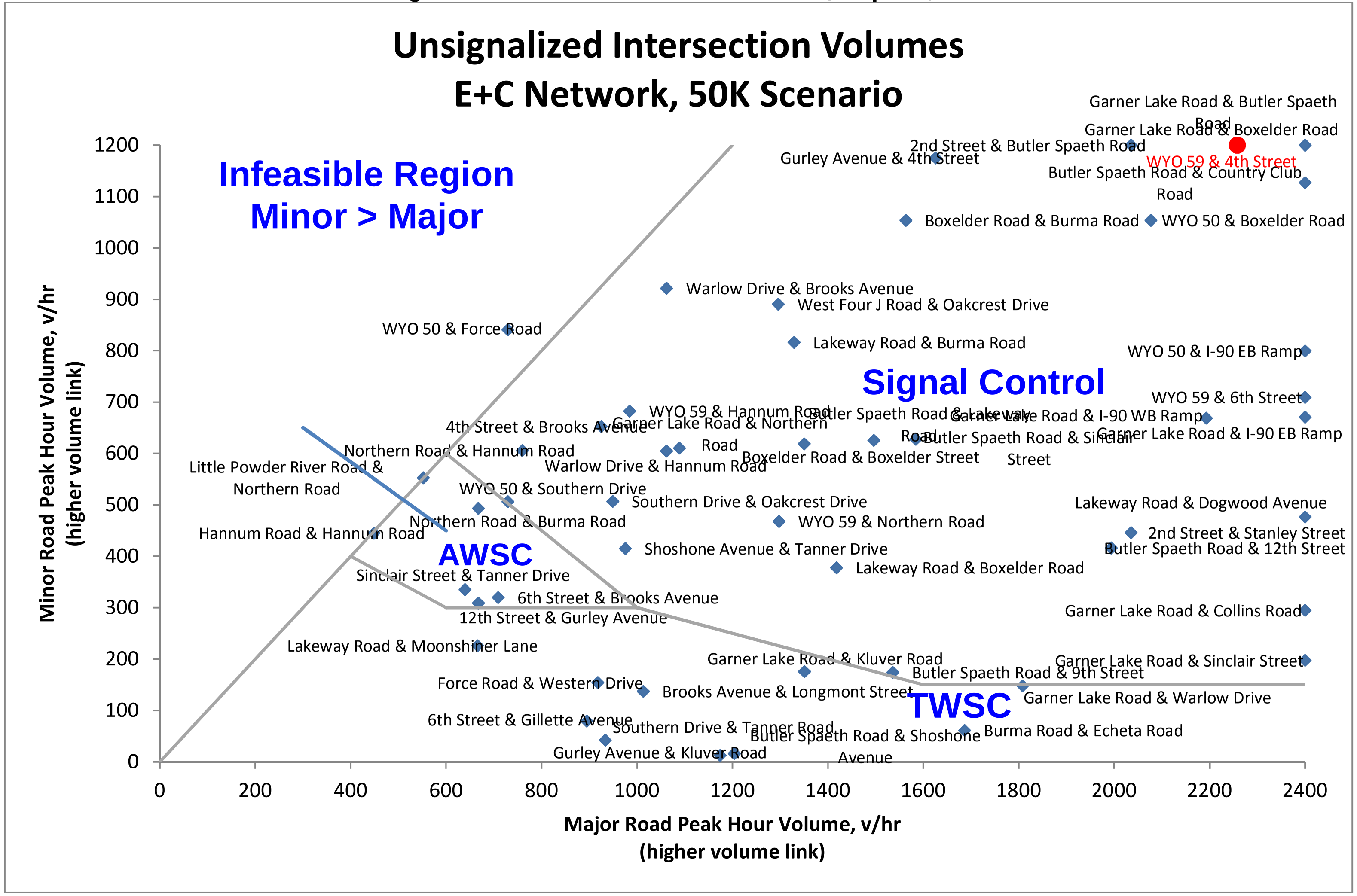


Figure C-3: Intersection Control Chart, Pop. 50,000



Crash Data Analysis

Intersections for which the traffic volumes were plotted within the Traffic Signal region in were evaluated on crash history. Crash data for the City of Gillette was provided by the City of Gillette Police Department and Wyoming Department of Transportation (WYDOT). The number of crashes within a 100-foot radius of the intersections was determined for each year from 2010 to 2015. Table 2 shows the intersection crashes.

Table 2: Intersection Crashes

Intersection	2015	2014	2013	2012	2011	2010	Total
2nd Street & Butler Spaeth Road	4	2	0	3	4	1	14
2nd Street & Stanley Street	0	2	0	0	0	1	3
2nd Street & Stocktail Avenue	0	0	2	2	0	0	4
6th Street & Brooks Avenue	0	1	1	0	0	1	3
Boxelder Road & Boxelder Street	0	0	0	0	0	0	0
Boxelder Road & Burma Road	0	0	0	0	0	0	0
Butler Spaeth Road & Country Club Road	0	2	1	1	0	0	4
Butler Spaeth Road & Lakeway Road	1	0	2	3	0	0	6
Force Road & WYO 50	1	2	9	1	4	3	20
Garner Lake Road & Boxelder Road	0	4	1	2	1	3	11
Garner Lake Road & Butler Spaeth Road	1	1	1	2	2	1	8
Garner Lake Road & Collins Road	0	2	2	1	0	0	5
Garner Lake Road & I-90 EB Ramp	0	1	0	1	1	0	3
Garner Lake Road & Kluver Road	0	0	0	0	3	1	4
Gurley Avenue & 4th Street	2	4	2	4	5	3	20
Lakeway Road & Dogwood Avenue	0	3	1	0	2	3	9
Warlow Drive & Brooks Avenue	1	3	3	0	0	1	8
Warlow Drive & Hannum Road	0	1	2	2	1	1	7
WYO 50 & Boxelder Road	0	0	0	0	0	0	0
WYO 50 & I-90 EB Ramp	1	1	1	1	3	3	10
WYO 50 & Southern Drive	3	1	2	1	1	1	9
WYO 51 & Fox Park Road	0	0	1	0	0	0	1
WYO 59 & 6th Street	0	0	5	2	2	2	11

These crash data were used to perform the analysis of Warrant 7 of the *Manual on Uniform Traffic Control Devices* (MUTCD) traffic control signal needs studies, Crash Experience. As stated in MUTCD, the need for traffic signal should be considered if five or more reported crashes that are susceptible to correction by traffic signal must have occurred within a 12-month period. As shown in the yellow highlighted values in Table 2, Force Road and WYO 50, Gurley Avenue and 4th Street, and WYO 59 and 6th Street intersections satisfy this criterion.

Traffic Counting

We collected peak hour turning movement counts at the following intersections. These traffic counts were used for level of service (LOS) and signal warrant analysis.

Brooks Avenue / Warlow Drive

- *Approaches*: 3
- *Control*: Stop sign on Brooks Street

Brooks Avenue

- *Lane Configuration*: North bound approach has shared right/left/through lane.

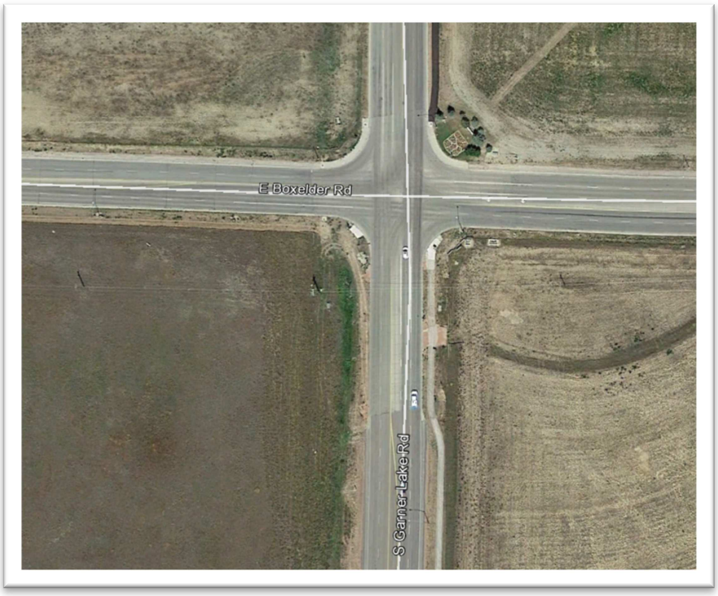
Warlow Drive

- *Lane Configuration*: East bound approach has one through lane and one shared through/right lane. West bound approach has one through lane and one shared through/left lane.

Brooks Street and Warlow

Garner Lake Road / Boxelder Road

- *Approaches*: 4
- *Control*: All-way stop
- *Configuration*: All approaches have a shared right/though lane, through lane, and left turn lane.



Garner Lake Road and Boxelder Road

Lakeway Road / Dogwood Avenue

- *Approaches*: 4
- *Control*: two-way stop, stop signs on Dogwood Avenue

Lakeway Road

- *Lane Configuration*: Both approaches are composed of a shared right/through lane, through lane and a left turn lane.

Dogwood Avenue

- *Lane Configuration*: Each approach has a shared right/left/through lane.

Lakeway Road and Dogwood Avenue

Lakeway Road / Butler Spaeth Road

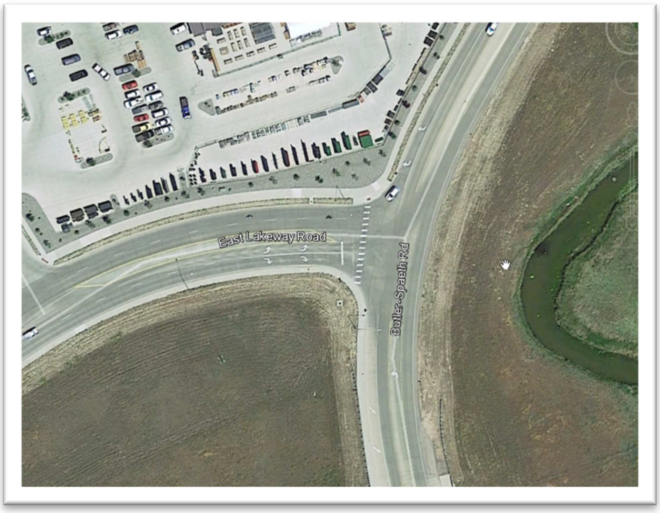
- *Approaches*: 3
- *Control*: stop sign on Lakeway Road

Lakeway Road

- *Lane Configuration*: Eastbound approach has a right and left turn lane.

Butler -Spaeth Road

- *Lane Configuration*: South bound approach has one through lane and one right lane. North bound approach has one through lane and one left lane.



Lakeway Road and Butler-Spaeth Road

Intersection Analysis

The turning movement counts were used to calculate level of service (LOS) and perform signal warrant analyses for the four priority intersections, where applicable. Synchro software was used for this evaluation. No intersections met any of the signal warrants.

A summary of the LOS analysis follows:

Lakeway Road and Dogwood Avenue									
		Unsignalized (Existing)		**Signalized (Existing)**		**Unsignalized (E+C 38K)**		**Signalized (E+C 38K)**	
PM Peak Hour		**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Intersection		2.2	A	6.4	A	1.9	A	8.5	B
Approach	Lakeway EB	-	A	4.8	A	-	A	7.9	A
	Lakeway WB	-	A	4.9	A	-	A	8.7	A
	Dogwood NB	23.4	C	9.5	A	17.7	C	10.9	B
	Dogwood SB	32.6	D	9.6	A	24.4	C	11.2	B

Lakeway Road and Butler Spaeth Road									
		Unsignalized (Existing)		**Signalized (Existing)**		**Unsignalized (E+C 38K)**		**Signalized (E+C 38K)**	
PM Peak Hour		**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Intersection		5.4	A	6.1	A	13.8	B	11.8	B
Approach	Lakeway EB	15.5	C	8.9	A	31.1	D	19.7	B
	Butler Spaeth NB	-	A	5.1	A	-	A	5.6	A
	Butler Spaeth SB	-	A	4.8	A	-	A	11.6	B

Boxelder Road and Garner Lake Road									
		Unsignalized (Existing)		Signalized (Existing)		Unsignalized (E+C 38K)		Signalized (E+C 38K)	
PM Peak Hour		**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Intersection		12.6	B	11.2	B	163.5	F	41.9	D
Approach	Boxelder EB	12.8	B	13.4	B	25.6	D	46.1	D
	Boxelder WB	12	B	13.4	B	30.4	D	39.3	D
	Garner Lake NB	12.4	B	8.7	A	153.5	F	30.0	C
	Garner lakeSB	12.9	B	9.4	A	236.4	F	51.1	D

E Warlow Drive and N Brooks Avenue									
		Unsignalized (Existing)		Signalized (Existing)		Unsignalized (E+C 38K)		Signalized (E+C 38K)	
PM Peak Hour		**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Intersection		5.4	A	6.7	A	4.8	A	9.7	A
Approach	Warlow EB	-	A	5.9	A	-	A	6.8	A
	Warlow WB	-	A	6.1	A	2.3	A	6.8	A
	Brooks NB	13.6	B	8.1	A	15.4	C	9.3	A

The intersections on Lakeway Road and Butler Spaeth and Lakeway Road and Dogwood Avenue, the minor approach LOS would be improved significantly. With signals at these intersections, the LOS of the major approach goes down slightly or remains the same, due to new delay on the major approach.

