Draft Preliminary Report

Campbell County Coal Belt Transportation Study

Prepared for:

Campbell County, Wyoming
&
Wyoming Department of Transportation

Prepared by:

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Gillette, Wyoming

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Engineers Surveyors Planners

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KLJ Project Number – 10409112

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Phillip Giffin, P.E.	***Campbell County***
Josh Jundt, P.E.	***WYDOT***
Kevin McCoy	***WYDOT***
Tom Bonds	***FHWA***

DISCLAIMER

This document has been prepared using funds from the United States Department of Transportation. The United States Department of Transportation assumes no responsibility for the contents or us thereof. The firm of Kadrmas, Lee & Jackson prepared this document.

CERTIFICATION

I hereby certify that this transportation study for the coal-producing region of Campbell County, Wyoming was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State Wyoming.

_____ _____

Daniel T. Roberts, PE Date

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1.0 Introduction and Study Objective

The development of a transportation plan for the coal production regions (Coal Belt) of Campbell County is an important step toward establishing a future vision for sustained growth, development and industry operations. The region is highly dependent on the mobility, access and service provided by the surrounding transportation system. A long-term transportation plan will provide a framework assisting Campbell County staff, elected officials and appointed viewers with the following:

- *Making key decisions toward identifying and prioritizing roadways needing improvement, upgrades or extensions*
- *Preserving future corridors*
- *Clear and comprehensive decisions toward requests for roadway vacations and realignments*
- *The ability to effectively discuss collaborative implementation and funding efforts for new roadway projects*

Transportation funding can be a complex process involving private, local, state and federal agencies. Timeframes for need and funding availability do not often coincide with one another creating unique funding challenges and opportunities. The guidance provided by a comprehensive transportation plan will serve as a useful tool in the process of organizing opportunities and obtaining funding for roadway improvement projects.

Realizing the need to have a comprehensive transportation plan, Campbell County retained Kadrmas, Lee & Jackson (KL&J) in conjunction with WYDOT in September of 2009 to develop a transportation plan through the 2040 horizon year. The study objective has been to develop a prioritized, comprehensive transportation plan that services the primary coal, oil and gas production areas within Campbell County (see **FIGURE 1-1**). The study team conducted an extensive data collection and Stakeholder input process prior to analyzing Campbell County's existing roadway network and developing new roadway alternatives. The study was subsequently conducted in two phases involving the following work activities:

- *Phase I – identify Stakeholders, develop and implement Stakeholder input processes, collect data and conduct study needs analysis and identify initial funding source.*

- *Phase II - collect data and analyze the present roadway network, project potential corridors using GIS modeling, develop and prioritize transportation network alternatives through 2040*

The findings of the study are documented in this two-volume report. This volume describes the data collection and technical and policy framework for the Coal Belt Transportation Plan; summarizes findings from the technical analyses and provides recommendations for plan priorities and implementation. The detailed technical and non-technical data supporting the findings are provided in a volume of Appendices to this report.

1.1 Background

Campbell County is home to over 13 surface coal mines that collectively produce over 1/3 of the nation's coal. The surface mining coal industry has been active in Campbell County since the 1970s. Coal fired power plants are currently producing nearly 45 percent of our nation's energy. The nation's present high dependency on a resource that is easily accessible and abundant is a strong indicator that coal will remain the primary fossil fuel for energy production well into the future. As surface mines progress, they must eliminate, rebuild or reconfigure infrastructure at or below the surface to gain access to all mineable coal. Considerable advanced planning and coordination are necessary to respond to these needs while accommodating those of affected private industry, private land owners and government agencies.

The oil, gas, mining, rail and associated support services companies are the primary users of the transportation network within the study area. As the single largest employer and industrial operator within the study area, the mining industry has the most significant need for a well-planned and well maintained transportation system. Paved county roads currently provide the needed access to individual mine sites and minimize dust pollution that alternative gravel roads can produce. This can cause exceeding permits at adjacent air quality monitoring stations which could require mining companies to react with changes in mining operations. As mining operations continue to progress, the need to mine through county roads and state highways to access underlying coal is becoming a more common occurrence. Therefore mining companies frequently request to relocate or vacate the affected roadways. A comprehensive transportation plan has not been available to provide necessary guidance to make a decision on a comprehensive and permanent road corridor.

Campbell County's desire was to have a comprehensive transportation plan consisting of prioritized roadway improvements that can be implemented as the mining industry progressions dictate and remain as permanent corridors serving the needs of the individual mine sites, Campbell County citizens and the traveling public.

To this end, the Campbell County Coal Belt Transportation Study addresses:

- *Identification of Stakeholders to be involved in the study input processes*
- *Identification of the transportation needs of the mining industry, private land owners, federal, state and local governments and other industry operators within the study area*
- *Identification of safety, operational and geometric design deficiencies on county roads*
- *Development of a transportation plan to accommodate growth demands and operational needs of the mining industry, private land owners, government agencies and the traveling public*
- *Identification of routes for permanent transportation corridors providing needed access and mobility to replace those impacted by mining activity*

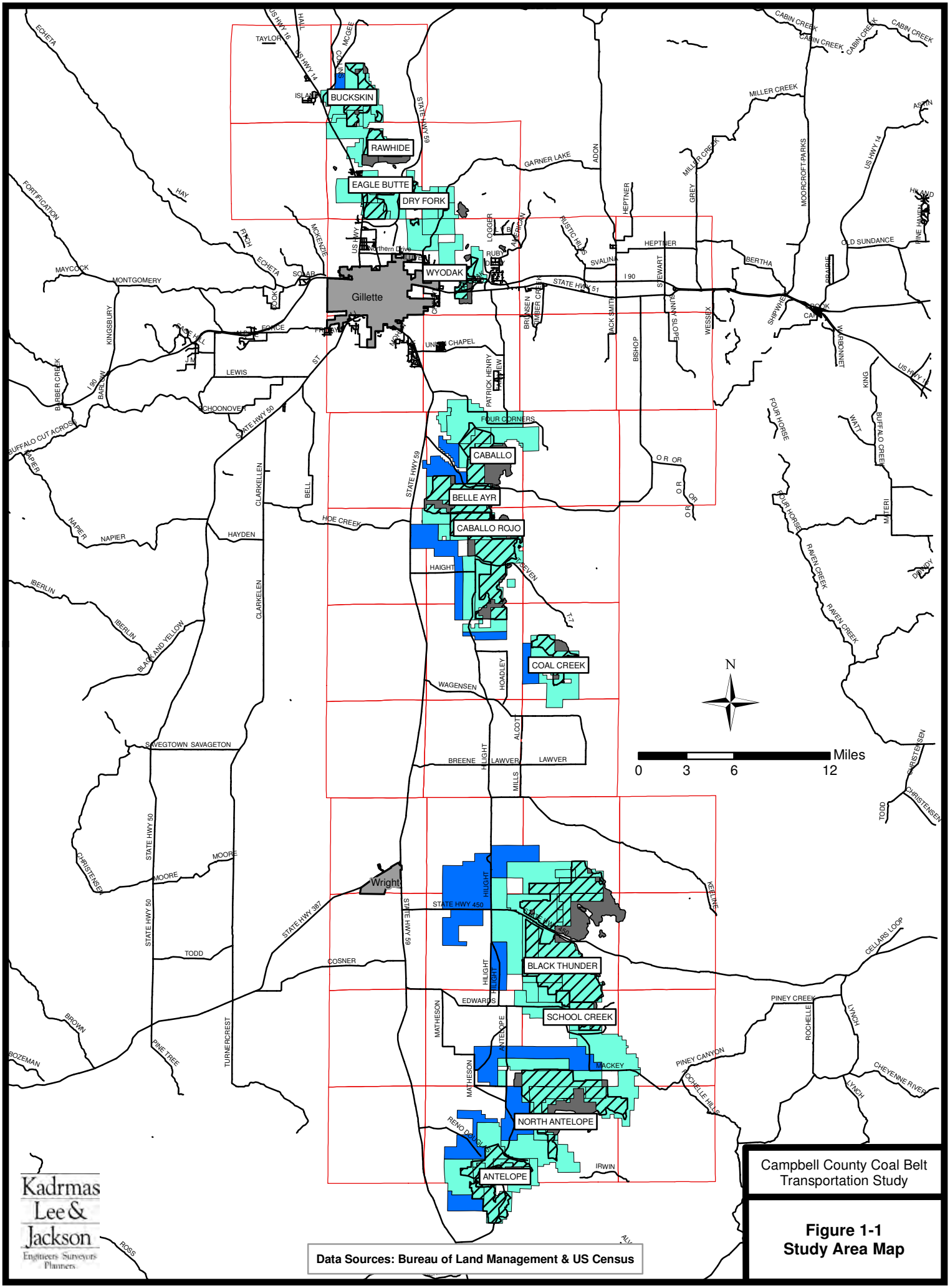
1.2 Study Process

This study was guided by the scope of services provided in **Appendix A** and was developed under the supervision of a Steering Committee chaired by Campbell County and represented by staff members of Campbell County, WYDOT and the Federal Highway Administration (FHWA). The following individuals from these agencies made up the steering committee and provided significant input throughout the study process.

Kevin King, PE	***Campbell County Public Works Director***
Phillip Giffin, PE	***Campbell County Engineering Services Manager***
Josh Jundt, PE	***WYDOT Resident Engineer***
Kevin McCoy	***WYDOT Planner***
James "Tom" Bonds	***FHWA Local Government Coordinator***

The consultant team met with the Steering Committee via conference calls on a bi-weekly basis throughout the study period. A three hour meeting/work session was conducted with the Steering Committee during each phase of the study to confirm findings and study direction prior to moving forward into the next phase. Minutes from Steering Committee conference calls and meetings are included as **Appendix B**.

Having effective public involvement processes throughout the study was one of the key success factors identified by the Steering Committee. Significant efforts were undertaken during Phase I to identify Stakeholders within the study area and solicit input through face-to-face interviews as well as mail-in or on-line questionnaires. Section 2.0 discusses the processes used and information gathered during the Stakeholder identification and involvement period. The study's preliminary findings and prioritized transportation network recommendations were produced during Phase II after which the Stakeholders were given the opportunity to review and comment on the preliminary report prior to public release of the information. The study was released to the general public during a Public Meeting/Open House which all Campbell County residents were invited to attend. Stakeholder review comments and comments from the Public Open House are provided in **Appendix C**.


BUCKSKIN
RAWHIDE
EAGLE BUTTE
DRY FORK
WYODAK
Gillette
CABALLO
BELLE AYR
CABALLO ROJO
COAL CREEK
BLACK THUNDER
SCHOOL CREEK
NORTH ANTELOPE
ANTELOPE
Wright
N
0 3 6 12
Miles
Data Sources: Bureau of Land Management & US Census
Kadrmas Lee & Jackson
Engineers Surveyors Planners
Campbell County Coal Belt Transportation Study
Figure 1-1
Study Area Map

2.0 Data Collection and Stakeholder Input

In order to effectively evaluate Campbell County's transportation system, the study team addressed the need to understand, identify and obtain relevant information from available resources utilizing or expressing interest in the transportation network within the study area. Resources considered include: individual land owners, private and public entities (referred to here-in as Stakeholders) and publicly available information. The following list outlines the resources identified by the study team and Steering Committee which directed both the data collection efforts and identification of Stakeholders.

- Campbell County parcel mapping and County Assessor's tax role records
- BLM mineral lease information
- Utility infrastructure ownership through research from the Public Facilities Commission
- WyGIS database information published by the University of Wyoming
- Wyoming Oil and Gas Conservation Commission
- Knowledge of industry operators
- Knowledge of local, state and federal government interests
- Knowledge of emergency service agencies serving within the study area
- Input from the Steering Committee.

2.1 Stakeholder Identification

Utilizing the surface owners generated from Campbell County's parcel mapping and the County Assessor's tax role records, a list of 2,570 owners within the study area which excluded the city of Gillette was created. With guidance from the Steering Committee the list of owners was sorted to develop a manageable number of Stakeholders. Land ownership in excess of 1,000 acres was established as the threshold number. Stakeholders with subsurface/mineral interests and industry operators were also identified for involvement. A total of 141 Stakeholders were identified and directly contacted (see **Appendix C** for a detailed list). **FIGURE 2-1** represents the surface owner holdings of the contacted Stakeholders and demonstrates a comprehensive representation of surface owners achieved using 1,000 acres as the threshold.

2.2 Stakeholder Involvement

Two methods were used to contact and involve Stakeholders during the input process.

***Method 1*: Written and personal contact letters followed by one-on-one interviews**

Stakeholders involved in this manner were viewed as having significant interest in and potentially having the greatest impact toward transportation corridors and planning. There were

33 Stakeholders identified for participation in this process. The Stakeholders were determined to have surface, mineral, infrastructure asset, regulatory or service interests within the study area. They were further classified under the following categories:

- Mining Stakeholders
- Power Company/ Electrical Stakeholders
- Oil and Gas Stakeholders
- Pipeline Stakeholders
- Office of State Lands & Investments
- State & Federal Agencies
- US Forest Service Stakeholder
- Local Government Stakeholders
- School District
- Emergency Services
- Rail Stakeholders
- Non-Industry/ Non-Government Stakeholders (large private landowners)

The following two Stakeholder groups were added to this participation process even though no known surface, mineral or operational interest representing these industries was identified:

- Wind Energy Stakeholders
- Uranium Mining Stakeholders

The landowners with the largest amount of surface ownership holdings within each of the top, middle and bottom third of the study area were identified for participation in the interview process.

Interview questions were developed specific to each Stakeholder group or industry. In total, 14 specific interview questionnaires were developed, reviewed and confirmed by the Steering Committee. The first Stakeholder interview was conducted on January 26, 2010 with Black Thunder Mine/Thunder Basin Coal. Of the 33 Stakeholders identified to be interviewed, 26 interviews were conducted by the conclusion of Phase I. The interview questionnaires and Stakeholder responses are provided in greater detail in **Appendix D**. The following are key items discussed and learned during the interviews.

- *Most active mine leases will extend mining operations to 2020 or slightly beyond. Lease by Applications (LBA's) are federal coal leases applied for by mining companies that are pending approval by the Bureau of Land Management (BLM). If acquired, LBA's will generally extend mine production plans another 10 years.*
- *Significant changes in operations or technologies are not anticipated in the coal mining industry.*

- *Highway 59 is the most frequently mentioned safety concern. Specific, supporting evidence toward these comments was not generally provided. The fire department indicated a high call-out rate due to accidents on Highway 59.*
- *Mining activity is not expected to move eastward toward the burn line or coal out-crop.*
- *Area between Coal Creek Mine and Black Thunder Mine is of poorer coal quality and unlikely to be mined prior to higher quality areas.*
- *The federal government possesses the majority of the mineral rights within the study area and leases to mine federally owned minerals are obtained through BLM.*
- *The government benefits greatly from having the coal mined. Not being able to mine coal under existing roads would cause a situation referred to as "sterilizing" the coal. Sterilized coal cannot be captured for the inherent energy and economic benefits mining it produces.*
- *BLM would strongly object to new corridors being placed over potentially mineable coal or other minerals.*
- *At-grade crossings over BNSF/UP mainline tracks would not be allowed. Below-grade or above- grade crossings would be allowed. Above grade crossings are preferred by the railroads*
- *Plan any above-grade crossings of mainline rail systems for four track widths in all areas to account for expansion in the mid and northern sections of the study area. Tracks are placed 25ft C-C.*
- *Expansion of mines in the southern sector will impact a larger number of county roads – some within the near term (0-5 yrs).*
- *The middle tier (Belle-Ayr Mine, Cordero Mine and Caballo Mine) will impact county roads within the next 3-5 yrs and Highway 59 by 2030.*
- *Companies plan for and pay for the relocation of roads as economically allowed. The North Antelope-Rochelle Mine (NARM) has a detailed plan of when these will occur through the year 2025.*
- *Quality and safety of roads is considered to be very good overall.*
- *Road access to mine sites is very good overall, with Coal Creek mine having some access and mobility limitations as they are farthest from any major route and do not have direct access to primary corridors.*
- *Mine administrative areas generally will not change in location as mines progress. Subsequently they serve as the primary transportation destinations for each mine site.*
- *No collaborative or cooperative efforts are currently being done by any of the mining companies to comprehensively plan the transportation system outside the areas of impact.*
- *Locate roads where coal has already been mined or will not be mined.*
- *Economics will drive mine growth and their degree of progression, driven by the:*

a. *Price of coal and the cost to deliver it*
    - *Strip ratios (currently 2:1 to 4:1). The limit based on today's coal prices has been projected at 7:1. Areas with higher strip ratios may never be mined which could establish areas of unlikely coal development and more likely areas to place future roads.*

- *DM&E is still moving forward with its rail corridor and is being planned along the eastern side of the current mining operations. Two track alignment options are available.*
- *Coal bed methane wells and operations are not increasing or expanding within the study area. In fact, large operators are planning to decommission up to 300 wells per year.*

***Method 2*: Stakeholder involvement through notice letter with mail-in survey or on-line survey**

Stakeholders owning 1,000 acres or more that were not interviewed were contacted by letter and invited to complete a written survey developed to obtain general input regarding the county's existing transportation network and information regarding the Stakeholder's impact or planned impact on the transportation network. The same written survey was made available to the Stakeholders to take on-line as well to help promote better participation.

A total of 108 surveys were sent to Stakeholders. A total of 22 written surveys were completed and returned and one on-line survey was taken.

The results from individual interviews and survey respondents were then reviewed, sorted, and tabulated to provide an overall summary of Stakeholder input by category. The survey questionnaires and responses, as well as the tabulated results are provided in **Appendix D**. The following is a brief summary of the survey results, highlighting common themes concluded from the data and Stakeholder comments.

