EXISTING AND PROJECTED CONDITIONS

Paradise Valley Corridor Planning Study
US 89 (Gardiner to Livingston)

FINAL

MONTANA MDT DEPARTMENT OF TRANSPORTATION

Prepared for:
MONTANA DEPARTMENT OF TRANSPORTATION

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ABBREVIATIONS/ACRONYMS

AADT	Average Annual Daily Traffic
AAGR	Average Annual Growth Rate
AASHTO	American Association of State Highway and Transportation Officials
ATR	Automatic Traffic Recorder
CAPS	Crucial Areas Planning Systems
CDP	Census Designated Place
CRF	Code of Federal Regulations
CO	Carbon Monoxide
DEQ	Department of Environmental Quality
EA	Environmental Assessment
EO	Executive Order
EPA	U. S. Environmental Protection Agency
FHWA	Federal Highway Administration
FONSI	Finding of no Significant Impact
FWP	Montana Fish, Wildlife, and Parks
GIS	Geographic Information Systems
HBP	Highway Bridge Program
HRDC	Human Resource Development Council
LUST	Leaking Underground Storage Tank
LWCFA	Land and Water Conservation Fund Act
LWQD	Local Water Quality District
LOS	Level of Service
MBMG	Montana Bureau of Mines and Geology
MDT	Montana Department of Transportation
MFISH	Montana Fisheries Information System
MRL	Montana Rail Link
mtons	Metric Tons
MSAT	Mobile Source Air Toxics
NAAQS	National Ambient Air Quality Standards
NHS	National Highway System
NPS	National Park Service
NRCS	Natural Resource Conservation Service (United States Dept. of Agriculture)

PM	Particulate Matter
REMI	Regional Economic Models, Inc.
RHRS	Rockfall Hazard Rating System
RP	Reference Post
SAMP	Special Area Management Plan
SOC	Species of Concern
SRMZ	Special River Management Zone
STIP	Surface Transportation Improvement Program
T&E	Threatened and Endangered
TMDL	Total Maximum Daily Loads
USACOE	US Army Corps of Engineers
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
UST	Underground Storage Tank
vpd	Vehicles per Day
YNP	Yellowstone National Park

EXISTING AND PROJECTED CONDITIONS

1.0 INTRODUCTION

The US Highway 89 (N-11) corridor provides the primary surface transportation link between Livingston and Yellowstone National Park (YNP). US 89 is one of the major routes in Montana used to access YNP through Gardiner. The highway passes through the "Paradise Valley" situated between Livingston and Yankee Jim Canyon in Park County, and generally parallels the Yellowstone River.

This report identifies existing and projected roadway conditions and social, economic and environmental factors for US 89 between Gardiner and Livingston. The analysis performed includes a planning level examination of the corridor by applying technical and environmental factors to determine known issues and/or areas of concern.

1.1 Study Area and Background

The study area for the *Paradise Valley Corridor Planning Study* includes a 0.75-mile buffer on each side of US 89 beginning at Reference Point (RP) 0.0 at the YNP Boundary in Gardiner and extending north through the communities of Corwin Springs and Emigrant to RP 52.5 just south of the City of Livingston. **Figure 1** shows the study area boundary, which is located entirely within Park County.

US 89 is classified as a Rural Principal Arterial Highway on the Non-Interstate National Highway System (NHS) within the study area. The highway is an integral part of the regional rural transportation network connecting local population and commerce to the NHS. While most of the land adjoining the corridor is undeveloped, cultivated and ranch lands, year-round and seasonal businesses, outdoor recreation sites, and residences also exist within the study area.

US 89 connects Interstate 90 (I-90) at Livingston to YNP at Gardiner. Gardiner is situated at the original entrance to YNP and is the only year-round vehicular entrance into the park. The Gardiner Entrance (also known as the North Entrance) is one of the most heavily used entrances into the park. The entrance provides access to the northern portion of YNP and year-round access to the Cooke City/Silver Gate areas.

National Park Service (NPS) visitation statistics for 2012 show that June through September traffic counts at the North Entrance ranged from approximately 27,000 to more than 58,000 vehicles each month. Peak traffic counts occurred in July. Traffic counts at the North Entrance during the fall and winter months ranged from 5,000 to 6,000 vehicles each month during 2012.

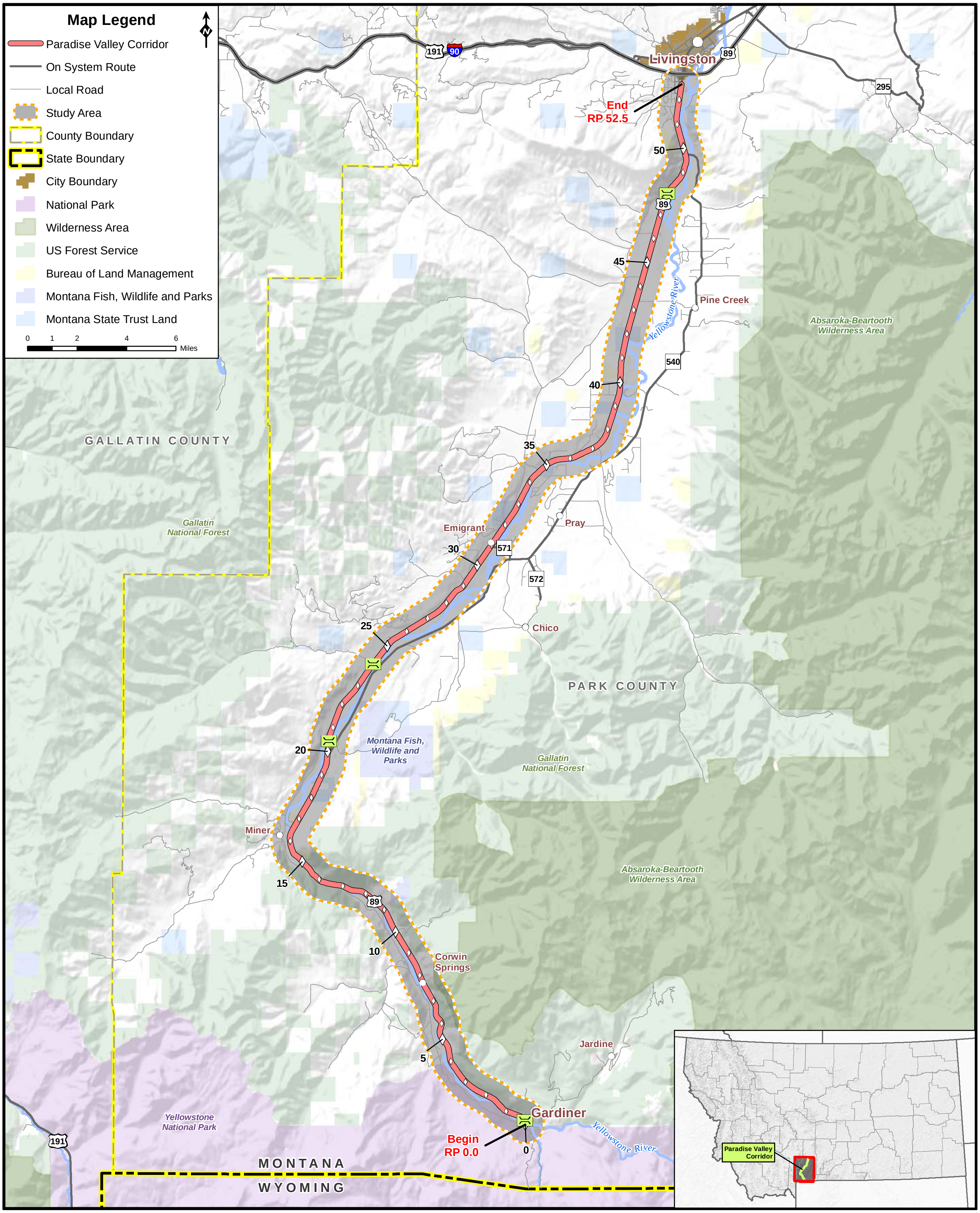

Figure 1: Vicinity Map

1.2 Past, Current, and Planned Projects in the Corridor

The Montana Department of Transportation's (MDT) online summary of road and bridge construction projects awarded since July 23, 1987, were reviewed to identify projects previously implemented on US 89 within the study area. Since 1987 MDT has completed thirteen projects along the corridor such as construction of the Emigrant Rest Area, the non-motorized path just south of Livingston, and various pavement preservation projects. **Table 1** lists these projects, along with a brief description of the scope if it was available in MDT's Program and Project Management System.

Table 1: MDT Projects on US 89 Since 1987

MDT Project Name	Description
Emigrant Rest Area – Park County	Rest area construction
4 Mi. So. of Livingston – Park County	N/A - no information available
South of Emigrant, Park County	N/A - no information available
Emigrant North & South	N/A - no information available
Yankee Jim Canyon – North	N/A - no information available
Emigrant – North	Asphalt overlay
Carter's Bridge Path – Livingston	Non-motorized path construction
Scott Street – Gardiner	Asphalt mill and fill
Turn Bay – 13 Km S of Livingston	Left turn lane construction
Livingston – South	Asphalt chip seal
Emigrant – South	Asphalt chip seal
South of Livingston - South	Asphalt chip seal
Livingston - South (US-89)	Asphalt mill and fill

Source: MDT Project List accessible at http://www3.mdt.mt.gov:7782/mttplc/mttplc.tplk0007.project_init

MDT's online summary of road and bridge construction projects shows two other projects on East River Road (S-540) that adjoin US 89 within the study area. These projects include:

- **Carters Bridge – South***:* This project was let in February 2010 and included a seal and cover and pavement markings on S-540 east of US 89.
- **East River Road – South of Emigrant***:* This project was recently completed and realigned a section of East River Road to provide a "T" intersection with US 89.
- **US 89 Slide N of Corwin Spring**: This emergency project is located at RP 8.6 to 8.7 and will repair damage from the recent wash out.

The Montana 2013-2017 *Final Surface Transportation Improvement Program* (STIP) is a federally-required publication that shows funding obligations over the next five years. This program identifies improvement projects to preserve and improve Montana's transportation system. The Montana 2013-2017 Final STIP identifies the following future projects for US 89 within the study area:

- **SF 110-Rumble Strips N-11**: This project involves installation of shoulder rumble strips along both sides of US 89 from the north end of the Gardiner Urban Limits (RP 1.2) to the south end of the Livingston Urban Limits (RP 49.5). Rumble strips will not be built across bridges, adjacent to guardrails, and at specified approaches, and they will be limited in locations close to residential homes. A modified rumble strip will be used in locations where the shoulder width is less than 4 feet.

- **Gardiner North**: This project involves a 0.15-foot mill and fill and full-width seal and cover treatment on US 89 between Gardiner and the Big Creek Bridge (RP 0 to RP 1.0). The project also includes ADA upgrades at the intersections and bridge deck repair.
- **North of Gardiner North**: This 12-mile-long project on US 89 involves a mill and fill and full-width seal and cover treatment on US 89 beginning at RP 1.10.
- **Yankee Jim Canyon-North**: This 10.9-mile-long project on US 89 involves a mill and fill and full-width seal and cover treatment on US 89 beginning at RP 13.17.
- **Cedar Cr – 16 km N of Gardiner**: Cedar Creek is currently conveyed under US 89 in culverts at RP 10.2. The project which will remove and replace the culverts.
- **SF 129 – Left Turn Ln Emigrant RA**: This safety project would provide a left-turn lane for southbound vehicles on US 89 at the Emigrant Rest Area (RP 23.5).

2.0 DEMOGRAPHICS

This section provides an overview of socioeconomic characteristics of the study area. Historic and recent trends in area demographics help define existing conditions and aid in forecasting techniques as there is a direct correlation between motor vehicle travel and socioeconomic indicators.

Demographic and socioeconomic information was reviewed to help determine recent trends in population, age distribution, employment, economic status, and commuting for area residents. Socioeconomic data sources do, however, often lag considerably behind the actual years of interest. This analysis presents the most recent data and statistics available and indicates recent and potential changes in the area.

2.1 Population Characteristics

A review of demographics within the study area is appropriate to gain an understanding of historical trends in population, age, race, and ethnicity. Understanding population composition is necessary, as the data may influence the types of improvements identified. For example, an aging population may indicate a need for specific types of transportation improvements such as transit services and/or non-motorized infrastructure improvements. The presence of a disadvantaged population may warrant other considerations.

Table 2 shows total population and growth statistics for the City of Livingston, the Gardiner Census Designated Place, and Park County. A comparison with similar statistics for the State of Montana and the United States is also provided. Census Designated Places (CDP) are delineated by the Census Bureau to provide data for settled concentrations of population that are identifiable by name, but that are not legally incorporated areas. The Gardiner CDP was created during the 2000 Census; thus data for earlier censuses are not available for this subdivision of Park County.

Table 2: Population Growth and Density

Area	Population (2000)	Population (2010)	Percent Growth (2000-2010)	Persons per Square Mile (2010)	Current Population (2012 Estimate)
City of Livingston	6,851	7,044	2.8%	1,170.50	(i)
Gardiner CDP	851	875	2.8%	152.4	(i)
Park County	15,694	15,636	-0.4%	5.6	15,592
State of Montana	902,195	989,415	9.7%	6.8	1,010,921
United States	281,421,906	308,745,538	9.7%	87.4	313,914,040

Source: US Bureau of the Census, Census of the Population
(i) Data Not Available

Between 2000 and 2010, the population in Park County remained generally flat. The City of Livingston and the Gardiner CDP, however, experienced a population growth of approximately 3 percent over this period. This contrasts with the 9.7 percent growth experienced in the State of Montana and the entire United States over the same period. In the 2010 Census, Park County has a density of 5.6 persons per square mile. This is slightly below the population density for the State of Montana as a whole.

Table 3 depicts the race and ethnicity characteristics in Park County, the City of Livingston, the State of Montana, and the United States at the time of the 2010 Census. The populations of both Park County and the City of Livingston are predominately white with percentages of minority populations well below those seen for the State of Montana and the nation. Data from the 2000 and 2010 censuses shows the ethnic composition of residents of the Gardiner CDP closely mirrors that of the county. Please note the population numbers for ethnic groups presented in the table may not match the Census total percentages and percentages may not add up to 100 percent.

Table 3: Population Race and Ethnicity Data (2010)

Race / Ethnicity	City of Livingston		Park County		State of Montana		United States	
White	6,777	96.2%	15,090	96.5%	884,961	89.4%	223,553,265	72.4%
Black or African American	6	0.1%	21	0.1%	4,027	0.4%	38,929,319	12.6%
American Indian and Alaska Native	56	0.8%	131	0.8%	62,555	6.3%	2,932,248	0.9%
Asian	21	0.3%	52	0.3%	6,253	0.6%	14,674,252	4.8%
Native Hawaiian and Other Pacific Islander	3	0.0%	5	0.0%	668	0.1%	540,013	0.2%
Some Other Race	43	0.6%	80	0.5%	5,975	0.6%	19,107,368	6.2%
Two or More Races	138	2.0%	257	1.6%	24,976	2.5%	9,009,073	2.9%
Hispanic or Latino (of any race)	175	2.5%	325	2.1%	28,565	2.9%	50,477,594	16.3%
Total Population	7,044		15,636		989,415		308,745,538	

Source: US Bureau of the Census, Census of the Population

Table 4 depicts the change in total population and age composition for Park County since 1980. The population in Park County increased by nearly 3,000 residents between 1980 and 2010. Between 1980 and 2010, the percentage of county residents in the 18-64 Years and the 65+ Years categories showed notable increases. During this same time, the number of residents in the <18 Years category decreased by approximately 10 percent. The median age of Park County residents also increased from 32.6 years in 1980 to 45.4 years in 2010. These statistics point to the aging of the population and follow similar trends within Montana and the United States.

Table 4: Park County Age Distribution (1980 – 2012)

Year	<18 Years		18-64 Years		65+ Years		Total Population	Median Age
1980	3,443	27.2%	7,380	58.3%	1,837	14.5%	12,660	32.6
1990	3,684	25.3%	8,592	59.0%	2,286	15.7%	14,562	37.1
2000	3,665	23.4%	9,700	61.8%	2,329	14.8%	15,694	40.6
2010	3,086	19.7%	9,961	63.7%	2,589	16.6%	15,636	45.4
Change (1980 – 2010)	**-357**	**-10.4%**	**2,581**	**35.0%**	**752**	**40.9%**	**2,976**	**12.8**

Source: US Bureau of the Census, Census of the Population

While specific data about the number of seasonal residents in Park County are unavailable, it is possible to extract numbers of seasonal residents by reviewing Census information about housing units and occupancy. **Table 5** presents information about housing units within Park County, the City of Livingston, and the Gardiner CDP at the time of the 2010 Census.