Signal warrant analysis was completed in accordance with the 2009 version of the Manual on Uniform Traffic Control Devices (MUTCD). Signal warrant 2 (four-hour vehicular volume) and warrant 3 (peak hour) were analyzed for this study.

Warrant 2 is intended for application where the volume of intersecting traffic is the principal reason to consider installing a traffic signal.

Warrant 3 is intended for application where, for one peak hour of the day, traffic conditions are such that minor-street traffic experiences undue delay or hazard in entering or crossing the main street.

None of the intersections currently meet the signal warrants.

This study is based on 2016 traffic counts and projections from the TransCAD travel forecasting model (using a population of 38,000). Changing conditions, improvements to the roadway network, or growth in a particular part of the City may change the traffic flow and priorities for signal installation. Generic signal timing and phasing inputs were used for this analysis. A signal timing and phasing study is recommended for each intersection prior to signal installation. Traffic signals may operate more efficiently than indicated in this report.

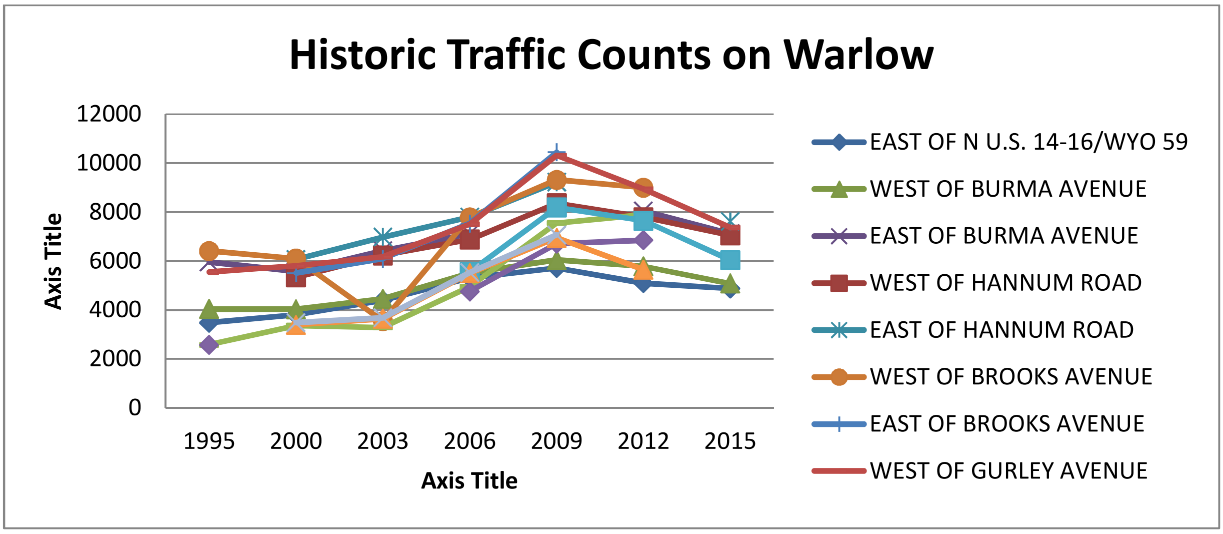
A brief discussion of each intersection evaluated follows:

Brooks Ave. / Warlow Drive

The intersection of Brooks Avenue and Warlow Drive is the closest to meeting signal warrants. If traffic volumes continue to increase, this intersection will likely meet the warrants within a year or two. The intersection has approaches with Level of Service A (EB and WB Warlow Road) and C (NB Brooks Ave.).

This intersection was also modeled with a signal and the overall intersection was a LOS A. The NB lane of Brooks would operate at a LOS A, the LOS of the EB lane would not change, and the LOS of the WB lane of Warlow would be reduced to a LOS B if a signal were installed.

Brooks Ave./Warlow Drive is mostly developed with little potential for change. Also, with the development of Northern Drive, traffic on Warlow Drive has decreased since 2009. Historic traffic volumes on Warlow Drive are shown below:



It appears that much of the traffic using this intersection uses Brooks Avenue/Hwy 59 to travel north-south across Gillette because it is a shorter path than using Gurley Avenue, especially when the Gurley Avenue railroad crossing is congested. With plans for increasing capacity of the Gurley Avenue railroad crossing, and other network improvements, this intersection may continue to see a reduction in traffic.

For the intersection of Brooks Street and Warlow Drive, LOS for a roundabout was also evaluated. The table below shows a comparison of the LOS for different types of control at the intersection of Brooks Street and Warlow Drive.

Intersection	Unsignalized (Existing)		Signalized		Roundabout	
	Delay	LOS	Delay	LOS	Delay	LOS
AM Peak Hour						
E Warlow Drive & N Brooks Avenue	11.8	B	5.7	A	4.7	A
PM Peak Hour						
E Warlow Drive & N Brooks Avenue	13.7	B	6.7	A	5.5	A

Garner Lake Road / Boxelder Road

The intersection of Garner Lake Road and Boxelder Road is high on the priority list. This intersection is currently running at a LOS B. All approaches have a LOS B as well. Although the intersection did not meet requirements for any of the warrants, it falls within the traffic signal control region on Figure 4 and Figure 5.

Signalization of this intersection could be rationalized due to its size. Garner Lake and Boxelder are both arterial roadways with four and five lanes at each approach, respectively. Relying on stop signs to halt several lanes of traffic could be hazardous due to location in the drivers' perspective, especially as traffic volumes increase and this area of Gillette is developed.

When modeled with a signal, this intersection operated at a LOS B. All approaches operate at a LOS A or B.

There is development occurring in the area that will likely influence future warrants during and after construction. Also, Garner Lake Road is a truck route with heavy truck traffic. Because of the size of the intersection, the amount of truck traffic, the amount of growth in the area, and the existing traffic volumes, it is recommended to install a signal at this intersection.

Lakeway Road / Dogwood Avenue

The intersection of Lakeway Road and Dogwood Avenue does not meet volume criteria for the time period analyzed. However the intersection did have approaches that operate at LOS D and C (NB and SB Dogwood Avenue).

When this intersection was modeled with a signal it operated at a LOS A or B, the EB left turn, EB through, and the WB through operate at a LOS B. The WB left turn, and NB and SB through operate at a LOS A. Installation of a signal at this intersection would definitely improve the LOS of the minor approaches and would slightly impact the LOS of the major street approaches.

Prior to installing this signal, a gap study and analysis should be performed. It may be possible to achieve platooning from the adjacent signals on Lakeway at Powder Basin Avenue and 4J Road.

Also, it should be noted that the future extension of Dogwood to the south will increase the traffic at this intersection.

Lakeway Road / Butler-Spaeth Road

The intersection of Lakeway Road and Butler-Spaeth does not meet volume criteria for the time period analyzed. However the Lakeway approach operates at LOS D. Similar to the intersection of Brooks and Warlow, this intersection may be a good candidate for a roundabout.

Traffic Data – Boxelder Road and Garner Lake Road

The following section includes traffic counts, LOS analysis results, and warrant analysis results.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	117	119	11	40	94	39	10	121	38	76	180	97
Future Volume (veh/h)	117	119	11	40	94	39	10	121	38	76	180	97
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1885	1900	1900	1782	1900	1900	1819	1900
Adj Flow Rate, veh/h	136	157	20	83	132	48	16	159	60	104	237	104
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.86	0.76	0.55	0.48	0.71	0.81	0.63	0.76	0.63	0.73	0.76	0.93
Percent Heavy Veh, %	0	0	0	0	0	0	0	8	8	0	6	6
Opposing Right Turn Influence	Yes			Yes			Yes			Yes		
Cap, veh/h	203	613	77	150	418	146	449	690	251	510	670	285
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
Prop Arrive On Green	0.11	0.19	0.19	0.08	0.16	0.16	0.28	0.28	0.28	0.28	0.28	0.28
Ln Grp Delay, s/veh	16.8	10.9	10.9	16.6	11.9	12.0	9.9	8.6	8.6	10.1	9.1	9.2
Ln Grp LOS	B	B	B	B	B	B	A	A	A	B	A	A
Approach Vol, veh/h		313			263			235			445	
Approach Delay, s/veh		13.4			13.4			8.7			9.4	
Approach LOS		B			B			A			A	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Case No		6.0	2.0	4.0		6.0	2.0	4.0
Phs Duration (G+Y+Rc), s		13.1	7.0	10.3		13.1	7.9	9.4
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green (Gmax), s		18.0	5.0	18.5		18.0	5.5	18.0
Max Allow Headway (MAH), s		4.9	3.8	5.1		4.9	3.7	5.1
Max Q Clear (g_c+I1), s		4.9	3.3	3.3		5.8	4.2	3.4
Green Ext Time (g_e), s		2.9	0.0	1.6		2.8	0.0	1.6
Prob of Phs Call (p_c)		1.00	0.50	0.98		1.00	0.68	0.98
Prob of Max Out (p_x)		0.16	1.00	0.02		0.20	1.00	0.03
Left-Turn Movement Data								
Assigned Mvmt		5	3			1	7	
Mvmt Sat Flow, veh/h		1056	1810			1181	1810	
Through Movement Data								
Assigned Mvmt		2		4		6		8
Mvmt Sat Flow, veh/h		2434		3228		2363		2605
Right-Turn Movement Data								
Assigned Mvmt		12		14		16		18
Mvmt Sat Flow, veh/h		885		405		1006		910
Left Lane Group Data								
Assigned Mvmt	0	5	3	0	0	1	7	0
Lane Assignment			(Prot)				(Prot)	
Lanes in Grp	0	1	1	0	0	1	1	0
Grp Vol (v), veh/h	0	16	83	0	0	104	136	0
Grp Sat Flow (s), veh/h/ln	0	1056	1810	0	0	1181	1810	0
Q Serve Time (g_s), s	0.0	0.4	1.3	0.0	0.0	2.3	2.2	0.0

Cycle Q Clear Time (g_c), s	0.0	2.9	1.3	0.0	0.0	3.8	2.2	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	1056	0	0	0	1181	0	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	8.6	0.0	0.0	0.0	8.6	0.0	0.0
Perm LT Serve Time (g_u), s	0.0	6.1	0.0	0.0	0.0	7.0	0.0	0.0
Perm LT Q Serve Time (g_ps), s	0.0	0.4	0.0	0.0	0.0	2.3	0.0	0.0
Time to First Blk (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
Lane Grp Cap (c), veh/h	0	449	150	0	0	510	203	0
V/C Ratio (X)	0.00	0.04	0.55	0.00	0.00	0.20	0.67	0.00
Avail Cap (c_a), veh/h	0	774	297	0	0	873	327	0
Upstream Filter (I)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d1), s/veh	0.0	9.9	13.4	0.0	0.0	9.9	13.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	3.2	0.0	0.0	0.2	3.8	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	9.9	16.6	0.0	0.0	10.1	16.8	0.0
1st-Term Q (Q1), veh/ln	0.0	0.1	0.7	0.0	0.0	0.7	1.1	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.1	0.8	0.0	0.0	0.7	1.3	0.0
%ile Storage Ratio (RQ%)	0.00	0.01	0.22	0.00	0.00	0.21	0.20	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	8
Lane Assignment		T		T		T		T
Lanes in Grp	0	1	0	1	0	1	0	1
Grp Vol (v), veh/h	0	109	0	87	0	171	0	89
Grp Sat Flow (s), veh/h/ln	0	1693	0	1805	0	1728	0	1791
Q Serve Time (g_s), s	0.0	1.5	0.0	1.2	0.0	2.4	0.0	1.3
Cycle Q Clear Time (g_c), s	0.0	1.5	0.0	1.2	0.0	2.4	0.0	1.3
Lane Grp Cap (c), veh/h	0	480	0	343	0	490	0	288
V/C Ratio (X)	0.00	0.23	0.00	0.25	0.00	0.35	0.00	0.31
Avail Cap (c_a), veh/h	0	1001	0	1097	0	1022	0	1059
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	8.3	0.0	10.5	0.0	8.7	0.0	11.3
Incr Delay (d2), s/veh	0.0	0.2	0.0	0.4	0.0	0.4	0.0	0.6
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	8.6	0.0	10.9	0.0	9.1	0.0	11.9
1st-Term Q (Q1), veh/ln	0.0	0.7	0.0	0.6	0.0	1.1	0.0	0.6
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	0.7	0.0	0.6	0.0	1.2	0.0	0.7
%ile Storage Ratio (RQ%)	0.00	0.03	0.00	0.01	0.00	0.01	0.00	0.02
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	18
Lane Assignment		T+R		T+R		T+R		T+R
Lanes in Grp	0	1	0	1	0	1	0	1
Grp Vol (v), veh/h	0	110	0	90	0	170	0	91
Grp Sat Flow (s), veh/h/ln	0	1626	0	1828	0	1641	0	1724
Q Serve Time (g_s), s	0.0	1.6	0.0	1.3	0.0	2.5	0.0	1.4
Cycle Q Clear Time (g_c), s	0.0	1.6	0.0	1.3	0.0	2.5	0.0	1.4
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	0.54	0.00	0.22	0.00	0.61	0.00	0.53
Lane Grp Cap (c), veh/h	0	461	0	347	0	465	0	277
V/C Ratio (X)	0.00	0.24	0.00	0.26	0.00	0.36	0.00	0.33
Avail Cap (c_a), veh/h	0	961	0	1111	0	970	0	1020
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	8.4	0.0	10.5	0.0	8.7	0.0	11.3
Incr Delay (d2), s/veh	0.0	0.3	0.0	0.4	0.0	0.5	0.0	0.7
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	8.6	0.0	10.9	0.0	9.2	0.0	12.0
1st-Term Q (Q1), veh/ln	0.0	0.7	0.0	0.6	0.0	1.1	0.0	0.7
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	0.7	0.0	0.7	0.0	1.2	0.0	0.7
%ile Storage Ratio (RQ%)	0.00	0.03	0.00	0.01	0.00	0.01	0.00	0.02
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Intersection Summary								
HCM 2010 Ctrl Delay		11.1						
HCM 2010 LOS		B						