- *The county roadway system rates very high in terms of safety, mobility, accessibility to property (highest rating) and roadway condition.*
- *The state and federal highway systems rate very high in terms of mobility and meeting Stakeholder transportation needs. Traffic congestion was rated lowest with only 57 percent of respondents rating it good or above.*
- *The greatest attributes of the roadway network were identified as:*
    a. *Roadway condition*
    b. *Roadway maintenance*
- *The transportation system's greatest shortfalls were listed as:*
    a. *Congestion and truck traffic on Highway 59*
    b. *Speeding and lack of law enforcement*
- *Of 21 survey responses, 81 percent felt transportation needs are being met. The following deficiencies were reported by the balance:*

a. *Fairview Road is not marked for speed and has sharp curves. Motorists tend to drive very fast on this road.*
b. *County roads with higher traffic impact the ability to cross roads to pasture cattle.*
c. *Fire department and ambulatory services have difficulty crossing at-grade railroad crossing to get north of Rozet.*
d. *Paving of county roads.*

- *Widening Highway 59 to four lanes and dust suppression are the most important actions that should be completed in the next six years.*
- *Most respondents to the survey are property owners or both property and business owners. A total of 21 of the 22 respondents make up these two categories. Most own mineral rights. Oil and gas production is occurring on most respondents' properties.*
- *A small amount of subdividing may occur.*
- *Thirty percent are open to transportation corridors running across their property.*
- *Most respondents are ranching businesses not generating much vehicular or truck traffic and do not expect to cause future increases in traffic.*

2.3 Needs Identification & Data Collection

The Stakeholder input process helped the study team better understand the needs of the transportation network's users and the impact they might have on the transportation network now and in the future. The needs and potential impacts of Stakeholders can be summarized as follows:

<u>Needs</u>

1. Accessibility
2. Mobility
3. Safe roads
4. Paved roads
5. A plan regarding where to relocate roads displaced by mining activities

<u>Potential Impacts</u>

1. Mining companies will, where economically feasible, mine through roadways placed in the way of future mine progressions
2. Stakeholders possess existing and are planning new physical barriers such as infrastructure that could impact new road alignments, constructability and costs
3. Environmental constraints can impact new road placement
4. Regulatory constraints can impact road alignments, constructability and costs
5. Right-of-way acquisition can impact constructability and costs

The county's desired outcome of this study was to develop a plan to build permanent transportation corridors. The needs echoed by Stakeholders throughout the input process

supported the same outcome. The initial discovery indicated the transportation network itself did not appear to have any glaring deficiencies neither observed nor supported by available data.
The Stakeholder input provided information and data that would guide the analysis of the existing transportation network and help develop a methodology for identification and prioritization of new road corridors ultimately serving as a long-term transportation plan.

Information and data collected was made available, or developed, in a GIS format. The resultant Geodatabase contained information related to Stakeholders, their needs, their present and future operations and the impacts they may have on a transportation network. As this information was evaluated, a change in approach and methodology occurred. With the support of the Steering Committee, the study team concluded that utilizing the Spatial Analyst Tool within ArcGIS to develop a decision making model would be the best approach to manage all the data and comprehensively evaluate it to determine the best alignments/locations for future transportation corridors. The collected data was filtered to determine if it was necessary for decision making then categorized as a potential obstacle or opportunity in terms of its impact on new corridor development. A complete list of GIS data layers, and their sources, obtained and evaluated are provided in **Appendix E**. **TABLE 2-1** lists the categories and corresponding GIS data layers serving as the primary layers utilized in the GIS model development.

TABLE 2-1 – GIS Data Categories and Data Layers

DATA CATEGORIES	DATA LAYERS
Coal Production Areas	Active Coal Leases Lease by Application (LBA) Reclamation Areas Strip Ratios (Overburden to Coal Thickness Ratios)
Transportation Systems	Classified Roads (Interstate, State Highways, County Roads) Railroads
Natural Barriers	Lakes, Streams, Alluvia's Topography Environmentally Sensitive Areas Forest Service Land Wildlife Management Areas
Man-Made Barriers	Utility Lines (Transmission lines above and below ground) Utility Structures (compressor stations, sub-stations) Hilight Gas Plant Nelson Brothers (Mining Explosives Depot) Bridges Cemeteries Communication Towers Airports
Surface Use	Surface Ownership Type Incorporated Areas

Figures 2-2 through 2-6 represent the above data layers in their GIS shape file format. The application of these GIS layers into a Spatial Analyst Model to develop transportation corridors is described in more detail in Section 4.0 of this report.

2.4 Key Findings - Data Collection and Stakeholder Input

- Stakeholders appear to maintain a general consensus that a well-coordinated and comprehensive roadway improvement plan, as envisioned by Campbell County, is necessary and will be mutually-beneficial in meeting the mobility needs of the Coal Belt region.

- While a majority of survey respondents rated Campbell County's roadway system at or above satisfactory levels (i.e., good, excellent, or superior ratings in regard to overall roadway conditions, accessibility, safety and adequacy of posted speeds), there are existing roadway deficiencies and safety enhancements the county may address as short-term improvements. Specific roadway safety improvements may be identified and implemented while long-range transportation improvement projects are planned and developed over time for future construction.

- The coal mining industry has the most significant impact on the transportation network within the study area. For this reason, this transportation planning study must accommodate the unique conditions associated with mining activity and mining progressions throughout the horizon period.

- Specific pieces of information discovered within coal operations and planning directly affect the approach toward planning permanent road corridor locations. The primary items to be considered are:

    1. **Coal leases** are considered to be either an active lease or a lease by application (LBA). Combined together will provide most mining operations with 20 years of production (10 years for current leases and 10 years for LBAs). GIS shape files of these coal leases were made available through BLM.
    2. **Strip Ratios** of overburden to coal. Based on current market pricing, this information will provide insight on where future mining will likely progress beyond mine-out of current leases and LBAs. A strip ratio of 7:1 is the projected limit based on current market prices.
    3. **Locations of administrative and operations facilities** will generally remain static throughout the life of the mine. Since all traffic to a mine site takes county roads to these locations, they should be considered transportation destination points during the transportation plan development.
    4. **Avoid new corridors over reclamation areas** without implementation of controlled compaction efforts suitable for road construction.
    5. New corridors within mine lease or reclamation areas could divide a mine's **air quality permit boundaries** which could affect mining operations if an air

quality exceedence were to occur within the road corridor. The Air Quality Division of WYDEQ felt a **1-mile buffer from a public road to mining operations** would limit any potential conflicts.

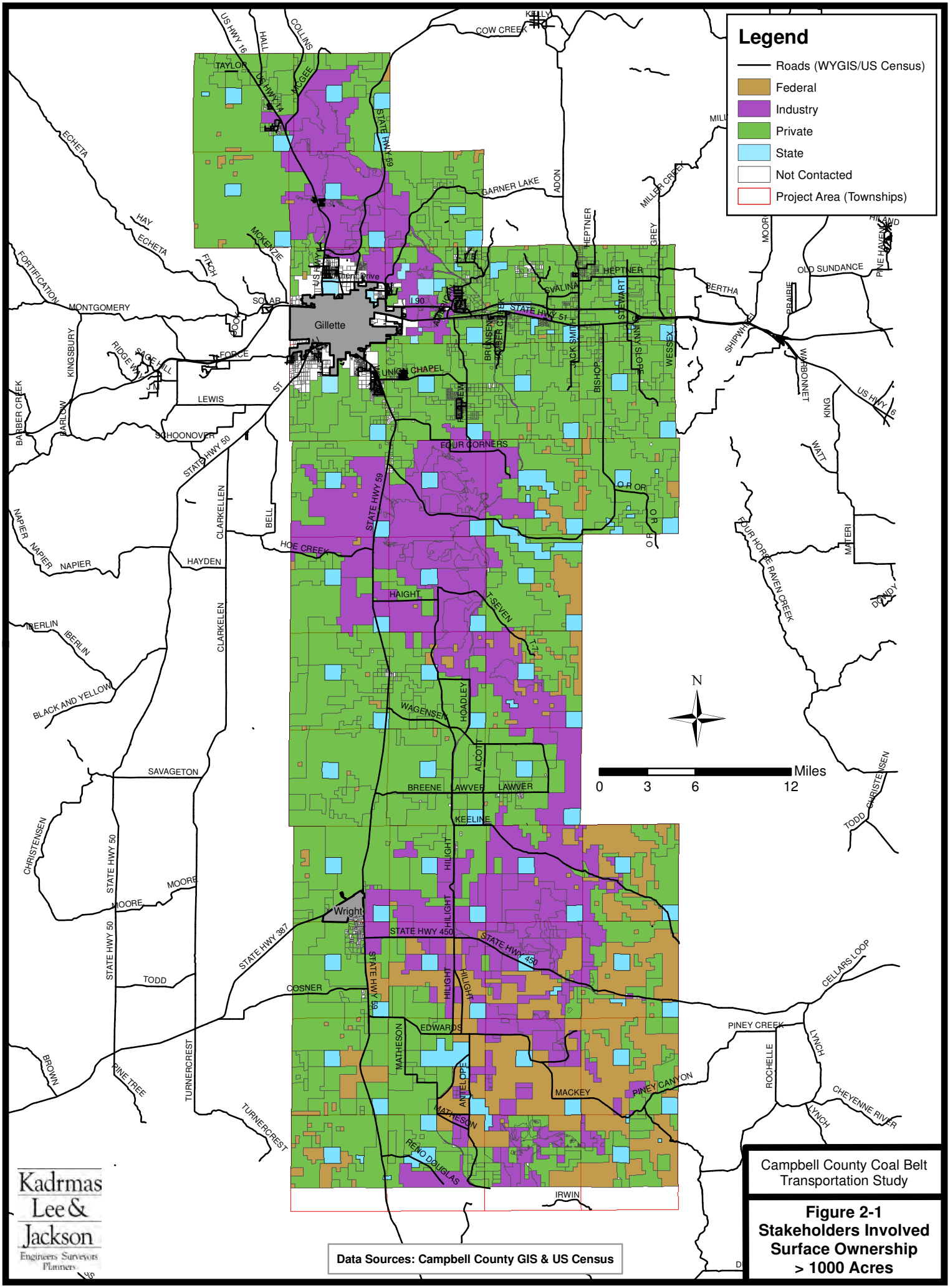
- There are numerous constraints within the study area that impacting, in some fashion, the planning and implementation of new transportation corridors. Some are minor having a minimal effect on cost to build, ability to implement and overall network functionality. Others are more significant with the potential for generating considerable costs to construct, imparting repetitive impacts on network functionality or affecting the overall plausibility of a road corridor altogether. Identifying the constraints/barriers and building a hierarchy of the effect each will have on the transportation network is the key to analyzing and developing a comprehensive transportation plan within the study area.

- Significant increases in land development or dense areas of development and population growth is not expected within the study area.

- Industrial growth as it pertains to mining and its service companies is expected to remain consistent with historical trends. Most mines reported that a 5 percent growth rate in employment as fairly typical.

- Growth in the mineral industry within the study area will remain focused on coal production. Campbell County staff has heard talk of potential uranium mining, but nothing definitive was discovered during the Stakeholder input and data collection process.

- The mining industry anticipates funding road projects based on specific needs and financial feasibility. The interest exists within the industry to minimize the need for these occurrences and participate in a funding program possessing comprehensive benefits with shared costs.


Legend
Roads (WYGIS/US Census)
Federal
Industry
Private
State
Not Contacted
Project Area (Townships)
Gillette
Wright
Miles
0
3
6
12
N
Campbell County Coal Belt Transportation Study
Figure 2-1
Stakeholders Involved
Surface Ownership
> 1000 Acres
Data Sources: Campbell County GIS & US Census
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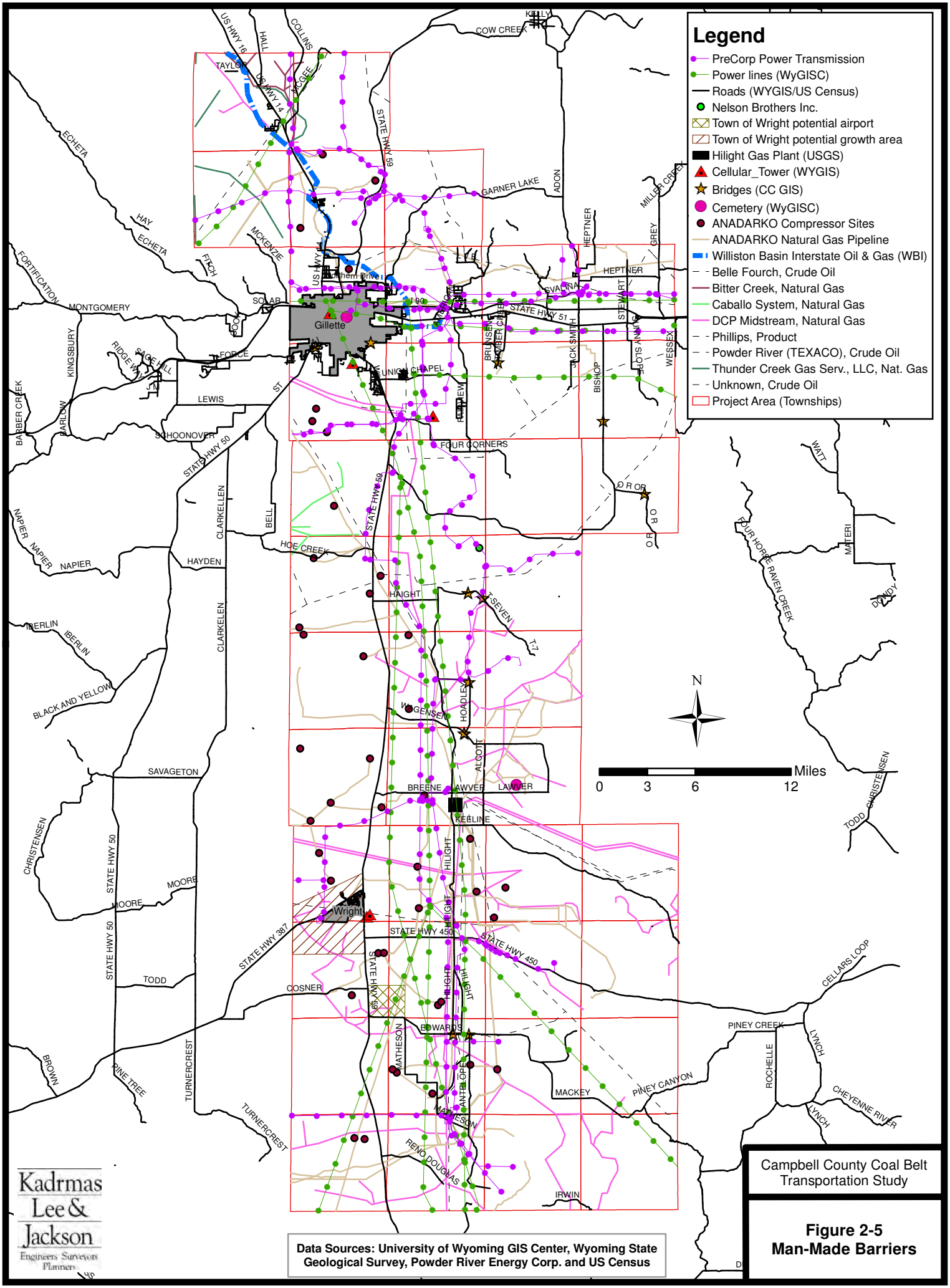
Engineers Surveyors Planners


Legend
PreCorp Power Transmission
Power lines (WyGISC)
Roads (WYGIS/US Census)
Nelson Brothers Inc.
Town of Wright potential airport
Town of Wright potential growth area
Hilight Gas Plant (USGS)
Cellular_Tower (WYGIS)
Bridges (CC GIS)
Cemetery (WyGISC)
ANADARKO Compressor Sites
ANADARKO Natural Gas Pipeline
Williston Basin Interstate Oil & Gas (WBI)
Belle Fourch, Crude Oil
Bitter Creek, Natural Gas
Caballo System, Natural Gas
DCP Midstream, Natural Gas
Phillips, Product
Powder River (TEXACO), Crude Oil
Thunder Creek Gas Serv., LLC, Nat. Gas
Unknown, Crude Oil
Project Area (Townships)
Gillette
Wright
N
Miles
0
3
6
12
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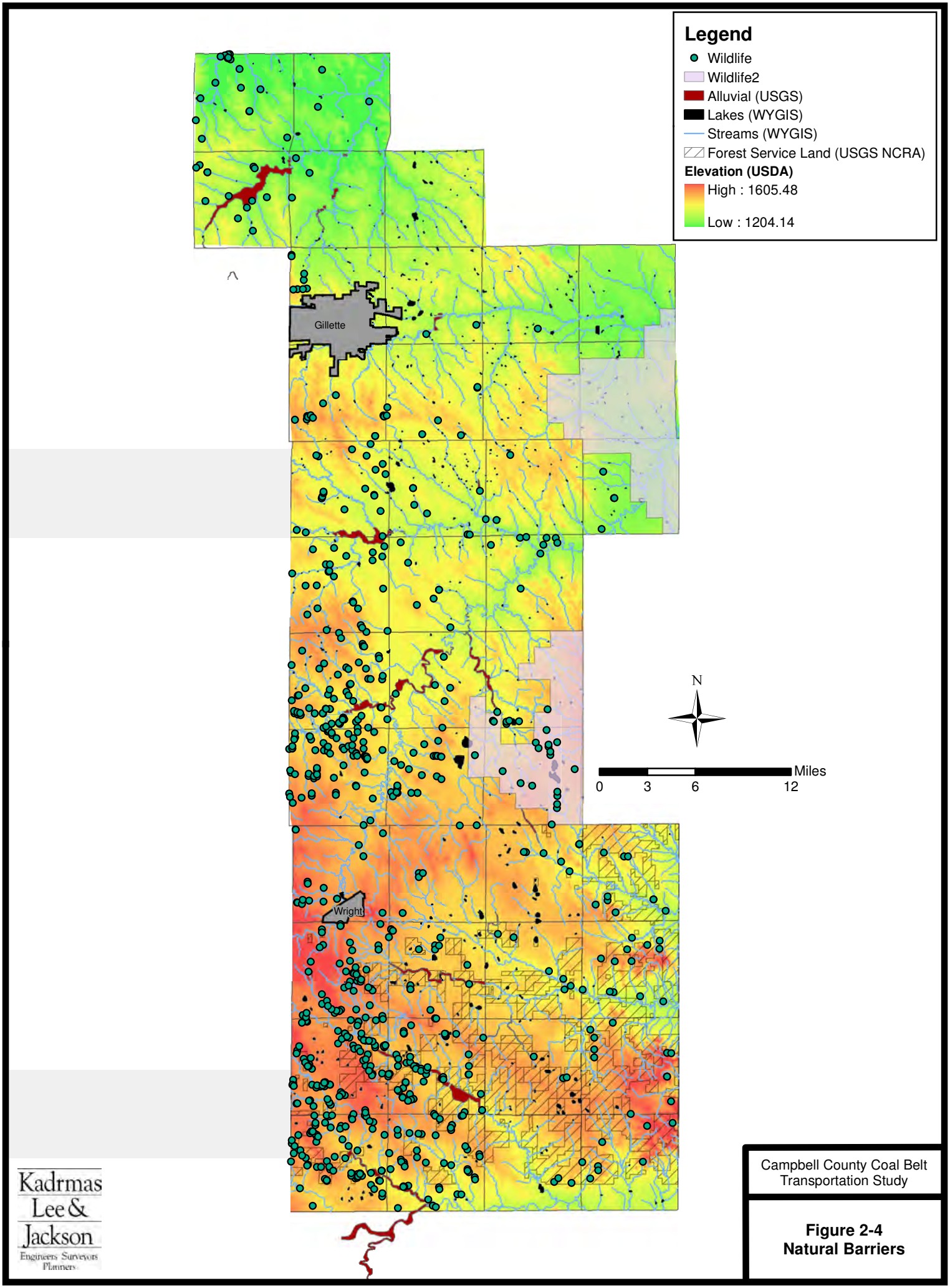
Campbell County Coal Belt Transportation Study
Figure 2-5
Man-Made Barriers
Data Sources: University of Wyoming GIS Center, Wyoming State Geological Survey, Powder River Energy Corp. and US Census