Park County had 9,375 housing units in 2010; these units consisted of 7,310 occupied housing units and 2,065 vacant housing units. Countywide, 63 percent (1,308) of the vacant housing units were considered to be seasonal, recreational, or occasional residences. More than 59 percent of the vacant housing units in the Gardiner CDP in 2010 were classified for seasonal, recreational, or occasional use. This trend is notably different for the City of Livingston where 21 percent of the vacant housing units were for seasonal, recreational, or occasional use.

Table 5: Housing Occupancy and Tenure in Park County (2010)

Area	Total Housing Units	Occupied Housing Units			Vacant Housing Units	
		Total Occupied	Owner Occupied	Renter Occupied	Total Vacant	For Seasonal, recreational or occasional use
Park County	**9,375**	7,310	4,938	2,372	2,065	1,308
City of Livingston	**3,779**	3,356	2,051	1,305	423	92
Gardiner CDP	**556**	460	257	203	96	57

Source: US Bureau of the Census, Census of the Population

2.2 Population Projections

The Montana Department of Commerce Census & Economic Information Center released county-level population projections through 2060 in April 2013. The projections were developed by Regional Economic Models, Inc. (REMI) for the State of Montana using the firm's *eREMI* model. Projections for Park County based on the *eREMI* model show the county's population increasing by more than 4 percent by 2060. In comparison, the model projects that the State of Montana's population will grow by more than 25 percent by 2060.

Table 6 shows the total populations for Park County and the State of Montana in the 2010 Census, and it provides population estimates for key years from 2012 through 2035 based on the *eREMI* model. The projections suggest Park County's population will increase slowly with an overall increase of approximately 2 percent by 2035.

Table 6: Population Projections through 2035

Area	2010	2012	Projected Population				
			2015	2020	2025	2030	2035
Park County	15,636	15,592	15,653	15,760	15,884	15,939	15,883
State of Montana	989,415	1,010,921	1,043,653	1,094,712	1,134,324	1,156,494	1,162,253

Source: US Bureau of the Census, Census of the Population and eREMI for Montana and Counties by Regional Economic Models, Inc.

2.3 Employment and Income Characteristics

Tourism and recreation are important parts of Park County's economy due to the presence of YNP and abundant public lands. Other important industries within the county include agriculture, logging, mining, and health care. Livingston Healthcare is the largest private employer. Chico Hot Springs Resort, the Mountain Sky Guest Ranch, and the Best Western Mammoth Hot Springs Hotel in Gardiner rank among the top ten employers.

Gardiner relies on recreation, tourism, and the service industry to support its economy. Primary employers in the area include NPS, Xanterra Parks & Resorts (a park concessioner), and the US Forest Service (USFS). NPS headquarters for YNP are located at Mammoth Hot Springs approximately 5 miles south of Gardiner within YNP.

Table 7 shows Park County employment by industry for the milestone years between 1980 and 2011. The most recent available data show that total full- and part-time employment in the county was 9,339 in 2011 with approximately 94 percent of the jobs being non-farm-related employment. Total employment in Park County in 2011 was nearly 50 percent higher than that recorded in 1980.

The data in **Table 7** shows the most notable net increase in employment between 1980 and 2011 occurred in the services industry where the total number of jobs nearly doubled. Other industry sectors showing sizable increases in employment since 1980 include finance, insurance, and real estate; construction; and state and local government. These trends likely reflect growth in the county's tourism and recreation-based service economy, as well as the boom in real estate development and building seen in portions of southwest Montana during the early 2000s. Notable declines in employment were seen in the transportation and public utilities sector, retail trade, and manufacturing.

The attractiveness of YNP as a tourist destination and the recreational opportunities available have created a tourist-based economy in Gardiner. The community receives significant income by providing goods and services to park visitors and to NPS employees residing in the area. Local businesses also benefit from annual NPS and concession expenditures for salaries, goods, and services from facilities at or near Gardiner.

Table 7: Employment Trends for Park County (1980 - 2011)

Industry	1980	1990	2000	2010	2011	Net Change (1980 - 2011)	
Agricultural Services & Forestry	71	125	251	(i)	175	104	146%
Mining	14	128	30	(i)	44	30	214%
Construction	294	379	734	703	660	366	124%
Manufacturing	414	347	451	331	341	-73	-18%
Transportation & Public Utilities	1,371	322	356	223	226	-1,145	-84%
Wholesale Trade	55	132	208	55	89	34	62%
Retail Trade	1,052	1,236	1,808	927	928	-124	-12%
Finance, Insurance & Real Estate	409	461	598	941	956	547	134%
Services	1,413	2,214	2,934	4,126	4,193	2,780	197%
Federal & Civilian Government	80	89	99	82	75	-5	-6%
Military	77	113	82	77	78	1	1%
State & Local Government	514	547	642	662	687	173	34%
Farm Employment	523	505	631	545	560	37	7%
Total Full/Part time Employment	**6,287**	**6,598**	**8,824**	**9,244**	**9,339**	**3,052**	**49%**

Source: US Department of Commerce Bureau of Economic Analysis – Table CA25 and Table CA25N.
(i) Not shown to avoid disclosure of confidential information.

Table 8 shows unemployment rates current as of May 2013. The data show a Park County unemployment rate above that for the State of Montana (5.3 percent versus 4.9 percent), but lower than the unemployment rate of 7.3 percent for the United States.

Table 8: Employment Statistics (2013)

Area	Total Labor Force	Employed	Unemployed	Unemployment Rate
Park County	8,658	8,200	458	5.3%
State of Montana	509,660	482,200	27,460	4.9%
United States	155,734,000	143,724,000	11,302,000	7.3%

Source: MT Department of Labor and Industry, Research and Analysis Bureau – Labor Force Statistics, May 2013 (data are not seasonally adjusted).

According to the 2007–2011 *American Community Survey* five-year estimates, median household income levels for Park County and residents of the City of Livingston and the Gardiner area were below those for the State of Montana and the United States. Park County's per capita income level was near the average for the State of Montana, but only 88 percent of the national average. The per capita income level for residents of the City of Livingston was below that of the county, state, and nation. The per capita income level for residents of the Gardiner CDP was estimated to be slightly higher than that of the United States. Park County, the City of Livingston, and the community of Gardiner all have a lower percentage of persons living below poverty than the State of Montana and United States. **Table 9** contains a summary of the income statistics data.

Table 9: Income Statistics (2007 - 2011)

Area	Median Household Income	Per Capita Income	Persons Below Poverty Level (%)
Gardiner CDP	$41,875	$28,346	4.4%
City of Livingston	$36,767	$21,358	11.7%
Park County	$41,232	$24,466	11.3%
State of Montana	$45,324	$24,640	14.6%
United States	$52,762	$27,915	14.3%

Source: US Bureau of the Census, American Community Survey 2007-2011, http://factfinder2.census.gov

2.4 Economic Development Trends

The economy of Park County has evolved as different industries have risen and fallen, including farming and ranching, mining, timber, railroad transportation and tourism. Agriculture has been a stable component of Park County's economy over the years, while tourism is currently one of its strongest elements, accounting for sales, jobs, and income for many residents. Economic growth in the tourism and service sectors will likely continue for the foreseeable future due to the recreational and tourism opportunities available in the county.

Park County, particularly in the Paradise Valley, has seen a persistent decline in the profitability of agricultural operations, while the value of lands historically used for agriculture has sharply increased. This has contributed to sales of agricultural land for conversion to residential and commercial development. This trend is likely to continue due to the perceived high quality of life and recreational amenities available in the county.

Gardiner has benefited from visitors who pass through and stay in the community due to its proximity to YNP. Growth has occurred in Gardiner's seasonal lodging and services businesses. YNP will likely continue to be an employer for local residents and a consumer of local goods and services.

3.0 PLANNING WITHIN THE US 89 CORRIDOR

Planning for lands in the study area is primarily the responsibility of Park County, the USFS (Gallatin National Forest), and NPS (for lands in YNP at Gardiner).

3.1 Park County Planning

The Park County Planning Department is responsible for all land-use planning activities in the county. The Planning Department administers the county's Subdivision Regulations, the regulations of all zoning districts, code enforcement, administration of the sign ordinance, and implementation of the Park County Growth Policy. The county's Planning and Development Board serves in an advisory capacity to Park County Commissioners. The board helps review community development proposals and is authorized to prepare and administer the growth policy.

3.1.1 Park County Comprehensive Plan (1998)

In 1998, Park County adopted its first Comprehensive Plan. The Comprehensive Plan examined data and trends relating to the economy, government, environment, wildlife, history, public services, transportation, schools, and land use. The Plan defined six planning areas throughout the county—Clyde Park, Wilsall, Springdale, Paradise Valley, Gardiner, and Cooke City—and outlined land-use goals and objectives for each area. The Park County Growth Policy replaced the 1998 document.

3.1.2 Park County Growth Policy (2008)

The 1999 Legislature revised state laws governing planning documents, requiring local governments to develop growth policies. A growth policy is an official public document adopted and used by Montana local governments as a general guide for decisions about the community's physical development. The document is not regulatory; it serves as an official statement of public policy to guide growth and manage change for the betterment of the community. State law requires growth policies contain several notable elements including the following:

- Community goals and objectives
- Information about existing conditions and trends
- A description of the policies, regulations, and other tools to be implemented in order to achieve the identified goals and objectives
- A strategy for development, maintenance, and replacement of public infrastructure

The focus of Park County's Growth Policy differs slightly from the 1998 Comprehensive Plan in that countywide goals, objectives, and implementation measures were developed instead of developing such elements for each planning area. The City of Livingston and the Town of Clyde Park are excluded from the scope of the Growth Policy. The Park County Growth Policy generally supports and promotes the following:

- Respect for and preservation of private property rights
- Protection of public health and safety
- Efficient delivery of services
- Encouragement of development near existing services and infrastructure
- Protection of the right to farm and ranch
- Protection of natural resources

Growth policies may include neighborhood plans, as long as the plans are consistent with the Growth Policy. A neighborhood plan is a plan for a geographic area within the boundaries of the jurisdictional area that addresses one or more of the elements of the growth policy in more detail. The Park County Growth Policy includes a Livingston Neighborhood Plan. The Livingston Neighborhood Plan applies to the 4.5-mile jurisdictional area that surrounds the City of Livingston (known colloquially as the "donut" area). The Livingston Neighborhood Plan recognizes the characteristics of the transitional area around the City of Livingston, and incorporates additional goals and objectives specific to the planning area. The Neighborhood Plan contains goals and objectives for transportation that stress the desire for a balanced transportation system that provides infrastructure for bicyclists, pedestrian, and special needs users (senior citizens, school children, etc.). Livingston developed and adopted its own Growth Policy in 2004.

3.2 Gallatin National Forest Plan

Gallatin National Forest lands in the Yellowstone and Gardiner Ranger Districts exist to the east and west of US 89. The Yellowstone District includes portions of the National Forest south of Livingston and east of the Yellowstone River, as well as land to the west of the Yellowstone River adjacent to the east side of the Bozeman Ranger District. The Gardiner District covers the southeast part of Gallatin National Forest, bordering YNP and includes the community of Gardiner. A portion of the West Unit of the Absaroka-Beartooth Wilderness Area is east of US 89 near Corwin Springs.

USFS administers Gallatin National Forest lands according to the goals and objectives and management direction established in the *1987 Gallatin National Forest Plan*. Amendments to the Forest Plan were completed in September 2009.

3.3 National Park Service Planning at Gardiner

NPS plans for and manages lands within YNP. The agency prepares a variety of planning and environmental documents to help guide management of park resources. In 2011, NPS prepared the *North Entrance & Park Street Improvement Plan/Environmental Assessment,* which examined potential actions to relieve traffic congestion and improve safety at the historic North Entrance to YNP, which is located in Gardiner. NPS identified a preferred improvement option that will be implemented as funding permits. The proposed improvements will include the following:

- Development of a new North Entrance station complex to speed up visitor entry to YNP
- Providing options for visitors to use a new access road to bypass congestion in the North Entrance area or to enter YNP through the historic Roosevelt Arch
- Expanded parking, new pedestrian walkways, and improved traffic circulation for visitors to access businesses along Park Street in Gardiner
- Moving the NPS administrative road in front of the Gardiner Transportation Center

Figure 2 illustrates the planned improvement concept for the North Entrance. A Finding of No Significant Impact (FONSI) on the *North Entrance & Park Street Improvement Plan/Environmental Assessment* was issued in October 2011.

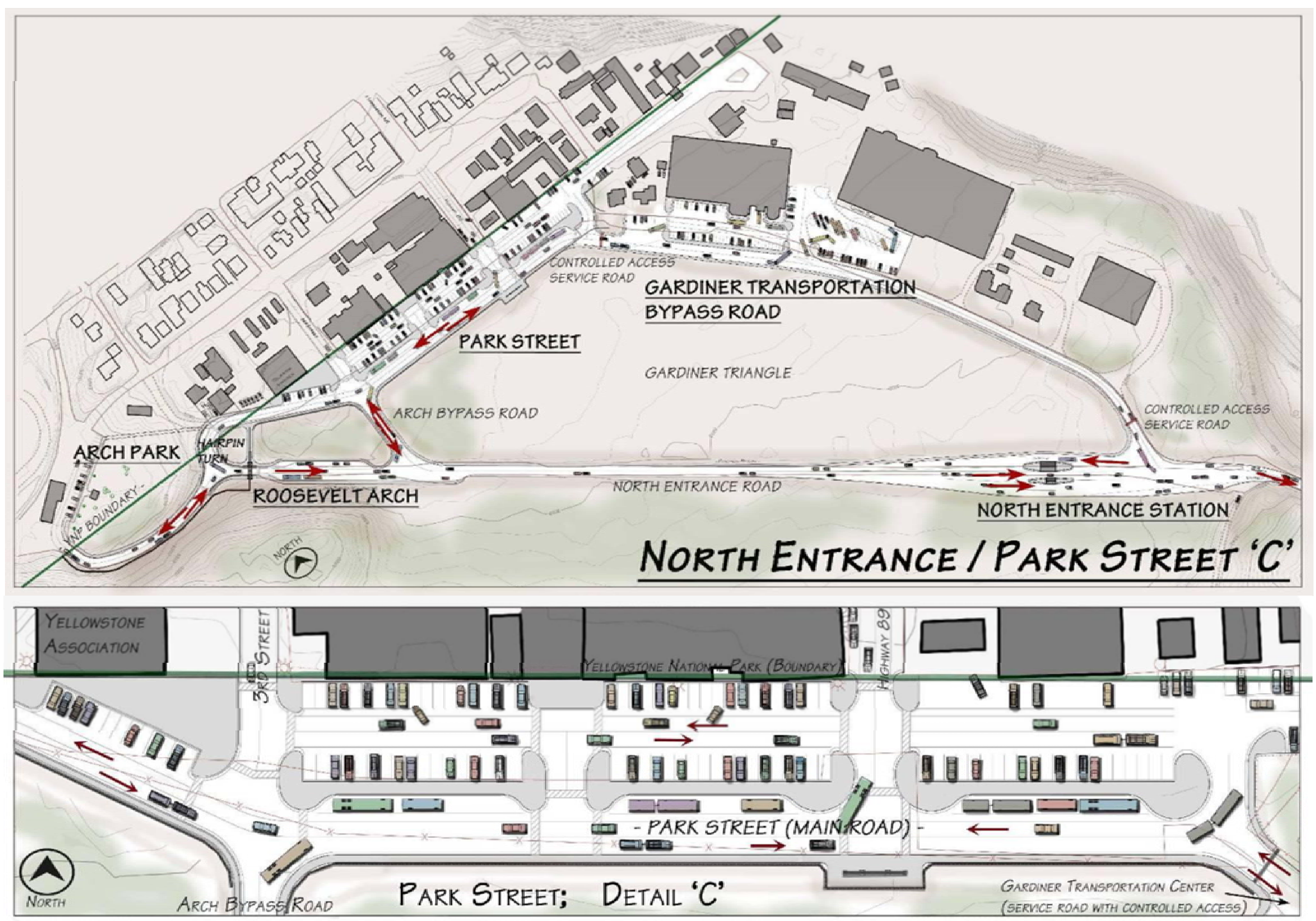

Figure 2: NPS North Entrance / Park Street Redevelopment Concept

3.4 Gardiner Gateway Project

Following the completion of the *North Entrance & Park Street Improvement Plan/Environmental Assessment*, the community of Gardiner and Park County saw an opportunity to work with NPS to develop a master plan for a revitalization project in the community that complemented NPS's planned improvements. These local efforts resulted in the Gardiner Gateway Project. The Gardiner Gateway Project is intended not only to help relieve traffic congestion and improve safety, but to enhance the experience of visitors to Gardiner and the North Entrance through beautification of the area and increased visitor services. Implementation of the project will provide essential upgrades to community infrastructure and additional economic opportunities for residents of Gardiner and Park County. A Preliminary Engineering Report for the project was completed in March 2013.

