Chapter 4. Cumulative Impacts Analysis

The I-70 PEIS was initiated, in part, to identify the cumulative impacts on the environment resulting from transportation alternatives at the Tier 1 level of National Environmental Policy Act (NEPA) analysis. Cumulative impacts may occur when the direct and indirect effects of the alternatives are considered in relationship to the other past, present, and reasonably foreseeable future impacts on the Corridor environmental resources and communities. Cumulative impacts have been identified to resources in proximity to I-70, as well as those in the surrounding region. Many of the cumulative issues are regional in nature, related to impacts from growth that may be induced beyond projections and plans for the Corridor region, as a result of the increased access and mobility opportunities of the PEIS transportation alternatives under evaluation. This chapter presents the cumulative impacts associated with the alternatives under study for the Corridor in the following sections:

- Regulatory Guidance
- Scope of Cumulative Impact Analysis
- Affected Environment and Cumulative Impacts

4.1 Regulatory Guidance

The requirements for federal agencies to address direct, indirect, and cumulative impacts in the NEPA process were established in 1978 through the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500–1508). Federal Highway Administration (FHWA) Regulations (23 CFR 771) and Technical Advisory (1987) provide additional guidance in preparing NEPA-compliant documents on federal transportation facilities. Note that most of existing I-70, especially the eastern Corridor area, was constructed before NEPA.

Methods and guidance on assessing cumulative impacts have been the focus of several recent documents. In 1997, the CEQ published *Considering Cumulative Effects Under the National Environmental Policy Act (NEPA)*. Most recently, FHWA prepared a memorandum in January 2003 titled "Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process." This interim guidance represents the steps that FHWA is taking to enhance the incorporation of cumulative impact considerations in project decision making. The methodology for determining cumulative impacts of the project alternatives is described in Appendix A, Environmental Analysis and Data, and is consistent with guidance from CEQ.

The CEQ regulations (40 CFR 1500–1508) define the impacts and effects that must be addressed by federal agencies in satisfying the requirements of the NEPA process. Direct and indirect impacts are defined and described in Chapter 3, Affected Environment and Environmental Consequences. As defined in the CEQ regulations, cumulative impacts:

- Result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions
- Can result regardless of what agency (federal or nonfederal) or person undertakes such other actions
- Can result from individually minor but collectively significant actions taking place over a period of time

These reasonably foreseeable future actions refer to future action projections, or estimates, of what is likely to occur when a proposed action is implemented. They are not part of the proposed action but are projections being made so that future impacts, cumulative and otherwise, can be estimated as required by NEPA. Cumulative effects are the total effect on a given resource or ecosystem of all actions taken or proposed (40 CFR 1508.7).

4.2 Scope of Cumulative Impact Analysis

This section documents the scope of the cumulative impact assessment, including:

- Cumulative impact issues
- Geographic scope for the analysis
- Timeframe for the analysis
- Past, present, and reasonably foreseeable future actions affecting resources of concern

Table 4-1 presents a summary of the cumulative analysis.

Supporting Documentation

- Appendix A, Environmental Analysis and Data
- Appendix G, Water Resources
- Appendix J, Social and Economic Values
- Appendix K, Overview of Water Availability and Growth, and Forest Service Land Management
- Appendix M, Recreation Resources
- Appendix N, Historic Property Survey, Native American Consultation, and Paleontological Resources

Table 4-1. Timeframe and Data Source for Cumulative Impacts

Cumulative Study Resource	Timeframe of Baseline Data	Source Data	Method
Air Quality	Within past 15 years	EPA MOBILE6 air quality modeling, conducted on a countywide basis	EPA MOBILE6 air quality modeling, based on future traffic conditions and emissions, assuming future regulatory and technical factors
Wildlife Habitat[a] and Vegetation	Current	CDOW Wildlife Resource Information System mapping of key habitats	GIS overlay of land use on key habitat areas (deer, elk, bighorn sheep, songbirds)
Wetlands	Within past 15 years	National Wetland Inventory mapping from USFWS; color infrared photography flown for Corridor	GIS overlay of land uses within 200 feet of water resource features (NWI mapping)
Water Quality	Current	Water quality monitoring program and modeling of phosphorous in watersheds	EPA BASINS water quality model and FHWA Driscoll stormwater runoff model
Stream Systems	• Before I-70 • Current	National Wetland Inventory mapping from USFS; historic aerial photography, before I-70	GIS overlay of land uses within 200 feet of water resource features
Social and Economic Values: Land Use	• Before I-70 • Current	County and municipal land use planning and zoning	Before I-70 aerial photographs compared to the existing I-70 footprint to estimate loss of structures and developed land
Social and Economic Values: Growth	• Within past 15 years • Current • Projected future	Past trends in population and I-70 traffic growth, Colorado Department of Local Affairs (DOLA) 2025 projections, and 2025 baseline traffic	Regression analysis of county populations and I-70 traffic; evaluation based on past 15-year trends in population and I-70 traffic growth, DOLA 2025 projections, and 2025 baseline traffic
Social and Economic Values: Economics	• Within past 15 years • Current • Projected future	Existing regional economic conditions, DOLA 2025 economic projections, and 2025 Baseline traffic conditions	Analysis of tourism spending and recreational travel; REMI model baseline scenario; evaluation based on existing regional economic conditions, DOLA 2025 economic projections, and Baseline traffic conditions
Noise	• Before I-70 • Current	I-70 monitoring and modeling studies	Description of changes in noise levels over time
Recreational Resources	• Current • Projected future	Existing and 2025 projected ARNF and WRNF visitation and recreational use	Analysis of USFS recreational use in relation to I-70 traffic: recreational trips Evaluation based on available data for existing and 2025 projected ARNF and WRNF visitation and recreational use

Cumulative Study Resource	Timeframe of Baseline Data	Source Data	Method
Visual Resources	• Current • Projected future	County and municipal land use planning and zoning	GIS overlay of land uses within I-70 viewshed to characterize planned changes in landscape character
Historic Communities	• Before I-70 • Current	Reconnaissance Survey in I-70 Mountain Corridor	Evaluation based on available historic (before I-70, 1956) and existing conditions aerial photography; existing national and state listing of historic properties, windshield survey, and local input on additional historic sites

[a] *Although cumulative evaluation of impacts on vegetation was limited due to available information, impacts on vegetation from planned development are provided in section 4.4.2 and Figure 4-4.*

4.2.1 Cumulative Impact Issues

Chapter 6, Public and Agency Involvement, provides an overview of project scooping. The scoping of cumulative impact issues was conducted in association with federal, state, and local agencies; special interest groups; the I-70 Mountain Corridor Advisory Committee (MCAC); and communities and residents along the Corridor.

In their scoping comments, the US Environmental Protection Agency (EPA) highlighted the likelihood of impacts on aquatic resources and the natural and human environment if greater access to mountain recreation, resort, and "high-amenity" residential areas is provided. Regarding the scope of cumulative impact analysis and key environmental receptors, EPA identified wetlands, water quality, air quality, threatened and endangered species and other fish and wildlife, and cultural and community resources. EPA also mentioned that the baseline for comparing impacts on the environment should be based on today's affected environment, at a minimum, and should include a historical baseline where appropriate (EPA 2001). In subsequent meetings and letters (EPA 2002a, 2002b), EPA has continued to stress the importance of the cumulative evaluation, emphasizing the previous assertion that "local and regional land use plans will be influenced by anticipated, expanded access to I-70" (EPA 2001).

The following issues were identified for the environmental receptors, based on a review of the lingering influences of past actions, present impacts, and induced growth effects from alternatives:

- **Air quality.** Dust and particulates from I-70 winter maintenance and from emissions. Possible cumulative effects from project alternatives were identified as increased emissions due to increased congestion and/or vehicles on I-70, increased winter maintenance and sanding, and increased emissions due to possible induced growth.
- **Wildlife and Threatened, Endangered, and Special Status (TES) species.** Habitat loss, collisions, increased barrier impacts, effects of winter maintenance, effects on "high-value" fisheries as defined by the Colorado Division of Wildlife (CDOW). The most important wildlife cumulative effects issues associated with project alternatives include planned development in the Corridor, possible induced growth associated with alternatives, fragmentation of habitat, and barrier effects on wildlife movement.
- **Wetlands.** Includes loss of wetlands and decreases in functional value from changes in hydrology, increased sedimentation from accelerated erosion and runoff rates, and increased exposure to contaminants. Adding lanes to roads requires additional winter maintenance materials that often affect wetlands/other waters of the US at downstream locations. Additional disturbance from earthmoving results in increased sedimentation, and additional impervious surfaces result in increased runoff rates and contaminant input. Such effects are associated with not only the proposed alternatives but also induced growth and expected development in general.
- **Water resources.** Winter maintenance, water quality, stream morphology (channelization), spills from transport on I-70. Water resources cumulative effects issues associated with the project alternatives include water quality impacts from roadway winter maintenance, highway stormwater runoff, stormwater runoff from existing and planned development, historic mining activities, water supply and growth issues, physical impacts on streams (encroachment, channelization), and impacts on stream hydrology and habitat.
- **Social and economic values.** Project alternative footprint impacts on communities and growth-related impacts. Cumulative effects on Corridor growth, development, and the regional economy.
- **Recreation**. Increased accessibility to recreation areas. Recreation resources cumulative effects issues include possible increased pressure for recreational visitation to national forests associated with the project alternatives.
- **Visual.** Changes in the "rural character" of the landscape. Visual resource cumulative effects issues associated with the Project alternatives include the visual impacts on I-70 travelers, recreational users, and residents.
- **Historic communities.** Cumulative effects on historic communities (National Historic Landmark District, Historic Districts, and potential historic areas).

4.2.2 Geographic Scope for the Analysis

Figure 4-2, Cumulative Impacts Analysis Study Area, illustrates the geographic scope of the analysis. The geographic scope for the analysis of cumulative impacts encompasses the portions of the Eagle River, Blue River, and Clear Creek watersheds adjacent to I-70 that are within the immediate development influence zone, based on a compilation of future land use zoning. In addition, cumulative effects on the regional economy and employment from alternatives are addressed within a nine-county region, including Garfield, Eagle, Pitkin, Summit, Lake, Park, Grand, Gilpin, and Clear Creek counties. The study area provides the basis for evaluating cumulative impacts adjacent to the Corridor and encompasses the geographic extent of the issues listed above. Specific environmental resources and community values are characterized based on county, community, and government jurisdictions. The Colorado River watershed is not included in the cumulative impacts study area because project alternative impacts would be extremely limited (interchange at Glenwood Springs) or nonexistent in the Colorado River watershed.

4.2.3 Timeframe for the Analysis

The timeframe for the cumulative impact analyses extends from before I-70 to 2025 and is summarized in Table 4-1, Timeframe and Data Source for Cumulative Impacts. This includes the influences of historic mining in Clear Creek County, as well as impacts that have persisted from the period before I-70 was built to the projected timeframe of 2025. This overall timeframe allows the incorporation of past, present, and future impacts. Past timeframes include the influences of historic mining (before I-70) and growth (1985-2000). Current represents 2000 or more recent data, where data were available to update. Future projections are made to 2025 for all resources except social and economic values, for which the timeframe is 2035. This extended projection period is made to allow for extended influences on economic indicators beyond the construction period, which ends in 2025. Other available information on housing (Southern Rockies Ecoregion data) was available for 2050 projections.

4.2.4 Past, Present, and Reasonably Foreseeable Future Actions

A sequence of regional growth patterns in the contiguous Rocky Mountain region of Colorado is provided on Figure 4-1, Housing Density Through Time in the Southern Rockies Ecoregion in Colorado. This figure provides regional context for historic, current, and projected (to 2050) growth in the nine-county region surrounding the Corridor. The growth on this figure does not specifically consider the influence of potential induced population associated with project alternatives.