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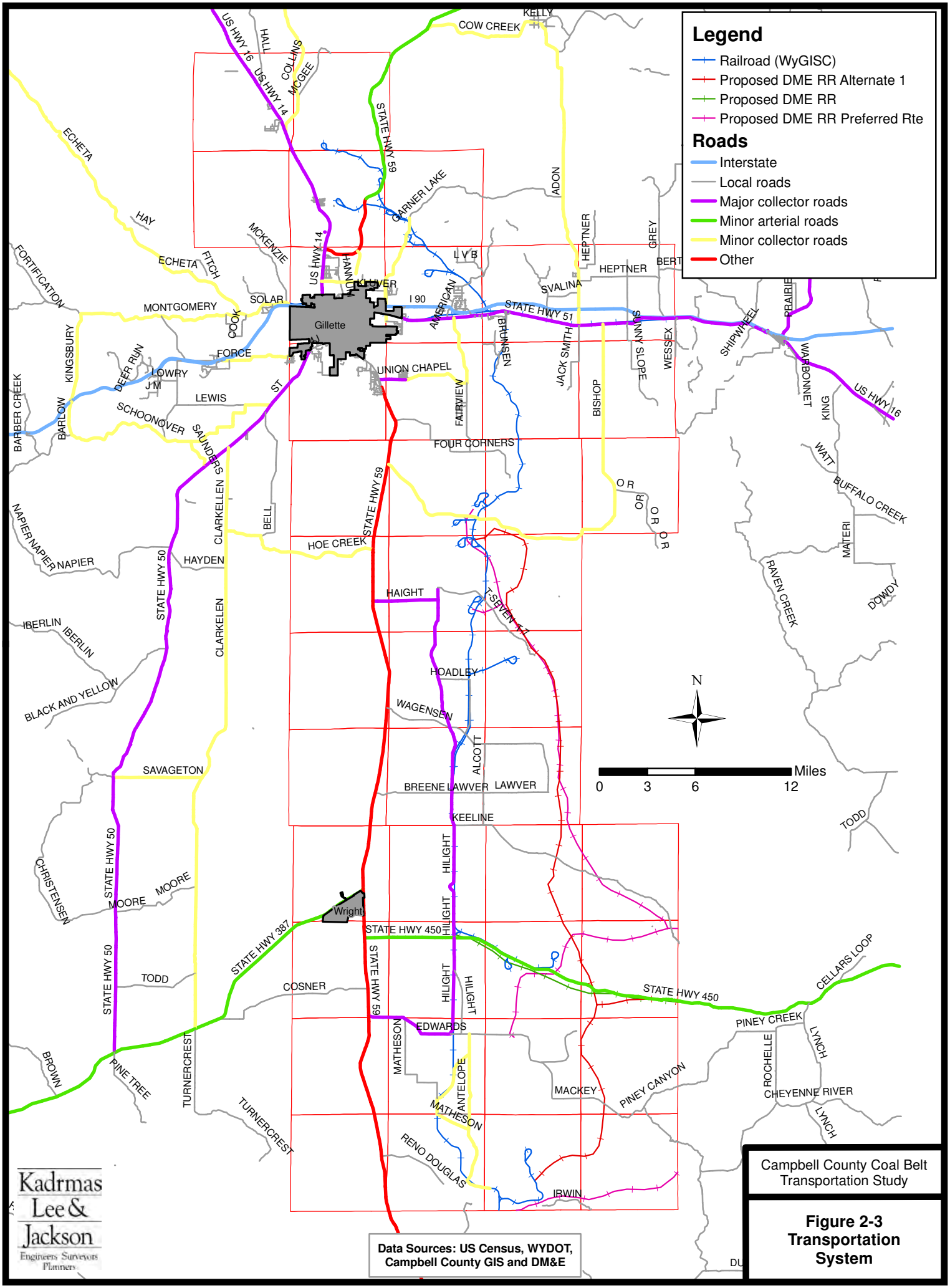
Campbell County Coal Belt Transportation Study

Figure 2-4
Natural Barriers


Legend
Railroad (WyGISC)
Proposed DME RR Alternate 1
Proposed DME RR
Proposed DME RR Preferred Rte
Roads
Interstate
Local roads
Major collector roads
Minor arterial roads
Minor collector roads
Other
Gillette
Wright
I 90
STATE HWY 59
STATE HWY 50
STATE HWY 387
STATE HWY 450
STATE HWY 51
US HWY 16
US HWY 14
COW CREEK
KELLY
HALL
COLLINS
MCGEE
ECHETA
HAY
FITCH
MCKENZIE
FORTIFICATION
MONTGOMERY
SOLAR
COOK
KINGSBURY
DEER RUN
LOWRY
FORCE
JM
LEWIS
SCHOONOVER
SAUNDERS
BARBER CREEK
BARLOW
NAPIER NAPIER NAPIER
HAYDEN
CLARKELLEN
CLARKELLEN
BELL
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IBERLIN
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BLACK AND YELLOW
SAVAGETON
CHRISTENSEN
MOORE
MOORE
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BROWN
PINE TREE
TURNERCREST
TURNERCREST
COSNER
RENO DOUGLAS
MATHESON
MATHESON
ANTELOPE
EDWARDS
HILIGHT
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HILIGHT
HOE CREEK
HAIGHT
HOADLEY
WAGENSEN
ALCOTT
BREENE LAWVER
LAWVER
KEELINE
FOUR CORNERS
UNION CHAPEL
FAIRVIEW
BRUNSEN
JACK SMITH
BISHOP
SUNNY SLOPE
WESSEX
SHIPWHEEL
PRAIRIE
WARBONNET
KING
WATT
BUFFALO CREEK
MATERI
RAVEN CREEK
DOWDY
TODD
CELLARS LOOP
PINEY CREEK
LYNCH
ROCHELLE
CHEYENNE RIVER
LYNCH
PINEY CANYON
MACKEY
IRWIN
DU
GARNER LAKE
ADON
HEPTNER
HEPTNER
GREY
BERT
SVALINA
AMERICAN
LVB
HANNUM
CULVER
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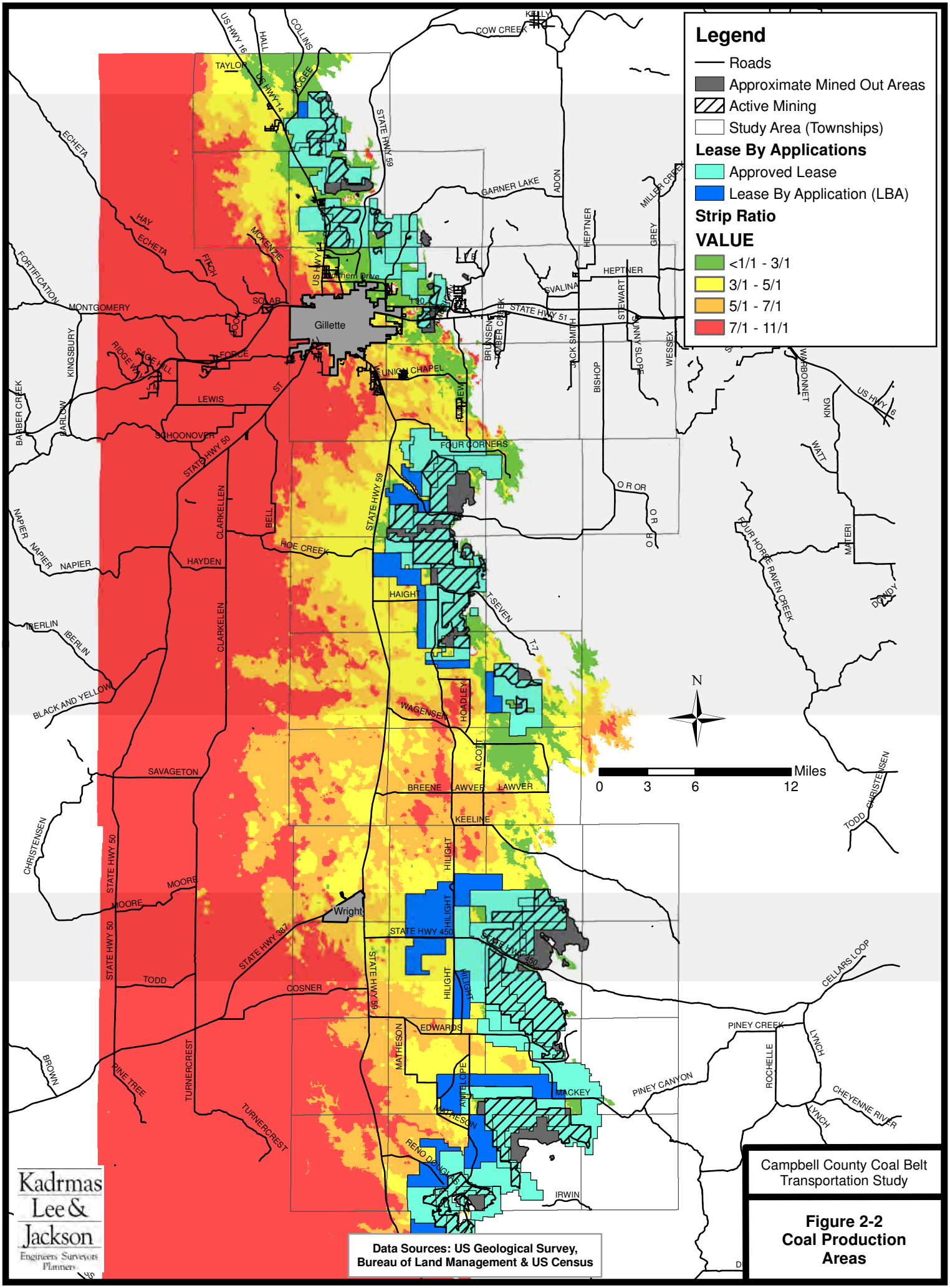
Campbell County Coal Belt Transportation Study
Figure 2-3 Transportation System
Data Sources: US Census, WYDOT, Campbell County GIS and DM&E


Legend
Roads
Approximate Mined Out Areas
Active Mining
Study Area (Townships)
Lease By Applications
Approved Lease
Lease By Application (LBA)
Strip Ratio
VALUE
<1/1 - 3/1
3/1 - 5/1
5/1 - 7/1
7/1 - 11/1
Gillette
Wright
Miles
0 3 6 12
N
Data Sources: US Geological Survey, Bureau of Land Management & US Census
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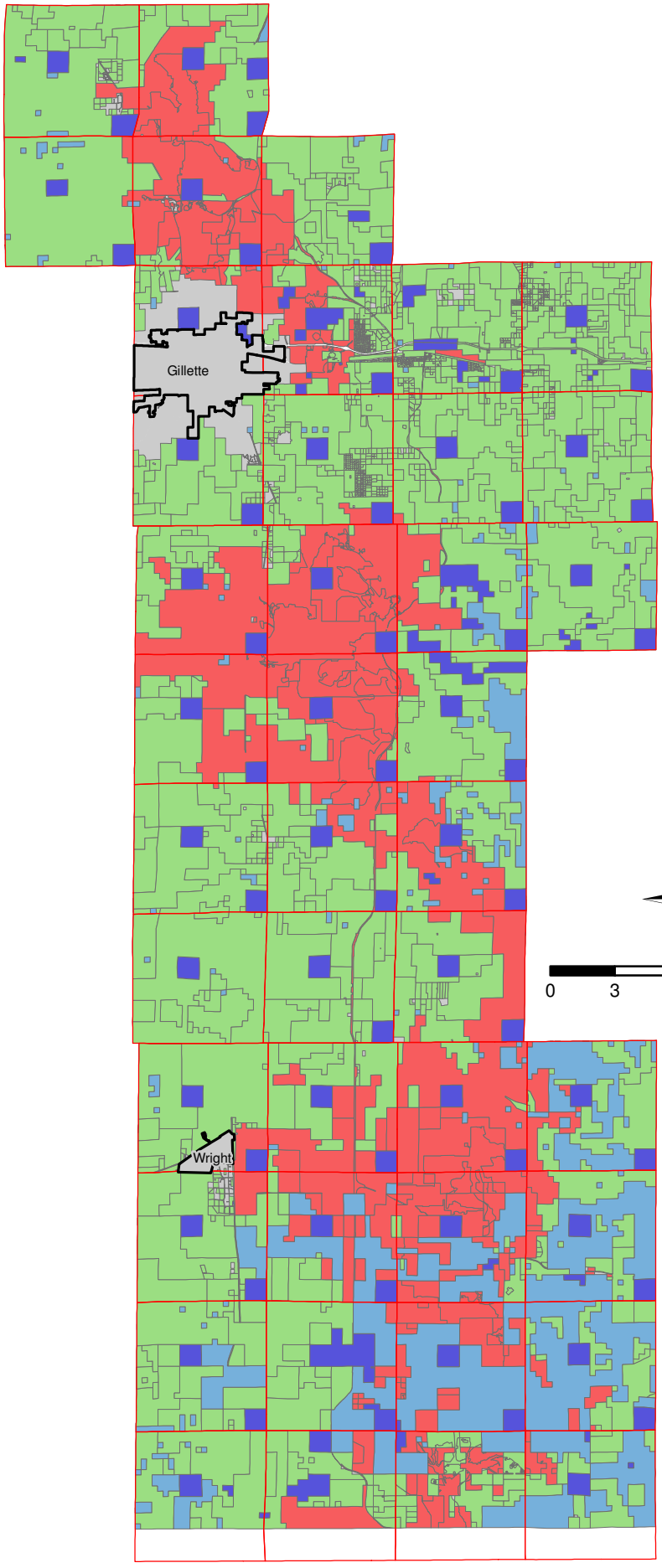
Campbell County Coal Belt Transportation Study
Figure 2-2
Coal Production Areas



Kadrmas Lee & Jackson
Engineers Surveyors Planners

Data Sources: Campbell County GIS

Campbell County Coal Belt Transportation Study

Figure 2-6
Surface Ownership Classifications

3.0 Existing Transportation Network

Input and data obtained during the stakeholder input process led the study team to believe that Campbell County's roadway network is well liked by users and does not have any known or obvious deficiencies or specific areas of concern. Although this speaks well of the county's transportation system, it is important to confirm how the roadway network is currently operating and will operate in the future.

To better understand Campbell County's transportation network and how it will serve the general public and industry within the Coal Belt region, answers related to three basic questions needed to be discovered.

1. Is it safe?
2. Is it functional today?
3. How will it functional in the future?

The sections to follow review and analyze roadway network conditions providing answers to these questions and drawing some conclusions regarding conditions and objectives driving the development of the Campbell County Coal Belt's future transportation network.

The transportation network to be evaluated was defined utilizing Campbell County's approved functional classification map and identifying county roads with a functional classification of Minor Collector or above. The Steering Committee included three unclassified roads (Wagensen Road, Hoadley Road and T-7 Road) to the list of roads to be evaluated. State Highways and I-90 were excluded from the study's safety and capacity analysis but were considered in terms of network mobility and interconnectivity. The following is a list of county roads evaluated in this study. **FIGURE 3-1** illustrates the roads and functional classifications as they exist within the study area.

1. Bishop Road (RR 12)
2. Adon Road (RR 1)
3. Hilight Road (RR 52)
4. Edwards Road (RR 30)
5. Union Chapel Road (RR 101)
6. Fairview Road (RR 34)
7. Antelope Road (RR 4)
8. Garner Lake Road (38 N)
9. Collins Road (RR 23)
10. Haight Road (RR 99A)
11. Breene Road (RR 16)
12. Hoe Creek Road (RR 54)
13. Wagensen Road
14. T-7 Road
15. Hoadley Road (RR 53)

3.1 Windshield Surveys & Crash Analysis

Windshield Surveys

Preliminary Windshield Surveys of Campbell County roadways were conducted to identify notable deficiencies and potential safety concerns. The survey methodology was developed based on guidelines obtained from the Wyoming Technology Transfer Center's technical brief *Roadway Safety Tools for Local Agencies – A Synthesis of Highway Practice*. The factors included in the surveys were:

- **Surface Condition**
- **Geometry (e.g., clear zone, sight distance, shoulder widths, horizontal and vertical curves, etc.)**
- **Signing and Delineation**
- **Intersections and Approaches**
- **Notable Roadway Features (e.g., bridges, railroad crossings, buildings close to R/W, etc.)**

Field observations regarding existing traffic control devices, posted speed limits, and indications of potential safety hazards were noted on survey forms for follow-up and additional review. Survey worksheets filled out for each individual roadway can be found in **Appendix F**.

Windshield Surveys - Findings and Recommendations

1. Roadway Condition - Overall condition of county roads is very good which confirms public opinion provided through Stakeholder Input Surveys.

2. Traffic Control Signing - The quality and placement of signs varies from good to very good. Traffic signs should be routinely inspected for damage and evaluated against most current Manual on Uniform Traffic Control Devices (MUTCD) standards for retroreflectivity, placement and consistent application. Specific locations of control devices requiring evaluation in the near term are:
    a. **Signing on all County Roads**– Inspect for minimum nighttime reflectivity requirements as found in the new MUTCD Sections 2A.09 and 3A.03 for signing and pavement markings respectively. Implement a maintenance plan to get signing and striping up to new standards.
    b. **Fairview Road** – At mile post (MP) 0.5 an advisory speed plate is worn off, at MP 0.8 northbound and southbound the curve speed advisory plates do not agree, at MP 2.0 there is a southbound but no northbound curve speed advisory plaque. Several damaged or deteriorated signs found on this road.
    c. **Bishop Road** – All curves appeared to have advanced warning signs. All but one does not have advisory speed plaques. Six curves were further evaluated (See Section 3.2) and found to have a design speed less than the posted speed of 55 mph. According to the MUTCD, advisory speed plaques are optional if the Average Daily Traffic (ADT) is less than 1,000 and required if ADT is greater than 1,000. Most of these curves are east of the

mine entrances and likely convey lower volumes of traffic (i.e., less than the 1,000 ADT threshold) as compared to the 1,116 ADT field collected at a location between the mine entrances and HWY 59. However, without further confirmation, it is recommended that advisory speed plaques be placed on the curves for improved safety. Section 3.2 performs a geometric evaluation of Bishop Road and provides advisory plaque recommendations.

d. **Breene Road** – Curve at MP 0.5 has a posted advisory speed plaque of 45 mph, but a calculated design speed of 40 mph. Consideration should be given to lowering the advisory speed plaque at this location. Vertical curves are not signed with reduced speed zones or reduced speed advisory plates. Limited stopping sight distance was noted during the windshield survey and confirmed through further evaluation, for the vertical curves at MP 3.5 and 3.7. These curves have a calculated design speed of 25 mph and should be considered for a reduced speed zone or advisory speed postings and ultimately geometric modifications.

e. **T-7 Road** – The roadway gradient is steep down to the Cordero Mine entrance. Warning signs for steep grade and reduced speed should be considered for evaluation and implementation. The gravel section (MP 2.9) should be further evaluated for curve and auto gate advanced warning signs as none currently exist.