Park County is one of approximately 15 project partners, including NPS, the Gardiner Chamber of Commerce, the Yellowstone Association, the Greater Gardiner Community Council, MDT, the Montana Department of Commerce, and non-profit organizations. The project partners signed a memorandum of understanding in June 2012. The goal is to have components of the three-phase revitalization project completed by 2016, which marks the 100th anniversary of the creation of NPS. More information can be found on the Gardiner Gateway Project website at: http://gardinergatewayproject.org/.

4.0 TRANSPORTATION SYSTEM

US 89 from Gardiner to Livingston follows the upper Yellowstone River through the Paradise Valley. The road's origins date back to the 1880s when a miner from Cooke City built the first road between Gardiner and Livingston. The original road was abandoned, and portions were taken over by Yankee Jim George and operated as a toll road. Park County acquired much of the roadway in 1893 after the public became dissatisfied with the condition of the roadway. In 1915, YNP opened to automobile traffic. Through the efforts of the Yellowstone Trail Association at approximately the same time, an automobile route from Livingston to Gardiner was built along and over the Yankee Jim Toll Road. The roadway was constructed or improved at various times, beginning in 1924.

4.1 Existing Roadway Users

Primary users of the roadway consist of local residents, commuters between Gardiner and Livingston, recreationists on lands and waters in the Paradise Valley, tourists visiting YNP and other attractions in the region, and commercial users. Land uses in the study area are mixed. They include commercial, industrial, crop/pasture, mine/quarry, mixed urban, and recreational uses. Numerous recreation sites exist along US 89, and others are reachable from the highway. These sites include public fishing access sites, picnic areas, and campgrounds.

4.2 Traffic Data

MDT collects annual traffic count data are at seven locations on US 89 within the study area. An Automatic Traffic Recorder (ATR) is located on US 89 approximately 17 miles north of Gardiner. The ATR collects traffic year-round from sensors imbedded in the roadway. Data from the other traffic count sites on US 89 are collected periodically for limited times by using pneumatic tube counters.

MDT provided historic data for the traffic count sites. **Table 10** shows the most recent 20 years of traffic data for each count location. The Average Annual Daily Traffic (AADT) ranges from approximately 4,700 vehicles per day (vpd) near the communities of Gardiner and Livingston, to as low as 1,700 vpd near RP 17.

Table 10: Average Annual Daily Traffic Data

Site ID	Location	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
34-3-10	RP 0.12	4,350	4,470	4,680	3,600	3,910	4,840	4,550	3,600	3,270	3,630
34-3-9	RP 0.64	3,380	3,640	2,990	2,680	2,900	4,060	3,660	2,900	2,790	2,980
34-3-1	RP 4.0	1,450	2,000	2,030	1,300	1,550	2,310	2,110	1,660	1,560	1,690
34-3-2/A-20[i]	RP 16.8	1,590	1,640	1,780	1,750	1,640	1,630	1,650	1,810	1,580	1,610
34-3-3	RP 32.0	2,120	2,080	1,960	1,840	1,870	2,570	2,290	2,040	1,780	2,040
34-2-2	RP 49.6	2,600	2,530	3,120	2,770	2,360	3,500	3,280	2,920	2,470	2,870
34-2A-5	RP 52.0	3,940	3,820	5,200	4,670	5,000	6,400	5,950	6,570	6,570	4,490

Site	Location	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
34-3-10	RP 0.12	4,280	4,140	4,020	4,020	4,150	4,080	4,490	4,710	4,640	3,260
34-3-9	RP 0.64	3,320	3,540	3,410	3,410	3,520	3,440	3,740	3,920	3,870	2,680
34-3-1	RP 4.0	1,830	2,080	2,040	2,040	2,100	2,030	2,120	2,220	2,190	1,830
34-3-2/A-20[i]	RP 16.8	1,590	1,600	1,550	1,540	1,630	1,550	1,680	1,740	1,670	1,710
34-3-3	RP 32.0	2,460	2,370	2,300	2,300	2,370	2,190	2,140	2,250	2,220	1,840
34-2-2	RP 49.6	3,850	3,420	3,290	3,290	3,390	3,320	3,350	3,510	3,460	2,710
34-2A-5	RP 52.0	6,720	4,980	4,700	4,700	4,850	5,020	5,150	4,770	4,700	3,970

Source: MDT Data and Statistics Bureau, Traffic Data Collection Section, 2013
[i] Automatic Traffic Recorder (ATR)

In addition to providing traffic volume data, the ATR counter located at RP 16.8 provides large truck volume percentages (RV's are not considered large trucks). For the year 2012, large trucks accounted for 2.4 percent of traffic at this location. Between 1993 and 2012, large trucks account for an average of 1.8 percent of traffic.

4.2.1 Future Traffic Projections

Projected transportation conditions were analyzed to estimate how traffic volumes and characteristics may change compared to existing conditions. The analysis was based on known existing conditions, and it extended out to 2035.

Average Annual Growth Rates (AAGR) were calculated at each traffic count location during multiple periods based on historic traffic data. Weighted AAGRs were calculated based on recent AADTs. The weighted AAGRs provide a representative picture of traffic growth on US 89 within the study area. Traffic volumes fluctuate throughout the study area, resulting in both positive and negative growth rates, as shown in **Table 11**.

Table 11: Average Annual Growth Rates

Site	Location	Average Annual Growth Rate				
		1993 - 2012	1993 - 1999	2000 - 2005	2006 - 2012	2000 - 2012
34-3-10	RP 0.12	-0.17%	0.41%	4.15%	-0.93%	1.30%
34-3-9	RP 0.64	0.51%	1.54%	4.77%	-1.43%	1.43%
34-3-1	RP 4.0	1.33%	4.17%	5.80%	-0.54%	2.11%
34-3-2/A-20[i]	RP 16.8	-0.08%	0.06%	-2.12%	1.72%	0.22%
34-3-3	RP 32.0	0.39%	2.19%	4.81%	-2.72%	0.18%
34-2-2	RP 49.6	1.19%	3.88%	5.48%	-1.72%	0.88%
34-2A-5	RP 52.0	-0.19%	8.29%	-5.83%	-2.19%	-2.82%
Average		0.35%	3.37%	1.88%	-1.29%	0.21%

[i] *Automatic Traffic Recorder (ATR), A-020*

AAGRs were estimated based on the values in **Table 11** for low-, medium-, and high-growth scenarios. The low-growth scenario represents average conditions experienced over the past 20 years. The medium-growth scenario reflects conditions experienced during the early 2000s, and the high-growth scenario describes the traffic growth during the 1990s. These growth scenarios were used to project AADT values for 2035 as seen in **Table 12**.

Table 12: Projected Traffic Data (2035)

Site	Location	Existing AADT[ii]	Projected AADT (2035)		
			Low Growth (0.35%)	Medium Growth (1.5%)	High Growth (3.3%)
34-3-10	RP 0.12	4,203	4,571	6,009	9,162
34-3-9	RP 0.64	3,490	3,795	4,989	7,607
34-3-1	RP 4.0	2,080	2,262	2,973	4,534
34-3-2/A-20[i]	RP 16.8	1,707	1,856	2,440	3,601
34-3-3	RP 32.0	2,103	2,287	3,007	4,585
34-2-2	RP 49.6	3,227	3,509	4,613	7,033
34-2A-5	RP 52.0	4,480	4,872	6,404	9,765
Average		3,041	3,307	4,348	6,630

[i] *Automatic Traffic Recorder (ATR), A-020*

[ii] *Existing AADT based on an average of 2010 and 2012 values to account for yearly variation.*

4.2.2 Seasonal Variations in Traffic

Due to the high recreational use of lands in the area and access the route affords to YNP, notable seasonal peaks in traffic volumes occur due to recreational travel. **Figure 3** shows the variation in traffic on US 89 at ATR Station A-020 by month for 2012 and 2000. The highest traffic volumes of the year occur from June through August. The lowest amount of travel occurs in January and December. Traffic volumes for July are nearly double those of the AADT volume at the ATR site. In 2012, the peak average volume was approximately 175 percent of the AADT. During the lowest travel months, the volumes were slightly more than half of the AADT volume at the ATR site.

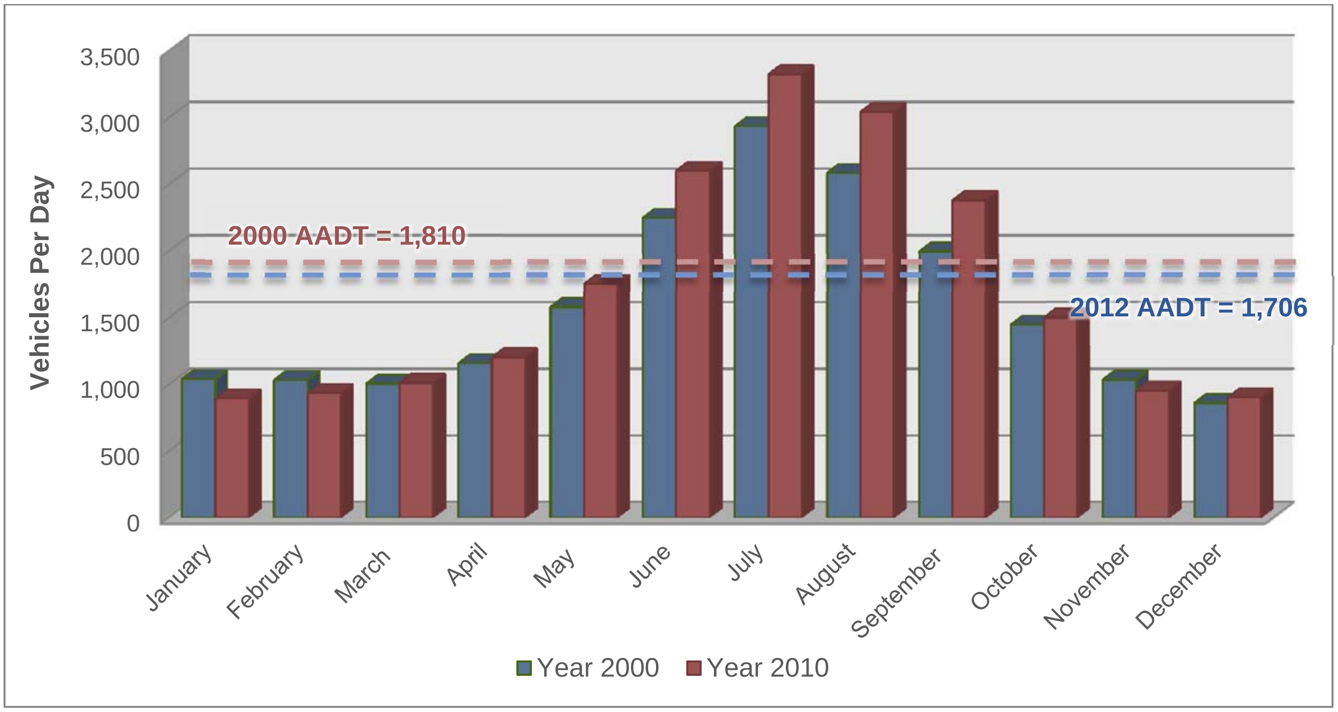

Figure 3: Monthly Variations in Traffic at ATR Station A-020

Table 13 shows the AAGR at the ATR station during the peak season. In general, traffic volumes increased at a lower rate during the peak seasons than during the entire year as represented by the AADT. Between 1993 and 2012, peak traffic volumes showed a negligible, or even negative, growth rate at the ATR station.

Table 13: ATR Station A-020 Average Annual Growth Rate – Peak Season

Month	Existing AADT	Average Annual Growth Rate				
		1993 - 2012	1993 - 1999	2000 - 2005	2006 - 2012	2000 - 2012
June	2,599	0.03%	-1.27%	1.14%	1.96%	1.03%
July	3,321	0.02%	-1.14%	0.50%	2.61%	1.02%
August	3,040	-0.25%	-1.15%	-0.46%	3.78%	1.10%
Peak Average	**2,987**	**-0.07%**	**-1.18%**	**0.36%**	**2.81%**	**1.05%**

Peak season traffic volumes increased since 2000, with the highest AGR occurring over the past seven years. **Table 14** provides projected 2035 peak season traffic volumes for the ATR site under low-, medium-, and high-growth scenarios.

Table 14: ATR Station A-20 Projected Traffic Data (2035) – Peak Season

Month	Existing AADT	Projected AADT (2035)		
		Low Growth (0.35%)	Medium Growth (1.00%)	High Growth (2.8%)
June	2,599	2,816	3,267	4,905
July	3,321	3,599	4,175	6,268
August	3,040	3,294	3,822	5,737
Peak Average	**2,987**	**3,237**	**3,755**	**5,637**

4.2.3 Highway Capacity and Level of Service

Capacity and Level of Service (LOS) are two terms used to describe traffic conditions and corridor operation. Capacity is intended to represent the theoretical ability of the roadway to handle a defined amount of traffic. LOS is used to describe the performance of the roadway from the driver's perspective. Both of these parameters are looked at when comparing corridor performance.

Individual roadway capacity varies greatly and is calculated based on the procedures identified in the *Highway Capacity Manual*. For planning and comparison purposes, a discussion about the relationship between highway capacity and LOS is provided. This discussion is not intended to be used to set any thresholds for roadway performance, but rather provide some general information to be used to compare roadway performance.

Table 15 shows generalized daily service volumes for use in planning and preliminary design. The daily service volumes shown in the table represent the maximum traffic volume that can theoretically be accommodated by the roadway segment. The values shown in this table are intended as generalized planning values. For example, for this class of roadway, an upper range traffic volume between 5,600 vpd and 7,300 vpd may be accommodated while achieving a LOS C.

Table 15: Generalized Daily Service Volumes

Level of Service	Daily Capacity Range Limit
LOS B	3,300 - 4,000
LOS C	5,600 - 7,300
LOS D	11,500 - 13,100
LOS E	24,100 - 24,900

Source: Highway Capacity Manual 2010, Chapter 15 / Two-Lane Highways, page 15-42

The maximum number of vehicles that could theoretically be accommodated on a roadway (i.e. physical capacity) is generally greater than the number typically acceptable to driver perception. The physical capacity of a roadway is based on roadway geometrics and other design factors and is generally higher than what a typical driver in a rural community would anticipate.

Roadway LOS is intended to provide a comparison value to represent the driver's perception of the roadway performance. The LOS is based on a combination of factors, all of which play a part in the driver's perception of how the roadway is performing. When drivers experience delays due to reduced travel speeds, lack of passing opportunities, heavy vehicles in the traffic stream, and steep roadway grades, the roadway LOS deteriorates. The following provides a description of each LOS as defined by the *Highway Capacity Manual.*

- **LOS A:** Represents free-flow conditions. Motorists experience high operating speeds and little difficulty in passing. Platoons of three or more vehicles are rare.

- **LOS B:** Passing demand and passing capacity are balanced. The degree of platooning becomes noticeable. Some speed reductions are present but are still relatively small.
- **LOS C:** Most vehicles are traveling in platoons. Speeds are noticeably curtailed.
- **LOS D:** Platooning increases significantly. Passing demand is high, but passing capacity approaches zero. A high-percentage of vehicles travel in platoons, and the time-spent-following is quite noticeable.
- **LOS E:** Demand is approaching capacity. Passing is virtually impossible, and the time-spent-following is more than 80 percent. Speeds are seriously curtailed.
- **LOS F:** Exists whenever demand flow in one or both directions exceeds the capacity of the segment. Operating conditions are unstable, and heavy congestion exists.

A LOS analysis was conducted using *Highway Capacity Software 2010* for two-lane highways. The results of the analysis are shown in **Table 16**. More detailed data is contained in **Appendix D**.

Table 16: Highway Segment Level of Service

Site	Begin RP	End RP	Segment Length (mi)	2012 AADT	% No-Passing	Access Point Density (per mile)	Level of Service: Average Annual 2012	Level of Service: Average Annual 2035	Level of Service: Peak Season[(ii)] 2012	Level of Service: Peak Season[(ii)] 2035
34-3-10	0	0.4	0.4	3,260	100	40	C	C	C	D
34-3-9	0.4	2.4	2.0	2,680	73	21	B	B	C	C
34-3-1	2.4	10.4	8.0	1,830	53	9	C	C	D	D
34-3-2/A-20[(i)]	10.4	24.4	14.0	1,710	55	4	C	C	C	D
34-3-3	24.4	40.7	16.3	1,840	28	4	B	C	C	C
34-2-2	40.7	50.6	9.9	2,710	38	6	C	D	D	D
34-2A-5	50.6	52.4	1.8	3,970	100	20	C	C	C	D

Highway Capacity Software 2010

[(i)] *Automatic Traffic Recorder (ATR), A-020*

[(ii)] *Peak season rates were determined based on data from the ATR site (A-020); see **Section 4.2.2** for more detail.*

Note that the MDT *Traffic Engineering Manual* lists a target LOS of B for a NHS Non-Interstate with level / rolling terrain. Based on the analysis shown in **Table 16**, segments of US 89 are currently operating at, or near, the target LOS for this facility.