Intersection	
Intersection Delay, s/veh	12.6
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	117	119	11	0	40	94	39	0	10	121	38
Future Vol, veh/h	0	117	119	11	0	40	94	39	0	10	121	38
Peak Hour Factor	0.92	0.86	0.76	0.55	0.92	0.48	0.71	0.81	0.92	0.63	0.76	0.63
Heavy Vehicles, %	2	0	0	0	2	0	0	3	2	0	8	3
Mvmt Flow	0	136	157	20	0	83	132	48	0	16	159	60
Number of Lanes	0	1	2	0	0	1	2	0	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	3	3	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	3
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	3
HCM Control Delay	12.8	12	12.4
HCM LOS	B	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2
Vol Left, %	100%	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%
Vol Thru, %	0%	100%	51%	0%	100%	78%	0%	100%	45%	0%	100%
Vol Right, %	0%	0%	49%	0%	0%	22%	0%	0%	55%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	81	78	117	79	51	40	63	70	76	120
LT Vol	10	0	0	117	0	0	40	0	0	76	0
Through Vol	0	81	40	0	79	40	0	63	31	0	120
RT Vol	0	0	38	0	0	11	0	0	39	0	0
Lane Flow Rate	16	106	113	136	104	72	83	88	92	104	158
Geometry Grp	8	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.036	0.227	0.23	0.299	0.215	0.145	0.186	0.185	0.185	0.221	0.317
Departure Headway (Hd)	8.078	7.714	7.29	7.907	7.407	7.255	8.035	7.535	7.198	7.631	7.233
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	443	466	492	454	484	495	447	477	498	471	497
Service Time	5.824	5.46	5.035	5.649	5.149	4.997	5.777	5.277	4.94	5.37	4.972
HCM Lane V/C Ratio	0.036	0.227	0.23	0.3	0.215	0.145	0.186	0.184	0.185	0.221	0.318
HCM Control Delay	11.1	12.7	12.2	14	12.2	11.2	12.6	12	11.6	12.5	13.3
HCM Lane LOS	B	B	B	B	B	B	B	B	B	B	B
HCM 95th-tile Q	0.1	0.9	0.9	1.2	0.8	0.5	0.7	0.7	0.7	0.8	1.3

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	76	180	97
Future Vol, veh/h	0	76	180	97
Peak Hour Factor	0.92	0.73	0.76	0.93
Heavy Vehicles, %	2	0	6	1
Mvmt Flow	0	104	237	104
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	3
Conflicting Approach Right	EB
Conflicting Lanes Right	3
HCM Control Delay	12.9
HCM LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	171	145	91	72	230	34	141	504	17	50	767	100
Future Volume (veh/h)	171	145	91	72	230	34	141	504	17	50	767	100
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1879	1900	1900	1846	1900	1610	1773	1900
Adj Flow Rate, veh/h	228	186	144	96	261	58	282	672	23	63	947	128
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.75	0.78	0.63	0.75	0.88	0.59	0.50	0.75	0.75	0.79	0.81	0.78
Percent Heavy Veh, %	0	0	0	0	0	0	0	3	3	18	8	8
Opposing Right Turn Influence	Yes			Yes			Yes			Yes		
Cap, veh/h	250	416	304	124	406	89	306	1580	54	77	1005	136
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
Prop Arrive On Green	0.14	0.21	0.21	0.07	0.14	0.14	0.17	0.46	0.46	0.05	0.34	0.34
Ln Grp Delay, s/veh	69.8	29.5	29.9	47.9	36.5	36.8	65.6	15.6	15.6	58.1	50.7	50.6
Ln Grp LOS	E	C	C	D	D	D	E	B	B	E	D	D
Approach Vol, veh/h		558			415			977			1138	
Approach Delay, s/veh		46.1			39.3			30.0			51.1	
Approach LOS		D			D			C			D	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Case No	2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0
Phs Duration (G+Y+Rc), s	8.7	42.5	10.2	21.9	18.6	32.6	16.0	16.1
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green (Gmax), s	10.0	32.5	10.3	19.2	14.1	28.4	11.5	18.0
Max Allow Headway (MAH), s	3.8	4.9	3.8	5.1	3.7	4.9	3.7	5.1
Max Q Clear (g_c+I1), s	5.4	12.9	6.3	9.2	14.8	27.7	12.3	9.2
Green Ext Time (g_e), s	0.0	10.6	0.1	2.6	0.0	0.4	0.0	2.4
Prob of Phs Call (p_c)	0.77	1.00	0.89	1.00	1.00	1.00	0.99	1.00
Prob of Max Out (p_x)	0.34	0.51	0.81	0.35	1.00	1.00	1.00	0.45

Left-Turn Movement Data								
Assigned Mvmt	1		3		5		7	
Mvmt Sat Flow, veh/h	1533		1810		1810		1810	

Through Movement Data								
Assigned Mvmt		2		4		6		8
Mvmt Sat Flow, veh/h		3461		1990		2983		2915

Right-Turn Movement Data								
Assigned Mvmt		12		14		16		18
Mvmt Sat Flow, veh/h		118		1458		403		637

Left Lane Group Data								
Assigned Mvmt	1	0	3	0	5	0	7	0
Lane Assignment	(Prot)		(Prot)		(Prot)		(Prot)	
Lanes in Grp	1	0	1	0	1	0	1	0
Grp Vol (v), veh/h	63	0	96	0	282	0	228	0
Grp Sat Flow (s), veh/h/ln	1533	0	1810	0	1810	0	1810	0
Q Serve Time (g_s), s	3.4	0.0	4.3	0.0	12.8	0.0	10.3	0.0

Cycle Q Clear Time (g_c), s	3.4	0.0	4.3	0.0	12.8	0.0	10.3	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	0	0	0	0	0	0	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Serve Time (g_u), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Q Serve Time (g_ps), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time to First Blk (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Lane Grp Cap (c), veh/h	77	0	124	0	306	0	250	0
V/C Ratio (X)	0.82	0.00	0.77	0.00	0.92	0.00	0.91	0.00
Avail Cap (c_a), veh/h	184	0	224	0	306	0	250	0
Upstream Filter (I)	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d1), s/veh	39.2	0.0	38.1	0.0	34.0	0.0	35.4	0.0
Incr Delay (d2), s/veh	18.9	0.0	9.8	0.0	31.5	0.0	34.5	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	58.1	0.0	47.9	0.0	65.6	0.0	69.8	0.0
1st-Term Q (Q1), veh/ln	1.4	0.0	2.2	0.0	6.3	0.0	5.2	0.0
2nd-Term Q (Q2), veh/ln	0.4	0.0	0.3	0.0	2.7	0.0	2.4	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
%ile Back of Q (50%), veh/ln	1.8	0.0	2.5	0.0	9.0	0.0	7.6	0.0
%ile Storage Ratio (RQ%)	0.58	0.00	0.69	0.00	1.13	0.00	1.15	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	8
Lane Assignment		T		T		T		T
Lanes in Grp	0	1	0	1	0	1	0	1
Grp Vol (v), veh/h	0	340	0	168	0	535	0	158
Grp Sat Flow (s), veh/h/ln	0	1754	0	1805	0	1684	0	1786
Q Serve Time (g_s), s	0.0	10.9	0.0	6.7	0.0	25.7	0.0	7.0
Cycle Q Clear Time (g_c), s	0.0	10.9	0.0	6.7	0.0	25.7	0.0	7.0
Lane Grp Cap (c), veh/h	0	800	0	377	0	568	0	249
V/C Ratio (X)	0.00	0.43	0.00	0.44	0.00	0.94	0.00	0.64
Avail Cap (c_a), veh/h	0	800	0	416	0	575	0	386
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	15.3	0.0	28.7	0.0	26.8	0.0	33.8
Incr Delay (d2), s/veh	0.0	0.4	0.0	0.8	0.0	23.9	0.0	2.7
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	15.6	0.0	29.5	0.0	50.7	0.0	36.5
1st-Term Q (Q1), veh/ln	0.0	5.2	0.0	3.4	0.0	11.9	0.0	3.4
2nd-Term Q (Q2), veh/ln	0.0	0.1	0.0	0.1	0.0	3.8	0.0	0.2
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	5.3	0.0	3.4	0.0	15.7	0.0	3.6
%ile Storage Ratio (RQ%)	0.00	0.16	0.00	0.07	0.00	0.13	0.00	0.09
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	18
Lane Assignment		T+R		T+R		T+R		T+R
Lanes in Grp	0	1	0	1	0	1	0	1
Grp Vol (v), veh/h	0	355	0	162	0	540	0	161
Grp Sat Flow (s), veh/h/ln	0	1826	0	1643	0	1702	0	1767
Q Serve Time (g_s), s	0.0	10.9	0.0	7.2	0.0	25.7	0.0	7.2
Cycle Q Clear Time (g_c), s	0.0	10.9	0.0	7.2	0.0	25.7	0.0	7.2
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	0.06	0.00	0.89	0.00	0.24	0.00	0.36
Lane Grp Cap (c), veh/h	0	833	0	343	0	573	0	246
V/C Ratio (X)	0.00	0.43	0.00	0.47	0.00	0.94	0.00	0.65
Avail Cap (c_a), veh/h	0	833	0	379	0	581	0	382
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	15.3	0.0	28.9	0.0	26.8	0.0	33.9
Incr Delay (d2), s/veh	0.0	0.3	0.0	1.0	0.0	23.8	0.0	2.9
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	15.6	0.0	29.9	0.0	50.6	0.0	36.8
1st-Term Q (Q1), veh/ln	0.0	5.4	0.0	3.3	0.0	12.0	0.0	3.5
2nd-Term Q (Q2), veh/ln	0.0	0.1	0.0	0.1	0.0	3.8	0.0	0.2
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	5.5	0.0	3.4	0.0	15.8	0.0	3.7
%ile Storage Ratio (RQ%)	0.00	0.17	0.00	0.07	0.00	0.13	0.00	0.09
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Intersection Summary								
HCM 2010 Ctrl Delay		41.9						
HCM 2010 LOS		D						

Intersection	
Intersection Delay, s/veh	163.5
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	117	119	11	0	82	192	80	0	44	534	168
Future Vol, veh/h	0	117	119	11	0	82	192	80	0	44	534	168
Peak Hour Factor	0.92	0.91	0.91	0.91	0.92	0.91	0.91	0.91	0.92	0.91	0.91	0.91
Heavy Vehicles, %	2	0	0	0	2	0	0	3	2	0	8	3
Mvmt Flow	0	129	131	12	0	90	211	88	0	48	587	185
Number of Lanes	0	1	2	0	0	1	2	0	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	3	3	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	3
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	3
HCM Control Delay	25.6	30.4	153.5
HCM LOS	D	D	F