3. Pavement Cross-Sections and Side Slopes - As part of scheduled maintenance activities, pavement cross-sections should be improved to meet the county's typical design standards requiring an overall pavement width of 32 feet with 14-foot travel lanes and 2-foot shoulder tapers. With the exception of the recently improved Haight and Hilight Roads, roadways presently do not meet these standards. As pavement improvements occur, side slope improvements should also be considered as many roads appear to have slopes greater than the 4:1 design standards. This was most apparent on Bishop Road, Fairview Road, Adon Road and Garner Lake Road.

4. Roadway Geometries - Bishop, Breene, Fairview, Hilight, Adon and Union Chapel Roads had roadway sections that were identified for further geometric evaluation as a result of the windshield surveys. The results of these evaluations are summarized in Section 3.2. The curve directly east of the railroad underpass on Bishop Road is noticeably challenging. There were no advisory plaques present and the curve cannot be safely negotiated at the posted speed. Future geometric improvements are recommended at this location for improved safety.

Crash Analysis

As part of this study, a preliminary review of crash history was performed on the aforementioned fourteen county roads. The Wyoming Department of Transportation provided 10 years of crash data to be used in the analysis. The detailed crash data sheets are provided in **Appendix G**. **FIGURE 3- 2** is a graphical display of the same crash data by location and type. Locations with crash clusters are visually identifiable to facilitate further research into crash types, frequency, conditions, causes and identifying potential preventive measures. The review documented factors such as light conditions, road conditions, vehicle rollover, collision with objects on the roadside, collision with wildlife and collisions involving other vehicles. It should be noted that a comparison of crash rates on county roads with similar facilities in

Wyoming would require specific data regarding the number of accidents per million miles of travel by type of facility. This type of accident data is not currently available from WYDOT. **TABLE 3-1** and **TABLE 3-2** summarize the results of the crash data evaluation.

TABLE 3-1 – Crash Summary by Type

Road Name	Total Number of Crashes	Total Number of Injuries	Total Number of Fatalities	All Crashes				
				Occurred at Night*	Poor Road Conditions	Type 1 Crash	Type 2 Crash	Type 3 Crash
Adon	68	20	2	22	30	17	48	3
Antelope	18	10	0	5	9	2	13	3
Bishop	86	26	1	37	31	30	44	12
Breene	7	4	0	3	2	0	5	2
Collins	16	11	0	5	6	5	11	0
Edwards	38	25	1	12	18	5	29	4
Fairview	36	17	0	17	11	6	25	15
Garner Lake	16	6	2	8	3	3	11	2
Haight	8	5	0	3	5	2	6	0
Hilight	40	23	0	12	8	7	30	3
Hoadley	3	1	0	2	1	1	2	0
Hoe Creek	5	3	0	2	1	0	5	0
T-7 Road	4	2	0	2	1	1	3	0
Union Chapel	38	21	1	9	11	5	28	5
Total	**383**	**174**	**7**	**139**	**137**	**84**	**260**	**49**

***:** Discounts Vehicle Crashes that Occurred at Night in Areas with Lighting
Type 1 Vehicle Crash = Caused by a Collision with an Animal
Type 2 Vehicle Crash = Caused by Drivers Inability to Control Vehicle (Collision with objects on roadside or vehicle overturn/rollover)
Type 3 Vehicle Crash = Caused by an Accident Involving another Vehicle

TABLE 3-2 – Analysis of Crashes Involving Injury or Fatality

Road Name	Crashes Involving an Injury or Fatality				
	Occurred at Night*	Poor Road Conditions	Type 1 Crash	Type 2 Crash	Type 3 Crash
Adon	33.3%	28.6%	4.8%	95.2%	0.0%
Antelope	14.3%	42.9%	0.0%	85.7%	14.3%
Bishop	25.0%	37.5%	8.3%	79.2%	12.5%
Breene	50.0%	25.0%	0.0%	75.0%	25.0%
Collins	16.7%	33.3%	0.0%	100.0%	0.0%
Edwards	20.0%	46.7%	0.0%	93.3%	6.7%
Fairview	40.0%	26.7%	0.0%	93.3%	6.7%
Garner Lake	50.0%	16.7%	0.0%	83.3%	16.7%
Haight	50.0%	50.0%	0.0%	100.0%	0.0%
Hilight	41.2%	23.5%	0.0%	88.2%	11.8%
Hoadley	100.0%	0.0%	0.0%	100.0%	0.0%
Hoe Creek	66.7%	0.0%	0.0%	100.0%	0.0%
T-7 Road	50.0%	50.0%	0.0%	100.0%	0.0%
Union Chapel	15.4%	23.1%	0.0%	100.0%	0.0%
Overall	**31.9%**	**31.2%**	**2.2%**	**90.6%**	**7.2%**

***:** Discounts Vehicle Crashes that Occurred at Night in Areas with Lighting
Type 1 Vehicle Crash = Caused by a Collision with an Animal
Type 2 Vehicle Crash = Caused by Drivers Inability to Control Vehicle (Collision with objects on roadside or vehicle overturn/rollover)
Type 3 Vehicle Crash = Caused by an Accident Involving another Vehicle

Crash Analysis – Findings and Recommendations

The overall results of the crash history review for county roads within the study area are summarized below:

1. Adon and Bishop Roads experienced the highest frequency of motor vehicle crashes during the study period with 68 and 86 crashes respectively.
2. Edwards and Collins Road were found to have high injury-to-crash rates. Edwards Road experienced a 25:38 injury-to-crash rate whereas Collins Road's injury-to-crash rate was 11:16.
3. 36.3 percent of all crashes occurred during the night in areas without lighting.
4. 35.8 percent of all crashes occurred during inclement weather conditions.
5. 67.9 percent of all crashes involved motorists colliding with an object on the side of the road or vehicle overturn/rollover.
6. 21.9 percent of all crashes were caused by a collision with an animal.
7. Only 12.8 percent of all crashes were caused by a collision with another vehicle.

8. Of all the crashes resulting in injury or fatality, 90.6 percent involved motorists colliding with an object on the side of the road or vehicle overturn/rollover.

Recommendations to improve conditions that can lessen the primary types and frequency of crashes that are experienced within Campbell County's roadway network are as follows:

1. As roadways are improved, upgrade Campbell County's current design standards for pavement cross-section.
2. Wider shoulders and side slope improvements should be considered for better vehicle recovery on roads where Type – 2 crashes are most common. Accordingly, Adon Road, Bishop Road, Hilight Road, Edwards Road and Union Chapel should receive first priority.
3. Consider taking measures to eliminate or minimize open range conditions where livestock are free to roam within the road right-of-way. Accidents due to this condition are most prevalent on Bishop Road.
4. Review and update roadway signing meeting the MUTCD's current retroflectivity standards and advisory speed plaque requirements for location and reduced speed.

3.2 Geometric Analysis

A key element in assessing the existing roadway network was to identify specific sections within the county's road network requiring further review for compliance with acceptable horizontal and vertical design standards. Evaluated roadway segments were identified by KL&J during the windshield surveys and supplemented by Campbell County's known and suspected areas of concern. The designated location of all curves evaluated are based on the mile post indicators represented on the county's roadway functional classification map as prepared and maintained by WYDOT.

Horizontal Alignment Evaluation

Campbell County provided an AutoCAD file containing horizontal alignments for all classified county roads. These alignments were field collected by Campbell County's surveyor with vehicular mounted GPS equipment. The data was considered suitable for reconstructing horizontal curves that could be analyzed in a broad manner for the purposes of this study. Because the data was available from the county, all county roads listed in Section 3.0 to be studied were evaluated for horizontal compliance.

A horizontal alignment was created for each road segment using Civil 3D design software. A 55 mph design speed was utilized as it is the desired design speed for county roads and is generally the posted speed on paved county roads. The American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets, 2004* was used to determine the design speed of each roadway segment. The following are the minimum standards based on assumed superelvation rates:

Exhibit 3-26 from AASHTO *A Policy on Geometric Design of Highways and Streets, 2004*
Minimum Required Radii for design speeds (V_d) and design superelvation rates e_{max} = 6% (e_{max} = 8%)

V_d = 55 mph; R = 1,060 ft (960 ft)
V_d = 50 mph; R = 833 ft (758 ft)
V_d = 45 mph; R = 643 ft (587 ft)
V_d = 40 mph; R = 485 ft (444 ft)

V_d = 35 mph; R = 340 ft (314 ft)

Horizontal curves were best fit to the surveyed polylines. Horizontal curves with radii less than 1,060 feet, based on an e_{max} = 6%, were identified. Horizontal curves with radii less than 1,060 feet were further investigated to identify design speed based on prevailing conditions. **TABLE 3-3** below summarizes the horizontal curves that were found to be less than the desired design speed:

TABLE 3-3 – Calculated Design Speeds for Horizontal Curves with V_d < 55mph

Horizontal Curves with V_d < 55 mph					
Road	**MP**	**Design Speed**	**Signs in place**	**Reduce Speed Posted**	**Comment**
Bishop	12.5	45	yes	no	Advisory plate optional if ADT<1000, if ADT>1000 advisory plate required
Bishop	13.5	50	yes	yes (35)	
Bishop	15.5	50	yes	no	Advisory plate optional if ADT<1000, if ADT>1000 advisory plate required
Bishop	20.5	50	yes	no	Advisory plate optional if ADT<1000, if ADT>1000 advisory plate required
Bishop	22	*45	yes	no	Advisory plate optional if ADT<1000, if ADT>1000 advisory plate required
Bishop	29.2	45	yes	no	advisory plate optional if ADT<1000, if ADT>1000 advisory plate required
Breene	0.5	40	yes	yes (45)	Not signed to meet projected design speed
Fairview	0.8	45	yes	yes (SB 40) (NB 30)	Advisory plates in conflict
Fairview	1	45	yes	yes (40)	Signed appropriately
Fairview	2	50	yes	yes (35)	No northbound signing
Fairview	7.8	45	Yes	no	Signing optional; Fairview < 1000 ADT
Hilight	0.2	50	yes	yes	Intersection with Edwards Rd.
Hilight	6	unknown	yes	yes	Intersection with HWY 450
Hilight	8	45	yes	yes (50)	Advisory plate optional if ADT<1000, if ADT>1000 advisory plate required
Hilight	27	50	yes	yes (45)	Signed appropriately
Union Chapel	4.2	50	yes	yes (40)	Signed appropriately
Union Chapel	5.2	40	yes	yes (35)	Signed appropriately

* Curve directly east of R/R underpass. Curve was noticeably challenging when driving. Curve was fairly flat - assumed superelevation rate likely too high. Confirm and evaluate before posting advisory speed plates. Geometric improvements should be considered in future.

Geometric improvements are the ideal solution to bring all the roadway segments identified in **TABLE 3-3** up to desired design speed standards. Since this is not always feasible or appropriate, signing in accordance with the MUTCD for the conditions present should be implemented to the fullest extent possible to improve roadway safety until geometric changes can be made. The identified county road

segments with reduced design speeds should be re-evaluated against the MUTCD standards and signing improvements made as necessary.

Section 2 of the MUTCD provides the guidance needed to properly evaluate and install advance warning signs associated with roadway alignments. **TABLE 3-4** below lists data from Table 2C-4 of the 2009 MUTCD that should serve as a guideline for advance warning sign field checking and placement. Due to the high 85th Percentile Speeds (**FIGURE 3-3**) being experienced on the county roads, it is recommended that the 85th Percentile Speeds be utilized for advance warning sign placement in lieu of the posted speed limit.

TABLE 3-4 – Advance Warning Sign Placement

Posted or 85th Percentile Speed	Advanced Placement Distance							
	Deceleration to the listed advisory speed (mph) for the condition.							
	0	10	20	30	40	50	60	70
55 mph	325'	275'	225'	200'	125'	NA	-	-
60 mph	400’	350’	325’	275’	200’	100’	-	-
65 mph	475’	450’	400’	350’	275’	200’	100’	-
70 mph	550’	525’	500’	450’	375’	275’	150’	-
75 mph	650’	625’	600’	550’	475’	375’	250’	100’

Source: 2009 MUTCD Table 2C-4

Vertical Alignment Evaluation

Three roadway sections were identified during the windshield surveys for further evaluation of vertical alignment. Because information containing vertical alignments of the roadway sections was not available, KL&J field-collected centerline and edge of road profiles using survey grade equipment to support evaluation of the vertical alignments. The data was evaluated using Civil 3D to create a best fit profile for the roadway segments in question. The vertical curve K-values were determined from these created alignments allowing an approximate design speed to be determined for each curve. The MP locations of the curves and their design speeds are listed in **TABLE 3-5** below.

TABLE 3-5 – Calculated Design Speeds for Vertical Curves with V_d < 55 mph

Calculated Design Speed for Vertical Curves with V_d < 55 mph					
Road	MP	Design Speed	Signs in place	Reduce Speed Posted	Comment
Adon	3.8 & 3.9	35	no	no	Advisory speed plates or reduced speed zone recommended
Breene	3.5 & 3.7	25	no	no	Advisory speed plates or reduced speed zone recommended in near term. Geometric improvements recommended in future.
Fairview	4.3	45	no	no	No recommended improvements due to posted speed of 45 mph.

The intersection of Fairview and Union Chapel was also investigated. Union Chapel Road ties into Fairview Road along the crest vertical curve identified in **TABLE 3-5** as not meeting a 55 mph design speed. Union Chapel Road ties into Fairview Road at a grade greater than the 7 percent (actual 10.5 percent) maximum allowed in the county's current design standards. The available stopping sight distance for vehicles on Fairview Road and the departure sight distance for vehicles stopped and departing from Union Chapel Road determine the design speed at which the intersection is operating.

Exhibit 6-2 in the AASHTO *A Policy on Geometric Design of Highways and Streets, 2004* provides the following Design Controls for Stopping Sight Distance and for Crest and Sag Vertical Curves:
At 55 mph:

Design Stopping Sight Distance = 495 feet
K_{crest} = 114
K_{sag} = 115

Equation 9-1 in combination with exhibits 9-54 and 9-55 of the AASHTO *A Policy on Geometric Design of Highways and Streets, 2004* was used to determine the intersection sight distance needed to meet a 55 mph design speed. This was determined to be 720 feet based on the departure sight distance needed for a vehicle stopped and departing from Union Chapel Road. The available departure/ intersection sight distance was measured in AutoCAD Civil 3D to be 280 feet. This condition results in the existing intersection being constructed to a 20 mph design speed. It should be noted that the posted speed on Fairview Road is 45 mph.

The approach grade on Union Chapel would need to be reduced to near 7 percent in order to obtain an intersection sight distance of 720 feet as needed for a 55 mph design speed, requiring geometric improvements to drop the elevation of the intersection approximately 23 feet in its current horizontal alignment. Other solutions would be to realign Union Chapel to intersect Fairview at the crest of the curve or in an alternate location confirmed through additional evaluation. Any of these solutions will require some measure of geometric modifications to both Union Chapel and Fairview roads in order to meet a 55 mph design speed.

Roadway Geometry Review – Findings and Recommendations

The key findings and recommendations from the roadway geometry review of the county roads are summarized below:

1. There are seventeen (17) horizontal curves that do not meet the county's desired design speed of 55mph. Crash rates over the past ten years have not caused any of these locations to stand out among curves meeting design standard. With the exception of the curve at MP 22 on Bishop Road, near-term geometric improvements do not appear to be necessary as long as placement of warning signs and speed advisory plates are further evaluated and implemented at these locations. Geometric improvements should be addressed as other improvements are planned in the future.

2. Confirm advisory sign spacing, type and placement to meet those recommended in the MUTCD (See Section 2C) and update as necessary. Attention should be focused on the roadway segments that do not meet current design speeds as identified in **TABLE 3-3** and **TABLE 3-5**. Other roadway segments should be field evaluated and appropriate adjustments made as necessary.

3. Confirm superelevation assumptions used in the evaluation prior to making any signing or geometric adjustments.

4. The horizontal curve on Bishop Road at approximate MP 22 (east of R/R underpass) needs advisory warning and speed signing as soon as possible. It is uncomfortable to drive at the calculated design speed of 45 mph and very uncomfortable at or near the posted speed of 55 mph. It is recommended that the curve be identified for further evaluation for geometric improvements in the near future.

5. The intersection of Fairview Road and Union Chapel Road presents several conditions that affect roadway safety. The crest vertical curve on Fairview Road meets a design speed of 45 mph which is superseded by a departure site triangle distance of 280 feet on Union Chapel Road - this equates to a design speed of 20 mph. The approaching grade on Union Chapel exceeds 10 percent and the county's current design standards of 7 percent for maximum grade. It is recommended that geometric modifications be addressed either by lowering the intersection or moving Union Chapel's connection with Fairview closer toward the crest of the curve, or some combination thereof, to improve available sight distance and meet current design standards and improve safety.

6. The vertical curves evaluated on Adon Road and Breene Road (identified in **TABLE 3-5**) should be appropriately signed with advance warning signs and advisory speed signs to match the design speed and considered for geometric improvements as future planned improvements allow.

3.3 Traffic Projections and Future Capacity

In order to analyze the existing county roadway network and make future traffic projections, it was necessary to obtain ADT on the county roads and make some reasonable projections as to the ADT in the horizon year of 2040.

WYDOT Planning provided ADT for state highways and I-90 but had limited information regarding ADT for Campbell County's roads. In order to obtain the necessary traffic counts, traffic counters were obtained from the Wyoming T2 Center and utilized to collect traffic count, classification and speed data at predetermined locations where free-flow traffic conditions were sure to occur. **FIGURE 3-4** shows the 2010 roadway network ADTs as a result of the field collection.

The 2040 horizon year ADT was projected using a 3.5 percent annual growth rate in ADT compounded over 30-years. These traffic counts are also included in **FIGURE 3-4** to demonstrate expected growth in traffic volumes on the existing roadway network. The 3.5 percent growth rate was chosen by the Steering Committee to be representative of recent projections for Campbell County annual population increases and the average annual percent increase in ADT on roads within the study area. A respective range for growth rates of 2.5 percent to 5 percent was discovered supporting the 3.5 percent chosen for the study's future traffic projections. The sources used to determine an acceptable growth rate were the Task 3C Report for the Powder Basin Coal Review Cumulative and Social Impacts, by ENSR International & Sammon/Dutton, LLC in December 2005 and WYDOT's 2009 Annual MADT, AADT, AADW summaries report which provided ADT on state highways for the past 10 years.