The LOS of the highway can be improved by reducing vehicular traffic and/or increasing roadway capacity. The capacity can be increased by providing additional passing opportunities and by reducing access density. Additional passing opportunities may be provided by decreasing the no passing zones (through pavement striping), or by constructing dedicated passing lanes.

4.3 Right-of-Way and Jurisdiction

Ownership of the land in the corridor is a mix of private and public. Various state and federal entities hold public land. There are also many areas held in easement for nongovernmental conservation groups such as the Gallatin Valley Land Trust, Montana Land Reliance, the Rocky Mountain Elk Foundation, and the Nature Conservancy. Montana Fish, Wildlife & Parks (FWP) also holds easements along the corridor. Adjacent to the highway, much of the land is in private ownership with low to moderate intensity development. Right-of-way widths vary within the corridor and typically range from 160 to 200 feet or more.

4.4 Crash Analysis

The MDT Traffic and Safety Bureau provided crash data for US 89 between RPs 0.0 and 52.5 from July 1, 2007, through June 30, 2012. Records show 286 crashes occurring on this section of roadway during the crash analysis period. One crash resulted in a fatality, 19 crashes produced incapacitating injuries, 35 crashes produced non-incapacitating injuries, and 11 crashes produced possible injuries. An incapacitating injury is defined as an injury, other than a fatality, which prevents the injured person from walking, driving, or normally continuing the activities they were capable of performing before the injury.

Table 17 provides a comparison of the crash rate, crash severity index, and crash severity rate on US 89 within the study area to the statewide averages for Non-Interstate NHS Routes. Information in the table comes from the Traffic and Safety Bureau. A percent difference between the statewide and US 89 rates was calculated for comparison purposes. The crash data presented in the table are based on crashes occurring from calendar years 2007 through 2011.

Crash rates are defined as the number of crashes per million vehicle miles of travel. For the US 89 corridor, the calculated crash rate was 1.27 crashes per million vehicle miles travelled. By comparison, the statewide crash rate for Non-Interstate NHS Routes in Montana was 1.01 crashes per million vehicle miles.

The crash severity index is the ratio of the sum of the level of crash degree to the total number of crashes. A crash severity index of 1.84 was calculated for the US 89 corridor, compared to the statewide average severity index of 2.05.

Crash severity rate is determined by multiplying the crash rate by the crash severity index. The US 89 corridor was determined to have a crash severity rate of 2.34 as compared to the statewide average rate of 2.07.

Table 17: Crash Data Analysis (2007 – 2011)

Crash Data Location	Crash Rate	Crash Severity Index	Crash Severity Rate
US 89 (RP 0.0 to 52.5)	1.27	1.84	2.34
Statewide Average for Non-Interstate NHS Routes	1.01	2.05	2.07

Source: MDT Traffic and Safety Bureau, 2013

4.4.1 Crash Trends, Contributing Factors, and Crash Clusters

On average, approximately 57 crashes occurred each year during the crash analysis period. Most of the crashes involved single vehicles (82 percent) and occurred on dry roads during clear or cloudy weather conditions. More than half (53 percent) of the crashes occurred in darkness or during low-light conditions (dawn or dusk). About 18 percent of the crashes during the analysis period happened when roads were icy, snowy, or wet. The primary contributing factors listed in crashes during the analysis period included alcohol or drug involvement (8 percent of crashes), driving too fast for conditions (6 percent of crashes), careless driving (5 percent of crashes), and failure to yield (5 percent of crashes).

Most of the crashes (95 percent) involved passenger vehicles (automobiles, pickups, SUVs, etc.). Records show seven crashes involving motorcycles, four involving trucks with trailers, and one each involving a bicycle and bus.

The main observed crash trend is wild animal encounters (142), 119 of which were deer, and 16 of which were elk. The second main observed crash trend is single-vehicle, run-off-the-road crashes (77). Of the single-vehicle, run-off-the-road crashes, 34 resulted in overturning. There have been 15 sideswipe crashes, 8 right-angle crashes, 9 rear-end crashes, and 9 domestic animal crashes.

About 6 percent of the reported crashes resulted in rollovers. The locations of these incidents were reviewed, and it was determined that these crashes were not concentrated in specific areas of the corridor.

MDT Safety Engineering Section personnel reviewed the section of US 89 from RP 1.2 to RP 49.7in 2010. As a result, a corridor-wide, shoulder-rumble-strip improvement was developed. The project is currently being completed under project SF 110 – Rumble Strips; UPN 7760000.

The section from RP 23.5 to RP 24.1 was identified as a crash cluster in 2012. As a result, the MDT Safety Engineering Section recommended installing a left-turn lane at the location. This modification is being advanced under project SF 129-Lft Turn Ln Emigrant RA, UPN 8024000.

Several other sections were identified as crash clusters over the 2009 through 2012 period, based on crash records. These areas are identified below:

- RP 13.623 to RP 14.124
- RP 24.95 to RP 25.51
- RP 33.3 to RP 33.8
- RP 39.7 to RP 40.25

After further review and analysis, the MDT Safety Engineering Section determined there were no specific crash trends at these locations.

4.4.2 Animal Carcasses

A review of the MDT Maintenance Animal Incident Database indicates that a minimum of 1,659 animal carcasses were collected on the corridor between January 2002 and December 2012. The carcass information from the database represents the number of animal carcasses recovered from the roadway and differs from Montana Highway Patrol (MHP) crash records presented in section 4.4.1. For starters, the period of record is different between the two. For MHP crash records, section 4.4.1 is based on a five-year data period (July 1, 2007, through June 30, 2012). For the carcass data, the period of record is for an eleven-year period. Also, the number of carcasses recovered is higher than the number of reported crashes involving animals as not all animal-vehicle collisions are reported to MHP. The 1,659 carcasses does not indicate 1,659 collisions. **Table 18** summarizes the large mammal species involved in the animal-vehicle collisions.

Table 18: Large Mammal Carcasses

Large Animal	Carcasses Collected	% by Species
Antelope	1	0.06%
Bighorn Sheep	6	0.36%
Bison	2	0.12%
Black Bear	1	0.06%
Elk	94	5.67%
Moose	1	0.06%
Deer (unknown species)	21	1.27%

Mule Deer	1,116	67.27%
White-tailed Deer	417	25.13%
TOTAL	**1,659**	**100%**

Source: MDT Animal Incident Database, Jan 01, 2002 to Dec 31, 2012

Deer accounted for over 93 percent of the carcasses collected along this section of US 89, with mule deer being the most common species. **Figure 4** shows the deer carcass density, per half mile segment, along the corridor. Peaks in recorded deer carcass density occur between RP 3 and RP 6, between RP 7 and RP 14, between RP 24 and RP 25, between RP 27 and RP 29, and near RPs 36, 40 and 52.

Other large mammal carcass data for the eleven-year period is shown on **Figure 5**. Of particular note on this figure is the portrayal of six bighorn sheep carcass locations. All six carcasses were collected between the months of November and July, near RPs 1.8, 4.8, 6.7, 12.8, and 14.2. There are also two bison carcasses noted on **Figure 5**, collected near RP 5 and RP 11. In order to limit bison movements to the area south of Yankee Jim Canyon, bison guards have been installed in the US 89 roadway as well as the county road on the west side of the Yellowstone River. Fencing was constructed adjacent to the bison guards, with gates that can be opened when bison are not present in Gardiner Basin. Currently the bison guards are installed and adjacent gates are closed from November through May, however FWP has an EA currently in progress proposing to allow bison to roam freely year-round. Refer to the MDT *Environmental Scan* for more detailed information on animal carcass data and large mammal migration routes and habitat.

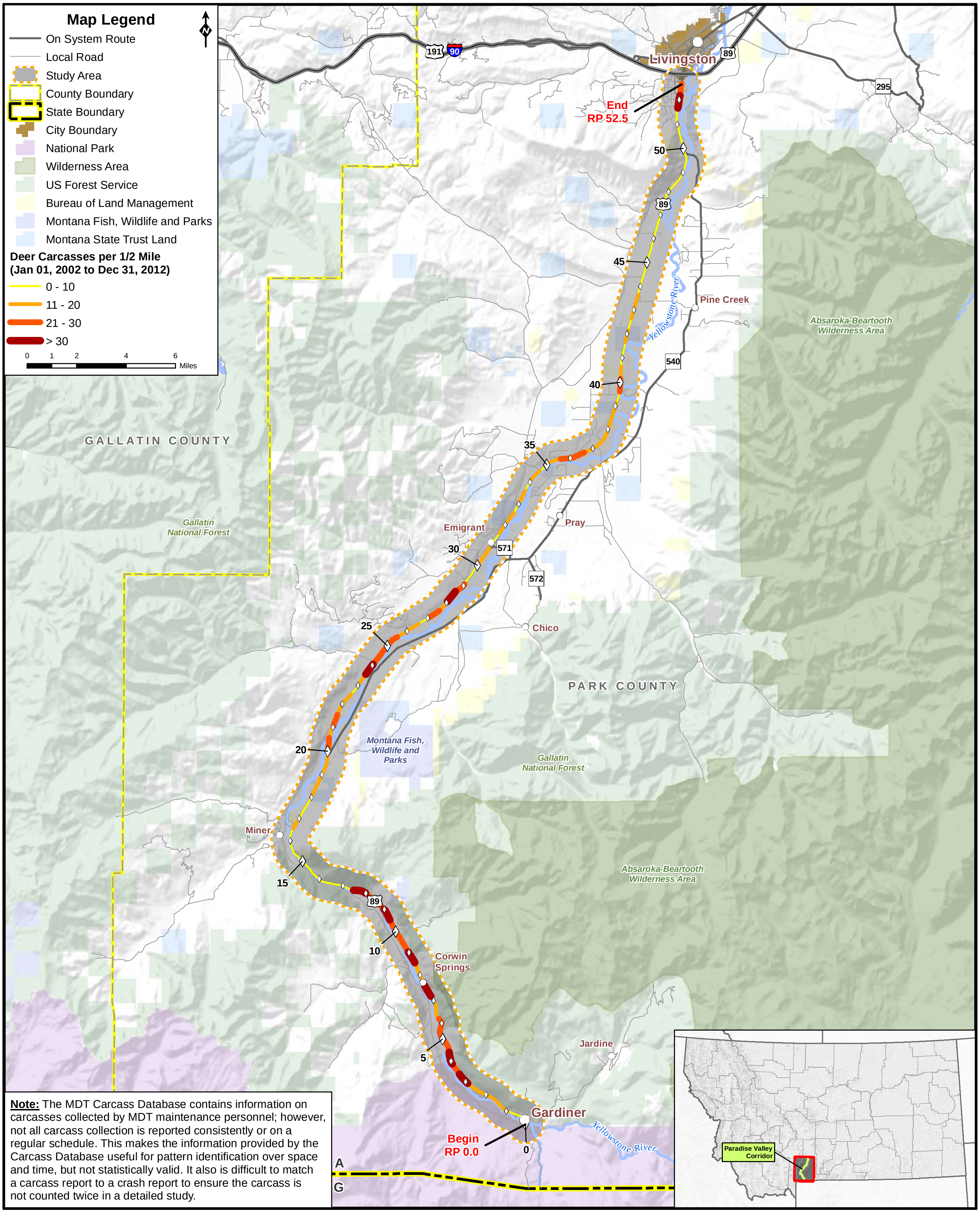

Figure 4: Deer Carcass Density - Per Half Mile

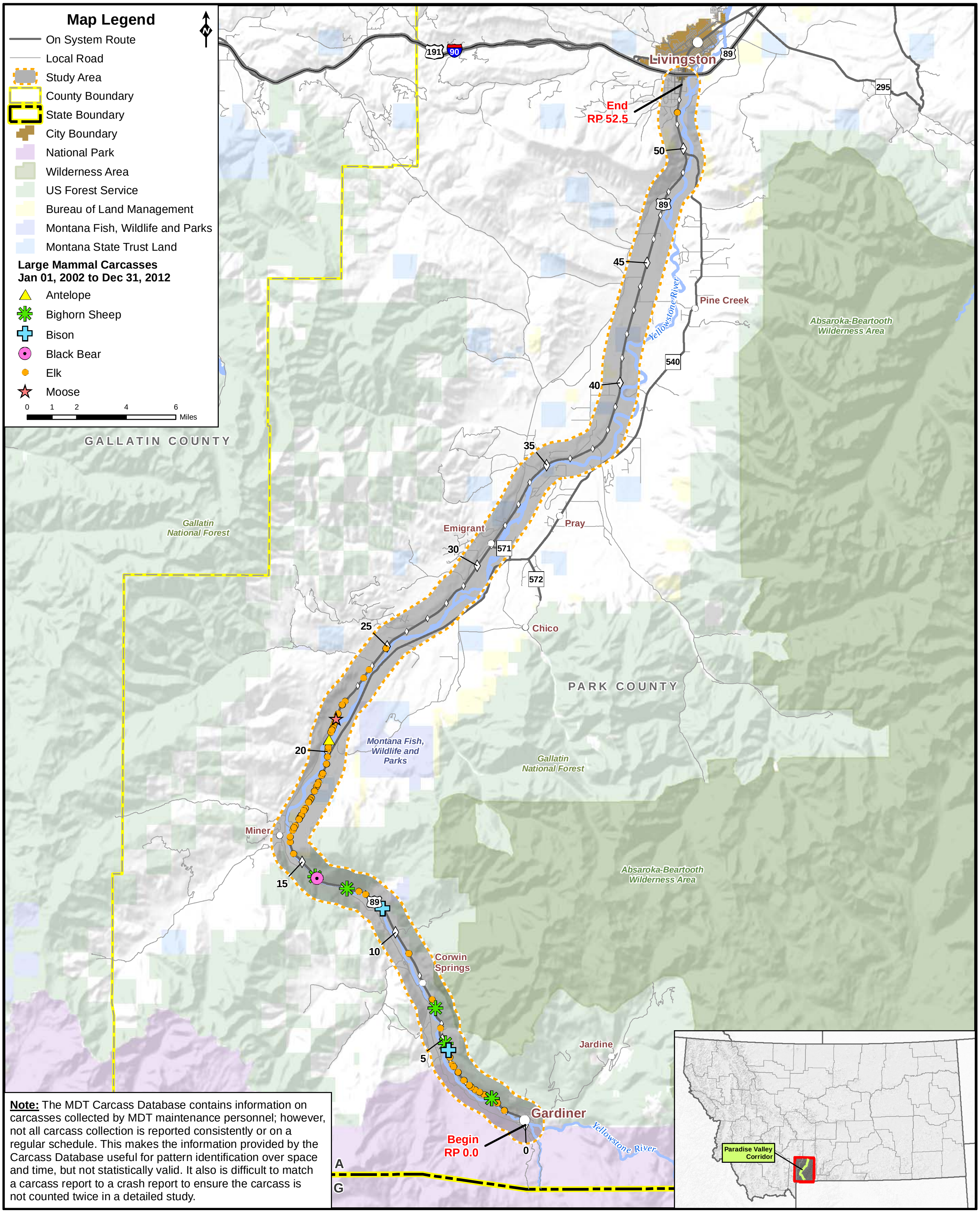

Figure 5: Large Mammal Carcasses

4.5 Design Standards

The MDT *Road Design Manual* specifies general design principles and controls that determine the overall operational characteristics of the roadway and enhance its aesthetic appearance. The geometric design criteria for the study corridor are based on the current MDT design criteria for a "Rural Principal Arterials (National Highway System-Non-Interstate) Highway." Arterial highways are characterized by a capacity to move relatively large volumes of traffic quickly and a restricted-access-point function to serve adjoining properties. In both rural and urban areas, the principal arterials provide the highest traffic volumes and the greatest trip lengths. **Table 19** lists the current design standards for rural principal arterial (NHS-Non-Interstate) routes according to MDT design criteria.

The design speed for a rural principal arterial roadway ranges between 50 and 70 mph, depending on terrain. MDT's *Road Design Manual* contains the following definitions for each terrain type:

- **Level Terrain** – The available stopping sight distances are generally long or can be made to be so without construction difficulty or major expense.
- **Rolling Terrain** – The natural slopes consistently fall below and rise above the roadway and occasional steep slopes offer some restriction to horizontal and vertical alignment.
- **Mountainous Terrain** – Longitudinal and traverse changes in elevation are abrupt and extensive grading is frequently needed to obtain acceptable alignments.

Based on these definitions, most of the study area appears to be level terrain (70-mph design speed) with some areas of rolling terrain (60-mph design speed). A determination of terrain type (i.e., level or rolling) has not however, been made for the study corridor. For the purposes of this study, areas that do not meet MDT's minimum design standards for level terrain were considered areas of concern.