The characterization of land use and growth in the cumulative impact study area is generally illustrated on Chart 4-1, Past, Present, and Reasonably Foreseeable Future Actions in Watershed Study Area, and Figure 4-2, Cumulative Impacts Analysis Study Area. At a site-specific level of cumulative analysis, reasonably foreseeable actions would typically be itemized. At the Tier 1 level, the PEIS inventory of future actions for cumulative analysis has been organized in a comprehensive format of county zoning classifications (see section 3.10, Land Use), which have been combined into planned urban and planned rural development categories. The inventory of planned urban and rural development is comprehensive, incorporating zoning and future development plans within the study area. It should be noted that there is no single comprehensive land use plan for the nine-county cumulative study area. In addition, I-70 2025 traffic projections are not considered in the DOLA 2025 population projections for the area.

Historic (before I-70) aerial photographs were acquired to evaluate changes to communities and resources in the Corridor. The "footprint" of I-70 was overlaid onto the historic aerial photographs, which are provided at the end of this chapter.

Geographic Information System (GIS)-based land use data were provided through data sharing agreements with Eagle, Summit, Clear Creek, Gilpin, and Jefferson counties, and the characterization of planned land uses was coordinated with county planners. Data layers were assembled and spatially defined for each respective watershed area under study (Eagle River, Blue River, and Clear Creek).

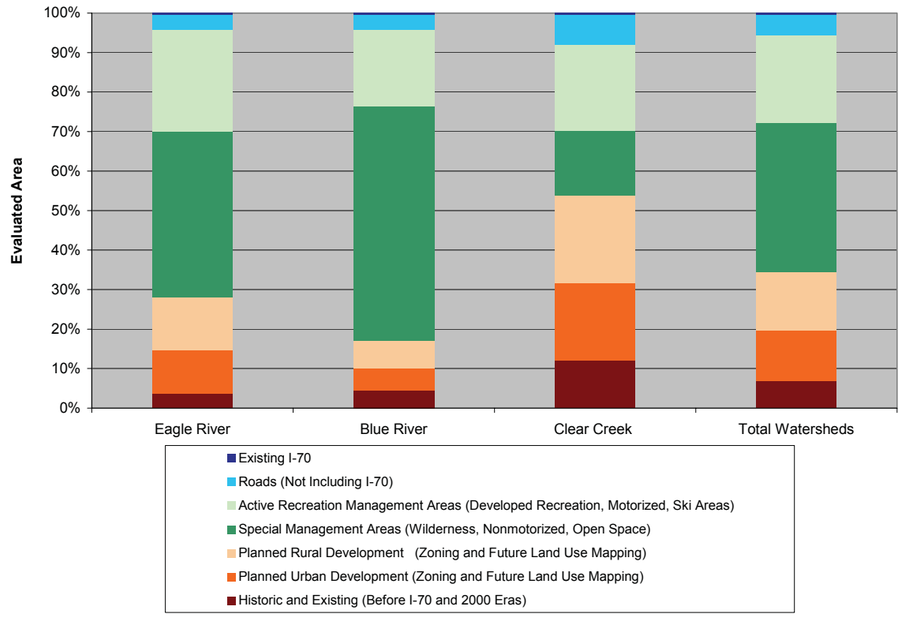
The GIS land use layers were categorized comprehensively such that all land falling within a given watershed was classified as one of the following:

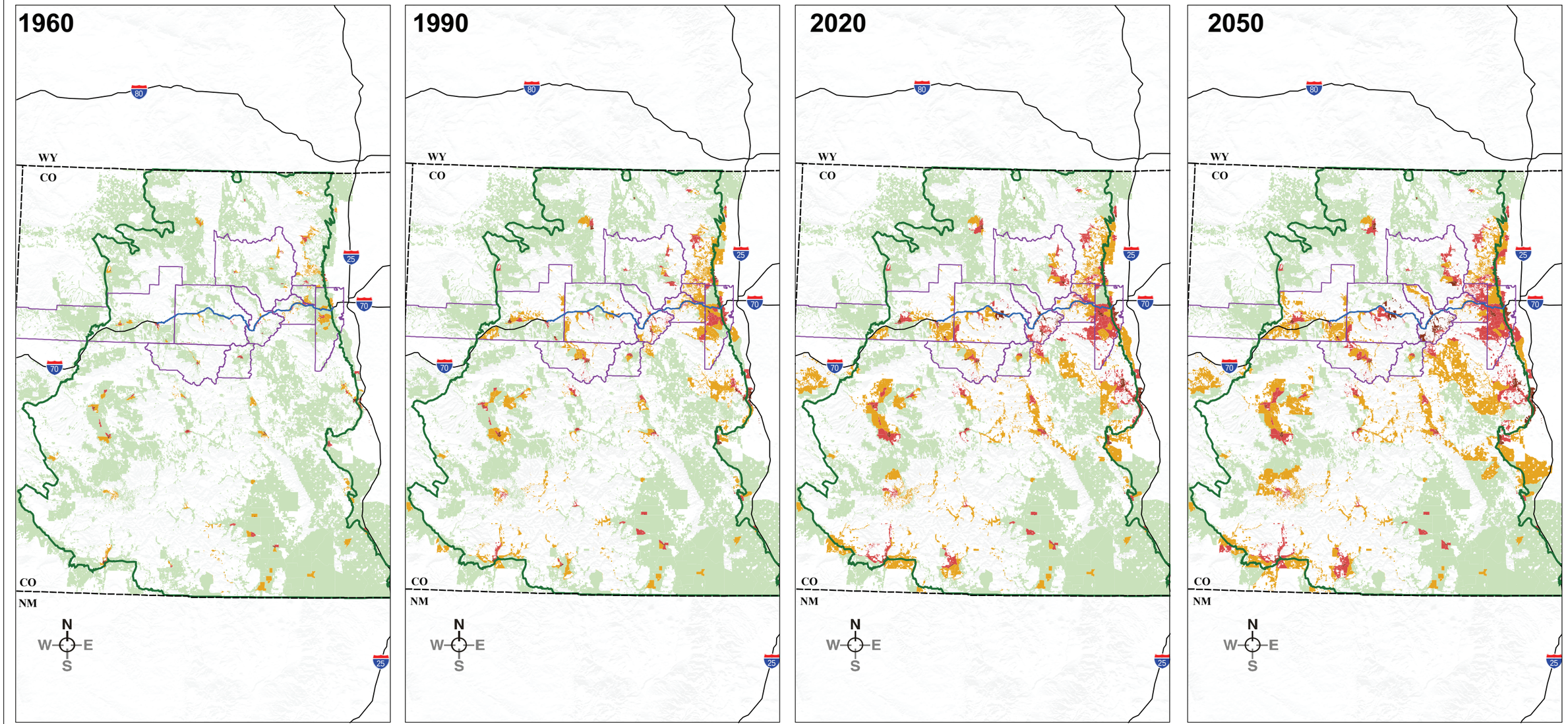
- Historic and existing development
- Planned urban development
- Planned rural development
- Special Management Areas (wilderness, nonmotorized, open space)
- Active Recreation Management Areas (developed recreation, motorized, ski areas)
- Roads (not including I-70)
- Existing I-70 (footprint and roadside cut and fills)
- Range of direct impacts associated with build alternatives

Chart 4-1 illustrates GIS-calculated acreage of the land uses within the Corridor watershed study areas.

The total area of planned urban and rural development in the combined watershed area (approximately 246,000 acres) is four times the existing developed area (61,240 acres). Planned development is expected to increase the total developed area within the watersheds from approximately 7 percent to 35 percent (approximately 307,000 acres). The remaining watershed area is in forest management, recreation, and open space uses. Existing I-70 is estimated to represent 0.5 percent of the evaluated land area, while other roads and highways represent 5 percent of the area. The area reported for roads and highways overlaps with the developed and forest management land area. Chart 4-1 shows the relative percentages of land use types by watershed and for the total three-watershed area.

Chart 4-1. Past, Present, and Reasonably Foreseeable Future Actions in Watershed Study Area





Housing Density through the Southern Rockies Ecoregion in Colorado

- Rural: <1 Unit Per 40 Acres
- Exurban: 1 Unit Per 5-40 Acres
- Suburban: 1 Unit Per 1-5 Acres
- Urban: >1 Unit Per Acre
- Undeveloped Areas

General Features

- Southern Rockies Ecoregion
- State Boundaries
- Interstate Highways
- I-70 Between Glenwood Springs and C-470
- 9 County Socioeconomic Study Area

SOURCE: Housing density information derived by David Theobald (2001) in conjunction with the Natural Resource Ecology Lab at Colorado State University and the U.S. Forest Service. Density information calculated from 1990 U.S. Census Bureau data (see methods chapter in the Southern Rockies Ecosystem Project, The Denver Zoological Foundation and The Wildlands Project 2003 - Southern Rockies Wildlands Network Vision). Hillshade calculated from DEM data provided by the USGS. All other data provided by SREP. Map produced by SREP March 2003.

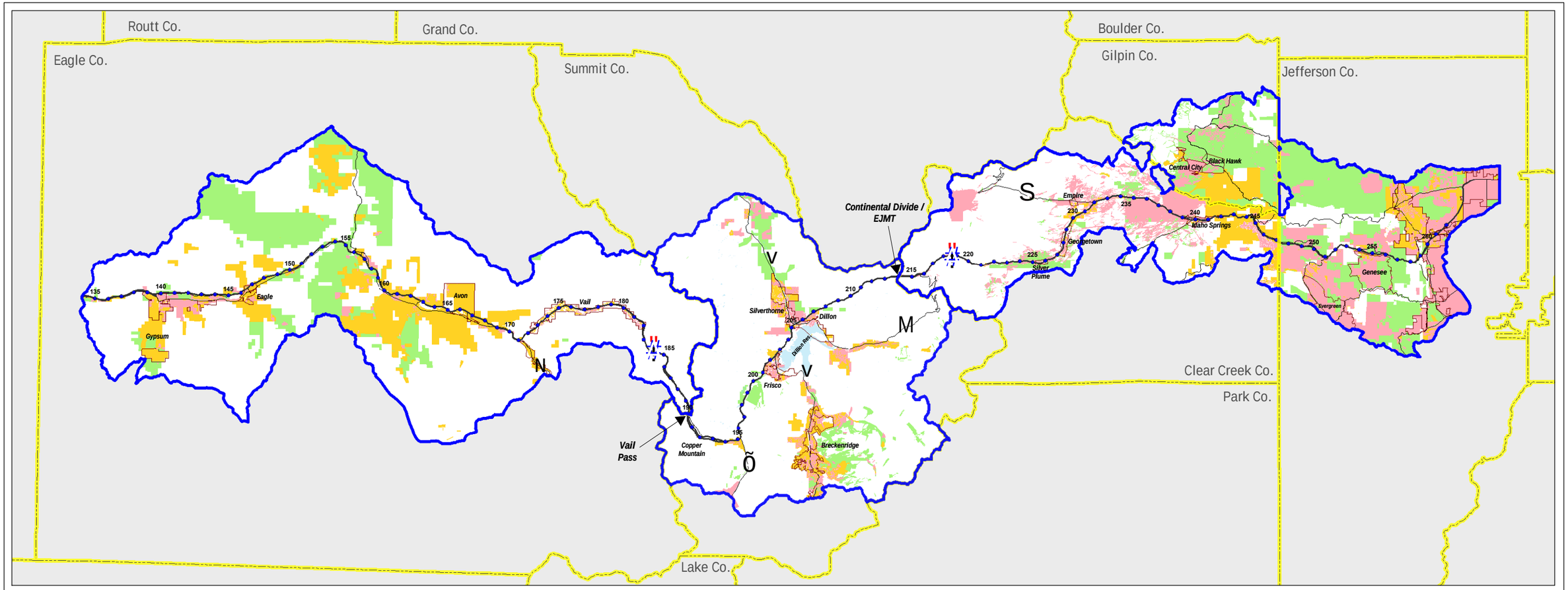
N W E S

0 50 100 Miles

SCALE - 1:4,118,400 or 1" = 65 Miles

SOUTHERN ROCKIES ECOSYSTEM PROJECT

Figure 4-1. Housing Density Through Time in the Southern Rockies Ecoregion in Colorado