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2
Vol Left, %	100%	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%
Vol Thru, %	0%	100%	51%	0%	100%	78%	0%	100%	44%	0%	100%
Vol Right, %	0%	0%	49%	0%	0%	22%	0%	0%	56%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	44	356	346	117	79	51	82	128	144	262	414
LT Vol	44	0	0	117	0	0	82	0	0	262	0
Through Vol	0	356	178	0	79	40	0	128	64	0	414
RT Vol	0	0	168	0	0	11	0	0	80	0	0
Lane Flow Rate	48	391	380	129	87	56	90	141	158	288	455
Geometry Grp	8	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.161	1.263	1.183	0.477	0.312	0.197	0.33	0.496	0.543	0.887	1.352
Departure Headway (Hd)	12.881	12.517	12.092	14.512	14.012	13.86	15.199	14.699	14.361	11.342	10.944
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	280	293	304	249	258	261	238	248	253	322	337
Service Time	10.581	10.217	9.792	12.212	11.712	11.56	12.899	12.399	12.061	9.042	8.644
HCM Lane V/C Ratio	0.171	1.334	1.25	0.518	0.337	0.215	0.378	0.569	0.625	0.894	1.35
HCM Control Delay	18	177.4	146.1	29.8	22.9	19.9	25.2	31	32.9	60.5	206.6
HCM Lane LOS	C	F	F	D	C	C	D	D	D	F	F
HCM 95th-tile Q	0.6	17.3	15.4	2.4	1.3	0.7	1.4	2.5	3	8.3	22

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑↱	
Traffic Vol, veh/h	0	262	621	334
Future Vol, veh/h	0	262	621	334
Peak Hour Factor	0.92	0.91	0.91	0.91
Heavy Vehicles, %	2	0	6	1
Mvmt Flow	0	288	682	367
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	3
Conflicting Approach Right	EB
Conflicting Lanes Right	3
HCM Control Delay	236.4
HCM LOS	F

Traffic Data – Lakeway Road and Butler-Spaeth Road

The following section includes traffic counts, LOS analysis results, and warrant analysis results.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	151	125	83	182	235	153
Future Volume (veh/h)	151	125	83	182	235	153
Number	7	14	5	2	6	16
Initial Q, veh	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)	1.00	1.00	1.00			1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	164	136	90	198	255	166
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Opposing Right Turn Influence	Yes		Yes			
Cap, veh/h	341	304	618	735	735	625
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Prop Arrive On Green	0.19	0.19	0.39	0.39	0.39	0.39
Ln Grp Delay, s/veh	8.9	8.8	6.0	4.7	4.9	4.7
Ln Grp LOS	A	A	A	A	A	A
Approach Vol, veh/h	300			288	421	
Approach Delay, s/veh	8.9			5.1	4.8	
Approach LOS	A			A	A	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Case No		6.0		9.0		7.0		
Phs Duration (G+Y+Rc), s		13.1		8.7		13.1		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green (Gmax), s		18.0		18.0		18.0		
Max Allow Headway (MAH), s		4.8		3.9		4.8		
Max Q Clear (g_c+I1), s		5.7		3.8		4.1		
Green Ext Time (g_e), s		2.9		0.8		3.1		
Prob of Phs Call (p_c)		1.00		0.84		1.00		
Prob of Max Out (p_x)		0.20		0.00		0.14		
Left-Turn Movement Data								
Assigned Mvmt		5		7		1		
Mvmt Sat Flow, veh/h		962		1774		0		
Through Movement Data								
Assigned Mvmt		2		4		6		
Mvmt Sat Flow, veh/h		1863		0		1863		
Right-Turn Movement Data								
Assigned Mvmt		12		14		16		
Mvmt Sat Flow, veh/h		0		1583		1583		
Left Lane Group Data								
Assigned Mvmt	0	5	0	7	0	1	0	0
Lane Assignment								
Lanes in Grp	0	1	0	1	0	0	0	0
Grp Vol (v), veh/h	0	90	0	164	0	0	0	0
Grp Sat Flow (s), veh/h/ln	0	962	0	1774	0	0	0	0
Q Serve Time (g_s), s	0.0	1.6	0.0	1.8	0.0	0.0	0.0	0.0

Cycle Q Clear Time (g_c), s	0.0	3.7	0.0	1.8	0.0	0.0	0.0	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	962	0	1774	0	0	0	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	8.6	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Serve Time (g_u), s	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Q Serve Time (g_ps), s	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Time to First Blk (g_f), s	0.0	0.0	0.0	0.0	0.0	8.6	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00
Lane Grp Cap (c), veh/h	0	618	0	341	0	0	0	0
V/C Ratio (X)	0.00	0.15	0.00	0.48	0.00	0.00	0.00	0.00
Avail Cap (c_a), veh/h	0	1033	0	1466	0	0	0	0
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	5.9	0.0	7.8	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.1	0.0	1.1	0.0	0.0	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	6.0	0.0	8.9	0.0	0.0	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.4	0.0	0.9	0.0	0.0	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.4	0.0	1.0	0.0	0.0	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	0
Lane Assignment		T				T		
Lanes in Grp	0	1	0	0	0	1	0	0
Grp Vol (v), veh/h	0	198	0	0	0	255	0	0
Grp Sat Flow (s), veh/h/ln	0	1863	0	0	0	1863	0	0
Q Serve Time (g_s), s	0.0	1.6	0.0	0.0	0.0	2.1	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	1.6	0.0	0.0	0.0	2.1	0.0	0.0
Lane Grp Cap (c), veh/h	0	735	0	0	0	735	0	0
V/C Ratio (X)	0.00	0.27	0.00	0.00	0.00	0.35	0.00	0.00
Avail Cap (c_a), veh/h	0	1539	0	0	0	1539	0	0
Upstream Filter (I)	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	4.5	0.0	0.0	0.0	4.6	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	4.7	0.0	0.0	0.0	4.9	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.8	0.0	0.0	0.0	1.1	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.8	0.0	0.0	0.0	1.1	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.03	0.00	0.00	0.00	0.08	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	0
Lane Assignment				R		R		
Lanes in Grp	0	0	0	1	0	1	0	0
Grp Vol (v), veh/h	0	0	0	136	0	166	0	0
Grp Sat Flow (s), veh/h/ln	0	0	0	1583	0	1583	0	0
Q Serve Time (g_s), s	0.0	0.0	0.0	1.7	0.0	1.5	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	0.0	0.0	1.7	0.0	1.5	0.0	0.0
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00
Lane Grp Cap (c), veh/h	0	0	0	304	0	625	0	0
V/C Ratio (X)	0.00	0.00	0.00	0.45	0.00	0.27	0.00	0.00
Avail Cap (c_a), veh/h	0	0	0	1308	0	1308	0	0
Upstream Filter (I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	0.0	0.0	7.8	0.0	4.5	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	1.0	0.0	0.2	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	0.0	0.0	8.8	0.0	4.7	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.0	0.0	0.7	0.0	0.6	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.0	0.0	0.8	0.0	0.7	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.00	0.00	0.01	0.00	0.05	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	6.1
HCM 2010 LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	301	249	72	157	309	201
Future Volume (veh/h)	301	249	72	157	309	201
Number	7	14	5	2	6	16
Initial Q, veh	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)	1.00	1.00	1.00			1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	327	271	78	171	336	218
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Opposing Right Turn Influence	Yes		Yes			
Cap, veh/h	427	381	509	1068	769	654
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Prop Arrive On Green	0.24	0.24	0.07	0.57	0.41	0.41
Ln Grp Delay, s/veh	20.0	19.3	6.7	5.2	12.0	11.0
Ln Grp LOS	B	B	A	A	B	B
Approach Vol, veh/h	598			249	554	
Approach Delay, s/veh	19.7			5.6	11.6	
Approach LOS	B			A	B	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Case No		4.0		9.0	1.2	7.0		
Phs Duration (G+Y+Rc), s		32.2		16.1	7.7	24.5		
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		
Max Green (Gmax), s		27.7		18.3	5.0	18.2		
Max Allow Headway (MAH), s		4.8		3.9	3.8	4.8		
Max Q Clear (g_c+I1), s		4.1		10.3	3.1	8.2		
Green Ext Time (g_e), s		3.8		1.3	0.0	2.7		
Prob of Phs Call (p_c)		1.00		1.00	0.65	1.00		
Prob of Max Out (p_x)		0.00		0.22	1.00	0.00		
Left-Turn Movement Data								
Assigned Mvmt				7	5	1		
Mvmt Sat Flow, veh/h				1774	1774	0		
Through Movement Data								
Assigned Mvmt		2		4		6		
Mvmt Sat Flow, veh/h		1863		0		1863		
Right-Turn Movement Data								
Assigned Mvmt		12		14		16		
Mvmt Sat Flow, veh/h		0		1583		1583		
Left Lane Group Data								
Assigned Mvmt	0	0	0	7	5	1	0	0
Lane Assignment					(Pr/Pm)			
Lanes in Grp	0	0	0	1	1	0	0	0
Grp Vol (v), veh/h	0	0	0	327	78	0	0	0
Grp Sat Flow (s), veh/h/ln	0	0	0	1774	1774	0	0	0
Q Serve Time (g_s), s	0.0	0.0	0.0	8.3	1.1	0.0	0.0	0.0

Cycle Q Clear Time (g_c), s	0.0	0.0	0.0	8.3	1.1	0.0	0.0	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	0	0	1774	851	0	0	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	0.0	0.0	0.0	22.0	0.0	0.0	0.0
Perm LT Serve Time (g_u), s	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0
Perm LT Q Serve Time (g_ps), s	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Time to First Blk (g_f), s	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00
Lane Grp Cap (c), veh/h	0	0	0	427	509	0	0	0
V/C Ratio (X)	0.00	0.00	0.00	0.77	0.15	0.00	0.00	0.00
Avail Cap (c_a), veh/h	0	0	0	672	574	0	0	0
Upstream Filter (I)	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	0.0	0.0	17.1	6.6	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	2.9	0.1	0.0	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	0.0	0.0	20.0	6.7	0.0	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.0	0.0	4.0	0.5	0.0	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.0	0.0	4.3	0.5	0.0	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.00	0.00	0.08	0.02	0.00	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	0
Lane Assignment		T				T		
Lanes in Grp	0	1	0	0	0	1	0	0
Grp Vol (v), veh/h	0	171	0	0	0	336	0	0
Grp Sat Flow (s), veh/h/ln	0	1863	0	0	0	1863	0	0
Q Serve Time (g_s), s	0.0	2.1	0.0	0.0	0.0	6.2	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	2.1	0.0	0.0	0.0	6.2	0.0	0.0
Lane Grp Cap (c), veh/h	0	1068	0	0	0	769	0	0
V/C Ratio (X)	0.00	0.16	0.00	0.00	0.00	0.44	0.00	0.00
Avail Cap (c_a), veh/h	0	1068	0	0	0	769	0	0
Upstream Filter (I)	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	4.8	0.0	0.0	0.0	10.2	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.3	0.0	0.0	0.0	1.8	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	5.2	0.0	0.0	0.0	12.0	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	1.0	0.0	0.0	0.0	3.2	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	1.1	0.0	0.0	0.0	3.6	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.05	0.00	0.00	0.00	0.24	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	0
Lane Assignment				R		R		
Lanes in Grp	0	0	0	1	0	1	0	0
Grp Vol (v), veh/h	0	0	0	271	0	218	0	0
Grp Sat Flow (s), veh/h/ln	0	0	0	1583	0	1583	0	0
Q Serve Time (g_s), s	0.0	0.0	0.0	7.6	0.0	4.5	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	0.0	0.0	7.6	0.0	4.5	0.0	0.0
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00
Lane Grp Cap (c), veh/h	0	0	0	381	0	654	0	0
V/C Ratio (X)	0.00	0.00	0.00	0.71	0.00	0.33	0.00	0.00
Avail Cap (c_a), veh/h	0	0	0	600	0	654	0	0
Upstream Filter (I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	0.0	0.0	16.8	0.0	9.7	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	2.5	0.0	1.4	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	0.0	0.0	19.3	0.0	11.0	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.0	0.0	6.4	0.0	4.6	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.0	0.0	6.6	0.0	4.9	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.00	0.00	0.12	0.00	0.33	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Intersection Summary								
HCM 2010 Ctrl Delay		14.0						
HCM 2010 LOS		B						

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	151	125	83	182	235	153
Future Volume (Veh/h)	151	125	83	182	235	153
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	164	136	90	198	255	166
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	633	255	421			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	633	255	421			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	60	83	92			
cM capacity (veh/h)	409	784	1138			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	164	136	90	198	255	166
Volume Left	164	0	90	0	0	0
Volume Right	0	136	0	0	0	166
cSH	409	784	1138	1700	1700	1700
Volume to Capacity	0.40	0.17	0.08	0.12	0.15	0.10
Queue Length 95th (ft)	47	16	6	0	0	0
Control Delay (s)	19.6	10.6	8.4	0.0	0.0	0.0
Lane LOS	C	B	A			
Approach Delay (s)	15.5		2.6		0.0	
Approach LOS	C					