A facility's design speed and its operating speed differ. The design speed is a selected speed used to determine the various geometric design features of the roadway. The operating speed is the highest overall speed at which a driver can travel on a given section of roadway under favorable weather conditions and under prevailing traffic conditions without at any time exceeding the safe speed as determined by the design speed. Speed limit postings are typically determined by measuring the speeds 85 percent of the drivers are travelling at or below, and establishing signing for that speed within 5 mph of the result. This is typically referred to as the 85th percentile speed.

Table 19: Geometric Design Criteria

Design Element			Design Criteria		
Design Controls	Design Forecast Year (Geometrics)		20 Years		
	Design Speed [i]	Level	70 mph		
		Rolling	60 mph		
		Mountainous	50 mph		
	Level of Service		Level/Rolling: B Mountainous: C		
Roadway Elements	Travel Lane Width		12'		
	Shoulder Width		Varies		
	Cross Slope	Travel Lane [i]	2%		
		Shoulder	2%		
	Median Width		Varies		
Earth Cut Sections	Ditch	Inslope	6:1 (Width: 10')		
		Width	10' Min.		
		Slope	20:1 towards back slope		
	Back Slope; Cut Depth at Slope Stake	0' - 5'	5:01		
		5' - 10'	Level/Rolling: 4:1; Mountainous: 3:1		
		10' - 15'	Level/Rolling: 3:1; Mountainous: 2:1		
		15' - 20'	Level/Rolling: 2:1; Mountainous: 1.5:1		
		> 20'	1.5:1		
Earth Fill Slopes	Fill Height at Slope Stake	0' - 10'	6:1		
		10' - 20'	4:1		
		20' - 30'	3:1		
		> 30'	2:1		
Alignment Elements	DESIGN SPEED		50mph	60 mph	70 mph
	Stopping Sight Distance [i]		425'	570'	730'
	Passing Sight Distance		1835'	2135'	2480'
	Minimum Radius (e=8.0%) [i]		760'	1200'	1810'
	Superelevation Rate [i]		$e_{max} = 8.0\%$		
	Vertical Curvature (K-value) [i]	Crest	84	151	247
		Sag	96	136	181
	Maximum Grade [i]	Level	3%		
		Rolling	4%		
		Mountainous	7%		
	Minimum Vertical Clearance [i]		17.0'		

Source: MDT Road Design Manual, Chapter 12, Figure 12-3, "Geometric Design Criteria for Rural Principal Arterials (National Highway System-Non-Interstate), 2008

[i] Controlling design criteria (see Section 8.8 of the MDT Road Design Manual)

4.6 Roadway Geometrics

Existing roadway geometrics were evaluated and compared to current MDT standards. The analysis was conducted based on a review of public information, MDT as-built drawings, Geographic Information Systems (GIS) data, and field observations. As-built drawings were available and were reviewed for most of the study corridor. Current as-built drawings were unavailable for the sections between RP 0.0 to RP 5.6, RP 10.7 to RP 16.6, and RP 49.9 to RP 52.5. Field reviews of the study corridor took place in May 2013 and July 2013 to confirm and supplement information contained in as-built drawings, as well as to identify additional areas of concern within the study area. **Appendix A** provides a log of photos taken during the field review. **Appendix B** contains summary tables of data from available as-built drawings.

4.6.1 Horizontal Alignment

Elements comprising horizontal alignment include curvature, superelevation (i.e., the bank on the road), and sight distance. These horizontal alignment elements influence traffic operation and safety and are directly related to the design speed of the corridor. MDT's standards for horizontal curves are defined in terms of curve radius, and they vary based on design speed. For a 70-mph design speed (level terrain) the maximum recommended radius is 1,810 feet. The minimum recommended radius for a 60-mph design speed (rolling terrain) is 1,200 feet.

Horizontal curve radius was determined based either on as-built drawings, or, for areas where current as-built drawings were unavailable, on estimates made by using aerial photography. Eight horizontal curves were identified that do not meet current MDT standards. **Table 20** provides a summary of the eight substandard horizontal curves.

Table 20: Substandard Horizontal Curves

RP	Element	Value (ft)	Standard(s) Not Met
0.24	Radius	450 [i]	Level, Rolling, Mountainous
5.75	Radius	1,146	Level, Rolling
6.50	Radius	1,637	Level
13.85	Radius	1,000 [i]	Level, Rolling
14.35	Radius	1,200 [i]	Level
15.42	Radius	1,200 [i]	Level
49.10	Radius	1,433	Level
49.35	Radius	1,433	Level

[i] *Current as-built drawings not available; values estimated based on aerial photography*

4.6.2 Vertical Alignment

Vertical alignment is a measure of elevation change of a roadway. The length and steepness of grades directly affect the operational characteristics of the roadway. The MDT *Road Design Manual* lists recommendations for vertical alignment elements such as grade, rate of vertical curvature (K-value), and stopping sight distance. Recommendations are made based on roadway classification and terrain type.

According to the *Road Design Manual*, the maximum allowable grades are 3 percent for level terrain and 4 percent for rolling terrain. For vertical curves, stopping sight distance, and K-values are controlling design criteria. K-values are defined as a function of the length of the curve compared to the algebraic change in grade, which comprises either a sag or a crest vertical curve. **Table 21** provides a list of substandard vertical alignment areas based on current as-built drawings. Vertical alignment was not analyzed for areas where current as-built drawings were unavailable.

Table 21: Substandard Vertical Alignment Areas

RP	Element	Value	Standard Not Met
8.33	Vertical Curvature	149.4	Level
8.33 - 8.56	Grade	4.06%	Rolling
8.97 - 9.37	Grade	-3.82%	Level
9.37	Vertical Curvature	162.5	Level
18.94 - 19.17	Vertical Curvature	3.06%	Level
49.19	Vertical Curvature	138.9	Level
	Stopping Sight Distance	574.7	Level

4.6.3 Roadside Clear Zone

The roadside clear zone, starting at the edge of the traveled way, is the total roadside border area available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope, and/or a recovery area. The desired clear zone width varies depending on traffic volumes, speeds and roadside geometry. Clear zones are evaluated individually based on the roadside cross section. According to MDT, clear zone should be attained by removing or shielding obstacles, if costs are reasonable.

In certain instances within the study area, it may be impractical to protect or remove certain obstacles within the clear zone. As improvement options develop, roadside clear zones should be designated, to a practical extent, to meet current MDT design standards.

4.7 Passing Zones

Passing opportunities are provided along the corridor in areas where roadway geometrics allow. Passing areas are designated by broken yellow center pavement markings. No passing zones are established in areas where there is insufficient passing sight distance or near public approaches. The following information summarizes the guidelines for no-passing zones as contained in the MDT *Road Design*[1] *Manual*:

- For determining a no-passing zone, the distance along a driver's line-of-sight is measured from a 3.5-foot height of eye to a 3.5-foot height of object.
- For 2-lane rural highways on the NHS, the no-passing zone design speed will be 70 mph.
- The minimum passing sight distance required for a 70-mph no-passing zone design speed is 1,200 feet.
- The minimum length for a no-passing zone is 500 feet.
- If the length between successive no-passing zones in the same direction of travel is less than 1,000 feet, then the gap between the no-passing zones should be closed.
- A no-passing zone should be marked in advance of intersections at a minimum distance of 500 feet.

Figure 6 shows the passing zones along the corridor as documented through on-site field review, aerial imagery from July 2011, and *Google Street View* imagery from August 2011. An analysis of the existing passing zones reveals that there are seven locations where passing zones are less than 1,000 feet long and one location where passing is allowed in front of a public approach.

[1] MDT Road Design Manual, Section 13.3, November 2007.

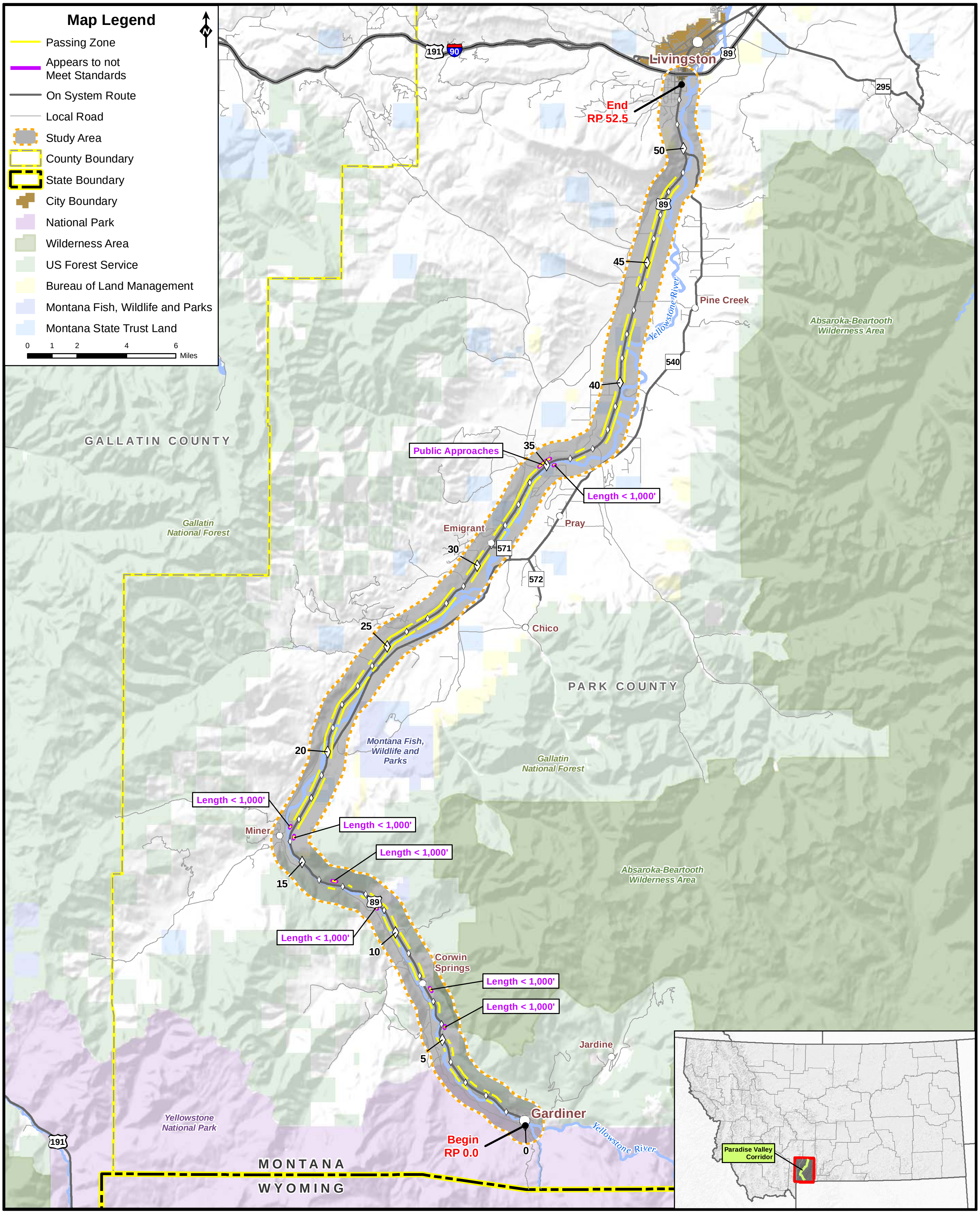

Figure 6: Existing Passing Zones

4.8 Roadway Surfacing

The corridor consists of paved roadway of varying widths, from 44 feet to 32 feet. Existing roadway surfacing characteristics were determined from MDT's *Montana Road Log* and on-site field review. The *Road Log* contains information for surface width, lane width, shoulder width, surfacing thickness, and base thickness. **Table 22** shows the typical width of the existing roadway and the surfacing type.

The MDT *Road Design Manual* requires a minimum travel lane width of 12 feet. The MDT *NHS Route Segment Plan* suggests a width of 40 feet or greater for the corridor. However, the *NHS Route Segment Plan* no longer defines the standard roadway width. The MDT Roadway Width Committee is responsible for determining the appropriate width during future project development. According to the *Road Log*, US 89 has a road width less than 40 feet from RP 1.1 to RP 53.048.

Table 22: Existing Roadway Surfacing

Begin RP	End RP	Lanes	Typical Width			Surfacing	Last Surface	Last Treatment
			Surface	Lane	Shoulder			
0	1.1	2	40	12	8	Asphalt	2003	2003
1.1	14	2	32	12	4	Asphalt	1998	2010
14	24	2	32	12	4	Asphalt	1998	2010
24	34	2	32	12	4	Asphalt	1998	2008
34	40.712	2	32	12	4	Asphalt	2001	2010
40.712	48.98	2	32	12	4	Asphalt	1999	2008
48.98	53.048	2	32	12	4	Asphalt	1999	2008

Source: MDT Road Log, 2011

4.9 Pavement Condition

Pavement condition indices are measured and tracked annually in the corridor by MDT. MDTs pavement management system (PvMS) is used to analyze the collected data to determine the relative performance of the pavement. Items of primary interest include the presence and degree of cracking and rutting, and overall ride quality. By understanding the condition of pavement, MDT can identify the most appropriate treatments and resources to extend pavement life. Several pavement condition indices are monitored through MDTs PvMS. The performance measures and corresponding indices are such that the numerical value of 100 is assigned to a new pavement with no flaws and zero is assigned to a highly degraded pavement. The following performance measures are routinely used to track pavement conditions:

- Ride Index (IRI) – Determined by using an internationally applied roughness index in inches per mile, and converting to a 0 to 100 scale.
- Rut Index (RI) - Calculated by converting rut depth to a 0 to 100 scale. Rut measurements are taken approximately every foot and averaged into one-tenth mile reported depths
- Alligator Crack Index (ACI) - Measured by combining all load associated cracking, and converting the index into a 0 to 100 scale
- Miscellaneous Cracking Index (MCI) - Calculated by combining all non-load associate cracking, and converting the index into a 0 to 100 scale
- Overall Performance Index (OPI) - Determined by combing and placing various weighting factors on the IRI, RI, ACI, and MCI figures, and converting the index to a 0 to 100 scale. The OPI is calculated to provide a single index describing the current general health of a particular route or system.

Table 23: Pavement Condition Indices

Begin RP	End RP	Ride Index (IRI)	Rut Index (RI)	Alligator Crack Index (ACI)	Miscellaneous Cracking Index (MCI)	Overall Performance Index (OPI)
0	1.1	62.00	67.67	93.42	98.48	58.50
1.1	14	73.08	67.48	97.80	94.92	64.92
14	24	81.27	74.64	95.60	97.32	71.89
24	34	78.95	74.19	96.34	97.21	70.94
34	40.712	80.62	75.69	95.69	97.58	72.26
40.712	48.98	81.75	68.99	97.78	97.56	70.49
48.98	53.048	78.59	63.92	94.45	97.67	64.83

Source: MDT Pavement Management System, 2012

The various pavement condition performance measures indicate a well maintained roadway with little immediate concern for surface treatment. For example, for the ride index performance measure, a ride index of 80 to 100 is considered "good", 60 to 79.9 is "fair", and 0 to 59.9 is "poor". All of the sections noted in **Table 23** for ride index are in the good category or the upper end of the fair category. The exception is the first 1.1 miles of US 89 in Gardiner.

The most important performance measure is the overall performance index (OPI) as this is an index that includes all the aforementioned indices. All of the segments presented are in the fair to good category, again with the exception of the first 1.1 miles in Gardiner.

4.10 Access Points

Access points were identified through a review of available GIS data accessed in June 2011, and aerial photography from July 2011. Based on this review, there are approximately 341 access points along the corridor. Most of the access points are private/farm field approaches.

The angle of approach is the angle at which the approaching road intersects the major road. Desirably, approaching roadways should intersect at or as close to 90° as practical. Intersection skews greater than 30° from perpendicular are undesirable, as the driver's line of sight for one of the sight triangles becomes restricted. Accordingly, based on MDT standards[2], the approach angle should be between 60° and 120°. **Table 24** provides a summary of access points grouped in incremental segments along the study area.

[2] Montana Department of Transportation, *Approach Standards for Montana Highways*, 1983.

Table 24: Access Points

Location (RP)		Length (mi)	Access Points	Density (Access / mi)	Skewed < 60° Angle	Comments
Begin	End					
0	4	4.0	67	16.8	2	Gardiner
4	8	4.0	30	7.5	3	Gardiner to Corwin Springs
8	12	4.0	50	12.5	0	North of Corwin Springs
12	17	5.0	9	1.8	0	Yankee Jim Canyon
17	23	6.0	19	3.2	0	East River Road
23	29	6.0	32	5.3	1	
29	35	6.0	16	2.7	0	Emigrant
35	42	7.0	25	3.6	0	Mill Creek
42	49	7.0	24	3.4	5	Pine Creek
49	52.5	3.5	69	19.7	0	South of Livingston
TOTAL		52.5	341	6.5	11	

4.11 Parking

On-street parking is provided in the Gardiner urban area. The MDT *Traffic Engineering Manual* provides guidelines for on-street parking facilities. The guidelines are shown in **Figure 7** and are summarized below[3]:

- Prohibit parking within 20 feet of any crosswalk.
- Prohibit parking at least 10 feet from the beginning of the curb radius at mid-block approaches.
- Prohibit parking from areas designated by local traffic and enforcement regulations.
- Prohibit parking within 30 feet from end of curb return on the approach leg to any intersection with a flashing beacon, stop sign or traffic signal.
- Prohibit parking on bridges.
- Eliminate parking across from a T-intersection.