EAGLE RIVER WATERSHED Study Area

BLUE RIVER WATERSHED Study Area

CLEAR CREEK WATERSHED Study Area

RESOURCE DESCRIPTION		Geographic Areas (Aggregated HUC 6 Watersheds)	Acres	Past, Present, and Future Development Activities in Corridor: COUNTY AND TOWN DEVELOPMENT — Historic and Existing (Before I-70 and 2000 Eras)	Planned Urban Development (Zoning and FLUM*)	Planned Rural Development (Zoning and FLUM*)	Total	FOREST MANAGEMENT, RECREATION, OPEN SPACE — Special Management Areas (Wilderness, Nonmotorized, Open Space)	Active Recreation Management Areas (Developed Recreation, Motorized, Ski Areas)	ROADS AND HIGHWAYS — Roads (Not Including I-70)	Existing I-70 (Footprint and Roadside Cut and Fills)	Range of Direct Impacts Associated with Build Alternatives
				acres	acres	acres	acres	acres	acres	miles / acres	miles / acres	acres (unless otherwise noted)
				percent	percent	percent	percent	percent	percent	percent	percent	percent
SELECTED HUC 6 WATERSHED AREAS	Watershed areas in acres (HUC 6) adjacent to I-70 Corridor (includes existing and future development)	Eagle River	342,820	13,167 4%	39,377 11%	47,703 14%	100,247 29%	149,932 44%	91,507 27%	900 / 13,642 4%	56 / 1,653 0.5%	33 to 202 0.010% to 0.06%
		Blue River	222,420	10,476 5%	13,261 6%	16,789 8%	40,526 18%	140,796 63%	45,830 21%	600 / 9,094 4%	24 / 1,039 0.5%	7 to 96 0.003% to 0.04%
		Clear Creek	287,370	37,597 13%	59,915 21%	68,856 24%	196,713 68%	50,277 17%	67,097 23%	1,490 / 23,500 8%	46 / 1,589 0.6%	97 to 308 0.034% to 0.11%
		Total	**852,610**	**61,240** **7%**	**99,965** **12%**	**113,558** **13%**	**337,486** **40%**	**336,178** **39%**	**196,249** **23%**	**2,990 / 46,236** **5%**	**126 / 4,280** **0.5%**	**111 to 140** **0.01% to 0.02%**

U.S. Department of Transportation Federal Highway Administration

DOT Department of Transportation

JFS&A J.F. SATO AND ASSOCIATES

Existing Development (includes mining - Clear Creek Co.)

Planned Urban Development

Planned Rural Development

Forest Management / Open Spaces

Watershed Study Area

Surrounding Counties

0 2.5 5 10 Miles

0 2.5 5 10 Kilometers

N W E S

SCALE - 1:468,000 or 1" = 39,000'

Figure 4-2. Cumulative Impacts Analysis Study Area

4.3 Assessment Approach

4.3.1 Approach

This section summarizes the development of the cumulative impact study area and assessment process. Figure 4-2, Cumulative Impacts Analysis Study Area, summarizes Baseline conditions and analysis methods used to describe the affected environment for cumulative impacts. Steps in the process include the following.

GIS Database Preparation

The overlay of the GIS development layers onto the baseline mapping of environmental receptors within the watersheds with the land use patterns illustrated in Figure 4-2 allows the quantification of regional impacts within the watershed study area, including the Eagle River, Blue River, and Clear Creek watersheds. The interaction between the development, land management, and highways and roads overlaying the environmental resources provides the basis for analyzing trends and patterns of past, present, and planned future changes to the study area.

Cumulative Impact Quantification

Cumulative impacts at the watershed level are tied to the indirect impacts from induced growth on resources. As indicated in Chapter 3, Affected Environment and Environmental Consequences, direct impacts on resources are generally localized and minor when compared to the indirect growth-related impacts on environmental resources. Possible induced growth in Eagle and Summit counties could lead to pressure for additional development (beyond planned development).

Induced Growth

The development of I-70 has influenced land use patterns in the Corridor over the past 30 years, and a relationship between growth in traffic and population in the Corridor region (past 15 years) suggests that changes in travel demand in the future will also affect growth in the region. The analysis of induced growth from alternatives is tied to past relationships of I-70 traffic and land use. The potential influence of induced or suppressed travel demand (in relation to 2025 Baseline travel as discussed in Chapter 2, Description and Comparison of Alternatives) on land use development patterns, population, and employment projections in the Corridor Region vary by alternative and by Corridor county/watershed (see section 3.9, Social and Economic Values). The No Action and Minimal Action alternatives would have the potential to suppress population growth in the Corridor region. Improved access from Highway alternatives may result in sustained or some induced growth, while the increased mobility of the Transit and Combination alternatives could have the greatest potential to induce growth beyond plans and projections. Clear Creek County is not expected to experience growth-inducing effects from I-70.

Growth-related impacts on the environment are key components of the cumulative assessment. The assessment includes (1) evaluating the influence that the capacity and mobility changes of alternatives may have on the distribution of future land use patterns and (2) quantifying possible effects of induced growth on environmental resources. The framework for estimating indirect impacts includes the following steps:

- Organizing alternatives into mode designations that reflect similar levels of suppressed or induced growth. The following groups of alternatives were established for cumulative impact assessment: No Action, Minimal Action, Transit, Highway, and Combination alternatives.
- Estimating the change in 2000–2025 DOLA (Colorado demographic information source) populations due to the possible induced or suppressed travel demand associated with project alternatives.
- Quantifying the impacts of land use changes and induced population from alternatives to environmental resources.

Estimates were made for the acres of induced development, beyond the planned urban and rural development, as illustrated on Figure 4-2. Estimates of induced development assume the following: (1) 2025 population and completion of planned development are directly related and occur at the same time and (2) induced population growth will lead to developed acreage impacts at the same ratio as 2000–2025 population/development trends. These assumptions provide a theoretical worst-case scenario for land use impacts from induced growth. This scenario is thought to be worst-case because some Corridor planned development is likely to occur later than 2025 and Corridor counties indicate that DOLA projections may be low, which would result in increased population densities relative to the calculated ratio.

Distribution of Induced Growth

Susceptibility to changes in population due to induced or suppressed travel demand would be limited to Eagle and Summit counties. Clear Creek County is not expected to experience growth-inducing effects from project alternatives (see section 3.9). Coordination with Garfield, Eagle, and Summit county planners resulted in the following assumptions regarding the distribution of induced growth (indirect impacts on land use):

- Transit alternatives are expected to concentrate induced growth in urban areas surrounding transit centers in areas of existing or planned urban development.
- Highway alternatives are expected to distribute growth based on existing trends for urban/rural development in each county, resulting in increased densities in rural areas of the Eagle and Blue River watersheds.
- Combination alternatives are expected to distribute induced growth equally between the above Transit and Highway distribution scenarios, also resulting in increased pressure on areas planned for rural development.

Land Use Growth Impact Factors

The impacts associated with induced growth to the environment are expected to vary by alternative, and by the type of impact based on the distribution patterns described above. The differences in the influence of the growth-distribution "scenarios" are reflected in the "factors" shown on Table 4-2.

Table 4-2. "Induced" Land Use Growth Impact Factors

Type of impacts	Factors applied to alternatives for impact quantification				
	No Action	Minimal Action	Transit	Highway	Combination
Wildlife and Wetland Impacts	0	0	0.1	1	0.5
Water Quality and Visual Impacts	0	0	0.5	1	0.75

The factors shown in Table 4-2 reflect assumed differences in the impacts that may occur due to "induced development" by alternative, according to the growth distribution assumptions. The following are assumptions about the variable influences induced growth from alternatives could have on land use patterns.

Factors for Wildlife and Wetland Impacts

Indirect impacts on wildlife habitats (elk, deer, bighorn sheep, songbird) and wetlands are measured in terms of acres of potential disturbance. The factors shown for each alternative are based on assumptions for the distribution of induced growth described as follows:

- The acreage impact factor of "0.1" assumes that the influence of Transit alternatives on land use patterns could minimize acreage impacts from possible "induced growth" by concentrated growth in urban areas surrounding transit centers, within areas of existing or planned urban development.
- The acreage impact factor of "1" assumes that the influence of Highway alternatives on land use patterns could distribute growth based on existing trends for urban/rural development.
- The acreage factor of "0.5" assumes that the influence of Combination Highway/Transit alternatives on land use could result in increased pressure on areas planned for both urban and rural development.

Impacts were quantified based on a GIS overlay process that is illustrated on Figure 4-6, Regional Impacts on Key Deer Habitats; Figure 4-7, Regional Impacts on Key Elk Habitat; Figure 4-8, Regional Impacts on Key Bighorn Sheep Habitats; and Figure 4-9, Regional Impacts on Surface Water and Wetlands.

Factors for Water Quality Impacts

Factors described for acreage-related resource impacts have been modified to account for the potential for induced population needs for additional public supply, resulting in additional wastewater capacity/effluent. Sedimentation impacts from new land development, however, would be minimized. Thus, the growth impact factor for Transit was increased from 0.1 to 0.5 and from 0.5 to 0.75 for Combination Highway/Transit alternatives. Existing and planned land use impacts on water quality are based on the EPA Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) model, and results are reported in lbs/year of phosphorus.

Factors for Visual Resource Impacts

Factors for growth-related effects on visual resources were also modified, as shown on Table 4-2, to account for the potential changes to the rural character of the landscape as a result of changes in development patterns due to growth. Transit alternatives are expected to concentrate growth in urban areas by increasing the density of existing and planned urban development. The resulting "urbanization" due to transit could affect the "mountain-related" visual image and character of town centers. Induced growth in rural areas from Highway alternatives could result in broader changes in the rural character of the landscape (factor of 1), and to a lesser degree for Combination Highway and Transit (factor of 0.75). Existing and planned land use impacts on visual resources are based on the area (acreage) visible from I-70.

Note that indirect impacts on air quality and on historic properties from possible induced growth are not quantified but discussed qualitatively in the air quality section (see section 4.4.1 and methodology on Table 4-1, Timeframe and Data Source for Cumulative Impacts) and the historic properties section (see section 4.4.8 and Table 4-1), respectively.

Methods for Calculating Possible Development Impacts from Induced Growth

The calculation of possible development impacts from induced growth (indirect impacts) includes the considerations and factors that have been described above and is generally described in the following formula (separate calculations were performed for each watershed and associated county area):

$$\frac{\text{total current \& planned development - current development (resource specific change)}}{\text{2025 DOLA population - 2000 DOLA population}} \times \text{induced population prediction (alternative specific)} \times \text{land use growth impact factor (alternative specific)}$$

The formula used to calculate impacts specific to land use impacts is provided as follows (see results on Chart 4-2, Corridor Cumulative Impacts on Land Use; Chart 4-3, Eagle River Watershed Cumulative Impacts on Land Use; and Chart 4-4, Blue River Watershed Cumulative Impacts on Land Use):

$$\frac{\text{total current \& planned development* - current development* (acres)}}{\text{2025 DOLA population - 2000 DOLA population}} \times \text{induced population prediction (alternative specific**)} \times \text{land use growth impact factor - acreage (alternative specific***)}$$

Provided below is an example calculation of possible indirect impacts on elk habitat (in the Eagle River watershed and for the Transit alternatives) from induced growth.

Example:

$$\frac{\text{total current \& planned development (GIS overlay on elk habitat area*) - current development* (GIS overlay on elk habitat area*) (acres)}}{\text{2025 DOLA population - 2000 DOLA population}} \times \text{induced population prediction (alternative specific**)} \times \text{land use growth impact factor - acreage (alternative specific***)}$$

Number calculation: elk habitat (Eagle River watershed, Transit alternatives):

$$\frac{\text{14,937 - 1,431 (acres)}}{\text{76,161 - 42,027}} \times \text{15,000 (Transit)} \times \text{0.1 acreage factor (Transit)} = \text{594 acres (indirect impact from possible induced growth)}$$

Environmental consequences sections for each applicable resource include resource-specific equations for calculating indirect impacts from induced growth. The equations include references to specific data sources.