For the purpose of this study, it was important to evaluate the conditions at which the current roadway network is operating and the projected operation during the 2040 horizon year. This will help identify existing roadway segments that may fail at some point in the future to meet the level of service (LOS) Campbell County desires to maintain for its roads.

The *Highway Capacity Manual 2000* (HCM) defines LOS as the qualitative measures characterizing operational conditions within traffic flow and how they are perceived by motorists. The factors characterizing these conditions are speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. Six levels of service are defined. They are given letter designations from A to F, with LOS A representing the best operating conditions and LOS F the worst. The maximum flow rate, or capacity, that a roadway can handle is considered its service flow rate and represents a LOS E.

The HCM provides guidance on determining the level of service for Type I and Type II two-lane highways. For analysis purposes, it was assumed that the county's roads would be considered Type I two-lane highways in the HCM. The capacity of a two-lane highway under base (ideal) conditions is 3,200 passenger vehicles per hour (pc/h). The capacity for the roads within the study area were adjusted from the base condition which is necessary to account for known roadway conditions such as terrain, grade, truck traffic, peak hour volumes, etc. The following calculation was used to determine an adjusted roadway capacity representative of roads within the study area:

$C = (3{,}200 \text{ pc/h} * PHF * f_G * f_{HV}) - V_{NP}$

Whereas:

Peak Hour Factor:	PHF = 0.88	(HCM default 2-lane rural road)
Grade Adjustments:	$f_G = 0.71$	(HCM Exhibit 20-7, Rolling, < 600 pc/h)
Heavy Vehicle Factor:	$f_{HV} = 1/\ 1+P_T\ (E_T-1)$	(HCM Exhibit 20-9, Rolling, $E_T = 2.5$) (Field verified, $P_T = 16\%$ or 0.16)
No Passing Vol. Adjustment:	$V_{NP} = f_{NP}\ /0.00776$	(HCM Exhibit 20-11, $f_{NP} = 1.9$)

Maximum Capacity: C = 1375 pc/h (both directions)

Calculated capacity for Type I two-lane roads can reasonably be compared to the peak hour volumes of the existing county roads to determine the percent of operation capacity and the operation capacity in 2040. In order to make these projections, the field collected peak hour volumes (Vp) for the studied county roads were projected to 2040 using the 3.5 percent growth rate used for ADT projections. These volumes were utilized to calculate a volume to capacity ratio (Vc) when divided by the calculated maximum capacity (C = 1,375 pc/h) identified above.

There are five (5) service flow rates associated with the five levels of service A through E (LOS F is excluded). Using service flow rates, we can draw some conclusions as to how the various roadway segments may be operating now and/or in the future. **TABLE 3-6** illustrates the values for Vp and Vc for the present and future network conditions.

TABLE 3-6 – Existing Network Volume to Capacity Ratios

Roadway	2010		2040	
	Vp (pc/h)	***Vc**	**Vp** (pc/h)	***Vc**
Bishop	181	0.13	508	0.37
Adon North I-90	136	0.10	382	0.28
Adon South I-90	83	0.06	233	0.17
Hilight ID #1	23	0.02	65	0.05
Hilight ID #3	25	0.02	70	0.05
Edwards	110	0.08	309	0.22
Union Chapel	122	0.09	342	0.25
Fairview	90	0.07	253	0.18
Antelope	126	0.09	354	0.26
Garner Lake	61	0.04	171	0.12
Collins	16	0.01	45	0.03
Haight	213	0.15	598	0.43
Breene	28	0.02	79	0.06
T-7	178	0.13	500	0.36

***Vc = Vp/C = Vp/1375**

The primary measures for LOS for a Type I two-lane highway are percent-time-spent following and average travel speed. Exhibit 20-3 in the HCM allows graphical identification of LOS based on these criteria. The lowest average daily gap found on the network was experienced on Union Chapel road at 51 seconds with the lowest hourly gap appearing on Haight Road at 16 seconds which occurred during the peak hour. The other roadways have significantly higher average gaps by comparison. It can be concluded that the percent time-spent-following is measurably low (0 to 10 percent) for all roads based on the evidence. Average speeds are known for all roads based on present conditions allowing LOS to be approximated using Exhibit 20-3, however, projecting the factors to future conditions are less reliable than looking at service flow rates and capacity.

The HCM identifies LOS criteria, as found in **TABLE 7,** for peak flow rates according to baseline conditions:

TABLE 7 – Level of Service Baseline and Adjusted Criteria

Level of Service	Avg Speed (mph)	Driver Delay (%)	*Max Flow Rate (Vp)	**Adjusted Max Flow Rate (Vp)	County Roads in 2040 (From Table 6)
					Collins Hilight #1 Hilight #3
LOS A	55	35	490	211	Breene Garner Lake Fairview
					Adon S Edwards Union Chapel
LOS B	50	50	780	335	Adon N Antelope T-7
					Bishop (LOS B or Better)
LOS C	45	65	1190	512	Haight at LOS C
LOS D	40	80	1830	786	No Roads at this LOS
LOS E	<40	>80	3200	1375	No Roads at this LOS

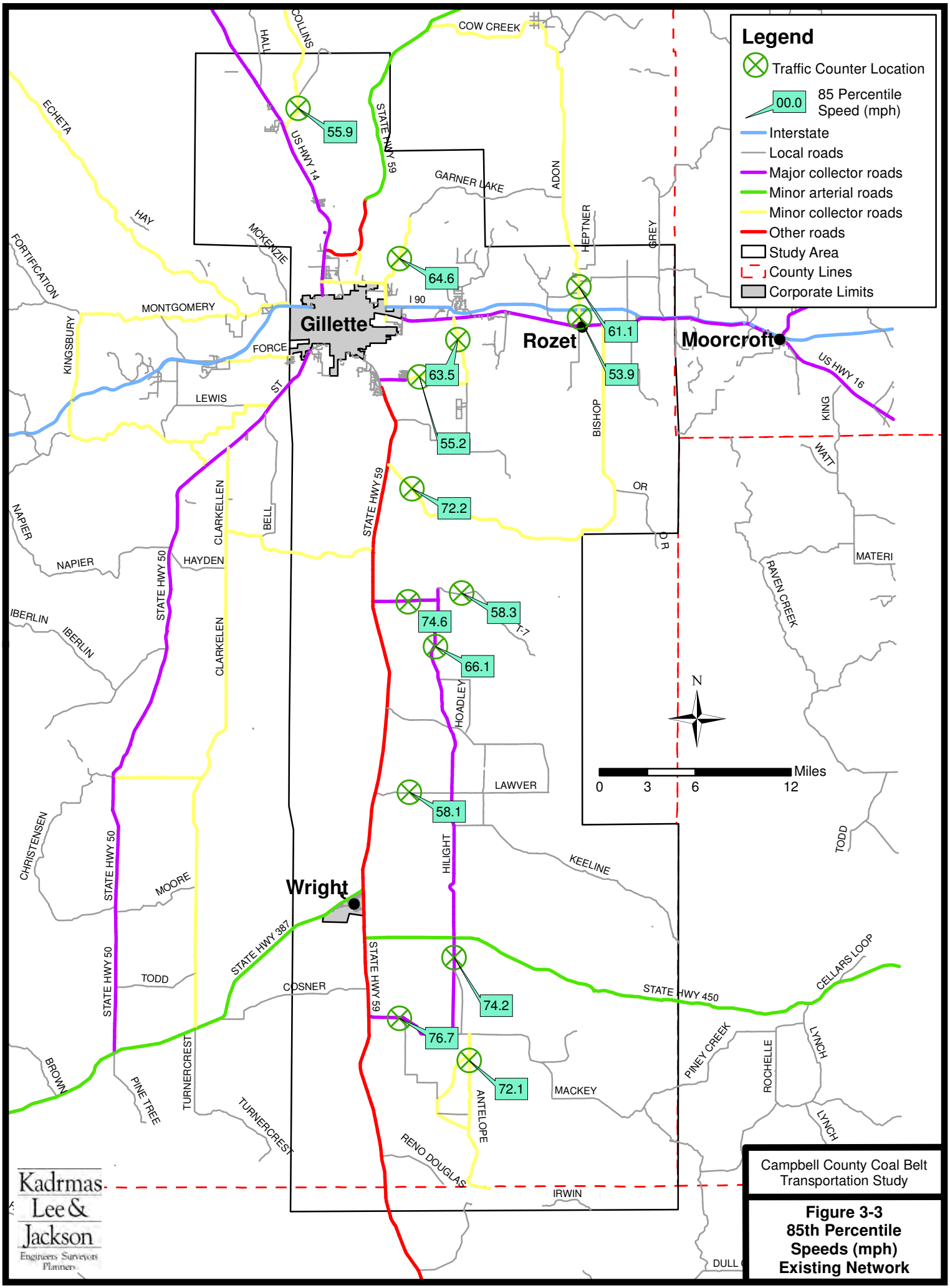
***Vp based on base conditions**
****Vp adjusted based on more restrictive factors (affects of geometry, terrain, %trucks)**

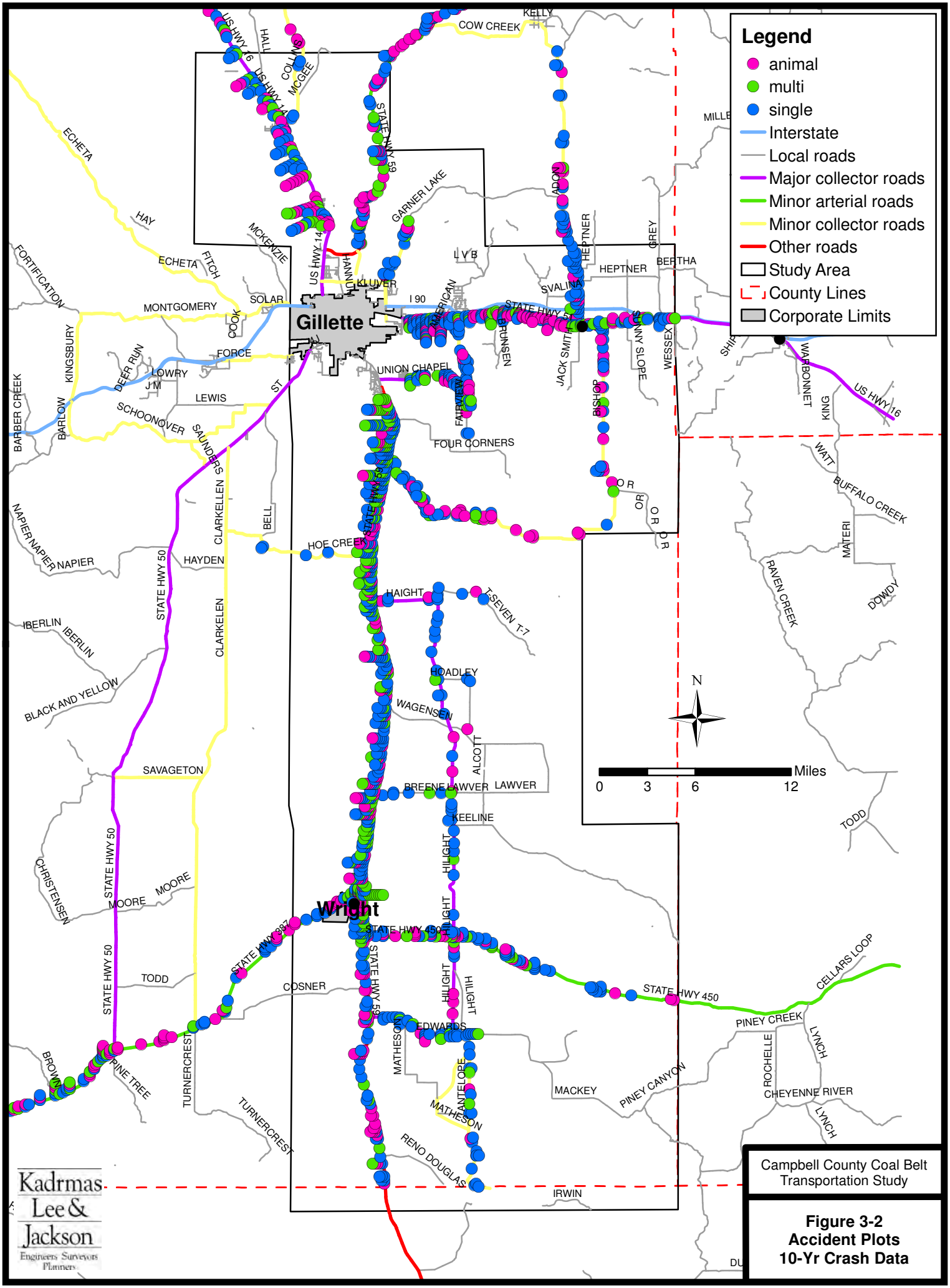
Comparing the above service flow rates with those projected in **TABLE 3-6** indicates that no roadway in the existing network is expected to operate below a LOS C in the 2040 horizon year with the majority of the roadway network expected to operate at a LOS A or LOS B. These conditions will meet or exceed general design LOS standards for agencies with similar facilities. The HCM suggests that a LOS C or D is an acceptable standard for design for most agencies.

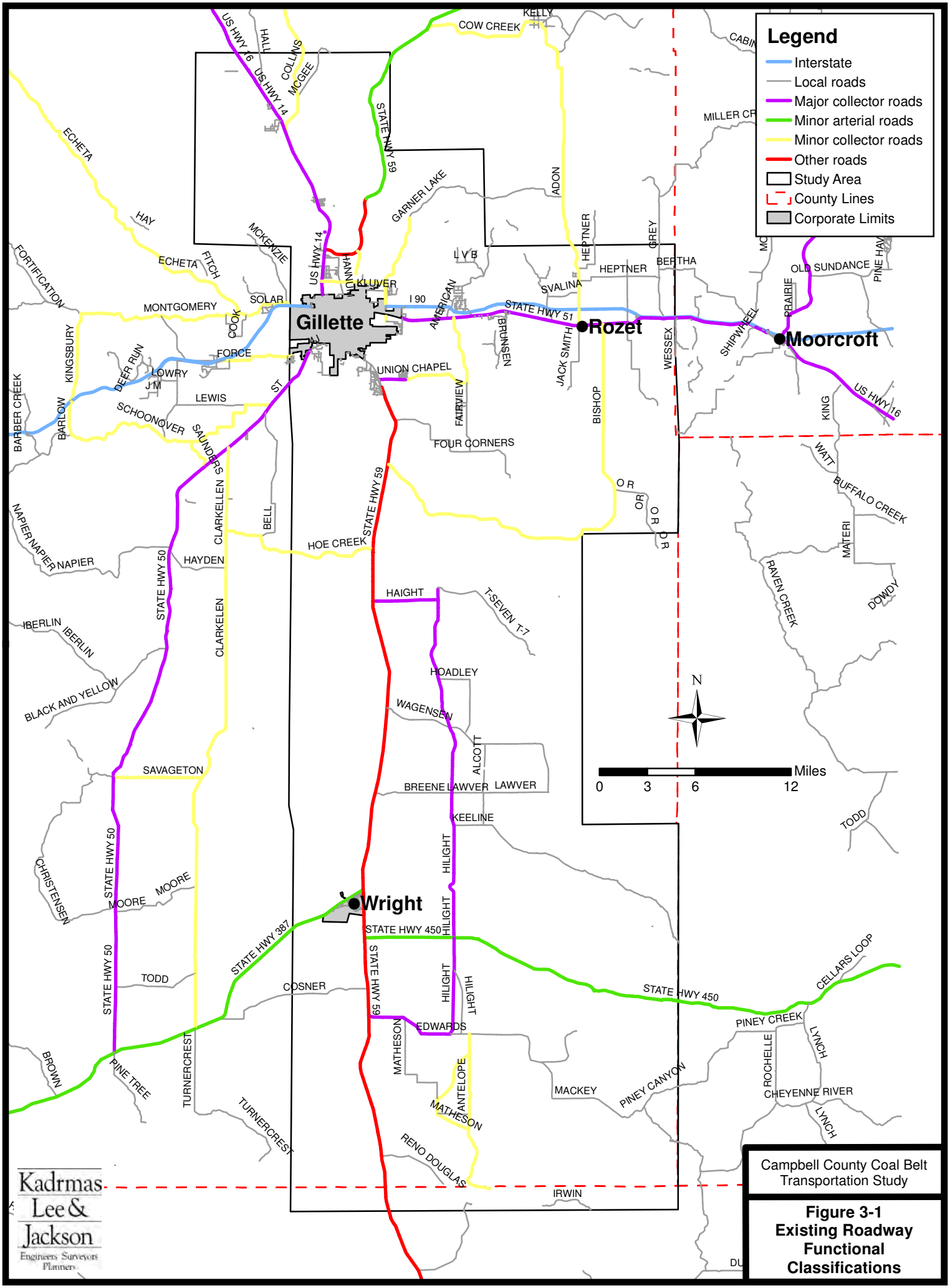
Traffic Projections and Future Capacity - Findings and Conclusions

1. The present and future traffic projections on the roads studied are fairly low volume roads.
2. The roadways evaluated as part of the study currently operate at acceptable LOS levels (LOS A or LOS B).
3. The projected 2040 service flow rates (Vd) suggests the existing network will operate at a LOS C or above in the 2040 horizon year.
4. Inasmuch as the existing roadway network has sufficient capacity to accommodate future increases in traffic levels, network connectivity improvements should be evaluated to enhance the overall mobility and accessibility within the Coal Belt region.

5. Increasing network capacity is not a consideration in developing the future network. Impacts to roads due to mining operations is the confirmed, key consideration dictating future development of the roadway network.