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	301	249	72	157	309	201
Future Volume (Veh/h)	301	249	72	157	309	201
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	327	271	78	171	336	218
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	663	336	554			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	663	336	554			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	17	62	92			
cM capacity (veh/h)	394	706	1016			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	327	271	78	171	336	218
Volume Left	327	0	78	0	0	0
Volume Right	0	271	0	0	0	218
cSH	394	706	1016	1700	1700	1700
Volume to Capacity	0.83	0.38	0.08	0.10	0.20	0.13
Queue Length 95th (ft)	192	45	6	0	0	0
Control Delay (s)	45.9	13.2	8.8	0.0	0.0	0.0
Lane LOS	E	B	A			
Approach Delay (s)	31.1		2.8		0.0	
Approach LOS	D					

Intersection Summary			
Average Delay	13.8		
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

Traffic Data – Lakeway Road and Dogwood Avenue

The following section includes traffic counts, LOS analysis results, and warrant analysis results.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	627	14	16	634	69	17	2	21	36	1	25
Future Volume (veh/h)	22	627	14	16	634	69	17	2	21	36	1	25
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	24	682	15	17	689	75	18	2	23	39	1	27
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Opposing Right Turn Influence	Yes			Yes			Yes			Yes		
Cap, veh/h	508	1731	38	536	1574	171	257	63	154	324	51	113
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
Prop Arrive On Green	0.49	0.49	0.49	0.49	0.49	0.49	0.18	0.18	0.18	0.18	0.18	0.18
Ln Grp Delay, s/veh	6.0	4.7	4.7	5.6	4.9	4.9	9.5	0.0	0.0	9.6	0.0	0.0
Ln Grp LOS	A	A	A	A	A	A	A			A		
Approach Vol, veh/h		721			781			43			67	
Approach Delay, s/veh		4.8			4.9			9.5			9.6	
Approach LOS		A			A			A			A	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Case No		8.0		6.0		8.0		6.0
Phs Duration (G+Y+Rc), s		9.5		17.9		9.5		17.9
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green (Gmax), s		18.0		18.0		18.0		18.0
Max Allow Headway (MAH), s		5.6		5.3		5.6		5.3
Max Q Clear (g_c+I1), s		2.6		6.4		2.9		5.8
Green Ext Time (g_e), s		0.5		6.9		0.5		7.2
Prob of Phs Call (p_c)		1.00		1.00		1.00		1.00
Prob of Max Out (p_x)		0.00		0.70		0.00		0.68
Left-Turn Movement Data								
Assigned Mvmt		5		7		1		3
Mvmt Sat Flow, veh/h		388		700		634		745
Through Movement Data								
Assigned Mvmt		2		4		6		8
Mvmt Sat Flow, veh/h		345		3541		281		3220
Right-Turn Movement Data								
Assigned Mvmt		12		14		16		18
Mvmt Sat Flow, veh/h		843		78		617		350
Left Lane Group Data								
Assigned Mvmt	0	5	0	7	0	1	0	3
Lane Assignment		L+T+R				L+T+R		
Lanes in Grp	0	1	0	1	0	1	0	1
Grp Vol (v), veh/h	0	43	0	24	0	67	0	17
Grp Sat Flow (s), veh/h/ln	0	1577	0	700	0	1532	0	745
Q Serve Time (g_s), s	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.4

Cycle Q Clear Time (g_c), s	0.0	0.6	0.0	4.4	0.0	0.9	0.0	3.7
Perm LT Sat Flow (s_l), veh/h/ln	0	1404	0	700	0	1408	0	745
Shared LT Sat Flow (s_sh), veh/h/ln	0	1825	0	0	0	1810	0	0
Perm LT Eff Green (g_p), s	0.0	5.0	0.0	13.4	0.0	5.0	0.0	13.4
Perm LT Serve Time (g_u), s	0.0	4.1	0.0	9.6	0.0	4.4	0.0	10.1
Perm LT Q Serve Time (g_ps), s	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.4
Time to First Blk (g_f), s	0.0	1.9	0.0	0.0	0.0	1.3	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	0.6	0.0	0.0	0.0	0.9	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	0.42	0.00	1.00	0.00	0.58	0.00	1.00
Lane Grp Cap (c), veh/h	0	474	0	508	0	488	0	536
V/C Ratio (X)	0.00	0.09	0.00	0.05	0.00	0.14	0.00	0.03
Avail Cap (c_a), veh/h	0	1186	0	625	0	1181	0	662
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	9.4	0.0	6.0	0.0	9.5	0.0	5.6
Incr Delay (d2), s/veh	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	9.5	0.0	6.0	0.0	9.6	0.0	5.6
1st-Term Q (Q1), veh/ln	0.0	0.3	0.0	0.1	0.0	0.4	0.0	0.1
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	0.3	0.0	0.1	0.0	0.4	0.0	0.1
%ile Storage Ratio (RQ%)	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	8
Lane Assignment				T				T
Lanes in Grp	0	0	0	1	0	0	0	1
Grp Vol (v), veh/h	0	0	0	341	0	0	0	378
Grp Sat Flow (s), veh/h/ln	0	0	0	1770	0	0	0	1770
Q Serve Time (g_s), s	0.0	0.0	0.0	3.3	0.0	0.0	0.0	3.8
Cycle Q Clear Time (g_c), s	0.0	0.0	0.0	3.3	0.0	0.0	0.0	3.8
Lane Grp Cap (c), veh/h	0	0	0	865	0	0	0	865
V/C Ratio (X)	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.44
Avail Cap (c_a), veh/h	0	0	0	1163	0	0	0	1163
Upstream Filter (I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	0.0	0.0	4.4	0.0	0.0	0.0	4.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	0.0	0.0	4.7	0.0	0.0	0.0	4.9
1st-Term Q (Q1), veh/ln	0.0	0.0	0.0	1.6	0.0	0.0	0.0	1.8
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	0.0	0.0	1.7	0.0	0.0	0.0	1.9
%ile Storage Ratio (RQ%)	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.07
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	18
Lane Assignment				T+R				T+R
Lanes in Grp	0	0	0	1	0	0	0	1
Grp Vol (v), veh/h	0	0	0	356	0	0	0	386
Grp Sat Flow (s), veh/h/ln	0	0	0	1849	0	0	0	1801
Q Serve Time (g_s), s	0.0	0.0	0.0	3.3	0.0	0.0	0.0	3.8
Cycle Q Clear Time (g_c), s	0.0	0.0	0.0	3.3	0.0	0.0	0.0	3.8
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	0.53	0.00	0.04	0.00	0.40	0.00	0.19
Lane Grp Cap (c), veh/h	0	0	0	904	0	0	0	880
V/C Ratio (X)	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.44
Avail Cap (c_a), veh/h	0	0	0	1215	0	0	0	1183
Upstream Filter (I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d1), s/veh	0.0	0.0	0.0	4.4	0.0	0.0	0.0	4.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	0.0	0.0	4.7	0.0	0.0	0.0	4.9
1st-Term Q (Q1), veh/ln	0.0	0.0	0.0	1.7	0.0	0.0	0.0	1.8
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
%ile Back of Q (50%), veh/ln	0.0	0.0	0.0	1.8	0.0	0.0	0.0	1.9
%ile Storage Ratio (RQ%)	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.08
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Intersection Summary								
HCM 2010 Ctrl Delay		5.2						
HCM 2010 LOS		A						

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	474	11	15	593	65	16	2	20	34	1	24
Future Volume (vph)	17	474	11	15	593	65	16	2	20	34	1	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.93			0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.97	
Satd. Flow (prot)	1770	3527		1770	3487			1693			1711	
Flt Permitted	0.35	1.00		0.46	1.00			0.85			0.80	
Satd. Flow (perm)	647	3527		850	3487			1471			1406	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	515	12	16	645	71	17	2	22	37	1	26
RTOR Reduction (vph)	0	3	0	0	14	0	0	18	0	0	21	0
Lane Group Flow (vph)	18	524	0	16	702	0	0	23	0	0	43	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	13.0	12.3		13.0	12.3			6.7			6.7	
Effective Green, g (s)	13.0	12.3		13.0	12.3			6.7			6.7	
Actuated g/C Ratio	0.39	0.37		0.39	0.37			0.20			0.20	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	277	1306		352	1291			296			283	
v/s Ratio Prot	c0.00	0.15		0.00	c0.20							
v/s Ratio Perm	0.02			0.02				0.02			c0.03	
v/c Ratio	0.06	0.40		0.05	0.54			0.08			0.15	
Uniform Delay, d1	6.2	7.7		6.2	8.2			10.7			10.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.1	0.2		0.1	0.5			0.1			0.3	
Delay (s)	6.3	7.9		6.3	8.7			10.9			11.2	
Level of Service	A	A		A	A			B			B	
Approach Delay (s)		7.9			8.7			10.9			11.2	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	33.2	Sum of lost time (s)	13.5
Intersection Capacity Utilization	31.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
161: Dogwood Avenue & E Lakeway Rd/E Lakeway Road

12/05/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	627	14	16	634	69	17	2	21	36	1	25
Future Volume (Veh/h)	22	627	14	16	634	69	17	2	21	36	1	25
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	24	682	15	17	689	75	18	2	23	39	1	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	764			697			1144	1536	348	1174	1506	382
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	764			697			1144	1536	348	1174	1506	382
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			87	98	96	71	99	96
cM capacity (veh/h)	845			895			142	110	648	135	114	616

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	24	455	242	17	459	305	43	67
Volume Left	24	0	0	17	0	0	18	39
Volume Right	0	0	15	0	0	75	23	27
cSH	845	1700	1700	895	1700	1700	238	196
Volume to Capacity	0.03	0.27	0.14	0.02	0.27	0.18	0.18	0.34
Queue Length 95th (ft)	2	0	0	1	0	0	16	36
Control Delay (s)	9.4	0.0	0.0	9.1	0.0	0.0	23.4	32.6
Lane LOS	A			A			C	D
Approach Delay (s)	0.3			0.2			23.4	32.6
Approach LOS							C	D

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
161: Dogwood Avenue & E Lakeway Rd/E Lakeway Road

12/05/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	474	11	15	593	65	16	2	20	34	1	24
Future Volume (Veh/h)	17	474	11	15	593	65	16	2	20	34	1	24
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	515	12	16	645	71	17	2	22	37	1	26
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	716			527			938	1305	264	1029	1276	358
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	716			527			938	1305	264	1029	1276	358
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			98			92	99	97	79	99	96
cM capacity (veh/h)	880			1036			203	153	735	176	160	638

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	18	343	184	16	430	286	41	64
Volume Left	18	0	0	16	0	0	17	37
Volume Right	0	0	12	0	0	71	22	26
cSH	880	1700	1700	1036	1700	1700	324	248
Volume to Capacity	0.02	0.20	0.11	0.02	0.25	0.17	0.13	0.26
Queue Length 95th (ft)	2	0	0	1	0	0	11	25
Control Delay (s)	9.2	0.0	0.0	8.5	0.0	0.0	17.7	24.4
Lane LOS	A			A			C	C
Approach Delay (s)	0.3			0.2			17.7	24.4
Approach LOS							C	C

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		

Traffic Data – Warlow Drive and Brooks Avenue

The following section includes traffic counts, LOS analysis results, and warrant analysis results.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	199	43	71	200	70	135
Future Volume (veh/h)	199	43	71	200	70	135
Number	6	16	5	2	7	14
Initial Q, veh	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)		1.00	1.00		1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1885	1900	1900	1887	1900	1900
Adj Flow Rate, veh/h	212	52	96	233	76	214
Adj No. of Lanes	2	0	0	2	0	0
Peak Hour Factor	0.94	0.83	0.74	0.86	0.92	0.63
Percent Heavy Veh, %	1	1	1	1	0	0
Opposing Right Turn Influence			Yes		Yes	
Cap, veh/h	866	208	419	785	122	344
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Prop Arrive On Green	0.30	0.30	0.30	0.30	0.28	0.28
Ln Grp Delay, s/veh	5.9	5.9	6.0	6.1	8.1	0.0
Ln Grp LOS	A	A	A	A	A	
Approach Vol, veh/h	264			329	291	
Approach Delay, s/veh	5.9			6.1	8.1	
Approach LOS	A			A	A	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Case No		8.0		12.0		8.0		
Phs Duration (G+Y+Rc), s		11.0		10.6		11.0		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green (Gmax), s		18.0		18.0		18.0		
Max Allow Headway (MAH), s		5.1		4.0		5.1		
Max Q Clear (g_c+I1), s		3.6		5.3		3.2		
Green Ext Time (g_e), s		2.9		0.8		2.9		
Prob of Phs Call (p_c)		1.00		1.00		0.97		
Prob of Max Out (p_x)		0.12		0.01		0.11		
Left-Turn Movement Data								
Assigned Mvmt		5		7		1		
Mvmt Sat Flow, veh/h		547		434		0		
Through Movement Data								
Assigned Mvmt		2		4		6		
Mvmt Sat Flow, veh/h		2686		6		2960		
Right-Turn Movement Data								
Assigned Mvmt		12		14		16		
Mvmt Sat Flow, veh/h		0		1223		688		
Left Lane Group Data								
Assigned Mvmt	0	5	0	7	0	1	0	0
Lane Assignment		L+T		L+T+R				
Lanes in Grp	0	1	0	1	0	0	0	0
Grp Vol (v), veh/h	0	185	0	291	0	0	0	0
Grp Sat Flow (s), veh/h/ln	0	1516	0	1663	0	0	0	0
Q Serve Time (g_s), s	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0