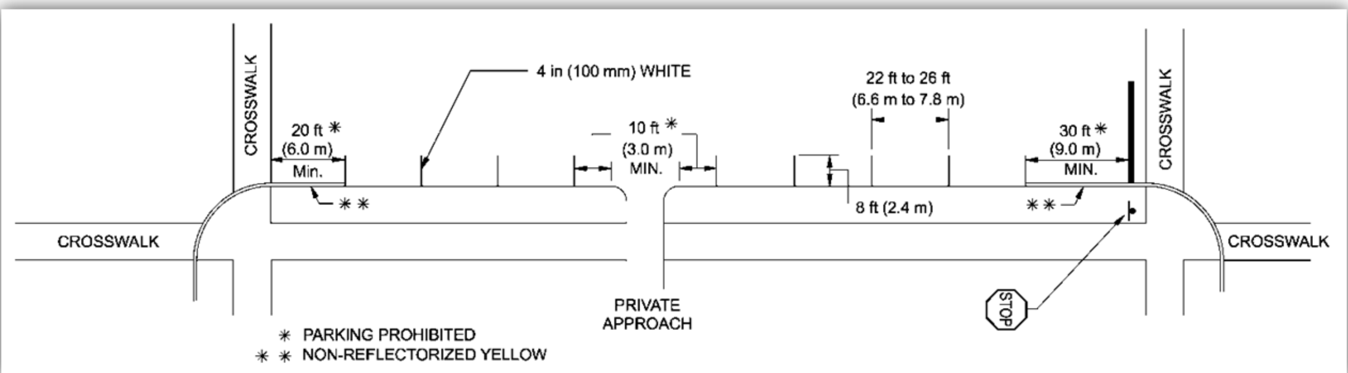

Figure 7: Typical Markings for On-Street Parking[4]

An inventory of existing on-street parking areas and crosswalk locations was conducted through on-site field review, aerial photography from July 2013, and *Google Street View* imagery from August 2011. **Figure 8** shows the existing parking areas and crosswalks in the Gardiner urban area.

[3] MDT Traffic Engineering Manual, Section 31.4.1.3, November 2007.
[4] MDT Traffic Engineering Manual, Figure 19.5i, November 2007

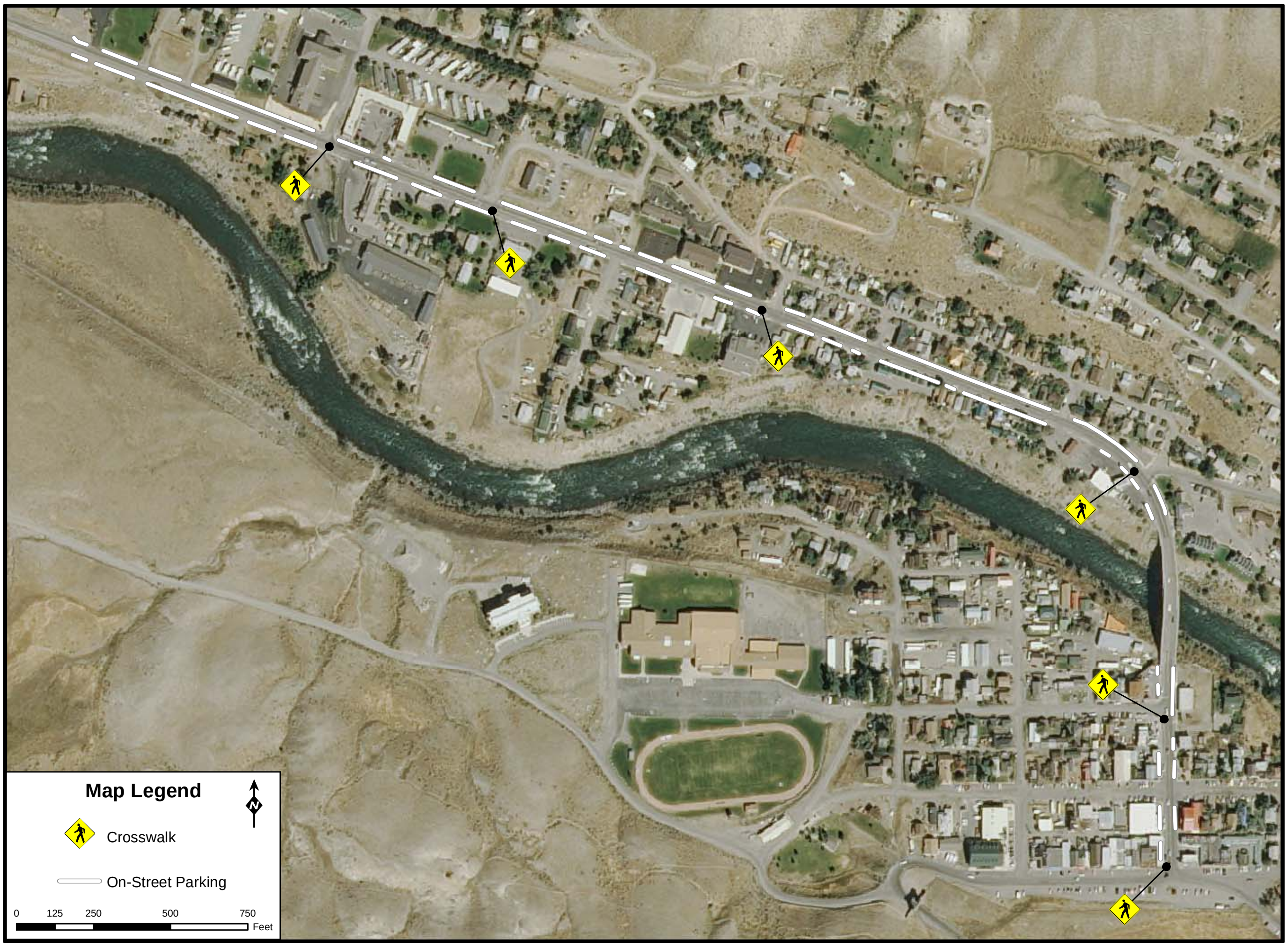

Figure 8: Existing On-Street Parking and Crosswalks

4.12 Special Speed Zones

Speed zones were reviewed by comparing on-the-ground speed limit signage with adopted statutory and special speed zones on record with MDT's Traffic and Safety Bureau. The intent of this review was to confirm speed limit signage on US 89 within the study area matches special speed zone beginning and ending reference posts. To perform this review, Google aerial imagery and field observations were utilized to confirm speed limit sign compliance with termini points of the special speed zones as documented by past Montana Transportation Commission resolutions. This review found that all special speed zones were signed in compliance with the Montana Transportation Commission resolutions. **Table 25** shows the locations of the special speed zones and the statutory speed areas, by reference post range.

Table 25: Statutory and Special Speed Zones

Location (RP)		Length (mi)	Area Name	Speed Limit
Begin	End			
0.00	0.66	0.66	Gardiner	25 MPH
0.66	0.87	0.21	Gardiner	35 MPH
0.87	1.21	0.34	Gardiner	45 MPH
1.21	1.45	0.24	Gardiner	55 MPH
1.45	7.42	5.97		70 MPH
7.42	7.90	0.48	Corwin Springs	60 MPH
7.90	30.78	22.88		70 MPH
30.78	31.17	0.39	Emigrant	55 MPH
31.17	49.17	18.00		70 MPH
49.17	52.36	3.19	Livingston	55 MPH
52.36	52.65	0.29	Livingston	45 MPH
52.65	53.74	1.09	Livingston	35 MPH

Source: MDT Traffic and Safety Bureau, August 29, 2013.
Note: Corridor study terminus is RP 52.50. Speed information is shown to RP 53.74 to show continuity of 45 mph to 35 mph step-down thru Livingston.

4.13 Hydraulics

4.13.1 Drainage Conditions

US 89 crosses the Yellowstone River at two locations within the study area. The corridor also crosses 11 named streams and several unnamed drainages. Runoff from the highway is typically directed to either or both shoulders depending on location and subsequently conveyed to outfall locations via graded roadside slopes and constructed roadside ditches. A review of as-built plans identified more than 50 locations along the corridor where culverts were installed to convey runoff beneath US 89.

4.13.2 Bridges

Three bridge crossings and an arch culvert are located along the corridor according to the MDT *Bridge Management System*. All structures have recent inspection reports available (**Appendix C**). **Table 26** shows each structure, and lists the location, type, size, year constructed, and feature crossed. All of the structures are open to full legal loads.

Table 26: Bridge Locations and Type

Bridge Information	
	**P00011000+01651 - GARDINER** **Location:** RP 0.16 **Type of Bridge:** 3-span steel truss structure **Dimensions:** 38’ wide x 409’’ long **Year Constructed:** 1930 **Feature Crossed:** Yellowstone River
	**P00011020+04171 - 11 MI SW OF EMIGRANT** **Location:** RP 20.36 **Type of Bridge:** 4-span steel girder structure **Dimensions:** 28’ wide x 455’ long **Year Constructed:** 1958 **Feature Crossed:** Yellowstone River
	**P00011024+00721 - 7 MI SW OF EMIGRANT** **Location:** RP 24.02 **Type of Bridge:** 3-span concrete T-beam structure **Dimensions:** 28’ wide x 90’ long **Year Constructed:** 1960 **Feature Crossed:** Big Creek
	**P00011047+09001 - 10 KM S LIVINGSTON** **Location:** RP 47.74 **Type of Bridge:** Steel Culvert **Dimensions:** 32’ wide x 15’ long **Year Constructed:** 1964 **Feature Crossed:** Farm Access

Source: MDT Bridge Management System, 2012

MDT’s Highway Bridge Program (HBP) emphasizes asset management and preservation. This emphasis promotes a “right treatment at the right time” philosophy in prioritizing and selecting projects on MDTs bridge system. MDT has defined bridge program objectives and performance measures. The objectives and measures are intended to identify the right treatments for Montana’s bridge assets, and are intended to promote cost effective bridge preservation, appropriate safety related work, and economic growth.

MDT uses a Structure Condition Performance Measure and a Deck Performance Condition Measure. These measures categorize bridge condition as Good, Fair, or Poor based on the condition rating given to the bridge Deck (riding surface), Superstructure (generally beams underneath the riding surface), and Substructure (support structure extending into the ground). These elements are ranked on a 0-9 scale during routine bridge condition inspections. Additionally, the Structure Condition Performance Measure assigns a Poor rating to a bridge that is Structurally Deficient. **Figure 9** illustrates the Structure Condition performance measure.

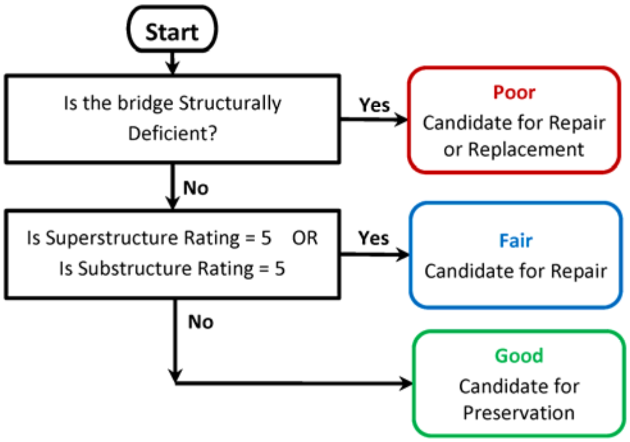

Figure 9: Structure Condition Performance Measure

A bridge is considered Structurally Deficient if load carrying elements have deteriorated enough to be considered to be in "poor condition" or the adequacy of the waterway opening provided by the bridge is insufficient causing intolerable traffic interruptions. When a bridge is classified as Structurally Deficient, it doesn't mean that it is unsafe. A Structurally Deficient bridge typically requires increased maintenance and repair to remain in service and eventual rehabilitation or replacement to address the overall deficiencies.

The Deck Condition performance measure uses the NBI deck rating to give an indication of the deck condition and a planning level indication of needed preservation treatment. The Deck Condition rankings are a general indicator of the condition of any individual deck. The rankings are useful for planning purposes on a system wide basis. **Figure 10** illustrates the Deck Condition performance measure.

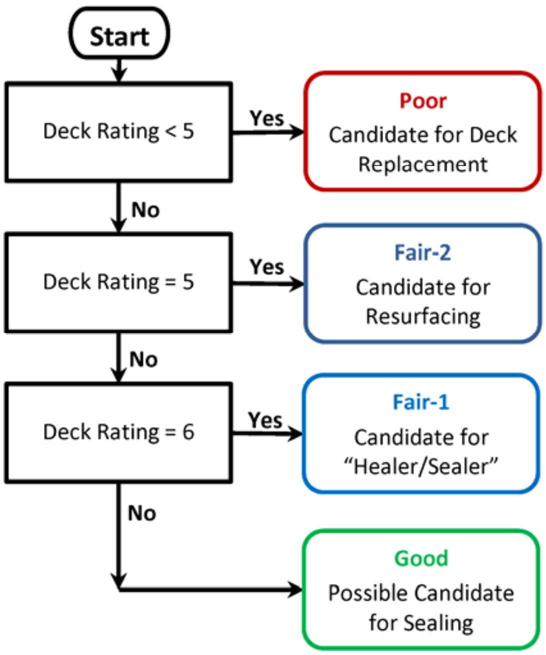

Figure 10: Deck Condition Performance Measure

Table 27 shows the performance measure rankings, for the four structures within the study area. None of the bridges within the study are structurally deficient

The three bridges in the study area rank "good" for the Structure Condition performance measure, indicating they are candidates for continued preservation. The bridge decks (riding surfaces) are candidates for preservation treatments ranging from crack sealing to resurfacing.

Table 27: Bridge Sufficiency Rating

Criteria	Bridge at RP 0.16	Bridge at RP 20.36	Bridge at RP 24.02	Culvert at RP 47.74
Based on Inspection Form	04/18/2013	10/02/2012	01/02/2013	08/23/2011
Structure Condition Performance Measure	GOOD	GOOD	GOOD	N/A*
Deck Condition Performance Measure	FAIR-2	FAIR-1	GOOD	N/A*

** The Performance Measures are not applicable to culverts. This culvert is considered to be in "Good" condition.*
Source: MDT Bridge Management System, 2012

The Yellowstone River Bridge in Gardiner is a steel truss. Truss bridges are typically "fracture critical" meaning if one part of the truss should fail, the entire bridge span may fail. The bridge requires special fracture critical inspections to help safeguard against the possibility of a failure.

4.14 Geotechnical Considerations

4.14.1 Landslide Areas

The Montana Bureau of Mines and Geology (MBMG), in cooperation with MDT, completed a study and compilation of landslide data for MDT's Butte District (District 2) during 2002. The study identified more than 4,600 landslides within the district through field mapping, aerial reconnaissance, aerial photograph interpretation, and literature references. MBMG produced a database for identified landslide areas with key characteristics like location, type, geologic aspect, and size. A priority rating system was developed and assigned to areas with landslide clusters. The rating system (using values ranging from 1 to 5) helped determine areas with the highest priorities for more detailed landslide hazard investigations.

The study indicated that formations containing volcanic materials (due to the ash and clay content) and areas with poorly consolidated sediments are particularly prone to landslides. Causes and contributing factors to landslides are steep topography, previous glaciations, orientation of bedding, human activities, and stream undercutting. Landslide triggers can include earthquakes, increased moisture or water, and toe excavation. There was also a strong relationship between the locations of faults and landslides in the Butte District.

A portion of the study examined landslide occurrences and conditions in the Livingston and Gardiner areas. Landslides in the Livingston area are most often associated with debris flows, debris slides, and earth slides. In the Gardiner area, landslides include both debris and rockslides, as well as earth; debris; and rock flows. The Landslide Report identifies three landslide cluster areas adjoining US 89 within the study area. These cluster areas are discussed below.

- **Gardiner-Area 7**: Includes an area where landslides are located along tributaries of the Yellowstone and Gardiner Rivers. The area contains a large earth flow, debris slides, and very large debris flows. US 89 from RP 0 to approximately RP 5 lies within this cluster area which contains numerous faults and intrusive volcanic dikes that contribute to landslides. The earth flow and a debris slide are located immediately east of US 89 and the remaining landslides are on or near tributaries of the Yellowstone River. New or renewed movement could affect any or all of these features. This cluster area was assigned a medium priority (Priority 3) for more detailed study and risk assessment.