Legend
Traffic Counter Location
00.0 85 Percentile Speed (mph)
Interstate
Local roads
Major collector roads
Minor arterial roads
Minor collector roads
Other roads
Study Area
County Lines
Corporate Limits
55.9
64.6
61.1
53.9
63.5
55.2
72.2
58.3
74.6
66.1
58.1
74.2
76.7
72.1
Gillette
Rozet
Moorcroft
Wright
COW CREEK
GARNER LAKE
ADON
HEPTNER
GREY
ECHETA
HAY
FORTIFICATION
MONTGOMERY
KINGSBURY
FORCE
LEWIS
MCKENZIE
COLLINS
HALL
US HWY 14
STATE HWY 59
I 90
BISHOP
OR
D R
US HWY 16
KING
WATT
MATERI
RAVEN CREEK
NAPIER
HAYDEN
CLARKELLEN
BELL
IBERLIN
T-7
HOADLEY
LAWVER
KEELINE
HILIGHT
TODD
CHRISTENSEN
MOORE
STATE HWY 50
STATE HWY 387
COSNER
STATE HWY 450
CELLARS LOOP
PINEY CREEK
ROCHELLE
LYNCH
BROWN
PINE TREE
TURNERCREST
MACKEY
ANTELOPE
RENO DOUGLAS
IRWIN
DULL
N
0 3 6 12 Miles
Kadrmas Lee & Jackson
Engineers Surveyors Planners
Campbell County Coal Belt Transportation Study
Figure 3-3
85th Percentile Speeds (mph)
Existing Network

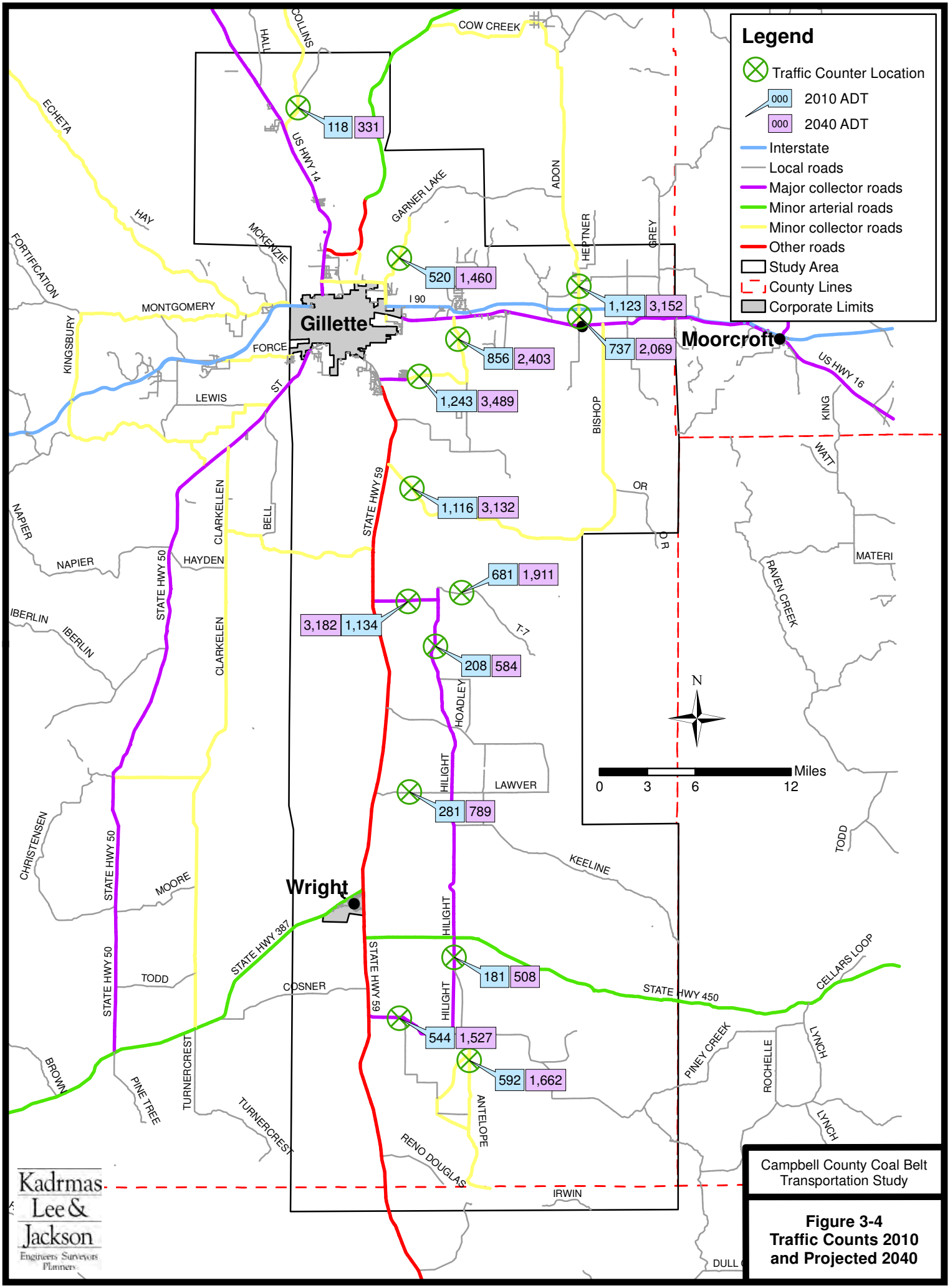

Legend
animal
multi
single
Interstate
Local roads
Major collector roads
Minor arterial roads
Minor collector roads
Other roads
Study Area
County Lines
Corporate Limits
Gillette
Wright
N
0 3 6 12 Miles
Campbell County Coal Belt Transportation Study
Figure 3-2
Accident Plots
10-Yr Crash Data
Kadrmas Lee & Jackson
Engineers Surveyors Planners



Kadrmas Lee & Jackson
Engineers Surveyors Planners

Campbell County Coal Belt Transportation Study

Figure 3-1
Existing Roadway Functional Classifications


Legend
Traffic Counter Location
000 2010 ADT
000 2040 ADT
Interstate
Local roads
Major collector roads
Minor arterial roads
Minor collector roads
Other roads
Study Area
County Lines
Corporate Limits
118 331
520 1,460
1,123 3,152
737 2,069
856 2,403
1,243 3,489
1,116 3,132
681 1,911
3,182 1,134
208 584
281 789
181 508
544 1,527
592 1,662
Gillette
Moorcroft
Wright
COW CREEK
ECHETA
HAY
FORTIFICATION
MONTGOMERY
KINGSBURY
LEWIS
FORCE
MCKENZIE
GARNER LAKE
ADON
HEPTNER
GREY
BISHOP
KING
WATT
OR
D R
MATERI
RAVEN CREEK
TODD
KEELINE
LAWVER
HOADLEY
HILIGHT
T-7
BELL
CLARKELLEN
STATE HWY 59
STATE HWY 50
STATE HWY 387
STATE HWY 450
US HWY 14
US HWY 16
I 90
NAPIER
HAYDEN
IBERLIN
CHRISTENSEN
MOORE
COSNER
TURNERCREST
PINE TREE
BROWN
ANTELOPE
RENO DOUGLAS
IRWIN
DULL
PINEY CREEK
ROCHELLE
LYNCH
CELLARS LOOP
N
0 3 6 12 Miles
Kadrmas Lee & Jackson
Engineers Surveyors Planners
Campbell County Coal Belt Transportation Study
Figure 3-4
Traffic Counts 2010 and Projected 2040

4.0 Future Transportation Network

The future transportation network within the Coal Belt Region must be developed to meet future needs of its users and traffic demands placed on the network. It was confirmed the existing roadway network has the functionality and capacity to meet user needs through the 2040 horizon year. Impacts to the county roadway network due to the progression of mining operations is the single most significant condition affecting the need for future changes in the county's roadway network. The future transportation network, must address impacts as they occur over time in a comprehensive fashion resulting in a transportation network providing equal or improved levels of service to users and free from mining impacts within the foreseeable future.

The majority of the county roads within the study area will be impacted by mining at some point in the future. Mining Stakeholder input has allowed the study team to understand which roadways will be impacted within the next 20 years. Future mine progressions can also be reasonably predicted to understand where impacts may occur beyond 20 years, by identifying active mine lease boundaries, boundaries of future leases and areas with favorable strip ratios where future mining is more likely to occur. The GIS layers representing this information were previously identified in **FIGURE 2-2**. In order to meet the primary objective of this study and develop a roadway network that will not be impacted by future mining operations, development of the future roadway network must be conducted with the utmost regard for these factors. Numerous other factors will ultimately affect the placement of new corridors, the feasibility of future corridor development and how corridors combine together to make up an overall, functional network. The study team and Steering Committee identified important factors to be considered in developing alignments/locations of new road corridors for the future network. They were ranked in order of importance as follows:

Important Factors (model considerations)

1. **Permanent corridor development (avoid mine impacts in future)**
2. **Meeting county design standards for grade (<7 percent)**
3. **Use of existing corridors**
4. **Minimize railroad crossings**
5. **Impacts to non-industry and non-government land (private landowners)**
6. **Crossing over and/or under manmade structures**
7. **Impacts to environmentally sensitive areas**

The data categories and GIS data layers used to support decisions and analysis related to these factors are identified in Section 2.3 and specifically in **TABLE 2-1** of this report. To solve the needs of the transportation network within the study area, the study team had to develop a way to consider the important factors, and specifically the myriad of supporting data layers, collectively and develop solutions for new road corridors agreeing with the conditions the primary factors represent. This was accomplished utilizing the Spatial Analyst Extension within ArcGIS to build a corridor analysis model identifying the available corridors meeting the conditions associated with the primary factors.

4.1 Modeling Process

The corridor analysis modeling process involved conversion of all the GIS data layers supporting the important factors into a raster format. Buffers were applied to each data layer shape file, as appropriate, prior to conversion into a raster layer. The extent of buffers used were guided by regulatory constraints, the need to define the physical limits of certain vector data layers, i.e., roads and railroads, and other factors discovered during the Stakeholder input and data collection process, i.e., the need to add a 1-mile buffer around mine leases to ensure ambient air quality within new road corridors. **Examples of buffers used in the model development are as follows:**

- Road Corridors – 50 feet from centerline (100 feet total)
- Active coal lease and LBA boundaries – 1 mile (added protection against air quality impacts from adjacent mining operations)
- Wildlife
    - Bald Eagle nesting – 1 mile
    - Raptor Nest – ¼ mile
- Compressor stations – ¼ mile
- Utility structures – 250 feet
- Utility lines – 50 feet
- Alluvia's, lakes and streams – 50 feet
- Nelson Brothers Explosives depot – 2 miles (separation requirement from a public corridor as per the ATF Regulations based on amount of explosives housed at this location)
- Railroads – 150 feet from centerline (300 feet total)

Solving the need for a permanent, long term transportation network within the study area required assessment of the newly created raster layers. The raster layers developed for this model contained a cell size of 30 by 30 feet. Each cell contains a value that is representative of its real world value (For example: the slope of the ground may vary from 0 to 20 percent and each raster cell in the digital terrain raster layer will carry a value representative of the slope within that particular 30 by 30-foot section of ground). Because the raster layers represent various types of information with different value scales, a weighted overlay of each raster layer was developed in order for the model to apply a common scale of values to the diverse and dissimilar input creating an integrated analysis of the data. The study team utilized a numeric evaluation scale of 1 to 10, with a value of 1 being the most desirable condition (i.e., 2 percent slopes) and 10 being the least desirable condition (i.e., > than 7 percent slopes). Each raster layer was reclassified by assigning a value between 1 and 10 for each input raster cell.

Since all factors in the analysis are not equally important, a weighting factor was applied to all raster layers based on the chosen degree of importance. The Steering Committee and study team weighted the raster layers to the degree they supported the ranking of the important factors listed above. The important factors, associated raster layers and assigned weighting for those raster layers are identified in **TABLE 4-1**. It should be noted that permanent corridor development and the raster layers associated with analyzing permanent corridor development were weighted the highest at 28 percent. It should be noted that the sum of all layer weighting must be equal to 100 percent in order for the model to run the corridor analysis. The following demonstrates how the raster layer classification and weighting is applied to develop an output value for each raster cell.

Weighted Overlay Analysis

The two raster layers above have been reclassified and each raster cell given a value from a scale of 1 to 3 in this example. The first raster is assigned a weighting of 75 percent and the second is 25 percent. The cell values are multiplied by their weighting then added together to get the output value – the output value is discrete and rounded. The calculation for the red cell's output value in this example is as follows:

(2*.75) + (3*.25) = 1.5+.75 = 2.25 (rounded to 2)

There are 21 raster layers utilized in the study's model that will be analyzed in this fashion and added together to develop an overall output value for each 30 by 30-foot raster cell within the study area. A complete list of GIS layers, buffers applied and applied raster values utilized in the model analysis and a flow chart of the modeling process are provided in **Appendix I.**

When identifying corridors, the model will seek alignments meeting the conditions for the information given. As it applies to the model developed for this study, cells with the lowest values best meet the desired conditions.

4.2 Modeled Corridor Alignments

The identification of transportation sources and destinations was necessary for the corridor analysis model to seek potential corridor alignments best serving motorists getting to and from identified sources and destinations. A source and destination study was not conducted as part of this study. The sources and destinations used in the model were developed based on input from the Steering Committee and the study team's observation and long-term knowledge of roadway network operation and service.

Transportation Sources

For analysis purposes, it was important to identify the main sources generating traffic to destinations within the study area. Field collected data and observation point toward individual mine sites as the primary destinations for motorists utilizing the county road network within the study area. The sources from which the motorists are coming point to surrounding population centers that have housing and industry supporting the mining industry. The study team identified the following as the primary sources from which motorists enter the study area network:

- City of Gillette – primary source for housing and service industry for all mine sites
- Town of Wright – source for housing and service industry for mine sites south of Gillette

- HWY 14/16 at the County Line – entry point into the study area providing access for mine workers and service industry to mine sites north of Gillette and south to Coal Creek Mine
- HWY 450 at the County Line - entry point into the study area providing access for mine workers and service industry to mine sites in the southern end of the study area
- HWY 59 at the Douglas County Line - entry point into the study area providing access for mine workers and service industry to mine sites at the southern end of the study area

Transportation Destinations

The Steering Committee and study team concluded most motorists do not use the transportation network (excluding State Highways and I-90) to pass through the region but rather to enter the region and return back to their origin. This study identified and focused on mine site access and administrative areas as being the true destination for the majority of motorists entering the Coal Belt Region. An important fact discovered through input from the Mining Stakeholders is the infrastructure for administrative and operations areas do not typically move with mine progression. This indicated to the study team that these areas will remain the transportation destinations at each mine site for many years.

Running the Model

Sources and destination locations were developed as described above and input into the model. Each source had several destinations associated with it, each making up one model run utilizing the weighted overlay analysis to produce best fit corridors between each source and its assigned destinations.

East West Corridors

Initial model trials produced a myriad of north-south potential corridor alignments, but the study team quickly realized interconnectivity and mobility would suffer within the future transportation network if sources and destinations generating more direct east-west corridors were not analyzed.

HWY 59 is the primary corridor and only route that extends completely north-south through the study area. Mining activity is primarily progressing toward HWY 59 in a westerly direction. Due to the lack of coal east of the existing mine sites, coal mining activity will not move farther east allowing new corridors along the eastern edge of mining activity to be fairly safe from future mining activity. In addition, mine site destinations are closest to the mines' eastern boundaries. These conditions caused the model to produce a north-south corridor along the eastern boundaries of the coal mines' sites. This corridor was used as a destination and HWY 59 was used as the source to analyze and generate potential east-west routes. The source and destination points were logically located along these corridors at the same latitude as each mine access.

The source and destination points used in the model runs and the best fit corridors it produced are identified in **FIGURE 4-1**. These potential alignments served as a basis for the future transportation network development.

4.3 Future Corridor Identification

The corridors in **FIGURE 4-1** produced from the initial model runs served as a base map of potential corridor opportunities needing further refinement. Engineering judgment was used to combine and eliminate corridor solutions narrowing them to a functional transportation network. The following are the primary factors that drove decision making:

1. **Create corridors with the highest likelihood of remaining permanent**
2. **Interconnectivity and Mobility**
    a. **Six mile spacing of east-west corridors (target value)**
    b. **Alternate north-south route through the study area**
3. **Use existing corridors where feasible**
4. **Take advantage of existing rail crossings and minimize new crossings**
5. **Improve access to mine sites**

FIGURE 4-2 is the culmination of working through this process and represents the future transportation plan alternatives. Since the primary objective of this study is to develop a plan for a permanent transportation network, it is apparent these transportation plan alternatives meet that need. It should be pointed out that some east-west corridors are proposed through what appears to be active mining. Although it was desired to avoid such occurrences, no other alternate solutions were available. Specific corridors should be implemented after mining and reclamation of the land takes place (this will be reflected in the transportation plan priority and implementation recommendations). Due to the uncontrolled backfill processes associated with reclaiming mined land, it is recommended Campbell County and the specific mining companies establish some measure of quality control and acceptable standards for reclamation of land that will be beneath a future, proposed road corridor.

4.4 Transportation Plan Recommendations

In order to develop recommendations for a comprehensive, prioritized transportation plan, it was important to understand when existing road corridors will be impacted by mining operations throughout the 30 year study period. Mining Stakeholders identified the approximate years in which mining operations will impact existing county roads. A prioritized implementation plan was created focusing on developing the future transportation network systematically in segments as impacts to the existing network occur due to mining. **FEGURE 4-2** identifies the approximate year in which specific road segments will be impacted by mining. It also identifies the recommended priority for each segment of the new transportation plan alternatives.

The resulting transportation plan priorities recommended for implementation in the next 10 years are described as follows:

10-year Planned Priorities

1. Reno/Edwards extension east to segment #2
2. New N-S corridor connection from HWY 450 to Mackey Road
3. New N-S corridor connection from Mackey Road to Antelope Road
4. Hoadley Road extension east to new N-S corridor (utilizes and upgrades existing Coal Creek mine access road)
5. New N-S corridor segment from Bishop Road to new Hoadley extension

6. Hoadley upgrade from Wagensen north to new Hoadley extension
7. Wagensen upgrade from HWY 59 to south end of Hoadley
8. Four Corners east extension
9. New N-S corridor segment from Bishop Road north to Four Corners
10. Extension of HWY 387 east and south to HWY 450
11. New N-S corridor segment from new Hoadley east extension to new HWY 387 east extension

Roadway segment priorities were further developed into an implementation plan for the following periods:

- 0 to 5 Year Plan
- 5 to 10 Year Plan
- 10 to 20 Year Plan
- >20 Year Plan

The implementations of these future network segments throughout the planning periods are identified in **FIGURES 4-4** thru **4-6.** A complete implementation schedule with cost estimates in 2010 dollars, recommended roadway functional classifications and segment descriptions are provided in **TABLE 4-2**. Worksheets used to estimate costs for each roadway segment are provided in **Appendix J**.

4.5 Funding Alternatives

As the owner and operator of the transportation system within the study area, with the exception of state highways and I-90, Campbell County is expected to be the primary funding source for new transportation improvements. The planned improvements identified in this study will improve the county's overall network by increasing mobility through improved roadway interconnectivity. The opportunity for these improvements will be created by mining impacts to existing roads. Without these impacts, significant changes to the network, such as what is recommended in this plan, cannot be justified based on transportation needs.

There are many beneficiaries to the improvements recommended in this plan:

- Campbell County Residents
- Mining Companies
- Campbell County
- The State of Wyoming
- The Federal Government

Each entity stands to benefit either financially or functionally or both. It is reasonable to assume that some formulation of cost sharing to fund these transportation plan improvements will be the key to implementation. Sources of funding and cost sharing scenarios should be discussed further with Stakeholders and policy makers at both the state and federal level. Potential ideas and solutions may come during review of the Preliminary Report and will be presented further in the Final Report document. Some initial ideas are as follows:

- **Establish a Road Impact Fee assessed through the county** based on a formula that examines impacts to existing roads and cost to rebuild new, and applies credit toward the shared benefits the new road will create.