Cycle Q Clear Time (g_c), s	0.0	1.6	0.0	3.3	0.0	0.0	0.0	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	1133	0	0	0	0	0	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Serve Time (g_u), s	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Q Serve Time (g_ps), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time to First Blk (g_f), s	0.0	1.6	0.0	0.0	0.0	6.5	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	0.52	0.00	0.26	0.00	0.00	0.00	0.00
Lane Grp Cap (c), veh/h	0	711	0	468	0	0	0	0
V/C Ratio (X)	0.00	0.26	0.00	0.62	0.00	0.00	0.00	0.00
Avail Cap (c_a), veh/h	0	1452	0	1385	0	0	0	0
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	5.8	0.0	6.8	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.2	0.0	1.4	0.0	0.0	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	6.0	0.0	8.1	0.0	0.0	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.8	0.0	1.5	0.0	0.0	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.9	0.0	1.6	0.0	0.0	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.03	0.00	0.02	0.00	0.00	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	0
Lane Assignment		T				T		
Lanes in Grp	0	1	0	0	0	1	0	0
Grp Vol (v), veh/h	0	144	0	0	0	131	0	0
Grp Sat Flow (s), veh/h/ln	0	1631	0	0	0	1791	0	0
Q Serve Time (g_s), s	0.0	1.5	0.0	0.0	0.0	1.2	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	1.5	0.0	0.0	0.0	1.2	0.0	0.0
Lane Grp Cap (c), veh/h	0	493	0	0	0	541	0	0
V/C Ratio (X)	0.00	0.29	0.00	0.00	0.00	0.24	0.00	0.00
Avail Cap (c_a), veh/h	0	1359	0	0	0	1492	0	0
Upstream Filter (I)	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	5.8	0.0	0.0	0.0	5.7	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.3	0.0	0.0	0.0	0.2	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	6.1	0.0	0.0	0.0	5.9	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.7	0.0	0.0	0.0	0.6	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	0
Lane Assignment						T+R		
Lanes in Grp	0	0	0	0	0	1	0	0
Grp Vol (v), veh/h	0	0	0	0	0	133	0	0
Grp Sat Flow (s), veh/h/ln	0	0	0	0	0	1763	0	0
Q Serve Time (g_s), s	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	0.00	0.00	0.74	0.00	0.39	0.00	0.00
Lane Grp Cap (c), veh/h	0	0	0	0	0	533	0	0
V/C Ratio (X)	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00
Avail Cap (c_a), veh/h	0	0	0	0	0	1469	0	0
Upstream Filter (I)	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Intersection Summary								
HCM 2010 Ctrl Delay		6.7						
HCM 2010 LOS		A						

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	199	43	71	200	70	135
Future Volume (Veh/h)	199	43	71	200	70	135
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.83	0.74	0.86	0.92	0.63
Hourly flow rate (vph)	212	52	96	233	76	214
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			264		546	132
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			264		546	132
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		83	76
cM capacity (veh/h)			1312		438	899

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	141	123	174	155	290
Volume Left	0	0	96	0	76
Volume Right	0	52	0	0	214
cSH	1700	1700	1312	1700	705
Volume to Capacity	0.08	0.07	0.07	0.09	0.41
Queue Length 95th (ft)	0	0	6	0	50
Control Delay (s)	0.0	0.0	4.7	0.0	13.6
Lane LOS			A		B
Approach Delay (s)	0.0		2.5		13.6
Approach LOS					B

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	254	94	48	257	179	23
Future Volume (veh/h)	254	94	48	257	179	23
Number	6	16	5	2	7	14
Initial Q, veh	0	0	0	0	0	0
Ped-Bike Adj (A_pbT)		1.00	1.00		1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1886	1900	1900	1884	1834	1900
Adj Flow Rate, veh/h	282	112	72	338	344	40
Adj No. of Lanes	2	0	0	2	0	0
Peak Hour Factor	0.90	0.84	0.67	0.76	0.52	0.58
Percent Heavy Veh, %	1	1	1	1	0	0
Opposing Right Turn Influence			Yes		Yes	
Cap, veh/h	823	320	294	951	486	57
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Prop Arrive On Green	0.33	0.33	0.33	0.33	0.32	0.32
Ln Grp Delay, s/veh	6.8	6.8	6.7	6.9	9.3	0.0
Ln Grp LOS	A	A	A	A	A	
Approach Vol, veh/h	394			410	385	
Approach Delay, s/veh	6.8			6.8	9.3	
Approach LOS	A			A	A	

Timer:	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Case No		8.0		12.0		8.0		
Phs Duration (G+Y+Rc), s		12.7		12.4		12.7		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green (Gmax), s		18.0		18.0		18.0		
Max Allow Headway (MAH), s		5.1		3.9		5.1		
Max Q Clear (g_c+I1), s		4.2		6.9		4.2		
Green Ext Time (g_e), s		3.9		1.0		3.9		
Prob of Phs Call (p_c)		1.00		1.00		1.00		
Prob of Max Out (p_x)		0.24		0.03		0.24		
Left-Turn Movement Data								
Assigned Mvmt		5		7		1		
Mvmt Sat Flow, veh/h		316		1542		0		
Through Movement Data								
Assigned Mvmt		2		4		6		
Mvmt Sat Flow, veh/h		3002		4		2620		
Right-Turn Movement Data								
Assigned Mvmt		12		14		16		
Mvmt Sat Flow, veh/h		0		179		980		
Left Lane Group Data								
Assigned Mvmt	0	5	0	7	0	1	0	0
Lane Assignment		L+T		L+T+R				
Lanes in Grp	0	1	0	1	0	0	0	0
Grp Vol (v), veh/h	0	219	0	385	0	0	0	0
Grp Sat Flow (s), veh/h/ln	0	1603	0	1726	0	0	0	0
Q Serve Time (g_s), s	0.0	0.0	0.0	4.9	0.0	0.0	0.0	0.0

Cycle Q Clear Time (g_c), s	0.0	2.2	0.0	4.9	0.0	0.0	0.0	0.0
Perm LT Sat Flow (s_l), veh/h/ln	0	1006	0	0	0	0	0	0
Shared LT Sat Flow (s_sh), veh/h/ln	0	0	0	0	0	0	0	0
Perm LT Eff Green (g_p), s	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Serve Time (g_u), s	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
Perm LT Q Serve Time (g_ps), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time to First Blk (g_f), s	0.0	2.8	0.0	0.0	0.0	8.2	0.0	0.0
Serve Time pre Blk (g_fs), s	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Prop LT Inside Lane (P_L)	0.00	0.33	0.00	0.89	0.00	0.00	0.00	0.00
Lane Grp Cap (c), veh/h	0	713	0	544	0	0	0	0
V/C Ratio (X)	0.00	0.31	0.00	0.71	0.00	0.00	0.00	0.00
Avail Cap (c_a), veh/h	0	1284	0	1237	0	0	0	0
Upstream Filter (I)	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	6.5	0.0	7.6	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.2	0.0	1.7	0.0	0.0	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	6.7	0.0	9.3	0.0	0.0	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	1.2	0.0	2.2	0.0	0.0	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	1.2	0.0	2.5	0.0	0.0	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.04	0.00	0.03	0.00	0.00	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Middle Lane Group Data								
Assigned Mvmt	0	2	0	4	0	6	0	0
Lane Assignment		T				T		
Lanes in Grp	0	1	0	0	0	1	0	0
Grp Vol (v), veh/h	0	191	0	0	0	198	0	0
Grp Sat Flow (s), veh/h/ln	0	1629	0	0	0	1792	0	0
Q Serve Time (g_s), s	0.0	2.2	0.0	0.0	0.0	2.1	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	2.2	0.0	0.0	0.0	2.1	0.0	0.0
Lane Grp Cap (c), veh/h	0	531	0	0	0	584	0	0
V/C Ratio (X)	0.00	0.36	0.00	0.00	0.00	0.34	0.00	0.00
Avail Cap (c_a), veh/h	0	1168	0	0	0	1285	0	0
Upstream Filter (I)	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	6.5	0.0	0.0	0.0	6.4	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.4	0.0	0.0	0.0	0.3	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	6.9	0.0	0.0	0.0	6.8	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	1.1	0.0	0.0	0.0	1.0	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Right Lane Group Data								
Assigned Mvmt	0	12	0	14	0	16	0	0
Lane Assignment						T+R		
Lanes in Grp	0	0	0	0	0	1	0	0
Grp Vol (v), veh/h	0	0	0	0	0	196	0	0
Grp Sat Flow (s), veh/h/ln	0	0	0	0	0	1714	0	0
Q Serve Time (g_s), s	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
Cycle Q Clear Time (g_c), s	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
Prot RT Sat Flow (s_R), veh/h/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prot RT Eff Green (g_R), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop RT Outside Lane (P_R)	0.00	0.00	0.00	0.10	0.00	0.57	0.00	0.00
Lane Grp Cap (c), veh/h	0	0	0	0	0	559	0	0
V/C Ratio (X)	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00
Avail Cap (c_a), veh/h	0	0	0	0	0	1229	0	0
Upstream Filter (I)	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d1), s/veh	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0
1st-Term Q (Q1), veh/ln	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
2nd-Term Q (Q2), veh/ln	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
3rd-Term Q (Q3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q Factor (f_B%)	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00
%ile Back of Q (50%), veh/ln	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
%ile Storage Ratio (RQ%)	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Initial Q (Qb), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final (Residual) Q (Qe), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Delay (ds), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Q (Qs), veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sat Cap (cs), veh/h	0	0	0	0	0	0	0	0
Initial Q Clear Time (tc), h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Intersection Summary								
HCM 2010 Ctrl Delay		7.6						
HCM 2010 LOS		A						

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	284	61	77	216	76	147
Future Volume (Veh/h)	284	61	77	216	76	147
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	316	68	86	240	84	163
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			384		642	192
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			384		642	192
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		78	80
cM capacity (veh/h)			1186		381	823

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	211	173	166	160	247
Volume Left	0	0	86	0	84
Volume Right	0	68	0	0	163
cSH	1700	1700	1186	1700	591
Volume to Capacity	0.12	0.10	0.07	0.09	0.42
Queue Length 95th (ft)	0	0	6	0	51
Control Delay (s)	0.0	0.0	4.6	0.0	15.4
Lane LOS			A		C
Approach Delay (s)	0.0		2.3		15.4
Approach LOS					C

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	41.3%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

2nd STREET ROAD DIET ANALYSIS

City of Gillette 2017 Long Range Transportation Plan

2nd Street Road Diet Analysis – APPENDIX D

This appendix to the 2017 Long Range Transportation Plan documents the traffic analysis done for a proposed road diet on 2nd Street corridor between 4J Road and Brooks Avenue, located in the City of Gillette, Wyoming. A road diet is the conversion of four-lane undivided roadway into three-lane roadway (two through lanes and a center two-way left-turn (TWLT) lane).

Road Diets have the potential to improve safety, convenience, and quality of life for all road users. Operational and design changes that promote safety include reduced vehicle speed differentials, and reduced vehicle conflicts with other vehicles, pedestrians and bicycles. By removing the inside lanes shared by through and turning traffic, many vehicle to vehicle conflicts such as sideswipes, rear ends, and left turn conflicts can be reduced.

2nd Street is currently 4 lanes from Brooks Avenue on the east to 4J Road on the west, with no additional lanes at intersections. Three signalized intersections exist in this section including Brooks Avenue, Gillette Avenue, and 4J road. Eight unsignalized intersections also exist in this stretch of roadway.

Figure 1 shows the historic traffic volumes (ADT) on 2nd Street in this area.