Figure 4-1, Housing Density Through Time in the Southern Rockies Ecoregion in Colorado indicates historic and projected (to 2050) population distribution in the Southern Rockies Ecoregion in Colorado. The growth indicated on this figure does not specifically consider possible improvements to I-70 (such as project alternatives). Possible induced population growth from project alternatives is not reflected in the projected housing density growth illustrated here.

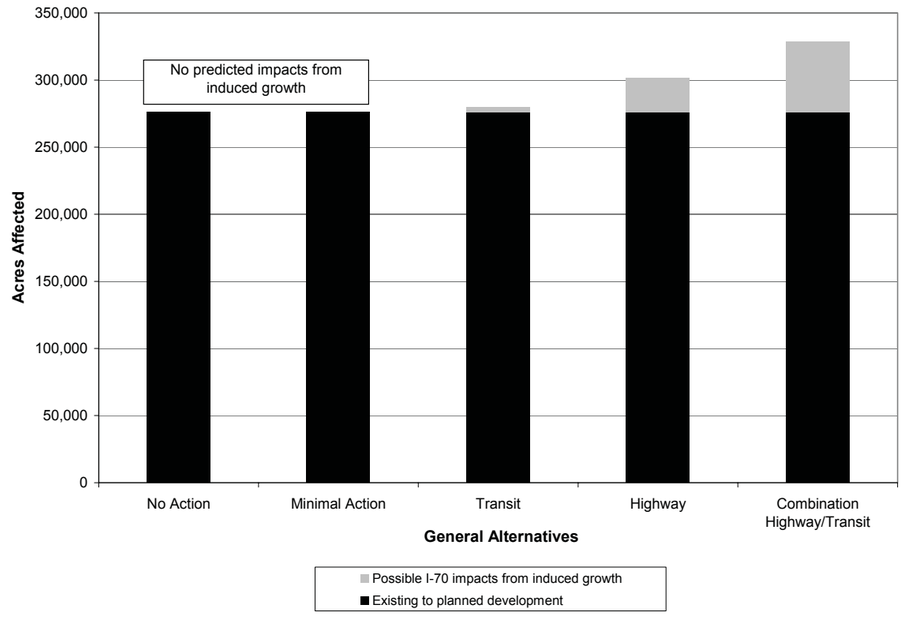
Chart 4-2, Corridor Cumulative Impacts on Land Use, illustrates the application of the growth factors and possible induced population growth to land use in the Corridor as added to the change in acreage from existing to planned land use. Although Transit alternatives are indicated to have a greater potential for induced population growth than the Highway alternatives, actual developed acreage impacts would be less than those of the Highway alternatives due to the assumption that such growth would take place in urban areas. In this theoretical approach, the Combination alternatives could increase developed land by approximately 52,600 acres (approximately an 18 percent increase beyond planned growth) by 2025. The likelihood of such impacts occurring would depend on factors such as

* see Figure 4-2
** see section 3.9
*** see Table 4-2

local and county government planning and land use restrictions, possible densification of areas previously developed, and infrastructure limitations.

Indirect impacts on land use have been described qualitatively in section 3.10, Land Use. The quantification of indirect impacts on land use associated with induced growth from alternatives is shown in the "gray" section of the bar chart illustrated in Chart 4-2, based on the process and criteria described above. This estimate of induced growth provided the basis for quantifying the effects of induced growth on wildlife habitat, wetlands, water resources, social and economic values, and visual resources. In contrast, the "black" section of the bar chart reflects impacts due to the change from existing to planned land use.

Chart 4-2. Corridor Cumulative Impacts on Land Use



Localized Impacts on Land Use

Chart 4-3, Eagle River Watershed Cumulative Impacts on Land Use, and Chart 4-4, Blue River Watershed Cumulative Impacts on Land Use, illustrate possible localized impacts on land use from induced growth by alternative for the Eagle River and Blue River watersheds. The Eagle River watershed is expected to have the greatest cumulative impacts on land use (possibly 40,000 acres of additional development), reflecting conditions of greatest possible induced population growth.

Chart 4-3. Eagle River Watershed Cumulative Impacts on Land Use

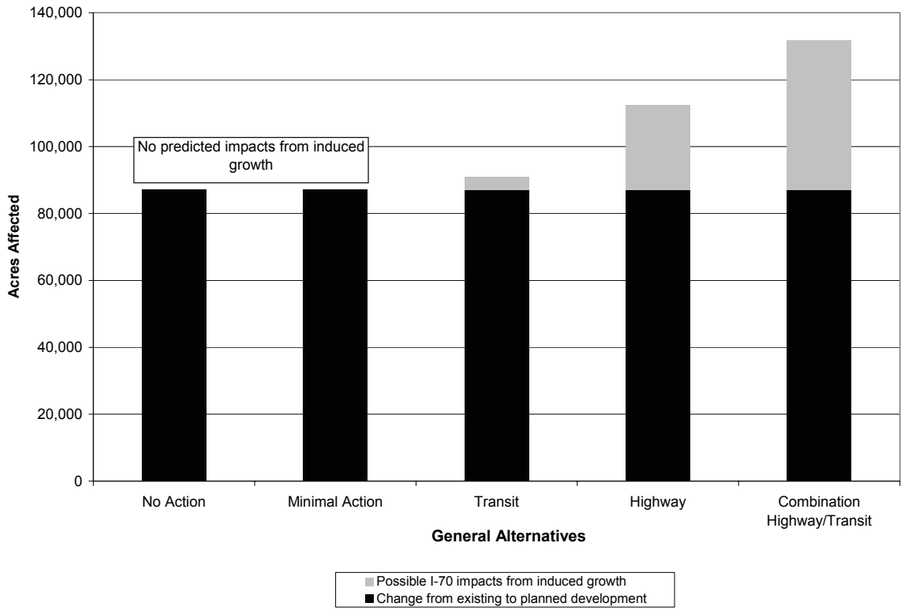
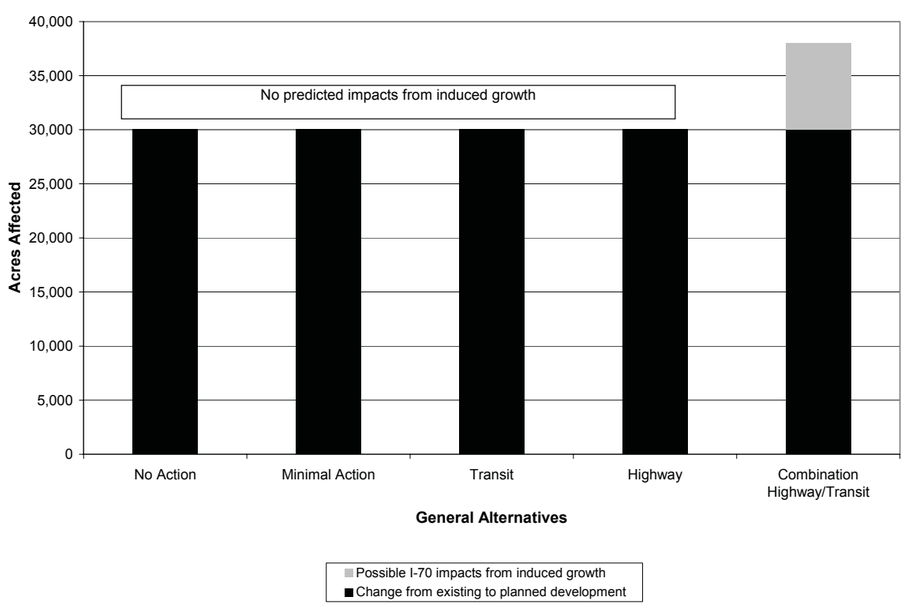


Chart 4-4. Blue River Watershed Cumulative Impacts on Land Use



4.4 Affected Environment and Cumulative Impacts

4.4.1 Air Quality

4.4.1.1 Affected Environment: Air Quality

The affected environment for cumulative impacts from air quality is based on countywide modeling for Eagle, Summit, Clear Creek, and Jefferson counties. Projected population and traffic growth could affect counties and communities beyond the immediate I-70 area. Existing air quality concerns include localized areas of traffic congestion, woodburning in urban areas, re-entrained dust from roadway sanding (winter maintenance), visibility, nitrogen deposition, and fugitive dust from development activities. Existing air quality issues and conditions form the basis of possible cumulative effects. Nitrogen, in the form of nitrogen oxides and ammonia, is among the many pollutants emitted by motor vehicles. Emissions of nitrogen oxides and ammonia not only contribute to visibility impairment but are also a source of nitrogen deposition in water and soil.

Air Pollution Control Division's decisions for establishing areas for air monitoring are based on sources of pollution: mobile and stationary dispersion characteristics, geography, and meteorology. Particulate matter is the only pollutant monitored in Garfield, Eagle, and Summit counties. Ozone is monitored in Jefferson County, and no air monitoring is done in Clear Creek County.

According to air quality modeling for the Corridor area, existing air quality parameters are well within the national standard levels. No measured violation of the carbon monoxide (CO) standard has been recorded in Colorado since 1995. Planned growth and development in the Corridor could affect air quality through increased traffic, fugitive dust from development sites, new commercial/industrial facilities, and increased woodburning. However, existing and future industrial point sources of air contaminants are negligible in the Corridor, future technological changes and regulatory controls are expected to reduce contaminants from mobile sources (including vehicles and highway maintenance), and local air quality programs are expected to control sources of re-entrained dust, fugitive dust, and smoke from woodburning.

4.4.1.2 Cumulative Impacts: Air Quality

Air quality can be affected by the following primary sources that exist in the Corridor:

- Emissions from vehicles on roadways
- Emissions from stationary commercial and industrial facilities (considered minimal in the Corridor)
- Re-entrained dust from roadway sanding
- Urban area emissions including woodburning and dust from construction sites

The cumulative impacts analysis for air quality is based on possible increases in the above sources. The Tier 1 study provides a qualitative evaluation of the cumulative impact magnitude. Air quality parameters evaluated include CO, PM_{10}, re-entrained dust, and air toxics.

Carbon Monoxide

Modeling shows that CO concentrations in the Corridor are low (3.0 ppm) compared to the federal 8-hour standard of 9.0 ppm. Although traffic volumes in the Corridor will continue to increase, CO emissions from motor vehicles will decrease in the future. Because newer, lower polluting vehicles will continue to replace older, higher polluting vehicles, the reduction in emissions is expected to more than offset the increase in traffic volume. Cumulative impacts from CO emissions are not indicated.

PM_{10}

Models show PM_{10} concentrations in the Corridor are low (16 $\mu g/m^3$) compared to the national standard of 150 $\mu g/m^3$. Diesel engines are the primary source of transportation emissions. New programs are proposed to substantially improve fuel and diesel engine emissions by target dates of 2007 and 2020. PM_{10} tailpipe emissions from mobile sources have decreased by 25 percent since 1970 and are expected to decrease in the future due to national mobile source control programs, including reformulated gasoline and required controls on heavy-duty diesel engines. Cumulative impacts from PM_{10} emissions are not indicated.

Re-entrained Dust

Re-entrained dust impacts are proportional to sanding for winter maintenance. Emission control programs such as street sweeping, mobile emission control programs, and woodburning controls are expected to continue to reduce emissions. Highway maintenance improvements, such as the immediate cleanup of sand following snowmelt and the increased use of deicers in appropriate weather conditions, will reduce emissions. Re-entrained dust and fugitive dust from construction are proportional to the increase in construction related to growth but can be managed by best management practices (BMPs; see section 3.1, Climate and Air Quality). Fugitive dust from gravel/rock quarries is regulated as a stationary source. Cumulative impacts from re-entrained dust would be considered minimal.