- **Gardiner-Area 1**: Parallels the Yellowstone River Valley and landslides occur on both sides of the valley. The cluster area contains a large debris slide/flow complex, large debris flows, and debris slides. US 89 from approximately RP 10 to RP 24 is located in the central portion of this landslide cluster area. New or renewed movement in this slide area could affect Big Creek, Tom Minor Creek, the Yellowstone River, and US 89. This cluster area was identified as a medium-high priority (Priority 2) for more detailed study and risk assessment.

- **Livingston-Area 12**: Includes the portion of US 89 from RP 47 to RP 51, and the majority of the landslide cluster is located west of the highway. Numerous faults and tight fold structures are present and there are debris slides and flows, and earth slides and flows found within the area. This cluster area was assigned a high priority (Priority 1) for more detailed study and risk assessment.

4.14.2 Rockfall Hazard Areas

MDT completed a Rockfall Hazard Classification and Mitigation System research project in September 2005[5]. As a result of the project, MDT implemented the Rockfall Hazard Rating System (RHRS) to provide the information needed to help the agency make informed decisions on where to invest the limited funding available for rockfall mitigation.

As part of the research project, an initial review of the state highway system (including US 89) was conducted, and more than 2,600 potential rockfall sites were identified using MDT's extensive photo log system. Input on the rockfall history and behavior information was then solicited from MDT Maintenance staff for each site. All identified sites were visited and categorized as being "A," "B," or "C" sites, denoting a high, moderate, or low potential to develop a hazardous rockfall situation. The project categorized 1,869 sites on the road system as either "A" or "B" sites, indicating their moderate to high potential to develop a hazardous rockfall situation. Sites in the "C" category were eliminated from further consideration due to their low rockfall hazard threat. Additional and more detailed ratings were conducted on the 869 "A" sites to narrow the list of sites and ultimately identify the top 100 A-rated sites on the state highway system.

The US 89 corridor contains 12 "A" or "B" rockfall hazard sites that were examined in the Rockfall Hazard Classification and Mitigation System research project and were incorporated into MDT's RHRS Database. **Table 28** identifies the RHRS sites that occur in the study area. Three of the sites along US 89 were included in the top 100 A-rated sites identified through the project.

[5] Landslide Technology, *Rockfall Hazard Classification and Mitigation System, Final Report*, FHWA/MT-05-011/8174, Prepared for State of Montana Department of Transportation Research Programs, September 2005.

Table 28: Rockfall Hazard Rating System Sites

RP Start	RP End	Side of Road	Maintenance Rating	Preliminary Rating	Type
6.01	6.06	Right	B	B	B
6.57	6.96	Right	A	A	A
12.2	12.46	Right	A	B	B
13.22	13.32	Right	A	B	B
13.32	13.66	Right	A	A	A (TOP 100)
13.66	13.84	Right	A	B	B
13.84	13.96	Right	A	A	A (TOP 100)
13.96	14.61	Right	A	A	A (TOP 100)
15.03	15.71	Right	--	B	B
15.71	15.84	Right	A	A	A
48.99	49.17	Left	B	B	B
49.32	49.38	Left	B	B	B

Source: Rockfall Hazard Classification and Mitigation System, Final Report, September 2005.

4.15 Other Transportation Modes

4.15.1 Pedestrians and Bicyclists

A pedestrian/bicyclist path exists along the west side of US 89, from the roadway's intersection with East River Road (S-540) at RP 49.8, north past the end of the study area at Merrill Lane (approximately RP 52.5). A sidewalk was installed along US 89 north of Merrill Lane. Within Gardiner, sidewalks are provided along US 89 from about Hellroaring Street (RP 0.8), across the Yellowstone River Bridge, to RP 0.0 at Park Street. In the rural portions of the corridor, no dedicated pedestrian facilities exist along US 89. Pedestrians and bicyclists use the roadway shoulder for travel.

Recreational opportunities, including fishing access sites, trailheads, and the close proximity to YNP, bring occasional pedestrians and bicyclists to this corridor. The communities of Gardiner, Corwin Springs, and Emigrant are located along US 89, and activities within these areas may also generate some pedestrian and bicyclist use of the highway.

When the rail line from Livingston to YNP was abandoned, adjoining landowners generally acquired the easement for the line. USFS maintains a portion of the former rail easement for use as a walking path in Yankee Jim Canyon north of Gardiner.

Portions of US 89 within the study area are on the route of the Cycle Greater Yellowstone tour, a seven-day, fully supported bicycle tour of the Greater Yellowstone area in Montana and Wyoming. The 2013 tour will occur in August, and participants will begin in Livingston and travel to Gardiner via US 89 and S-540 on one day of the tour (August 19, 2013). Other communities along the tour include West Yellowstone, Ennis, Silver Gate/Cooke City, Cody, and Red Lodge. The event may accommodate up to 1,000 riders.

4.15.2 Transit

Currently there are no transit services within the study area. Between Livingston and Bozeman, five-day-per-week commuter bus service is available from the Human Resource Development Council (HRDC)/Streamline. Attempts by HRDC/Streamline to expand public transportation options into the study area have been unsuccessful.

Angel Line Transportation provides transportation to Senior Citizens (over 60) and disabled persons (all ages) needing special care in Park County. Angel Line transports people for various purposes that include medical appointments, recreation, shopping, and work. Transportation services typically are available Monday through Friday (except holidays) from 8:00am to 4:30pm. Services are available one or two days per month for Gardiner. This service must be requested at least one business day in advance.

The study area experiences considerable seasonal use by local, regional, and national tour bus and charter bus operators between April and October. Karst Stage and Rimrock Stages charter transportation for seasonal visitors to YNP from Livingston. Karst Stage also offers daily trips into YNP from Livingston. The trips depart from Livingston at 6:30 daily and travel to Bozeman, West Yellowstone, and through YNP before exiting at Gardiner and returning to Livingston 12 hours later.

At least one company offers private wildlife and scenic tours originating from Gardiner.

4.15.3 Air Service

There are two landing strips/airports within the study area: Gardiner Airport and the Flying Y Ranch Airport. Gardiner Airport is a public-use airport located 2 miles northwest of the community. The Gardiner Airport is located west of US 89 and is accessed via Airport Road at RP 1.9. Approximately 7,600 annual operations (takeoffs or landings) occur at the airport consisting of itinerant general aviation (53 percent of the operations), local general aviation (39 percent of the operations), and air taxi (8 percent of the operations).[6]

Flying Y Ranch Airport is a private airport, and permission is required before using the landing strip at the airfield. The facility is located approximately 14 miles south of Livingston (0.3-mile northwest of Mill Creek Road intersection with US 89 at RP 37.2).

Mission Field is a public use airport located 2 miles east of Livingston and is outside of the study area.

4.15.4 Rail

Montana Rail Link (MRL) owns and operates the railroad facilities at Livingston. A rail spur, located along the west side of US 89, begins north of Merrill Lane (at RP 52.5) and continues northward along US 89 to join the MRL main line in Livingston. A spur line to a lumber company crosses US 89 at RP 52.7. Railroad crossing warning signals with appropriate roadway signing and pavement markings exist at the spur line crossing. The crossing is beyond the northern boundary of the study area, but it was noted due to its close proximity.

4.16 Utilities

Park Electric Cooperative and Northwestern Energy Electric provide power. Overhead power lines are present intermittently along both sides of the highway within the study area and occasionally cross over the roadway. Large electrical substations exist east of the highway north of Gardiner at RP 1.6 and southwest of the intersection of US 89 and Tom Miner Creek Road near RP 16.6. NorthWestern Energy also provides natural gas service within the study area. Century Link provides telecommunication services to the study area and has intermittently been installing fiber-optic cable to provide upgraded communications infrastructure to Yellowstone National Park and the community of Gardiner. Individuals obtain water and sewer service by wells and septic tanks, respectively.

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[6] AirNav, LLC, 2012, www.airnav.com.

5.0 ENVIRONMENTAL SETTING

This section provides a summary of the *Environmental Scan* developed by MDT[7]. The primary objective of the *Environmental Scan* is to determine potential constraints and opportunities within the study area. As a planning-level scan, the information is obtained from various reports, websites, and other documentation. This scan is not a detailed environmental investigation. Refer to the MDT *Environmental Scan* for more detailed information.

5.1 Physical Environment

5.1.1 Soil Resources and Prime Farmland

Information on soils was obtained to determine the presence of prime and unique farmland in the study area to demonstrate compliance with the Farmland Protection Policy Act. This act is intended "to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to assure that federal programs are administered in a manner that, to the extent practicable, will be compatible with State, unit of local government, and private programs and policies to protect farmland."

Farmland is defined by the act (in Section 4201) as including prime farmland; prime if irrigated farmland; unique farmland; and farmland, other than prime or unique farmland, that is of statewide or local importance. Prime farmland soils are those that have the best combination of physical and chemical characteristics for producing food, feed, and forage; the area must also be available for these uses. Prime farmland either can be non-irrigated or lands that would be considered prime if irrigated. Farmland of statewide importance is land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops.

The CPA-106 Farmland Conversion Impact Rating Form for Linear Projects is a way for the Natural Resource Conservation Service (NRCS) to keep inventory of the prime and important farmlands within the state. Soil map units found within the study area have been classified as prime and important farmlands. If a project is forwarded and lands are acquired from these areas, and the project is funded with federal funds, MDT would complete a CPA-106 Farmland Conversion Impact Rating Form for Linear Projects and will coordinate with NRCS. NRCS uses information from that form to keep an inventory of the Prime and Important Farmlands within the state.

5.1.2 Geologic Resources

Information was obtained on geology in the study area. Seismic information was reviewed for fault lines and seismic hazard areas. This geologic information can help determine potential design and construction issues related to embankments and road design.

There are three designated faults within the study area, the Northern Section of the Emigrant fault, the Southern Section of the Emigrant fault, and the East Gallatin – Reese Creek fault system. Improvements brought forward from the study should be developed based on sufficient borings to evaluate the soils at the location where work is proposed to ensure suitability for the planned project. If unsuitable soil is encountered, increased costs for excavation, haul-off, and import of materials should be expected. Seismic design of highway infrastructure takes place in accordance with American Association of State Highway and Transportation Officials (AASHTO) guidelines.

[7] MDT Environmental, *Environmental Scan – Paradise Valley Corridor Study*, 2013.

5.1.3 Surface Waters

Maps and GIS data were reviewed to identify the location of surface water bodies within the study area, including rivers, streams, lakes, or reservoirs.

The main surface water in the study area is the Yellowstone River. Additionally, various surface waters, including streams, natural drainages, and wetlands, are also present in the area. Impacts on these surface waters may occur from project improvements such as culverts under the roadway, or rip rap armoring of banks. If a project is forwarded impacts should be avoided and minimized to the maximum extent practicable.

5.1.3.1 Total Maximum Daily Loads Information

US 89 travels through the Upper Yellowstone Watershed (Hydrologic Unit Code: 10070002) within the study area. Information on the Yellowstone River and its tributaries was obtained from DEQ's website. Section 303, subsection "d," of the Clean Water Act requires the State of Montana to develop a list, subject to US Environmental Protection Agency (EPA) approval, of water bodies that do not meet water quality standards. When water quality fails to meet state water quality standards, the Montana Department of Environmental Quality (DEQ) determines the causes and sources of pollutants in a sub-basin assessment and sets maximum pollutant levels, called total maximum daily loads (TMDLs).

A TMDL sets maximum pollutant levels in a watershed. The TMDLs become the basis for implementation plans to restore the water quality to a level that supports its designated beneficial uses. The implementation plans identify and describe pollutant controls and management measures to be undertaken (such as best management practices), the mechanisms by which the selected measures would be put into action, and the individuals and entities responsible for implementation projects.

The Upper Yellowstone watershed is listed in the 2012 Integrated 303(d)/305(b) Water Quality Report for Montana by DEQ. The water bodies within the Upper Yellowstone Watershed that are located in the study area are Category 5 and Category 4C. Category 5 water bodies are waters where one or more applicable beneficial uses have been assessed as being impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat. Category 4C water bodies are waters where TMDLs are not required as no pollutant-related use impairment is identified. TMDLs have not yet been written for water bodies in this watershed. When TMDLs are prepared, and implementation plans are in place, if a project is forwarded, any construction practices would have to comply with the requirements set forth in the plan.

5.1.3.2 Upper Yellowstone River Special Area Management Plan

The US Army Corps of Engineers (USACOE) is responsible for issuing permits for work in the upper Yellowstone River in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The Yellowstone River is considered a Section 10 water from Emigrant to its confluence with the Missouri River.

The Upper Yellowstone River Special Area Management Plan (SAMP) covers the 86-mile stretch from the boundary of YNP to approximately seven river miles upstream of Springdale. The SAMP directs the USACOE to evaluate how a project may affect the entire watershed, floodplain, and valley before approving a permit.

The SAMP process created a Special River Management Zone (SRMZ), which is intended to provide enhanced protection within the 48-mile reach that is most susceptible to forced morphology. The SRMZ extends from approximately four river miles upstream Emigrant (river mile 531.8) to approximately seven river miles upstream of Springdale (river mile 483.6). If a project is forwarded, impacts on Waters of the United States associated project developments would require permitting from the USACOE. Impacts on

Waters of the United States within the SAMP/SRMZ would require specialized permitting from the USACOE. The USACOE will evaluate proposed transportation projects and potential impacts in detail, possibly making it more difficult to secure a Section 404 Permit. This difficulty and the potential increase in permitting time should be considered if improvements are forwarded from the study.

5.1.3.3 Wild and Scenic Rivers

Congress created the Wild and Scenic Rivers Act in 1968 to provide for the protection of certain selected rivers, and their immediate environments, that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. The NPS website was accessed for information on river segments that may be located within the study area with a wild and scenic river designation. At this time, neither the Yellowstone River, nor any one of its tributaries, carries the wild and scenic designation.

5.1.3.4 Groundwater

There are 5,444 wells are currently on record in Park County, and some of these wells exist within the study area. The wells in Park County have many different uses, with domestic use most common. If a project is forwarded from the study, impacts on existing wells would have to be considered.

5.1.3.5 Wetlands

The USACOE defines wetlands as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Most of the wetland areas logically occur within the riparian bottomlands associated with the Yellowstone River, its tributaries, and the major draws coming out from the mountains. A notable amount of potential wetland area occurs in the valley, adjacent to the current highway alignment. Any project forwarded from this study has the potential to impact wetland areas, riparian areas, and streams.

If projects that could impact wetlands are forwarded from the study, formal wetland delineations would have to be completed. Future projects in the corridor would have to incorporate project design features to avoid and minimize adverse impacts on wetlands to the maximum extent practicable.

5.1.3.6 Floodplains (EO 11988) and Floodways

Executive Order (EO) 11988, Floodplain Management, requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. EO 11988 and 23 Code of Federal Regulations (CFR) 650 Part A requires an evaluation of project alternatives to determine the extent of any encroachment into the base floodplain. The base flood (100-year flood) is the regulatory standard used by federal agencies and most states to administer floodplain management programs. A floodplain is defined as lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, with a 1 percent or greater chance of flooding in a given year. As described in FHWA's floodplain regulation (23 CFR 650 Part A), floodplains provide natural and beneficial values serving as areas for fish, wildlife, plants, open space, natural flood moderation, water quality maintenance, and groundwater recharge.

5.1.3.7 Irrigation

Irrigated grazing land exists in Park County adjacent to US 89 within the study area. Impacts on irrigation facilities should be avoided to the greatest extent practicable. However, depending on the improvement option(s) identified during the study, there is a potential to impact irrigation facilities. Irrigation canals, ditches, or pressurized systems that require modifications to the existing facilities will be redesigned and constructed in consultation with the owners to minimize impacts on agricultural operations. Additional expenses could be created if projects carried forward from the study create impacts on irrigation facilities.

5.1.4 Air Quality

EPA designates communities that do not meet National Ambient Air Quality Standards (NAAQS) as "non-attainment areas." States are then required to develop a plan to control source emissions and ensure future attainment of NAAQS. The Paradise Valley corridor is not located in a non-attainment area for Particulate Matter (PM-2.5 or PM-10) or Carbon Monoxide (CO). Additionally, there are no nearby PM-2.5, PM-10, or CO non-attainment areas. As a result, special considerations will not be required in future project designs to accommodate NAAQS non-attainment issues.

Depending on the scope of the project being considered along this corridor, an evaluation of Mobile Source Air Toxics (MSATs) may be required. MSATs are compounds emitted from highway vehicles and off-road equipment that are known or suspected to cause cancer or other serious health and environmental effects.

5.1.5 Hazardous Substances

The Montana Natural Resource Information System database was searched for underground storage tank (UST) sites, leaking underground storage tank (LUST) sites, abandoned mine sites, remediation response sites, landfills, National Priority List sites, hazardous waste, crude oil pipelines, and toxic release inventory sites in the vicinity of the study.