- Initiate discussion with congressional staff at both the state and federal level to accomplish: 1) Release **AML funding** for use and 2) **Change the language in state statutes** to be used for road/infrastructure projects impacted by mining operations.
- **Direct appropriations from the federal government.**
- Ask mining companies to make a lump sum payment today for planned future impacts. The money would go into a fund set aside for new network improvements and earn interest in the meantime generating additional revenue for project funding. The county would use the money to implement the transportation plan accommodating impacted roads in advance of the actual need occurring. If roads are not built for whatever reason, the money intended for that purpose would be refunded back to the contributing mining company or companies.
- Establish a **cost share formula** based on specific benefits each entity (mining companies, Campbell County, WYDOT) will realize as a result of each network improvement.

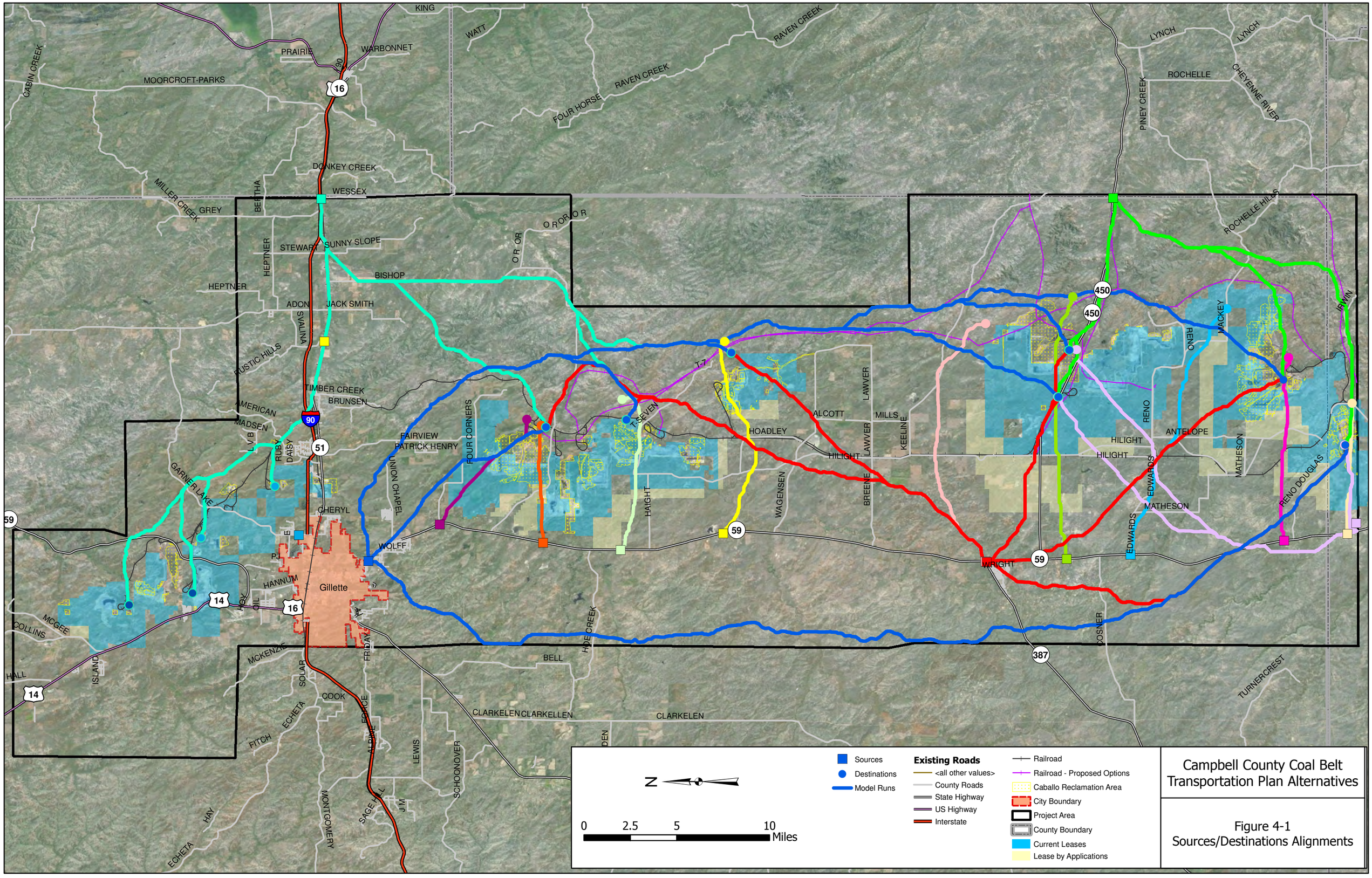
TABLE 4-1 - Important Factors & Raster Layer Weighting

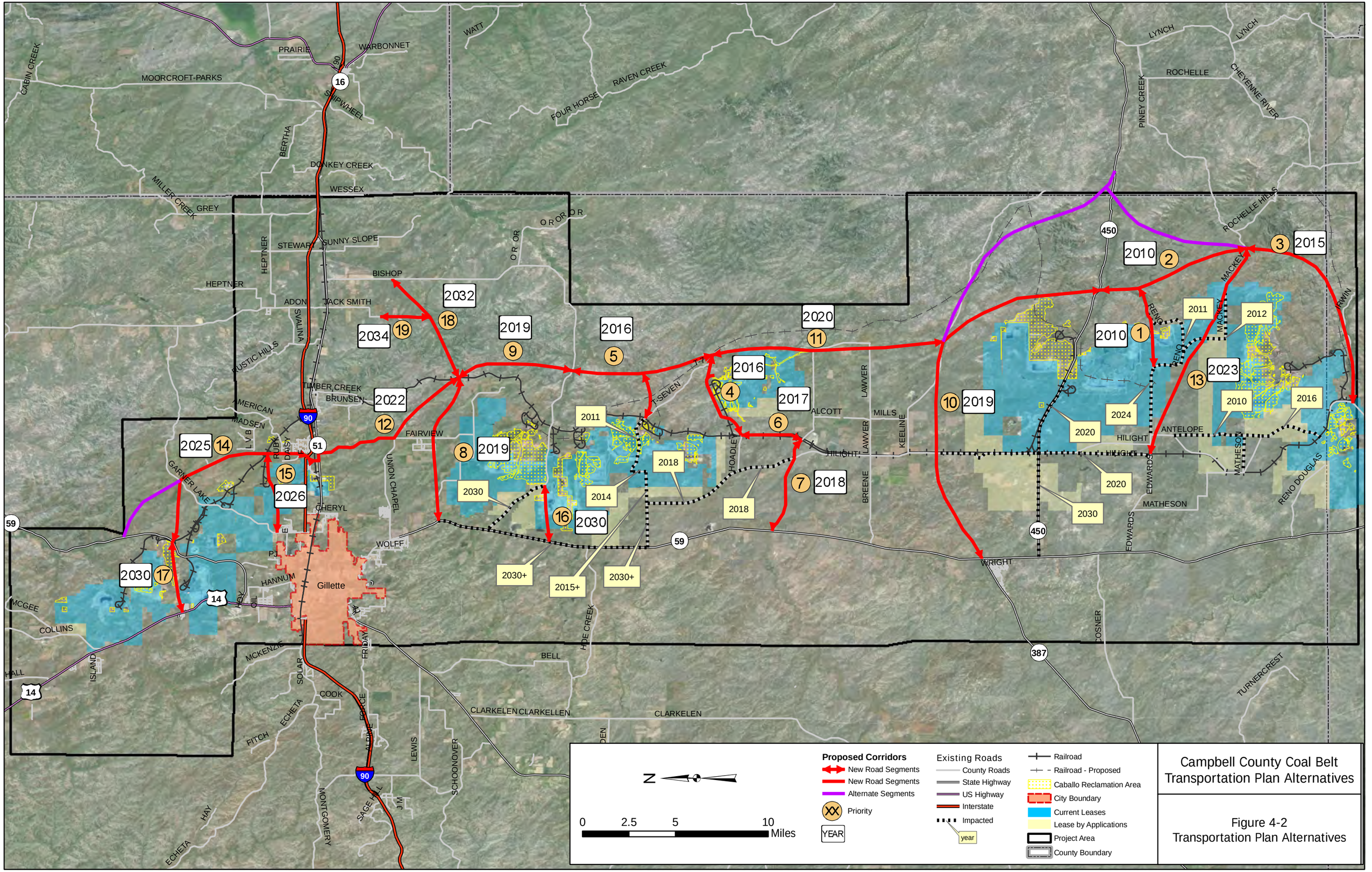
IMPORTANT FACTORS	RANK	GIS MODEL RASTER LAYER	WEIGHT (%)
Permanent Corridor Development	1		
		Coal Leases (LBA) In 1 layer Current Leases (In 1 layer) Reclamation areas (In 1 layer) Strip Ratios	28
Meeting Design Standards for Grade (7% Max)	2		
		Digital Elevation Model	18
Use of Existing Corridors	3		
		Existing Roads/ Roadway functional class	14
Impacts to Manmade Structures	4		
		Compressor Stations Cell Towers Substations Airports Nelson Brothers/ explosives depot Highlight gas plant Cemetaries	13
Crossing Railroads	**5**		
		BNSF Rail System Proposed DM&E	10
***Cost**	6		0
		Digital Elevation Model Existing Roads/ Roadway functional class	
****Use of Existing Corridors**	7		0
		Existing Roads/ Roadway functional class	
***Corridor Spacing**	8		0
		New Corridor Projections	
***Roadway Connectivity**	9		0
		Existing Roads/ Roadway functional class New Corridor Projections	
Impacts to non-industry/ non-government lands	10		
		Parcel map	7
Crossing over or under manmade structures	11		
		Oil and Gas Pipelines Electrical Transmission	5
Impact on environmentally sensitive areas	12		
		Wildlife (Eagles, Raptors, Sage Grouse) Alluvials Streams National Forest Floodplain (100 year)	5
		Total Weight %	100

* Not used in Model - manually defined and adjusted

** Moved and reprioritzed as #3

TABLE 4-1


Gillette
Sources
Destinations
Model Runs
Existing Roads
<all other values>
County Roads
State Highway
US Highway
Interstate
Railroad
Railroad - Proposed Options
Caballo Reclamation Area
City Boundary
Project Area
County Boundary
Current Leases
Lease by Applications
0 2.5 5 10 Miles
Campbell County Coal Belt Transportation Plan Alternatives
Figure 4-1
Sources/Destinations Alignments



Z

0 2.5 5 10 Miles

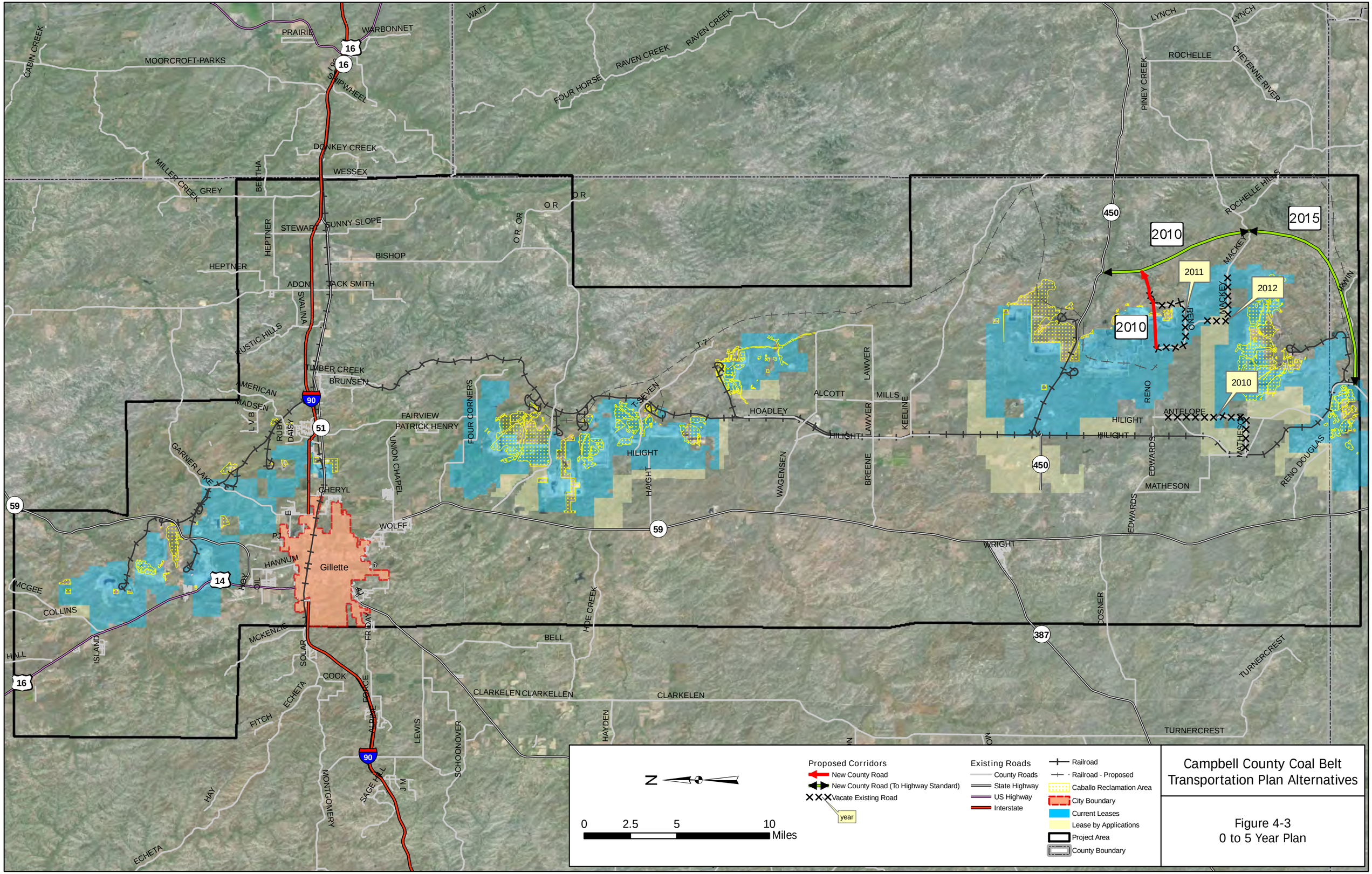
Proposed Corridors
- New Road Segments
- New Road Segments
- Alternate Segments
- XX Priority
- YEAR

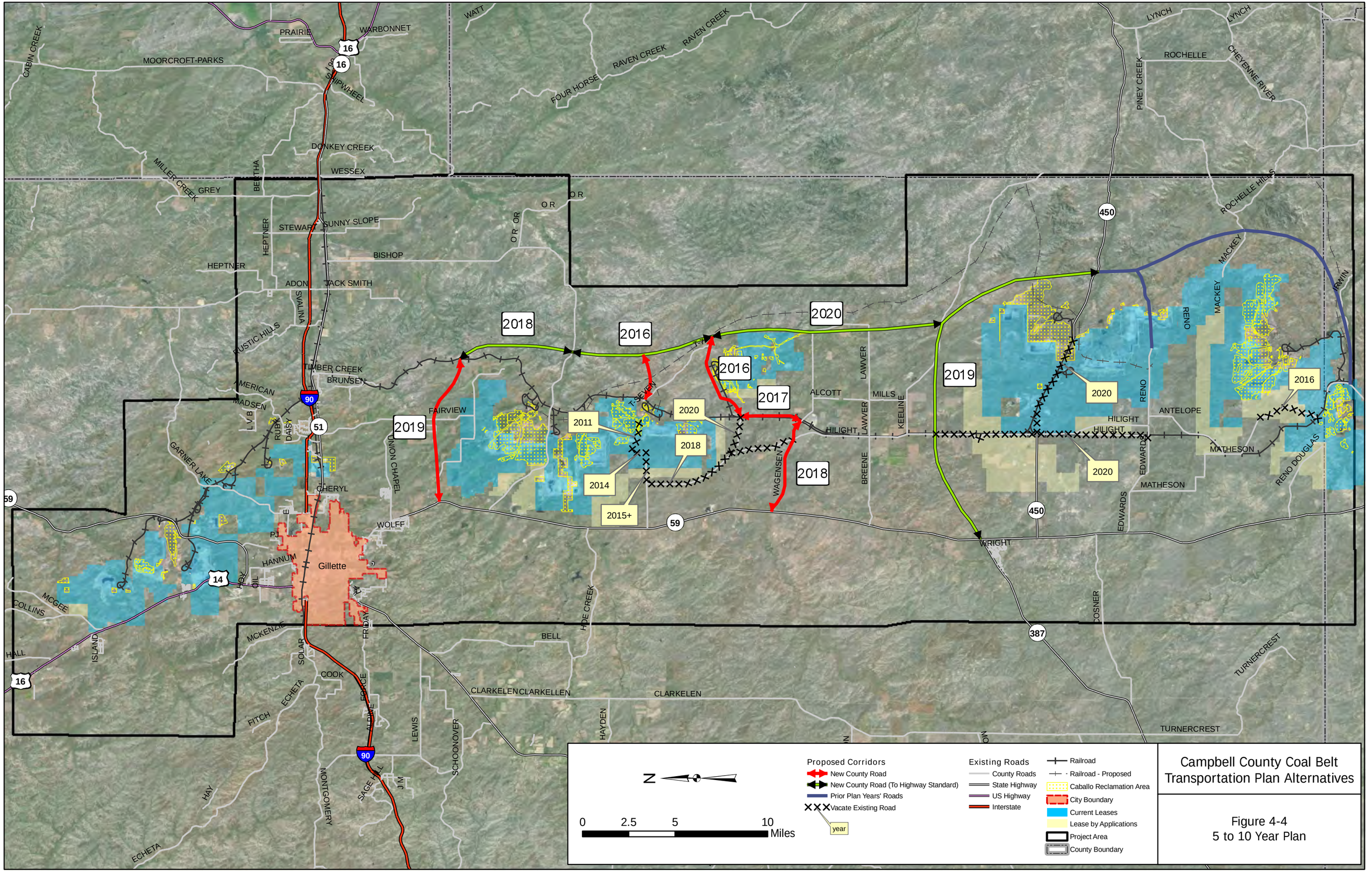
Existing Roads
- County Roads
- State Highway
- US Highway
- Interstate
- Impacted
- year