Visibility

The visibility impacts of the project alternatives were analyzed by comparing future (2025) emissions of motor vehicle pollutants and re-entrained road dust with existing (2000) emissions. Emissions were calculated for PM_{10}, $PM_{2.5}$, SO_2, and nitrogen oxides. $PM_{2.5}$ emissions include particulates in tailpipe exhaust (carbon and sulfates), plus brake and tire wear. SO_2 and nitrogen oxides are gaseous emissions that contribute to secondary particle formation. As shown in Appendix A, Environmental Analysis and Data, total daily emissions in 2025 of all pollutants that contribute to visibility impairment would be less than emissions in 2000, although 2025 traffic volumes would be higher. Future emissions of tailpipe exhaust pollutants will be lower because of stricter standards on vehicle emissions and the lower sulfur content of diesel fuel. Therefore, the future cumulative impacts on visibility from project alternatives would be less than those of existing conditions. None of the project alternatives would contribute to any deterioration in visibility in Class I Wilderness Areas.

Nitrogen Deposition

Similar to visibility impacts, the potential for nitrogen deposition associated with the project alternatives was analyzed by comparing future (2025) emissions of nitrogen with existing (2000) emissions. As shown in Appendix A, total daily nitrogen emissions in 2025, for all alternatives, would be less than current day (2000) nitrogen emissions. In 2025, emissions of nitrogen oxides would be 70 to 80 percent lower than 2000 emissions because of stricter standards on vehicle emissions, particularly heavy-duty diesel trucks. Future emissions of ammonia would increase as traffic volumes increase because emission control technology does not reduce ammonia emissions. However, nitrogen emissions from ammonia are only 15 to 20 percent of total motor vehicle nitrogen emissions. Therefore, total nitrogen emissions would be lower in 2025 and would not contribute cumulative effects with any of the project alternatives.

Air Toxics

Mobile sources emit approximately 21 percent of total air toxics. There are no manufacturing and few stationary sources of air toxics in the Corridor. New programs target reformulated fuels, low emission standards, and sulfur restrictions in diesel fuels. EPA has issued regulations to decrease mobile sources of air toxics by target dates in 2007 and 2020. Highway emissions would be reduced by 67 to 76 percent, and highway diesel particulate matter emissions would be reduced by 90 percent.

Reductions would occur as a result of national mobile source control programs, the cap on toxic content of gasoline, reformulated gasoline, required controls on heavy-duty engines, and highway diesel fuel sulfur control requirements. Cumulative impacts from air toxics are not indicated.

4.4.2 Wildlife Habitat and TES Species

The Corridor is completely encompassed within the Southern Rockies Ecoregion, a continuous diverse ecological network of lands through portions of Wyoming, Colorado, and New Mexico (see Figure 4-3, Level of Threat to the Southern Rockies Ecoregion). A series of interrelated factors have altered the natural function of the Southern Rockies Ecoregion (Southern Rockies Ecosystem Project, The Denver Zoological Foundation and The Wildlands Project 2003). These factors include:

- Loss and decline of native species
- Loss and degradation of terrestrial and aquatic ecosystems
- Loss and fragmentation of wildlife habitat
- Invasion by exotic plants and animal species
- Pollution and climate change

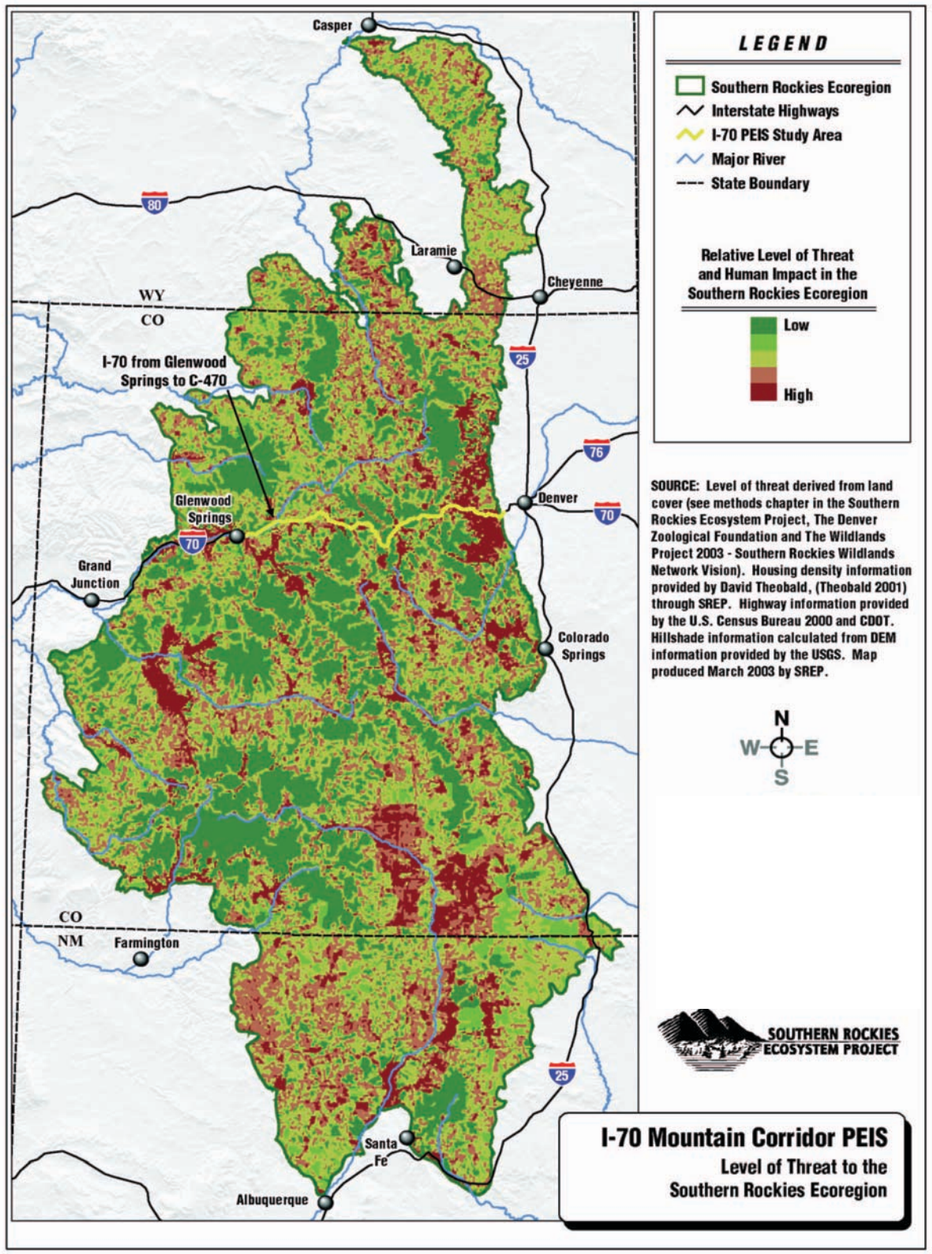
As a part of the Southern Rockies Wildlands Network Vision, a relative level of threat and human impact was digitally modeled, based on land cover, housing density, and road information covering the Southern Rockies Ecoregion (see Figure 4-3). Based on this modeling, the percentage of high-level threat and human impact through the Corridor cumulative effects study area would be 2.5 times greater than that of the rest of the Southern Rockies Ecoregion as a whole (see Table 4-3, Relative Area of Threat: Southern Rockies Ecoregion). I-70 bisects the entire width of the Southern Rockies Ecoregion and, as such, intersects natural wildlife movement corridors and linkage areas at numerous locations.

The cumulative effects of road and highway construction, recreation, and population growth in the Corridor have resulted in habitat loss and habitat fragmentation. State projected population growth and human development through the Corridor will continue to affect the natural ecological functions of the ecoregion.

Table 4-3. Relative Area of Threat: Southern Rockies Ecoregion

	Total Area (Square Miles)	Area of High Threat and Human Impact (Square Miles)	Percentage of Total Area Ranked as High Threat and Human Impact
Southern Rockies Ecoregion	64,410	6,624	10%
Corridor Cumulative Effects Study Area	1,264	313	25%

Figure 4-3. Level of Threat to the Southern Rockies Ecoregion



Corridor vegetation mapping information was available from US Forest Service (USFS), Bureau of Land Management (BLM), and CDOW GIS vegetation map layers. The mapping includes numerous vegetation classes, areas of development (where vegetation was not mapped), and barren/exposed rock areas. The vegetation classes were grouped into two general categories for GIS overlay cumulative impact analyses:

- **Forested Vegetation.** Forested vegetation includes the following vegetation classes: Aspen Forest, Spruce-Fir Forest, Spruce-Fir Mixed Forest, Aspen with conifer, Blue Spruce Forest, Douglas-fir Forest, Engelmann Spruce Forest, Engelmann Spruce Mixed Forest, Cottonwood Forest, Lodgepole Pine Forest, Lodgepole Pine Mixed Forest, Piñon/Juniper Forest, Mixed Conifer Forest, and Mixed Forest.
- **Non-Forested Vegetation.** Non-forested vegetation includes the following vegetation classes: Grass/Forb, Mountain Mahogany, Rabbitbrush, Sagebrush, Sedge/Rush, Serviceberry, Shrub, Snowberry, Willow, Big Sagebrush, Bare Ground Tundra, Irrigated Agriculture, Mixed Tundra, Mountain Big Sagebrush, Subalpine Meadow, and Xeric Upland Shrub.

A GIS overlay analysis was performed to determine impacts from planned rural and planned urban development to the forested and non-forested vegetation categories. The results are shown on Figure 4-5. Impacts on the forested vegetation category from planned development would comprise 102,680 acres, or 22 percent of the total mapped area. Impacts on the non-forested vegetation category from planned development would comprise 69,910 acres, or 39 percent of the total mapped area. Because mapped existing and historic development (see Figure 4-2 and Chart 4-1 for acreage information) did not include mapping of any vegetation in these areas, existing and historic impacts on vegetation could not be determined. However, a general idea of overall cumulative impacts (by alternative) to vegetation from planned development and possible induced growth can be discerned based on the land use impacts shown in Chart 4-2 through Chart 4-4. Direct impacts on vegetation (see section 3.2, Biological Resources) would be relatively minor in comparison.

4.4.2.1 Affected Environment: Wildlife Habitat

Cumulative impacts on key wildlife habitats are assessed within watersheds along the Corridor. Issues range from habitat loss, collisions, increased barrier impacts, and effects of winter maintenance. Primary wildlife issues include the potential for fragmentation of habitat and barrier effects on wildlife movement.

The following charts show impacts from planned development that are likely to affect key wildlife habitats:

- Chart 4-5, Deer Habitat Affected Environment
- Chart 4-6, Elk Habitat Affected Environment
- Chart 4-7, Bighorn Sheep Affected Environment
- Chart 4-8, Songbird Habitat Affected Environment

Figure 4-6, Regional Impacts on Key Deer Habitats, Figure 4-7, Regional Impacts on Key Elk Habitats, and Figure 4-8, Regional Impacts on Key Bighorn Sheep Habitats, also show impacts from planned development to key wildlife habitats. Development not only causes habitat loss but also fragments habitat into smaller units and changes movement patterns.

As shown in Figure 4-6, Regional Impacts on Key Deer Habitats, within the watershed study area, existing development occupies approximately 9 percent (approximately 9,900 acres) of key deer habitats. Under current plans, total development would increase to 52 percent (approximately 55,700 acres) within key deer habitats. The remainder of the watershed area key deer habitats would continue as forest management, recreation, and open space uses, which would protect key deer habitats within the watershed study area. Deer habitat is not anticipated to be affected by any development activities in the Blue River watershed.

As shown in Figure 4-7, within the watershed study area existing development occupies approximately 4 percent (approximately 3,500 acres) of key elk habitats. Under current plans, total development would increase to 44 percent (approximately 40,000 acres) within key elk habitats. The remainder of the watershed area key elk habitats would continue as forest management, recreation, and open space uses, which would protect key elk habitats within the watershed study area. The greatest impacts on elk habitat are anticipated in the Eagle River and Clear Creek watersheds.

As shown on Figure 4-8, within the watershed study area existing development occupies approximately 1 percent (approximately 1,000 acres) of key bighorn sheep habitats. Under current plans, total development would increase to 11 percent (approximately 9,300 acres) within key bighorn sheep habitats. The remainder of the watershed area key bighorn sheep habitats would continue as forest management, recreation, and open space uses, which would protect key bighorn sheep habitats within the watershed study area. Bighorn sheep habitat is not anticipated to be affected by any development activities in the Blue River watershed.