There is a cluster of the before mentioned sites around the City of Livingston and the unincorporated community of Gardiner. These sites can be found intermittently throughout the entire study area. The following is a brief synopsis of the three main types of sites within the study area identified with potential contamination impacts, which should be avoided if possible. If a project is forwarded and UST, LUST, or contaminated soils are encountered, removal and cleanup is required, which would increase costs.

5.1.5.1 Underground Storage Tanks

Approximately 29 USTs were identified. Most of the USTs are from agricultural farms with limited site assessment data and imprecise GIS location data. In agricultural situations such as seen in the study area, the USTs usually are located within the farm, near the shop, and away from the highway. Additional investigation of the precise locations of the USTs may be warranted if a project progresses.

5.1.5.2 Leaking Underground Storage Tanks

Approximately 29 LUSTs were identified. Most of the releases from these LUST sites have been resolved or characterized by previous investigations. Only one LUST site is designated as having a high priority ranking assigned by DEQ, and it is not located directly adjacent to the study area. Therefore, it is not anticipated that LUST sites would adversely impact future projects that may advance from the study. However, further review and potential investigation may be necessary if the highway alignment changes.

5.1.5.3 Abandoned and Inactive Mine Sites

Abandoned and inactive mine sites were identified. Most of the mine sites are underground mines, and they could cause subsidence issues underneath or on the embankment above the highway if the horizontal alignment shifts considerably. Some of the mines have been reclaimed by the DEQ Abandoned Mine Section. It is not anticipated that mines identified during the environmental scan will adversely impact highway expansion, but additional investigation may be necessary if a project progresses.

5.2 Noise

Traffic noise may have to be evaluated if improvements to US 89 are forwarded within the study area. Noise analysis is necessary for Type I projects. If the roadway improvements are limited (e.g., the horizontal and vertical alignments are not changed, and the highway remains a two-lane facility), then the project would not be considered a Type I project. If the improvements planned for the road would include a substantial shift in the horizontal or vertical alignments, increasing the number of through-lanes, passing lanes, or turning lanes, or increasing the traffic speed and volume, then the project would be considered a Type I project.

A detailed noise analysis would be required if the forwarded project is considered a Type I project. The analysis would include measuring ambient noise levels at selected receivers and modeling design-year noise levels using projected traffic volumes. Noise abatement measures would be considered for the project if noise levels would approach or substantially exceed the noise abatement criteria. The noise abatement measures must be considered reasonable and feasible before implementation.

5.3 Visual Resources

The visual resources of an area include landforms, vegetation, water features, and physical modifications caused by human activities that give the landscape its visual character and aesthetic qualities. Visual resources are typically assessed based on the landscape character (what is seen), visual sensitivity (human preferences and values regarding what is seen), scenic integrity (degree of intactness and wholeness in landscape character), and landscape visibility (relative distance of seen areas) of a geographically defined view shed.

The landscape throughout the study area contains an array of biological, scientific, historic, wildlife, ecological, geologic and cultural resources mixed with a remote location. The Roosevelt Arch marks the entrance to YNP near RP 0.0. YNP creates a large draw for many visitors to travel US 89 along the edge of the scenic Yellowstone River. The area along US 89 is a blended landscape that has been mildly developed, while still allowing the natural beauty to persevere. Evaluation of the potential effects on visual resources would have to be conducted if improvement options are forwarded from this study.

5.4 Biological Environment

Biological resources in the study area were identified using maps, aerial photographs, the endangered, threatened, proposed, and candidate species list for Montana counties (June 2013) from the US Fish and Wildlife Service (USFWS), Montana Natural Heritage Program data, and windshield surveys of the project site. This limited survey is in no way intended to be a complete and accurate biological survey of the study area. If a project is forwarded from the improvement option(s), consultations with FWP and USFWS field biologists on techniques to perpetuate the riparian corridor, promote fish passage, and accommodate wildlife movement and connectivity would occur, and a complete biological survey of the study area would have to be completed. Project costs may be higher than typically expected due to potential mitigation measures and should be budgeted in the planning process.

5.4.1 Wildlife

The information reflects a baseline natural resource condition of the study area. Depending on the level of detail available through the high-level baseline scan, some of the information has been provided at the county level, some at the corridor level (US 89 from RP 0.0 to RP 52.5), and some within the study area.

5.4.1.1 Mammals

The study area is home to a variety of mammal species, including whitetail deer, mule deer, elk, moose, bison, bighorn sheep, black bear, mountain lion, gray wolf, mountain lion, and coyote. A herd of bighorn sheep occupy habitat in and around Corwin Springs and are frequently observed on or adjacent to US 89, especially during winter. Other common mammals potentially occurring in the project area include porcupine, raccoon, striped skunk, badger, bobcat, red fox, beaver, muskrat, Richardson's ground squirrel, deer mouse, vole species, and a variety of bat species.

A migratory population of bison resides within YNP during the summer months. The bison migrate to lower elevation wintering range within and adjacent to the Park during winter. Bison have a tendency to use road systems for travel. During winter months, they frequently are observed on or immediately adjacent to US 89 south of Yankee Jim Canyon. In order to limit bison movements to the area south of Yankee Jim Canyon, cattle guards have been installed along US 89 as well as on the county road on the west side of the Yellowstone River. Fencing was constructed adjacent to the cattle guards, with gates that can be opened when bison are not present in Gardiner Basin. Currently the cattle guards are installed, and adjacent gates are closed from November through May; however, FWP has an Environmental Assessment in progress to allow bison to roam freely year-round.

A bighorn sheep herd exists in the study area. Bighorn sheep can be found on both sides of US 89 from RP 4.0 to RP 23.0, but especially during the winter months in three areas: 1) from RP 0.0 to RP 2.0 (Gardiner area), 2) RP 4.0 to RP 9.0 (Corwin Springs area), and 3) between RP 14.0 and RP 21.0 (Tom Miner Basin area).

A discussion about animal-vehicle collisions is provided in **Section 4.4.2**.

5.4.1.2 Amphibians and Reptiles

According to the Montana Natural Heritage Program - Natural Heritage Tracker database, which records and maps documented observations of species in a known location, amphibian species known to occur in Park County and potentially occurring in the study area include, but are not limited to, the Columbia spotted frog western toad, boreal chorus frog, northern leopard frog, barred tiger salamander, and plains spadefoot. More than a dozen invertebrate species, some listed as Montana Species of Concern (SOCs), have also been observed in the study area.

5.4.1.3 Birds

According to the Natural Heritage database, a few hundred different species of birds documented in Park County have the potential to occur and nest in the study area. These species include representative songbirds, birds of prey, waterfowl, owls, and shorebirds, including several state SOCs. Most avian observations occur in the riparian draws and hillsides associated with the numerous drainages within the study area.

There are multiple bald and golden eagle nests located within the study area. Bald and golden eagles are protected under the Migratory Birds Treaty Act and are managed under the Bald and Golden Eagle Protection Act. Any improvements forwarded from this study should consider potential constraints that may result from nesting times of migratory birds and the presence of bald and golden eagles' nests.

5.4.1.4 Threatened and Endangered Species

USFWS maintains the federal list of Threatened and Endangered (T&E) Species. Species on this list receive protection under the Endangered Species Act. An endangered species is one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. USFWS also maintains a list of species that are candidates or are proposed for possible addition to the federal list. According to USFWS, six threatened, endangered, or candidate species are listed as occurring in Park County.

Table 29: Threatened and Endangered Species in Park County

Common Name	Status
Canada Lynx	Listed Threatened, Critical Habitat
Grizzly Bear	Listed Threatened
Greater Sage-Grouse	Candidate
Sprague's Pipit	Candidate
Wolverine	Proposed
Whitebark Pine	Candidate

A search of the Montana Natural Heritage Program's National Heritage Tracker database revealed that three of the six T&E species potentially in Park County have occurrence buffers overlapping the study area. These species are listed in **Table 30**.

Table 30: Threatened and Endangered Species within the Study Area

Common Name	Status
Canada Lynx	Listed Threatened, Critical Habitat
Grizzly Bear	Listed Threatened
Wolverine	Proposed

An evaluation of potential impacts on all endangered, threatened, proposed, or candidate species will have to be completed during the project development process.

5.4.1.5 Species of Concern

Montana SOCs are native animals breeding in the state that are considered to be at risk due to declining population trends, threats to their habitats, and/or restricted distribution. Designation of a species as a Montana SOC is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to direct limited resources to priority data collection needs and to address conservation needs proactively. Each species is assigned a state rank that ranges from S1 (greatest concern) to S5 (least concern).

A search of the Montana Heritage Program was conducted for Park County (March 14, 2013). Fifteen species of concern identified in Park County had the potential to occur in the study area based on the presence of suitable habitat and occurrence.

If a project is forwarded a field investigation for the presence and extent of these species should be conducted during the project design phase. If present, special conditions for project design or construction should be considered to avoid or minimize impacts on these species.

5.4.2 Fish

The Yellowstone River is the major water body that parallels and is crossed by US 89 within the study area. Multiple tributaries to the Yellowstone River also are crossed by the highway. The Montana Fisheries Information System (MFISH) database was reviewed for the Yellowstone River and numerous tributaries within the study area. The following fish species were noted as historically or currently occurring in the various waterbodies:

- Brook Trout
- Brown Trout

- Rainbow Trout
- Mottled Sculpin
- Longnose Dace
- Longnose Sucker
- Mountain Whitefish
- White Sucker
- Yellowstone Cutthroat Trout
- Rainbow Trout

Fish passage and/or barrier opportunities should be considered at affected drainages if a project is forwarded from this study. Permitting by regulatory and resource agencies would likely require incorporation of design measures to facilitate aquatic species passage.

5.4.3 Vegetation

A combination of predominantly coniferous forests and sagebrush steppe habitat dominate the hillsides and foothills. Riparian woodland and shrub land line the riparian corridors of the drainages, especially the Yellowstone River. Practices outlined in both Standard Specification 201, and any related supplemental specifications should be followed to minimize adverse impacts on vegetation.

5.4.4 Noxious Weeds

Noxious weeds can degrade native vegetative communities, choke streams, compete with native plants, create fire hazards, degrade agricultural and recreational lands, and pose threats to the viability of livestock, humans, and wildlife. Areas with a history of disturbance, like highway rights-of-way, are at particular risk of weed encroachment. The Invaders Database System lists 114 exotic plant species and 15 noxious weed species documented in Park County, some of which may be present in the study area.

The study area will have to be surveyed for noxious weeds. County Weed Control Supervisors should be contacted regarding specific measures for weed control during project development if a project is forwarded.

5.4.5 Crucial Areas Planning System

The Crucial Areas Planning System (CAPS) is a resource intended to provide useful and non-regulatory information during the early planning stages of development projects, conservation opportunities, and environmental review. The finest data resolution within CAPS is at the square-mile section scale or waterbody. Use of these data layers at a more localized scale is not appropriate and may lead to inaccurate interpretations since the classification may or may not apply to the entire square-mile section. CAPS was consulted to provide a general overview of the study area. CAPS results are presented in the *Environmental Scan*.

CAPS provides general recommendations and recommendations specific to transportation projects for both terrestrial and aquatic species and habitat. These recommendations can be applied generically to possible project locations carried forward from the study.

5.5 Cultural and Archaeological Environment

5.5.1 Recreational Resources

The Yellowstone River and its tributaries provide a variety of recreational opportunities for floaters and fishers. These recreational areas may be protected under federal law. Section 4(f) of the U.S. Department of Transportation Act of 1966 was enacted to protect publically owned parks, recreation areas, wildlife and waterfowl refuges, and public and private historic sites of local, state, and national significance. Federally funded transportation projects cannot impact these properties unless there are no feasible and prudent avoidance alternatives and all possible planning to minimize harm has occurred.

Before approving a project that uses a Section 4(f) resource, FHWA must find that there is no prudent or feasible alternative that completely avoids the 4(f) resource. Use can occur when land is permanently incorporated into a transportation facility or when there is a temporary occupancy of the land that is adverse to a 4(f) resource. Constructive use can also occur when a project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under 4(f) are substantially impacted. Section 4(f) resource information was gathered by review of both Montana Fish Wildlife and Parks resources list for Park County.

There are possible 4(f) recreational resources within the study area. These resources will have to be evaluated more in depth if improvements will affect these locations. The following camping and picnic areas were identified within the study area:

- Yankee Jim Picnic Area
- La Duke Picnic Area
- Cinnabar Picnic Area
- Sphinx Creek Picnic Area
- Canyon Campground
- Gardiner Community Park

The National Land and Water Conservation Fund Act (LWCFA), or Section 6(f), was enacted to preserve, develop, and assure the quality and quantity of outdoor recreation resources. Section 6(f) protection applies to all projects that impact recreational lands purchased or improved with land and water conservation funds. The Secretary of the Interior must approve any conversion of LWCFA-encumbered property to a use other than public, outdoor recreation. At this time, there are Section 6(f) resources identified in the study corridor, with most being fishing accesses (refer to the Environmental Scan for a complete list of 6(f) resources. Impacts on 6(f) resources should be avoided; 6(f) use is a lengthy process involving rigorous mitigation requirements and approvals from several resource agencies.

5.5.2 Cultural Resources

If a project is federally funded, MDT will conduct a cultural resource survey of the Area of Potential Effect for this project as specified in Section 106 of the National Historic Preservation Act (36 CFR 800). Section 106 requires federal agencies to "take into account the effects of their undertakings on historic properties." The purpose of the Section 106 process is to identify historic and archaeological properties that could be affected by the undertaking, assess the effects of the project, and investigate methods to avoid, minimize, or mitigate any adverse effects on historic properties. Special protections for these properties are also afforded under Section 4(f) of the Transportation Act.

The study area contains several known cultural resources. Cultural resources will not likely be a substantial issue, but the issue is important to address as planning progresses.

A file search of the Montana State Historic Preservation Office revealed eight historic properties located within the study area. **Table 31** lists the properties, their approximate locations, and National Register of Historic Places (NRHP) eligibility. All of the sites have been previously recorded, and their NRHP status established. In addition, 13 NRHP historic and archaeological properties are located within 1 mile of US 89, but are likely outside the impact area for this study.

Table 31: Historic Properties

Site	Site No.	NRHP Eligibility	RP±
Roosevelt Arch	24PA0765	Listed	N/A
Yellowstone R. Bridge at Gardiner	24PA0790	Yes	0.1
Electric Mines/Electric HD	24PA0483	Yes	7±
OTO Homestead and Dude Ranch	24PA1227	Listed	15±
Carbella Bridge	24PA1237	Listed	15±
Emigrant Crossroad Arch.	24PA0969	Yes	
Park Branch Canal	24PA1114	Yes	40±
Carter Bridge	24PA0817	Listed	S-540

If a project is forwarded from the study, a cultural resource survey for unrecorded historic and archaeological properties within the Area of Potential Effect will be completed during the project development process. Flexibility in design will be important to avoid and/or minimize impacts on historically significant sites.

6.0 AREAS OF CONCERN AND CONSIDERATION SUMMARY

This section provides a list and description of areas of concern and consideration within the study area. These areas were identified through review of as-built drawings, field review, public databases, and other resources. More discussion has been provided in the previous sections, and it is reiterated here as appropriate.

6.1 Transportation System

The following transportation system areas of concern were noted:

Level of Service

- Segments of US 89 are currently operating at, or near, the target LOS for this facility.

Horizontal Alignment

- Eight horizontal curves do not meet current standards.

Vertical Alignment

- Four vertical curves do not meet current standards.
- Two locations have grades that do not meet current standards.

Safety

- Numerous animal-vehicle collisions occurred between January 2002 and December 2012.

Passing

- Seven passing zone locations do not meet current standards based on length.
- One passing zone does not meet standards near public approaches.

Surfacing

- US 89 from RP 1.1 to the end of the study area has a 32 foot roadway width which is less than the recommended standard of 40 feet or greater.

Access Points

- Eleven approaches do not meet current standards based on intersection angles.

Parking

- Locations with on-street parking in the Gardiner urban area do not appear to meet current standards.

Geotechnical

- Three landslide cluster areas were identified within the study area.
- Twelve rockfall hazard sites were identified, including three “top 100” sites.

6.2 Environmental Considerations

The following environmental considerations were noted:

Prime Farmland

- Areas of prime farmland are located within the study area.

Geologic Resources

- Three designate faults are located within the study area.

Surface Waters

- A Special River Management Zone exists for the Yellowstone River from Emigrant to Springdale.

Hazardous Substances

- One leaking UST is designated as having a priority ranking assigned by DEQ within the study area.
- Abandoned and inactive mine sites were identified within the study area.

Wildlife

- Six endangered, threatened, proposed, or candidate species are listed for Park County.
- Three endangered, threatened, proposed, or candidate species occur in the study area.
- Fifteen species of concern have the potential to occur in the study area.

Cultural and Archaeological Environment

- There are multiple 4(f) and 6(f) resources located within the study area.
- Eight historic properties were identified within the study area.