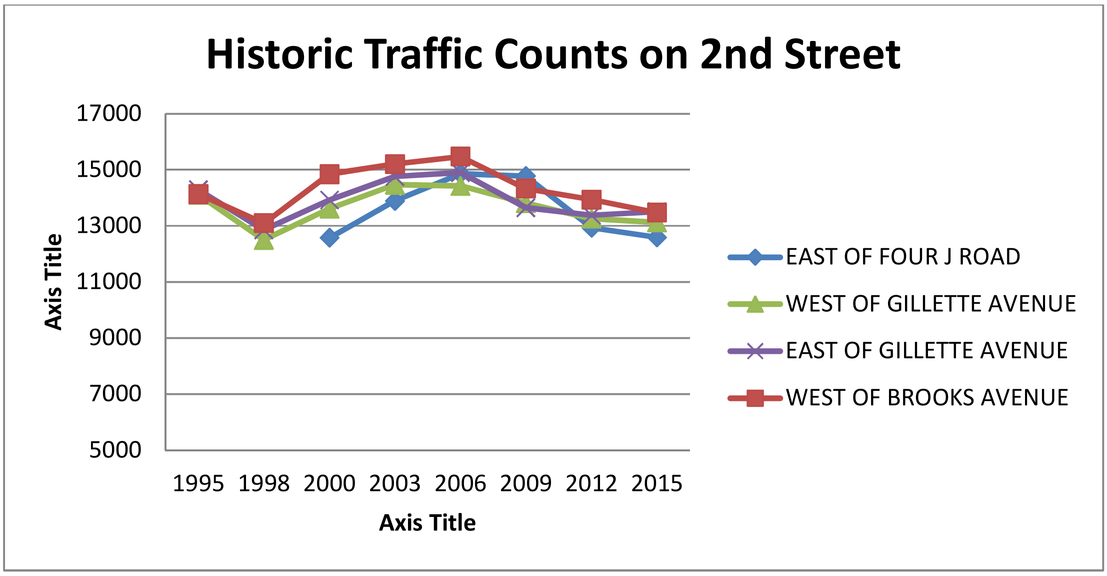


Figure 1: Historic Traffic Counts on 2nd Street in Study Area

Figure 1 shows there has been a steady decrease in traffic on 2nd Street since 2006. The decrease in traffic on 2nd Street is most likely due to an improved roadway network in other parts of Gillette.

A capacity analysis was performed to evaluate the adequacy of a road diet for the segment of East 2nd Street between 4-J Road and Brooks Avenue. The road diet improvements for this segment would be to modify the existing 4-lane facility into a 3-lane facility, which would consist of one lane for each direction and a center lane as a two-way left-turn (TWLT) lane. The TWLT lane would turn into a dedicated left-turn lane at the intersection approach. Figure shows the conceptual layout of the typical 4-lane road and a 3-lane road. The remaining roadway width after the road diet may be utilized as a parking lane, a bicycle lane, or a shoulder.

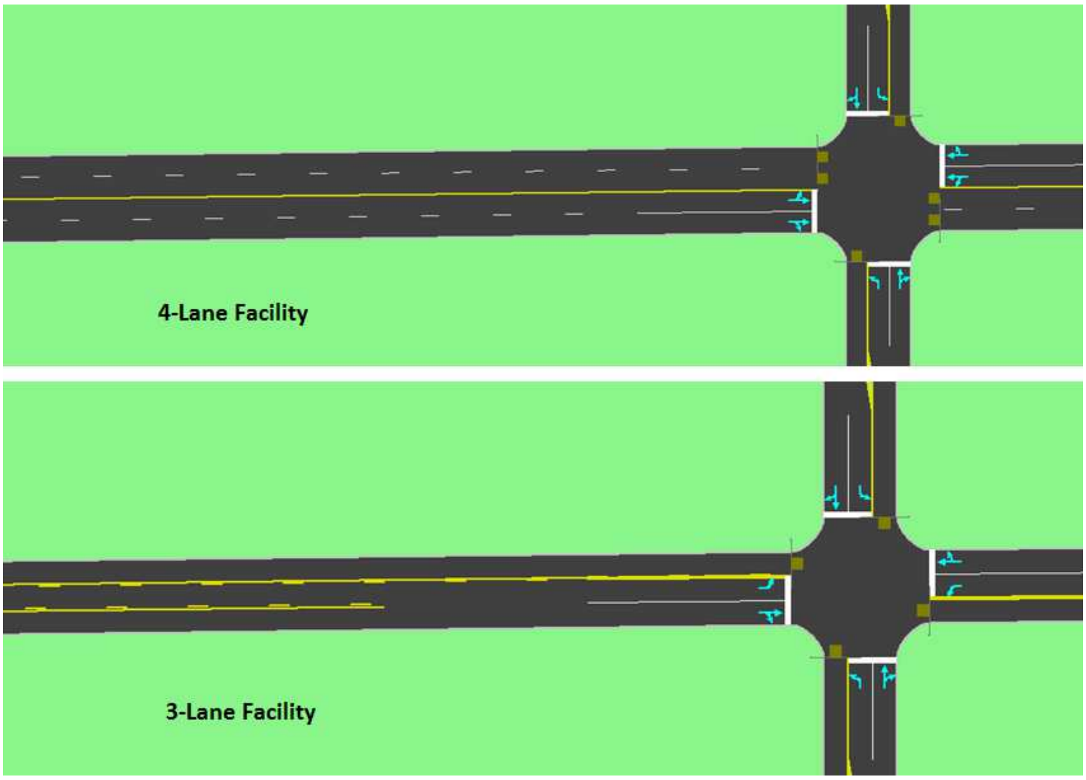


Figure 2: Conceptual Layout of 4-Lane and 3-Lane Roadway

Intersection traffic operations were analyzed at the following three signalized intersections along the study segment of East 2nd Street:

1. 4-J Road,
2. Gillette Avenue, and
3. Brooks Avenue.

Using Synchro Studio 9 traffic modeling software, the intersection delay and level of service (LOS) under the 4-lane and 3-lane scenarios were analyzed based on the Highway Capacity Manual (HCM) 2010 methodology. These outputs were determined for the traffic conditions during the evening (PM) peak hours of the existing year 2015. The AM Peak Hour was not considered in this sensitivity analysis because all volumes were lower than the PM Peak Hour volumes. Turning movement traffic volumes for the existing year were counted in 2015 by Wyoming Department of Transportation (WYDOT). The corresponding 2015 ADT for 2nd Street in the vicinity of Gillette Avenue was around 13,500.

The results of the existing condition and the proposed road diet operations for the 2015 traffic conditions are shown in Table 1.

Table 1 - Existing Traffic Operational Analysis

Intersection	4-Lane (Existing)		3-Lane (Build)	
	Delay	LOS	Delay	LOS
E 2nd Street/4-J Road	7.9	A	8.2	A
E 2nd Street/Gillette Avenue	8.3	A	12.2	B
E 2nd Street/Brooks Avenue	15.9	B	15.5	B

Existing volumes were grown evenly across the three intersections in order to determine at what level of traffic the LOS of the proposed road diet would fall below LOS C. The growth factors at which each intersection operates at a LOS D and LOS F is shown in Table 2 for the PM Peak Hour.

Table 2 - Road Diet – Thresholds for LOS C and D

Intersection	LOS Threshold	Delay	Growth Factor
E 2nd Street/4-J Road	D	36.5	2.06
	F	80.6	2.15
E 2nd Street/Gillette Avenue	D	35.8	2.03
	F	81.1	2.38
E 2nd Street/Brooks Avenue	D	35.7	1.64
	F	82.5	1.80

The earliest any of the three intersections may begin to see LOS D or below would be when the traffic volumes increase by a factor of 1.64 or 164%. The 2^{nd} Street & Brooks Avenue intersection may begin to operate at a LOS D at a 1.64 growth factor and a LOS F with a 1.80 growth factor. The other two intersections may begin to see LOS D or worse once growth in traffic is above a growth factor of 2 or 200%.

Table 3 shows a comparison of the 4-lane and 3-lane operations for increased traffic with a growth factor of 1.64, which corresponds to an ADT of 22,140. For comparison, travel forecasting modeling from the 2016 Long Range Transportation Plan update projects an ADT of around 13,000 for the population scenario of 50,000.

Table 3 Future Operational Analysis – Growth factor of 1.64

Intersection	4-Lane (Existing)		3-Lane (Build)	
	Delay	LOS	Delay	LOS
E 2nd Street/4-J Road	15.7	B	17.3	B
E 2nd Street/Gillette Avenue	9.9	A	14.7	B
E 2nd Street/Brooks Avenue	31.4	C	30.7	C

Figure shows the 2015 p.m. peak hour traffic volumes at the study intersections with existing lane configuration.

Figure 4 shows the 2015 p.m. peak hour traffic volumes at the study intersections with proposed lane configuration.

A detailed review of crashes was conducted and is attached to this document.

In summary, the proposed road diet lane configuration for 2nd Street from Brooks Avenue to 4J Road should operate acceptably for the foreseeable future. Benefits from this lane configuration include improved vehicle, pedestrian, and bicycle safety.

Figure 3: Existing Lane Configuration with 2015 PM Peak Hour Traffic Volumes

Figure 4: Proposed Road Diet Lane Configuration with 2015 PM Peak Hour Traffic Volumes

CRASH ANALYSIS TO ACCOMPANY 2ND STREET ROAD DIET

The Wyoming Department of Transportation (WYDOT) provided crash data for 2nd Street from 4-J Road to Brooks Avenue for the five-year period between 2010 and 2015. This data includes the manner of collision, weather and road conditions, number and severity of injuries, date, location and traffic volume. This data was compiled, analyzed and then compared to statewide and countywide data.

Crash Rate

The crash rate is a measure of the number of crashes in a roadway corridor per million vehicle miles (MVM) travelled. Since a higher number of crashes can generally be expected on roadway corridors with higher traffic volumes, this measurement offers an objective way to compare crash statistics for roadways with varying traffic volumes (which is also described as vehicle exposure). The crash rate is calculated as follows:

$$\text{Crash Rate} = \frac{\text{Total Number of Crashes} \times 1{,}000{,}000}{365 \times \text{Traffic Volume} \times \text{Analysis Time Period} \times \text{Segment Length}}$$

Severity Index

The severity index is a weighted measure of crashes occurring in a roadway corridor, with fatal crashes and crashes resulting in incapacitating injuries weighted more heavily (using a multiplier of 8) as compared to crashes resulting in less serious injuries (multiplier of 3) or property damage only (multiplier of 1) as provided by AASHTO. The severity index is calculated as follows:

$$\text{Severity Index} = \frac{(8 \times \text{Fatal \& Incapacitation Injuries}) + (3 \times \text{Other Injuries}) + \text{Property Damage}}{\text{Total Numbe of Crashes}}$$

Severity Rate

Finally, the severity rate is a measure of the severity of crashes per million vehicle miles (MVM) travelled and is calculated as follows:

$$\text{Severity Rate} = \text{Crash Rate} \times \text{Severity Index}$$

Table 3 compares the crash rate, severity index, and severity rate to state wide averages from 2015. It should be noted that the state wide averages include data collected for all roadway classifications, whereas 2nd Street is classified as a principal arterials.

Table 3 Crash History Comparisons – Statewide Average and 2nd Street from 4-J Road to Brooks Ave (2010 to 2015)

Criteria	Statewide Averages, 2015	2nd Street from 4-J Road to Brooks Ave (2010 to 2015)	Comparison of 2nd Street from 4-J Road to Brooks Ave to Statewide Average
Crash Rate (All Vehicles)	2.84	12.74	349%
Severity Index (All Vehicles)	1.45	1.57	7.7%
Severity Rate (All Vehicles)	4.13	19.96	383%

Source: WYDOT Crash Summary for 2010-2015.

Table 4 compares the crash rate, severity index, and severity rate for 2nd Street from 4-J Road to Brooks Avenue to Campbell County averages from 2015.

Table 4 Crash History Comparisons – Campbell County Average and 2nd Street from 4-J Road to Brooks Ave (2010 to 2015)

Criteria	Campbell County Averages, 2015	2nd Street from 4-J Road to Brooks Ave (2010 to 2015)	Comparison of 2nd Street from 4-J Road to Brooks Ave to County Average
Crash Rate (All Vehicles)	4.37	12.74	191%
Severity Index (All Vehicles)	1.51	1.57	3.9%
Severity Rate (All Vehicles)	6.59	19.96	203%

Source: WYDOT Crash Summary for 2010-2015.

Crash Data Details

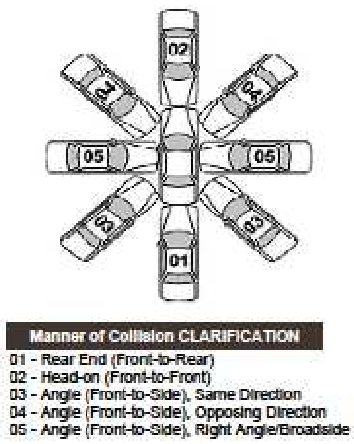
WYDOT provided crash data on 2nd Street from 4-J Road to Brooks Avenue for the five-year period from 2010 to 2015. During this period, a total of 211 crashes occurred on 2nd Street from 4-J Road to Brooks Avenue. Of the 62 crashes with injuries in the study area, ninety four (94) total injuries and no fatalities were reported. Of the 62 crashes with injuries, four (4) were identified as having an incapacitating injury, twenty five (25) were identified as having non-incapacitating injuries, and thirty three (33) were identified as having possible injuries.