The watershed study area existing development occupies approximately 3 percent (approximately 3,400 acres) of quality songbird habitats. Under current plans, total development would increase to 24 percent (24,000 acres) within quality songbird habitats. The remainder of the watershed area key songbird habitats would continue as forest management, recreation, and open space uses, which would protect quality songbird habitats within the watershed study area.

Chart 4-5. Deer Habitat Affected Environment

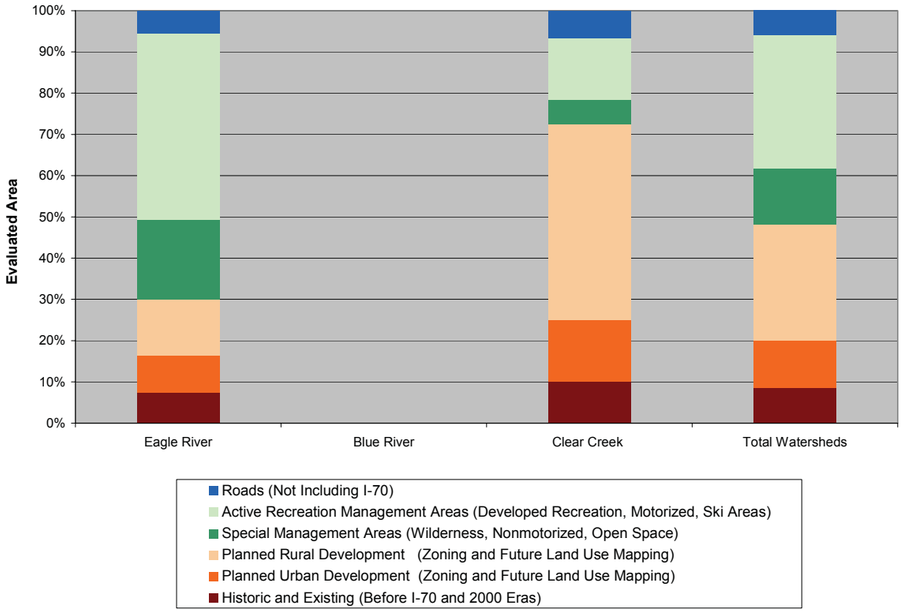


Chart 4-6. Elk Habitat Affected Environment

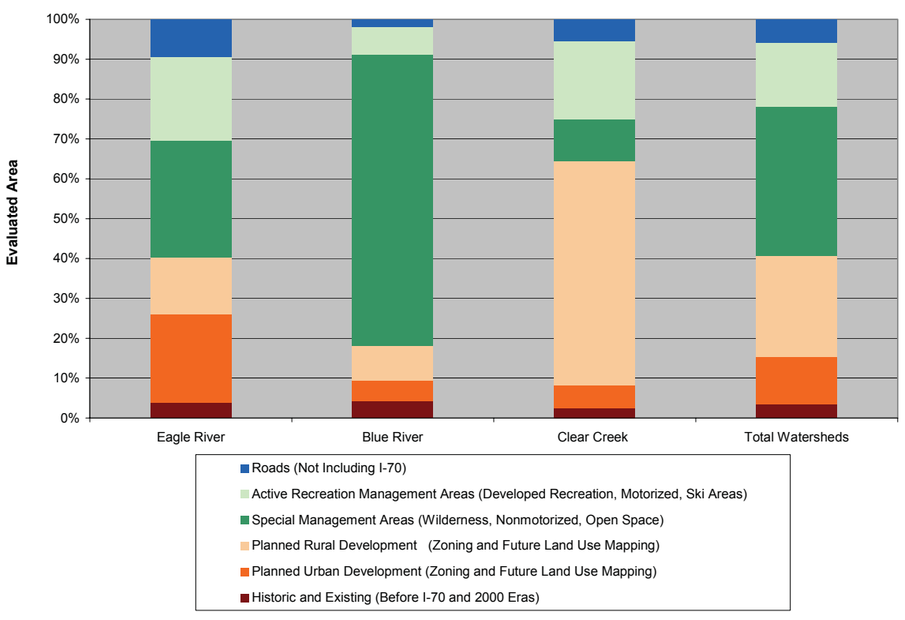


Chart 4-7. Bighorn Sheep Affected Environment

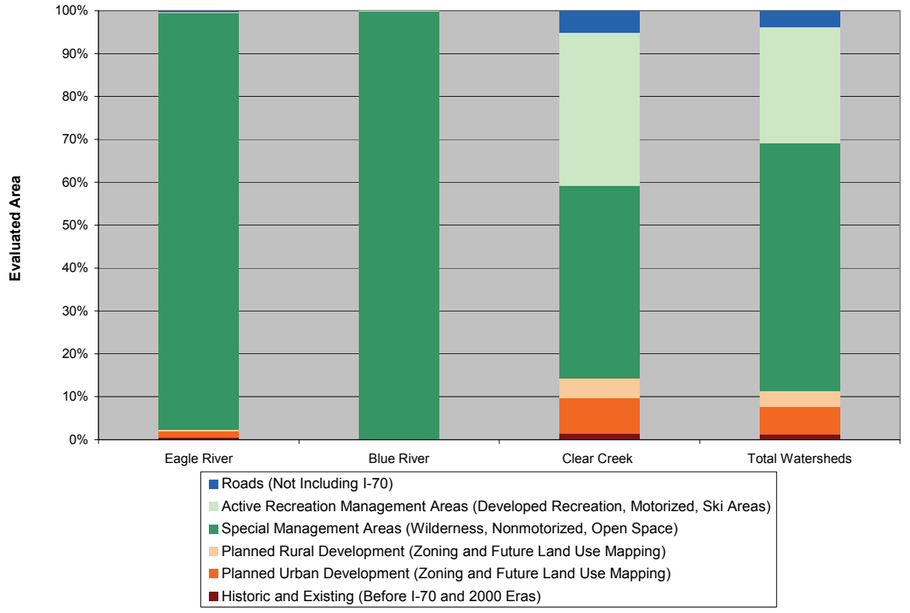
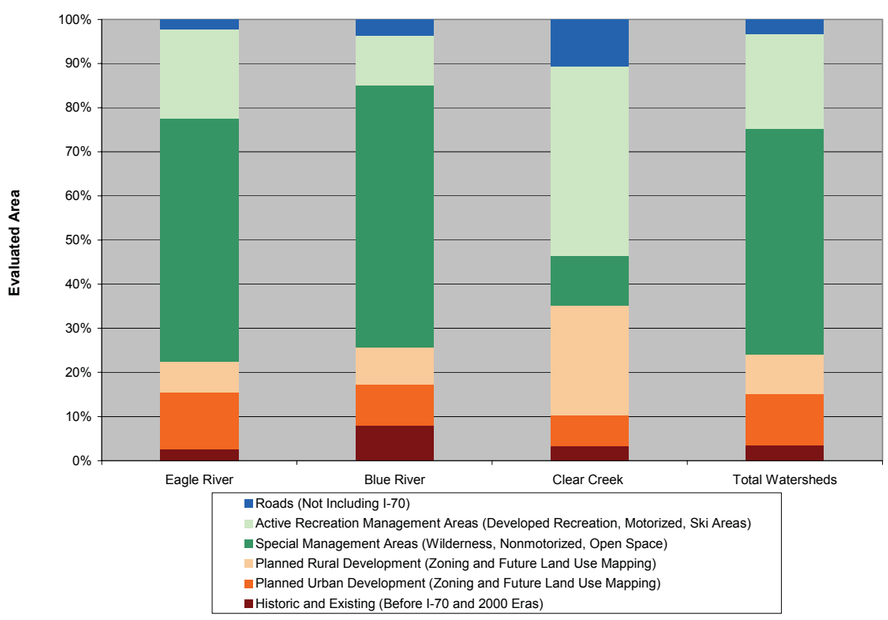


Chart 4-8. Songbird Habitat Affected Environment



4.4.2.2 Affected Environment: TES Species

TES species in the Corridor have been affected by increased human intrusion into their habitats and by habitat losses and intrusion into movement corridors from land development. Most of the habitat for these species occurs on USFS and BLM lands, which afford management and protection from direct habitat losses. However, increased use of these areas for recreation has increased the potential for human disturbance to wildlife and vegetation.

The more mobile species, such as lynx and wolverine, have large home ranges that are likely to be affected by future land development. Lynx linkage areas have been identified on USFS and BLM lands along the Corridor and include the following areas:

- Dowd Canyon connects north and south habitats. Residential development on the north along the Eagle River and to the south toward Minturn is expected to affect lynx crossing in this area.
- West Vail Pass is an ideal linkage between habitats and might be affected by increased winter recreation use.
- Officers Gulch connects habitat between the Tenmile Mountain Range, the Leadville area, and the Eagles Nest Wilderness Area. Continued development of the Breckenridge area will affect this linkage, which is the principal lynx habitat connection between Copper Mountain and Frisco.
- Laskey Gulch is part of a large linkage area that connects Loveland Pass, Peru Creek, and Jones Gulch. Continued development in parts of this linkage (such as in Keystone Resort, Jones Gulch, Breckenridge-Frisco area) will affect species movements.
- Herman Gulch connects lynx habitat and also contains boreal toad habitat along the Clear Creek drainage. Increased recreation that occurs from increased access and population centers outside the area is likely to affect the more sensitive species (such as lynx).

4.4.2.3 Cumulative Impacts: Wildlife and TES Species

Possible cumulative effects are listed below:

- Wildlife habitat encroachment and disturbance caused by development activities, recreational use, and roadways
- Barrier effects and movement interruption (between traditional habitat areas) to wildlife movement caused by rural development and roadways. As discussed earlier in this chapter, it is assumed that the Highway alternatives would induce growth, and distribution of induced growth would occur along existing trends, resulting in increased densities in rural areas of the Eagle and Blue River watersheds. It is also anticipated, therefore, that the Highway alternatives would have a greater potential to increase barrier effects in rural areas.
- Fragmentation, decreased connectivity, and "habitat isolation" of wildlife habitat caused by rural development and roadways
- Displacement of sensitive wildlife populations

The magnitude of cumulative effects on wildlife is determined based on the GIS overlay of planned/existing development over mapped key wildlife habitat and movement corridors shown in Figure 4-6, Regional Impacts on Key Deer Habitats; Figure 4-7, Regional Impacts on Key Elk Habitats; and Figure 4-8, Regional Impacts on Key Bighorn Sheep Habitats, located at the end of this chapter. The GIS overlay allows calculation of acreage impacts on identified key habitats for elk, deer, bighorn sheep, and songbird species. Possible additional acreage impacts from induced growth are estimated to provide a "worst-case" degree of magnitude.

The equation used to calculate indirect impacts from induced growth is provided as follows:

$$\frac{\text{total planned \& current development (GIS overlay on wildlife resource area*) - current development* (GIS overlay on wildlife resource area*) (acres)}}{\text{2025 DOLA population - 2000 DOLA population}} \times \text{induced population prediction (alternative specific**)} \times \text{land use growth impact factor - acreage (alternative specific***)}$$

Cumulative impacts on wildlife habitat are shown on the following charts:

- Chart 4-9, Cumulative Impacts on Deer Habitat
- Chart 4-10, Cumulative Impacts on Elk Habitat
- Chart 4-11, Cumulative Impacts on Bighorn Sheep Habitat
- Chart 4-12, Cumulative Impacts on Songbird Habitat

Direct impacts on key wildlife habitats from project alternatives are limited to approximately 111 to 443 acres (representing 0.02 to 0.3 percent of the total evaluated area) in comparison to impacts from existing and planned development (10 percent to 49 percent of the total evaluated area). Induced commercial and residential growth along I-70 could increase wildlife impacts (increasing habitat acreage impacts by 200 to 8,000 acres) in localized areas and contribute to regional barrier effects on wildlife movement, habitat loss, and habitat fragmentation. Areas of key wildlife habitat, TES movement areas, and linkage interference zones in the Eagle River watershed could come under increased impact pressure from development from the Combination and Highway alternatives. These wildlife areas could also come under increased impact pressure in the Blue River watershed from the Combination alternatives.