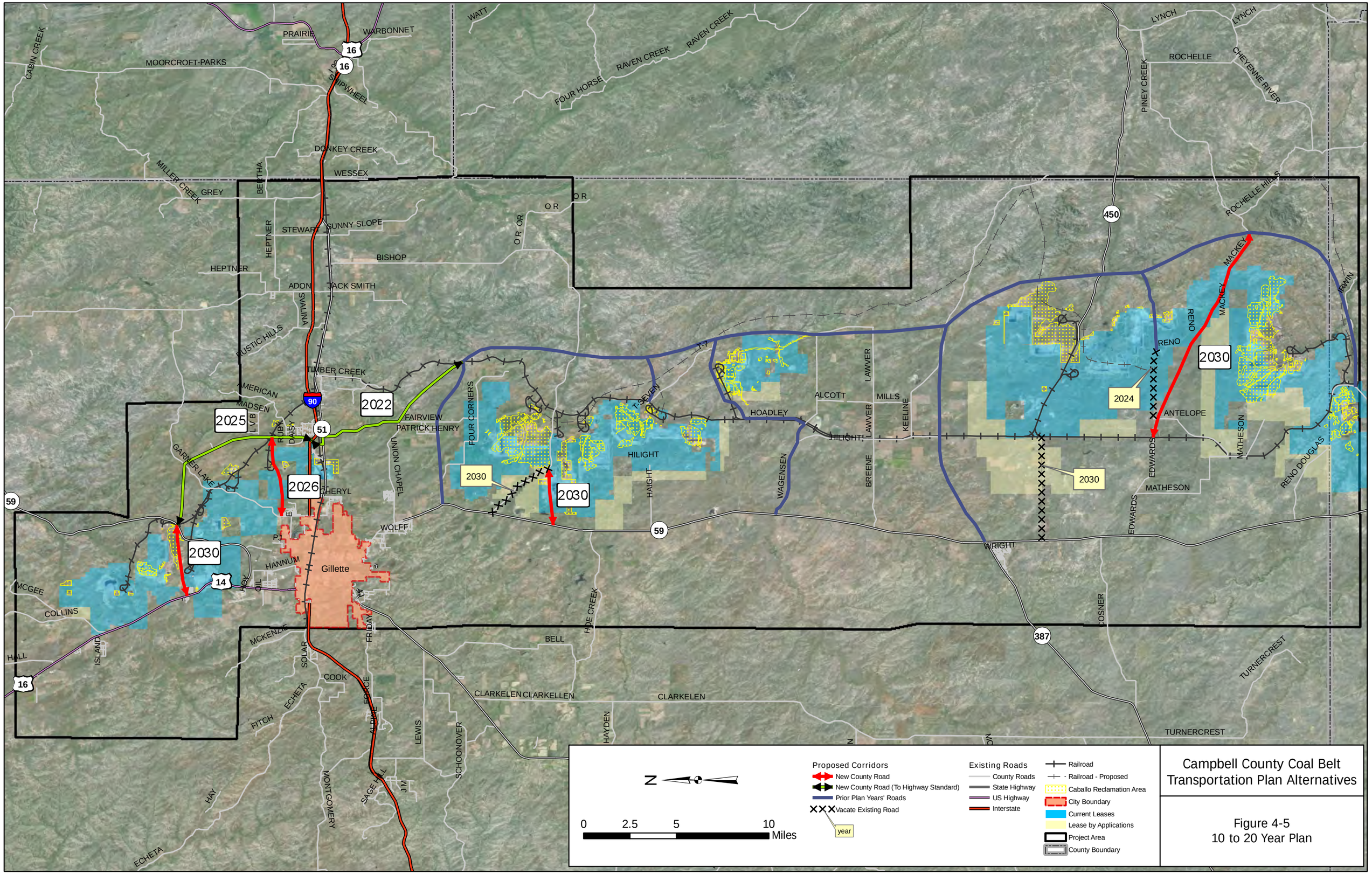
- Railroad
- Railroad - Proposed
- Caballo Reclamation Area
- City Boundary
- Current Leases
- Lease by Applications
- Project Area
- County Boundary

Campbell County Coal Belt Transportation Plan Alternatives

Figure 4-2
Transportation Plan Alternatives


Proposed Corridors
New County Road
New County Road (To Highway Standard)
Vacate Existing Road
year
Existing Roads
County Roads
State Highway
US Highway
Interstate
Railroad
Railroad - Proposed
Caballo Reclamation Area
City Boundary
Current Leases
Lease by Applications
Project Area
County Boundary
0 2.5 5 10 Miles
Campbell County Coal Belt Transportation Plan Alternatives
Figure 4-3
0 to 5 Year Plan


PRAIRIE
WARBONNET
MOORCROFT-PARKS
CABIN CREEK
SHIPWHEEL
DONKEY CREEK
WESSEX
MILLER CREEK
GREY
BEATTHA
HEPTNER
STEWART
SUNNY SLOPE
BISHOP
ADON
JACK SMITH
SVALINA
RUSTIC HILLS
TIMBER CREEK
BRUNSEN
AMERICAN
MADSEN
LVB
RUBY
DAISY
GARNER LAKE
CHERYL
UNION CHAPEL
FAIRVIEW
WATT
FOUR HORSE
RAVEN CREEK
LYNCH
ROCHELLE
PINEY CREEK
CHEYENNE RIVER
ROCHELLE HILLS
MACKEY
IRWIN
RENO
ANTELOPE
HILIGHT
MATHESON
EDWARDS
RENO DOUGLAS
ALCOTT
MILLS
LAWVER
KEELINE
BREENE
WAGENSEN
T-SEVEN
WOLFF
PJ
HANNUM
Gillette
JOY
OIL
MCGEE
COLLINS
HALL
ISLAND
MCKENZIE
SOLAR
FRIDAY
HYDE CREEK
BELL
COOK
ECHETA
FORCE
ALPINE
FITCH
LEWIS
SCHOONOVER
HAY
MONTGOMERY
SAGE HILL
JM
CLARKELEN
HAYDEN
WRIGHT
COSNER
TURNERCREST
2011
2014
2015+
2016
2017
2018
2019
2020
2016
2018
2019
2020
2020
2018
2020
2016
16
90
51
59
14
450
387
0
2.5
5
10
Miles
N
Proposed Corridors
New County Road
New County Road (To Highway Standard)
Prior Plan Years' Roads
Vacate Existing Road
year
Existing Roads
County Roads
State Highway
US Highway
Interstate
Railroad
Railroad - Proposed
Caballo Reclamation Area
City Boundary
Current Leases
Lease by Applications
Project Area
County Boundary
Campbell County Coal Belt
Transportation Plan Alternatives
Figure 4-4
5 to 10 Year Plan



Campbell County Coal Belt Transportation Plan Alternatives

Figure 4-5
10 to 20 Year Plan

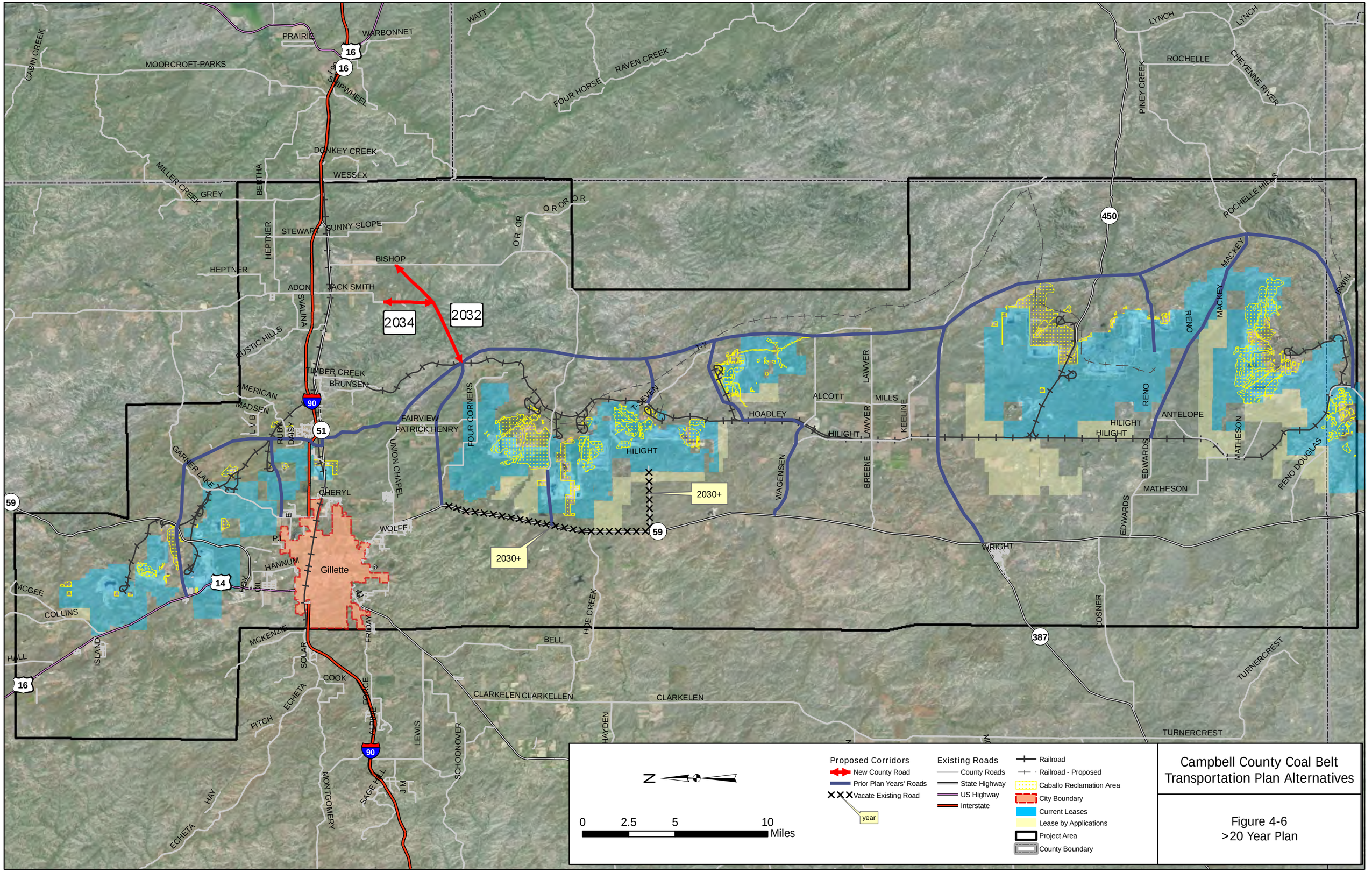

2034
2032
2030+
2030+
Gillette
BISHOP
JACK SMITH
STEWART
SUNNY SLOPE
WESSEX
DONKEY CREEK
PRAIRIE
WARBONNET
MOORCROFT-PARKS
SHIPWHEEL
GREY
BERTHA
HEPTNER
ADON
SVALINA
RUSTIC HILLS
TIMBER CREEK
BRUNSEN
AMERICAN
MADSEN
FAIRVIEW
PATRICK HENRY
FOUR CORNERS
UNION CHAPEL
HILIGHT
HOADLEY
ALCOTT
MILLS
LAWVER
KEELINE
WAGENSEN
BREENE
RENO
MACKEY
ANTELOPE
EDWARDS
MATHESON
RENO DOUGLAS
IRWIN
ROCHELLE
ROCHELLE HILLS
PINEY CREEK
CHEYENNE RIVER
LYNCH
WATT
RAVEN CREEK
FOUR HORSE
CABIN CREEK
MILLER CREEK
GARNER LAKE
CHERYL
WOLFF
HANNUM
MCGEE
COLLINS
HALL
ISLAND
MCKENZIE
SOLAR
FRIDAY
HYDE CREEK
BELL
COOK
ECHETA
FITCH
FORCE
N PINE
LEWIS
SCHOONOVER
MONTGOMERY
SAGE HILL
J M
HAY
CLARKELEN
CLARKELLEN
HAYDEN
WRIGHT
COSNER
TURNERCREST
59
16
90
51
14
387
450
Z
0 2.5 5 10 Miles
Proposed Corridors
New County Road
Prior Plan Years' Roads
Vacate Existing Road
year
Existing Roads
County Roads
State Highway
US Highway
Interstate
Railroad
Railroad - Proposed
Caballo Reclamation Area
City Boundary
Current Leases
Lease by Applications
Project Area
County Boundary
Campbell County Coal Belt Transportation Plan Alternatives
Figure 4-6
>20 Year Plan

TABLE 4-2

CAMPBELL COUNTY COAL BELT TRANSPORTATION STUDY

2010 to 2040

(PROPOSED THIRTY YEAR PLAN)

RECOMMENDED IMPROVEMENTS AND COST ESTIMATES

PLANNED IMPLMENTATION	PRIORITY & SEGMENT #	CONSTRUCTION YEAR (APPROX.)	SEGMENT NAME	PROPOSED FUNCTIONAL CLASSIFICATION	LENGTH (MILES)	ESTIMATED CONSTRUCTION COSTS	ESTIMATED PROFESSIONAL SERVICES (2010 DOLLARS)					ESTIMATED TOTAL COSTS	SEGMENT DESCRIPTION
						EXTENDED COSTS 2010 DOLLARS (MILLIONS)	LEGAL FEES	APPRAISAL AND R/W NEGOTIATION	CORRIDOR STUDY (INCLUDES LAND SURVEYING)	DESIGN ENGINEERING	CONSTRUCTION ENGINEERING	EXTENDED COSTS 2010 DOLLARS (MILLIONS)	
0 to 5 Years	1	2010	Reno/Edwards Extension East	Minor Collector	3.5	2.4	$ 13,000.00	$ 71,000.00	$ 53,000.00	$ 252,000.00	$ 252,000.00	3.1	Extension of Reno from existing vacation point to segment #2 and extension of Edwards Road to Reno.
	2	2010	HWY 450 S to Mackey	Major Collector/ HWY Standards	8.3	9.0	$ 46,000.00	$ 274,000.00	$ 125,000.00	$ 927,000.00	$ 927,000.00	11.3	Construct a new N-S county road from HWY 450 to Reno built to HWY Standards.
	3	2015	Extend Segment #2 to Antelope Road	Major Collector/ HWY Standards	11.7	16.4	$ 84,000.00	$ 385,000.00	$ 176,000.00	$ 1,679,000.00	$ 1,679,000.00	20.4	Continue and complete the southern section of the new N-S Corridor from Segment #2 to Antelope Road.
	4	2016	Hoadley Extension	Minor Collector	6.2	7.2	$ 37,000.00	$ 219,000.00	$ 93,000.00	$ 746,000.00	$ 746,000.00	9.1	Upgrade Coal Creek Mine access as an extension of Hoadley Road connecting to new N-S Corridor
											Sub-Total	**43.9**	
5 to 10 Years	5	2016	N-S corridor from Bishop to Hoadley Extension	Major Collector/ HWY Standards	10.2	14.1	$ 73,000.00	$ 361,000.00	$ 153,000.00	$ 1,451,000.00	$ 1,451,000.00	17.6	N-S corridor from Bishop Road to new Hoadley Extension (E-W Corridor, Segment #4).
	6	2017	Hoadley Upgrade	County Road/ Minor Road	3.3	2.3	$ 12,000.00	$ 66,000.00	$ 50,000.00	$ 238,000.00	$ 238,000.00	2.9	Upgrade section of Hoadley Road from Wagensen North to West end of Hoadley Extension (Segment #4).
	7	2018	Wagensen Upgrade	Minor Collector	5.4	4.4	$ 23,000.00	$ 109,000.00	$ 81,000.00	$ 454,000.00	$ 454,000.00	5.6	Upgrade Wagensen from HWY 59 to new Hoadley extension to be constructed as a minor collector
	8	2019	Four Corners Extension	Minor Collector	7.8	7.3	$ 38,000.00	$ 233,000.00	$ 117,000.00	$ 750,000.00	$ 750,000.00	9.2	Improve and extend Four Corners east to new N-S corridor
	9	2019	New N-S corridor from Bishop N to Four Corners	Major Collector/ HWY Standards	6.3	10.3	$ 53,000.00	$ 223,000.00	$ 95,000.00	$ 1,054,000.00	$ 1,054,000.00	12.8	Construct a new N-S corridor from Bishop Road to new Four Corners Extension - built to HWY Standards
	10	2019	Extension of HWY 387 E & S to HWY 450	Major Collector/ HWY Standards	21.6	30.9	$ 158,000.00	$ 739,000.00	$ 324,000.00	$ 3,161,000.00	$ 3,161,000.00	38.4	Extend a major collector or state HWY from HWY 387 and HWY 59 intersection to HWY 450 following an E then S alignment.
	11	2020	N-S Corridor from Hoadley to HWY 387	Major Collector/ HWY Standards	12.2	16.1	$ 82,000.00	$ 386,000.00	$ 183,000.00	$ 1,648,000.00	$ 1,648,000.00	20.0	Continue N-S Corridor South connecting Segments #5 and #10 - built to HWY Standards
											Sub-Total	**106.5**	
10 to 20 Years	12	2022	Upgrade and extend Fairview from I-90 to Four Corners	Major Collector/ HWY Standards	10.2	11.2	$ 57,000.00	$ 279,000.00	$ 153,000.00	$ 1,148,000.00	$ 1,148,000.00	14.0	N-S Corridor by upgrading and utilizing Fairview Road; Extend on N and S ends to I-90 and Four Corners.
	13	2023	Edwards extension to new N-S Corridor	Minor Collector	13	12.5	$ 65,000.00	$ 407,000.00	$ 195,000.00	$ 1,294,000.00	$ 1,294,000.00	15.8	Extend Edwards Road as a minor collector in a S & E alignment to connect to the new N-S Corridor
	14	2025	Upgrade and extend American from I-90 N to HWY 60	Major Collector/ HWY Standards	10.5	13.0	$ 67,000.00	$ 338,000.00	$ 158,000.00	$ 1,333,000.00	$ 1,333,000.00	16.2	Extend N-S Corridor by upgrading and utilizing American Road and extending from I-90 N to HWY 59.
	15	2026	Extend Northern Drive E to new N-S Corridor	Minor Collector	4.5	4.8	$ 25,000.00	$ 159,000.00	$ 68,000.00	$ 494,000.00	$ 494,000.00	6.0	Make the connection of Northern Drive to the new N-S Corridor.
	16	2030	Realign Bishop to HWY 59	Minor Collector	3	3.2	$ 16,000.00	$ 106,000.00	$ 45,000.00	$ 329,000.00	$ 329,000.00	4.0	Extend Bishop Road to HWY 59 as a minor collector.
	17	2030	Connection between HWY 14/16 & HWY 59	Minor Collector	4	4.4	$ 22,000.00	$ 141,600.00	$ 60,000.00	$ 450,000.00	$ 450,000.00	5.5	E-W connection between HWY 14/16 and HWY 59 N of Dry Fork and Eagle Butte Mines.
											Sub-Total	**61.5**	
> 20 Years	18	2032	Extension of Four Corners to Bishop	County Road/ Minor Road	6.6	7.1	$ 37,000.00	$ 234,000.00	$ 99,000.00	$ 735,000.00	$ 735,000.00	9.0	Extend the new Four Corners Extension to Bishop Road as a minor county road.
	19	2034	Extension of Jack Smith to Four Corners Extension	County Road/ Minor Road	6.6	6.1	$ 32,000.00	$ 170,000.00	$ 99,000.00	$ 631,000.00	$ 631,000.00	7.7	Extend Jack Smith Road to the new Four Corners Extension as a minor county road.
											Sub-Total	**16.7**	
											Total	**228.5**	

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