Table 5 presents the number and percentage of crashes and injuries (incapacitating, non-incapacitating and possible injuries) attributed to types of collisions during the five-year analysis period on 2nd Street from 4-J Road to Brooks Avenue.

Table 5 Collision Type – 2nd Street from 4-J Road to Brooks Ave (2010 to 2015)

	Attributes	2015 State Average Crashes	2nd Street Number of Crashes	Percent of Total Crashes	Number of Injuries	Percent of Total Injuries
Manner of Collision	Sideswipe (Same Direction)	2.9%	11	5.2%	0	0.0%
	Angle (front to side), opposing direction	7.2%	21	10.0%	16	17.0%
	Rear End	24.9%	82	38.9%	19	20.2%
	Single Vehicle Crash	19.5%	25	11.8%	16	17.0%
	Angle (Not Specific)	0.5%	2	0.9%	4	4.3%
	Angle right (Front to Side, includes broadside)	17.6%	46	21.8%	35	37.2%
	Head On	3.4%	4	1.9%	3	3.2%
	Rear to Front, Rear, or Side (Normally backing)	7.6%	3	1.4%	1	1.1%
	Angle Same Direction (Front to Side)	8.5%	15	7.1%	0	0.0%
	Unknown	1.5%	3	0.9%	0	0.0%
	Total	**100%**	**211**	**100%**	**94**	**100%**

Source: WYDOT, 2010-2015.



While the WYDOT data does not include specific details of the collisions, some inferences can be drawn from the data on Table 5. Over 60% of the crashes within the study corridor were classified as rear end (same direction) (82 out of 211, or 38.9%) and right angle-front to side (46 out of 211, or 21.8%). Additionally, over 57% of the injuries were associated with these two types of collisions.

When compared to the state wide averages, 2nd Street has higher than average percentage of sideswipe, angle, rear end, and angle right collisions. These manners of collision can be indicative of collision involving a vehicle that is attempting to make a turn. Same direction sideswipes may imply a vehicle is changing lanes to avoid a stopped vehicle making a turn. Angle (front to side) opposing directions are usually associated with vehicles turning into the path of on-coming traffic. While rear end collisions can be associated with a vehicle stopped waiting for a stop light or making a turn. Of the 82 rear end collisions on Table 5, 42 of the collisions, or 51%, occurred at the un-signalized intersections and in between intersections. This may indicate a stopped vehicle making a turn was involved.

Table 6 presents the number and percentage of crashes and injuries (incapacitating, non-incapacitating and possible injuries) attributed to weather, road, and light conditions during the five-year analysis period.

Table 6 Weather, Road, and Light Conditions – 2nd Street from 4-J Road to Brooks Ave (5/1/2008 to 4/30/2013)

Attributes		Number of Crashes	Percent of Total Crashes	Number of Injuries	Percent of Total Injuries
Weather Conditions	Clear	157	74.4%	78	83.0%
	Cloudy	11	5.2%	1	1.1%
	Snow	30	14.2%	7	7.4%
	Rain	5	2.4%	3	3.2%
	Unknown	2	0.9%	1	1.1%
	Sleet/Hail/Freezing Rain	0	0.0%	0	0.0%
	Blowing Snow	6	2.8%	4	4.3%
	Total	**211**	**100%**	**94**	**100%**
Road Conditions	Dry	124	58.8%	59	62.8%
	Ice/Snow	30	14.2%	13	13.8%
	Wet	26	12.3%	12	12.8%
	Snow	26	12.3%	8	8.5%
	Slush	4	1.9%	1	1.1%

	Unknown	1	0.5%	1	1.1%
	Total	**211**	**100%**	**94**	**100%**
Light Conditions	Daylight	174	82.5%	78	83.0%
	Dark (Lighted)	25	11.8%	15	16.0%
	Unknown	1	0.5%	0	0.0%
	Dusk	3	1.4%	1	1.1%
	Dawn	0	0.0%	0	0.0%
	Dark	8	3.8%	0	0.0%
	Total	**211**	**100%**	**94**	**100%**

Source: WYDOT, 2010-2015.

The majority of crashes and injuries on 2nd Street from 4-J Road to Brooks Avenue occurred during clear, dry, and daylight conditions.

Mitigation Strategy

Road Diets have the potential to improve safety, convenience, and quality of life for all road users. Operational and design changes that promote safety include reduced vehicle speed differentials, and reduced vehicle conflicts with other vehicles, pedestrians and bicycles. By removing the inside lanes shared by through and turning traffic, many vehicle to vehicle conflicts such as sideswipes, rear ends, and left turn conflicts can be reduced.

While it is common to refer to the “cause” of a crash, in reality, most crashes cannot be related to a singular causal event. Instead, crashes are the result of a convergence of a series of events that are influenced by a number of contributing factors (time of day, driver attentiveness, speed, vehicle condition, road design, etc.). These contributing factors influence the sequence of events before, during, and after a crash.

In some cases, roadway/environment may affect the expected average crash frequency. The quantification of this effect is referred to as a crash modification factor (CMF).

CMF is an index of how much crash experience is expected to change following a modification in design or traffic control. CMF is the ratio between the number of crashes per unit of time expected after a modification or measure is implemented and the number of crashes per unit of time estimated if the change does not take place. (Highway Safety Manual, 2010)

Table 7 summarizes the CMF for converting 2nd Street from 4-J Road to Brooks Avenue from a four-lane configuration to the proposed three-lane configuration with a center two-way left-turn lane. Standard error represents an estimated deviation (addition and subtraction) from the CMF that is expected to contain approximately 68% of results. While several comprehensive studies have been conducted on 4-lane to 3-lane with two way left turn lane have been conducted, the CMF selected was developed by the Iowa DOT and seemed to match the size and demographics of the City of Gillette. The Iowa study was based on 15 treatment sites with an additional 296 reference sites. The study focused on small urban communities with an average population of 17,000. The 15 treatment locations had a mean length of 1.02 miles and AADT after conversion ranged from 3,718 to 13,908 vpd.

Table 7 Potential Crash Effects of Four to Three Lane Conversion, or "Road Diet"

Treatment	Setting (Roadway Type)	Crash Type (Severity)	Crash Modification Factor (CMF)	Standard Error
Four to three lane conversion	Urban Arterial	All Types (All Severities)	0.53[1]	0.02

Source: Harkey, D., Srinivasan, R., Baek, J., Council, F., Eccles, K., Lefler, N., Gross, F., Persaud, B., Lyon, C., Hauer, E., and Bonneson, J.A., "Crash Reduction Factors for Traffic Engineering and ITS Improvements", NCHRP Report No. 617, (2008).

The expected change in average crash frequency was analyzed for all types of crashes, including the two highest crash types right-angle and rear-end crashes, following the conversion of 2nd Street from 4-J Road to Brooks Avenue from a four-lane configuration to the proposed three-lane configuration with a center two-way left-turn lane.

The average crash frequency during the five-year analysis period was calculated as follows:

$$\text{Average Crash Frequency (crashes per year)} = \frac{\text{(Total Number of Crashes)}}{\text{Period (years)}}$$

Table 8 presents the number of crashes and the crash frequency on 2nd Street from 4-J Road to Brooks Avenue at and between the study intersections and lists the expected change in the average crash frequencies for all crashes including the two highest crash types right-angle and rear-end crashes. The low and high figures represent an estimated range of variability (standard error) that is expected to contain approximately 68% of results. The CMF is multiplied directly with the base average crash frequency to estimate the projected average crash frequency following the conversion of 2nd Street from 4-J Road to Brooks Avenue from a four-lane configuration to the proposed three-lane configuration with a center two-way left-turn lane. At the 95% confidence level the upper and lower limits can be calculated using the following formulas:

$$\text{Low Estimate: CMF} - 1.96 \times \text{Standard Error} = 0.71 - 1.96 \times 0.02 = 0.67$$

$$\text{High Estimate: CMF} + 1.96 \times \text{Standard Error} = 0.71 + 1.96 \times 0.02 = 0.75$$

Table 8 Average Crash Frequency for All Crash Types – 2nd Street from 4-J to Brooks (2010 to 2015)

Location		Crashes (2010-2015)	Crash Frequency (All Crash Types and Severities)	Expected Change to Existing Crash Frequency	
				Low Estimate	High Estimate
1	2nd Street and 4-J Road	38	7.6	3.7	4.3
	2nd Street between 4-J Road and Rockpile	0	0	0.0	0.0
2	2nd Street and Rockpile Blvd	2	0.4	0.2	0.2
	2nd Street between Rockpile and Richards	2	0.4	0.2	0.2
3	2nd Street and Richards Avenue	6	1.2	0.6	0.7
	2nd Street between Richards and Ross	1	0.2	0.1	0.1
4	2nd Street and Ross Avenue	8	1.6	0.8	0.9
	2nd Street between Ross and Warren	1	0.2	0.1	0.1
5	2nd Street and Warren Avenue	13	2.6	1.3	1.5
	2nd Street between Warren and Gillette	8	1.6	0.8	0.9
6	2nd Street and Gillette Avenue	44	8.8	4.3	5.0
	2nd Street between Gillette and Kendrick	1	0.2	0.1	0.1
7	2nd Street and Kendrick Avenue	12	2.6	1.2	1.4
	2nd Street between Kendrick and Carey	0	0	0.0	0.0
8	2nd Street and Carey Avenue	8	1.6	0.8	0.9
	2nd Street between Carey and Emerson	0	0	0.0	0.0
9	2nd Street and Emerson Avenue	4	0.8	0.4	0.5
	2nd Street between Emerson and Osborne.	4	0.8	0.4	0.5
10	2nd Street and Osborne Avenue	9	1.8	0.9	1.0

	2nd Street between Osborne and Brooks	7	1.4	0.7	0.8
11	2nd Street and Brooks Avenue	43	8.6	4.2	4.9
	Total: 2nd Street from 4-J Road to Brooks Street	**211**	**42.2**	**20.7**	**24.0**

Source: WYDOT, 2010-2015.

The study intersection with the highest number of crashes and the highest crash frequency during the five-year analysis period occurred at 2nd Street and Gillette Avenue. The higher number of crashes at this intersection is not unexpected due to the higher volume of peak hour traffic as well as higher turning volumes.

Table 8 indicates that the average crash frequency for all types of crashes (all severities) is likely to decrease on 2nd Street from 4-J Road to Brooks Avenue by approximately 18 to 22 crashes per year due to the conversion from a four-lane to three-lane roadway with a center two-way left-turn.

Based on this expected reduction to the frequency of crashes along the 2nd Street corridor through the reconfiguration from four-lanes to three-lanes, a 3-lane typical section appears justified.

Impacts at Unsignalized Intersections and Side Street Access

In a white paper report titled "Guidelines for Road Diet Conversions, November 2012" submitted to the 2012 Transportation Research Board Annual meeting, Dr. N. Stamatiadies and A. Kick with the University of Kentucky evaluated the impacts to turning movements at signalized and un-signalized intersections using historical data, computer simulations and statistical analysis. The study used Critical Lane Analysis (CLA) to determine the capacity for various land configuration and volumes. CLA uses intersection geometry and traffic volumes to measure intersection performance and maximum capacity.

The computer simulations were conducted with Corridor Simulation (CORSIM) software. The CORSIM results were then analyzed using the Statistical Package for Social Sciences (SPSS) to develop road diet viability based on main and side street traffic volumes.

Un-signalized Intersections

In the study area, 8 of the 11 intersection are un-signalized with 4-J Road, Gillette Avenue, and Brooks Avenue having signals. In the "Guidelines for Road Diet Conversions" study, a delay and queuing analysis was performed for un-signalized intersections at varying traffic volumes and percentage of left turns from the main road. When compared to the undivided 4-lane, left turn traffic on the main road experienced slightly higher delays with the road diet option. However, the delay differences were very small, less than 2.5 seconds per vehicle and less than 1 second per vehicle in most traffic volume scenarios.

Side Street Access

The study also evaluated the delay for side streets trying to access the main road at un-signalized intersections. In the analysis, the road diet option improved the queuing time when compared to the 4 lane main road for any combination of main road volume and left-turn percentages. The apparent gains in level of service for side street traffic access to the road diet section may outweigh the minor increase in delays for left-turns on the main road.

1901 Energy Court, Suite 170 | Gillette, Wyoming 82718
307.686.4181

Lab
1800 W. Warlow, Unit A | Gillette, Wyoming 82716
307.686.4181