* see Figure 4-6 through Figure 4-8
** see Section 3.9
*** see Table 4-2

Chart 4-9. Cumulative Impacts on Deer Habitat

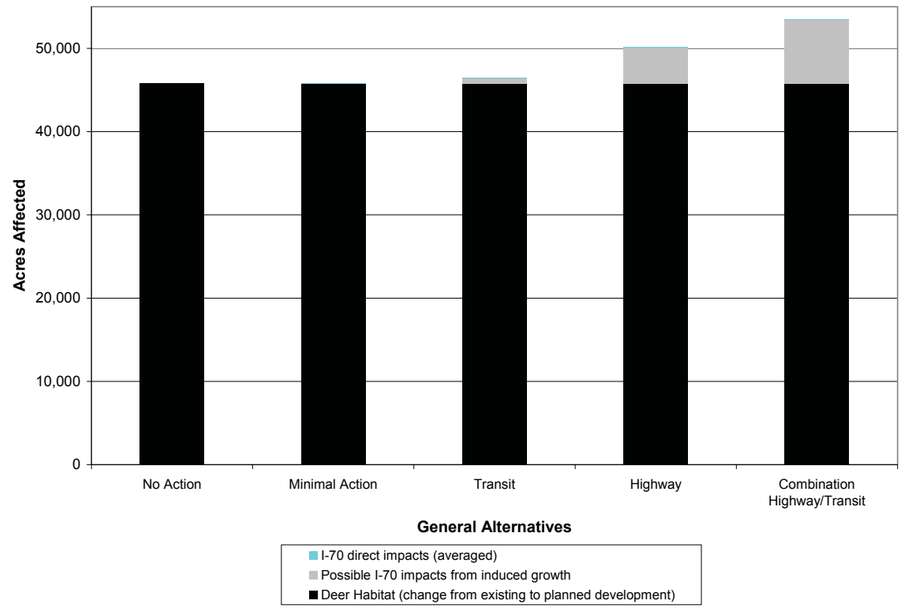


Chart 4-10. Cumulative Impacts on Elk Habitat

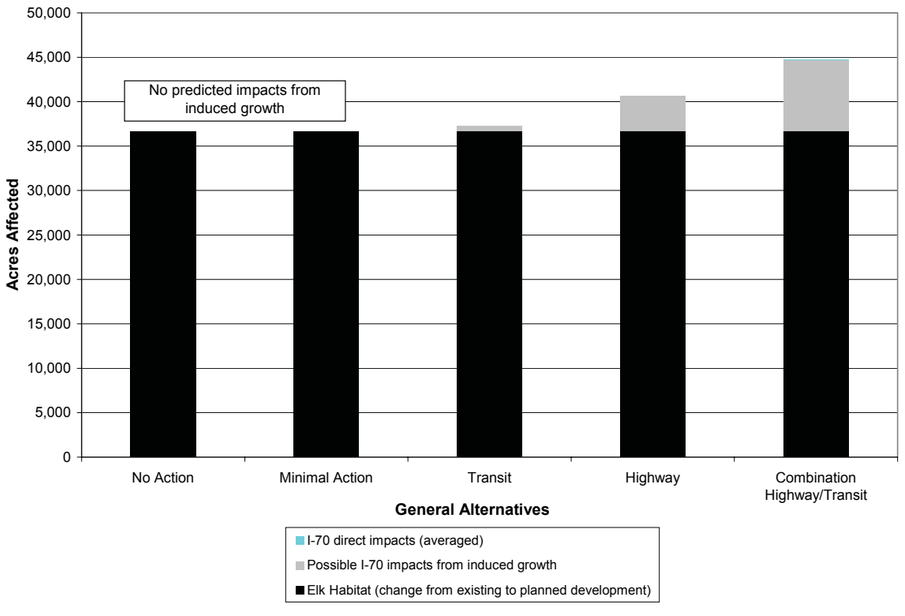


Chart 4-11. Cumulative Impacts on Bighorn Sheep Habitat

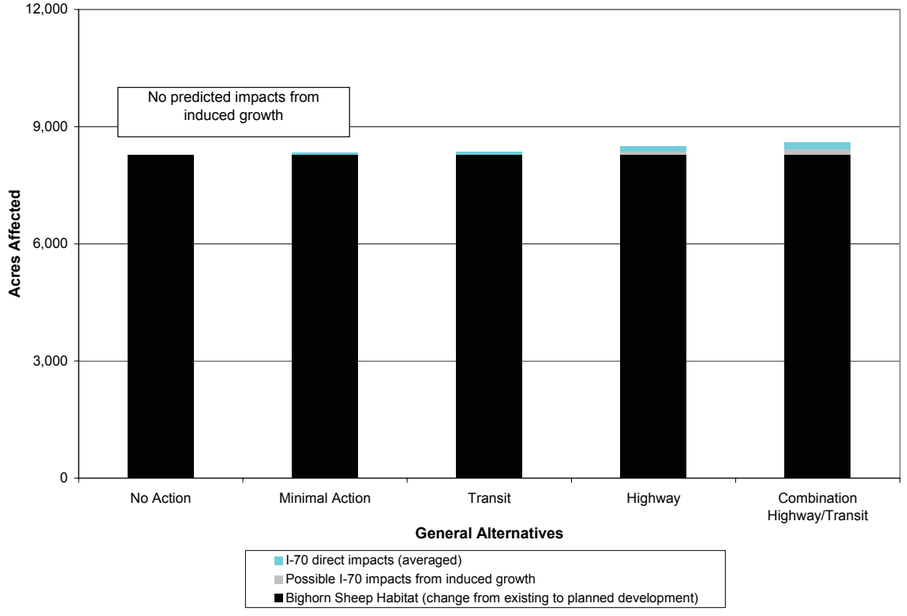
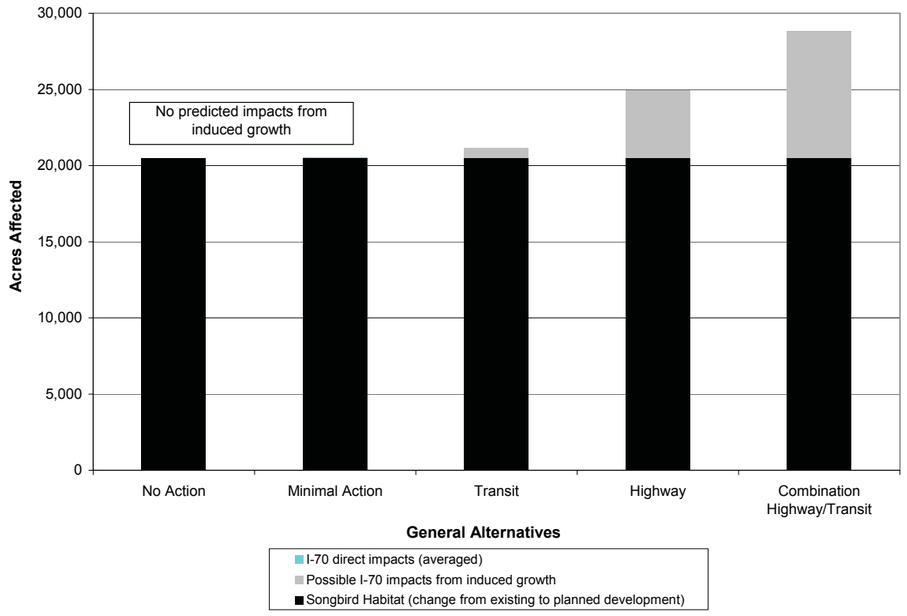


Chart 4-12. Cumulative Impacts on Songbird Habitat



Corridor and Localized Impacts

Predicted induced growth associated with the Transit and Combination alternatives could precipitate further development and increase impacts on key wildlife habitats in the Eagle River and Blue River watersheds (Eagle and Summit counties). Highway alternatives could cause a smaller amount of induced growth/development in Eagle County as illustrated on the following charts:

- Chart 4-13, Eagle River Watershed Cumulative Impacts on Deer Habitat
- Chart 4-14, Eagle River Watershed Cumulative Impacts on Elk Habitat
- Chart 4-15, Eagle River Watershed Cumulative Impacts on Songbird Habitat

The Combination Highway/Transit alternatives are also indicated to possibly cause limited induced growth/development in the Blue River watershed (see Chart 4-16, Blue River Watershed Cumulative Impacts on Elk Habitat). Cumulative impacts on wildlife habitat could be substantial in the Eagle River watershed due to planned development and possible induced growth associated with Transit and Combination alternatives in Eagle County. Measures to protect and preserve such habitats are discussed in section 3.19, Mitigation Summary.

Induced growth could cause increased fragmentation of lynx movement corridors. Land development is likely to affect the large home ranges of more mobile species, such as lynx and wolverine. Cumulative effects on lynx would include increased demand for use of forest-managed lands for dispersed recreation, particularly during the winter for cross-country skiing and snowmobiling, and urban/rural growth that encroaches on migration routes.

TES species could be affected by cumulative impacts that would include increased human intrusion into their habitats, habitat losses, and intrusion into movement corridors from land development. Most of the habitat for these species occurs on USFS and BLM lands, which affords some protection from direct habitat losses. However, increased use of these areas for recreation would increase the potential for human disturbance to wildlife and vegetation.

Chart 4-13. Eagle River Watershed Cumulative Impacts on Deer Habitat

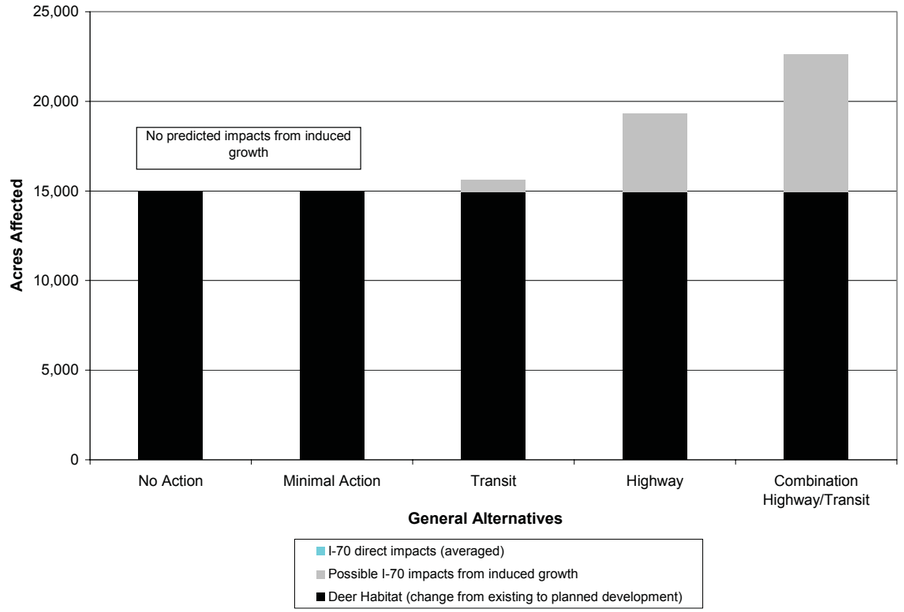


Chart 4-14. Eagle River Watershed Cumulative Impacts on Elk Habitat

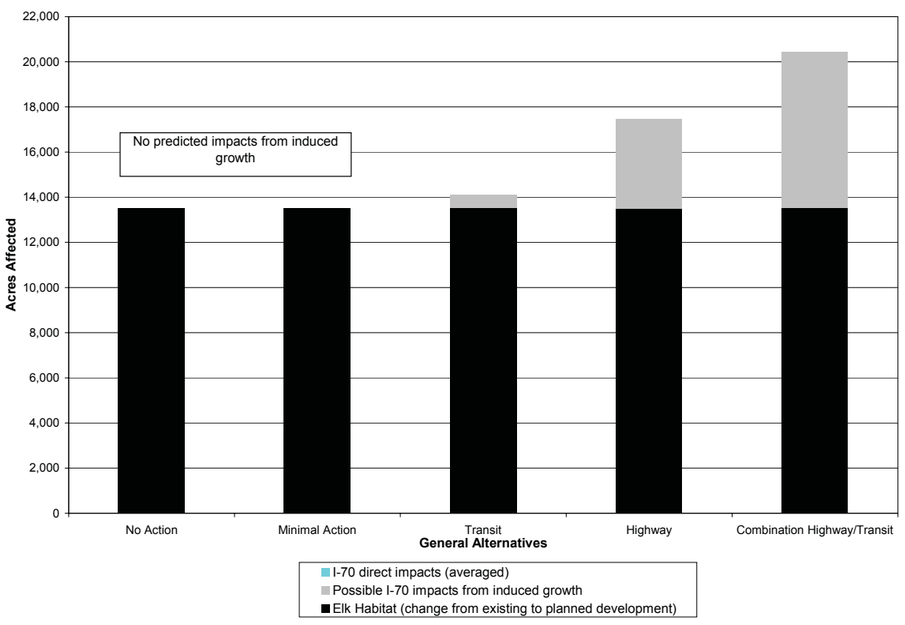


Chart 4-15. Eagle River Watershed Cumulative Impacts on Songbird Habitat

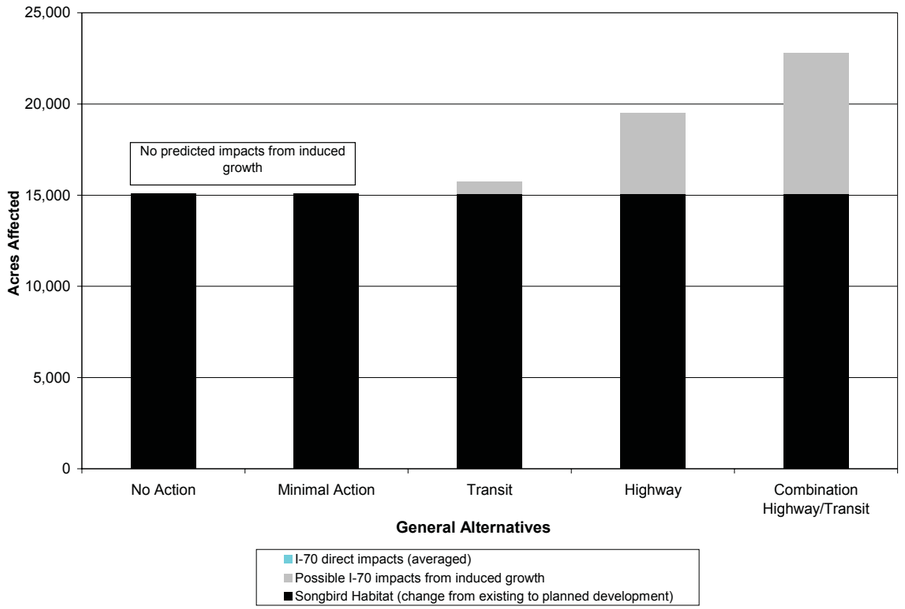
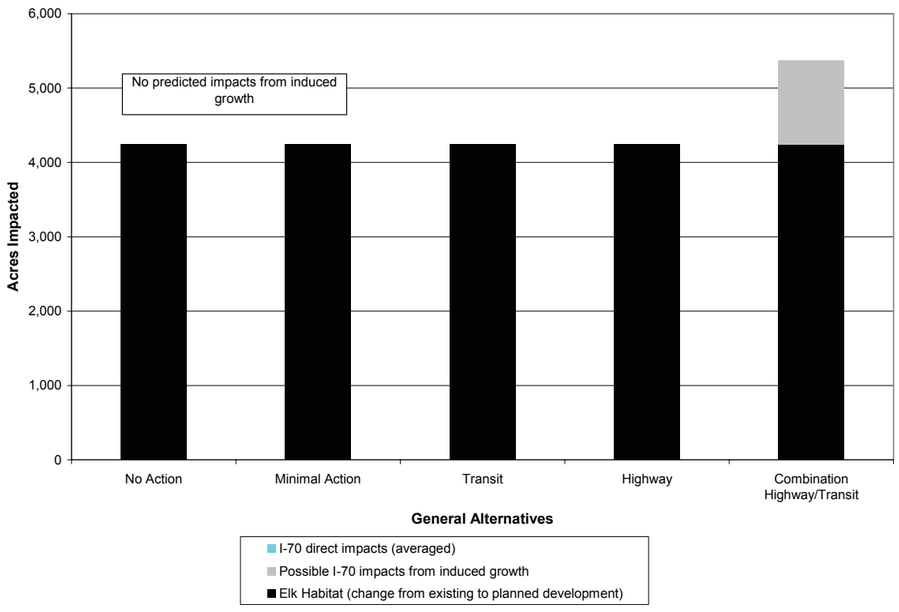


Chart 4-16. Blue River Watershed Cumulative Impacts on Elk Habitat



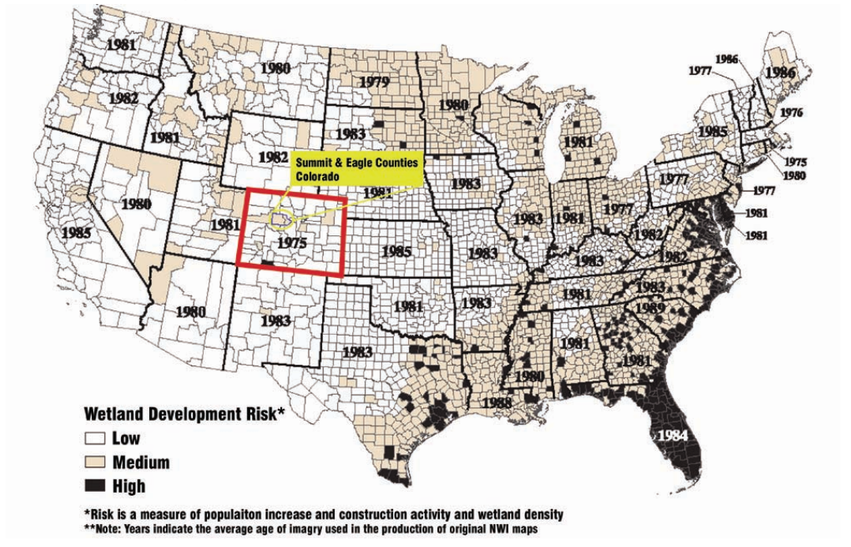
4.4.2.4 Affected Environment: Wetlands

Cumulative impacts on wetlands have been assessed within watersheds along the Corridor. There is a range of issues related to loss of area and decreases in functional value. Loss of area is primarily caused by construction (earthmoving) but also by increased runoff rates, stream incision, and loss of hydrology. Similarly, decreases in functional value (for example, habitat) may be caused by loss of hydrology and by input of sediments and contaminants from developed areas, including impervious surfaces. Functional value is also decreased by invasion of introduced and weedy plant species. Wetlands have been affected by historic mining practices, including runoff from waste materials, placer mining, mine drainage into wetland areas, mineralized rock, and disturbance of mining materials from urbanization and highway construction. However, historic mining impacts on Corridor wetlands are not well documented and, therefore, were not available for inclusion in the assessment of cumulative impacts. Wetland impacts from the construction of existing I-70 are not documented because much of I-70 was constructed during a time when these impacts did not require Corps of Engineers (COE) permits. Because I-70 was constructed primarily along valley floors adjacent to many of the drainage systems in the corridor, impacts on wetlands were likely extensive.

The effects of continued population growth and development pressure on the ecological integrity of aquatic ecosystems are of national concern, as recognized by the USFWS in *Goal 1 – Strategic Mapping*, of the *National Wetland Inventory: A strategy for the 21st Century* (2002). This report points out that "As the US population continues to grow, additional stresses resulting from human activities will be placed on wetlands."

As shown in Figure 4-4, the USFWS (2002) has rated the wetland development risk (low, medium or high) of population and construction activity increases to wetlands for each county of the lower 48 states to prioritize areas to update existing National Wetland Inventory (NWI) maps. In Colorado, two counties in the Corridor, Eagle and Summit, have been assigned a medium risk rating, indicating a concern for development to affect wetlands.

Figure 4-4. Potential Development Pressures on Wetlands



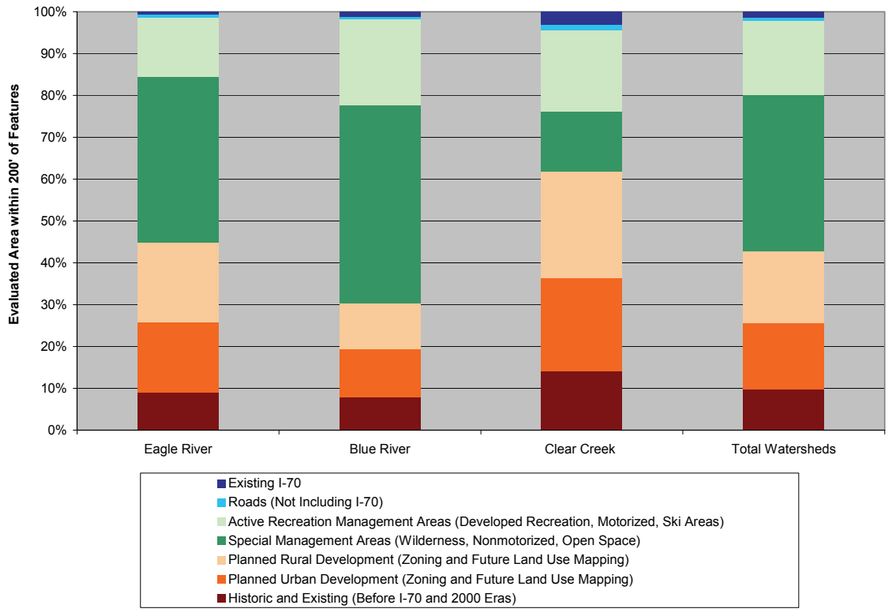
Source: National Wetlands Inventory: A strategy for the 21st Century, US Fish and Wildlife Service, January 2002

Considerations in the I-70 PEIS for impacts from existing and planned development to wetlands within the watershed study area are illustrated on Figure 4-9, Regional Impacts on Surface Water and Wetlands, located at the end of this chapter. Historic, existing, and planned development within 200 feet of wetlands is quantified and illustrated on Chart 4-17. In addition, forest management, recreation, and open space uses, as well as roads including I-70, within 200 feet of wetlands are quantified. Potential impacts on wetlands at the watershed level were considered to be likely within 200 feet in mountainous terrain and susceptible to increased sedimentation, runoff, and loss.

Within the watershed study area, existing development occupies approximately 10 percent of the evaluated area within 200 feet of wetlands. Under current plans, planned development would increase impacts within 200 feet of wetlands from the existing development impacts of 10 percent (6,600 acres) to 49 percent (32,000 acres) of the evaluated area. The remainder of the watershed area within 200 feet of wetlands would continue as forest management, recreation, and open space uses, which would protect wetland resources within the watershed study area.

The cumulative effects of stream channelization from highway construction and development within the Corridor have resulted in urbanized waterways and changes in stream morphology, including loss of wetlands and loss of functional value. Stream morphology is altered as the stream channel is constricted and floodplain areas are eliminated by highway fill material. As a result, wetlands are often confined to narrow areas along the stream bank. Several streams along I-70 have these characteristics, especially as they pass through urbanized areas. Stream hydrology is also affected by stream channel constriction and less surface area, generally causing water velocity to increase. This increase in velocity can result in erosion of streambed and bank material, which can result in deposition of sediment in wetland areas where the stream energy gradient is lower. The consequences of changes to stream channel morphology are generally long term and can translate into long-term potential cumulative impacts on wetlands.

Chart 4-17. Wetlands Affected Environment



4.4.2.5 Cumulative Impacts: Wetlands

Cumulative impacts are based on the addition of the direct and indirect impacts of project alternatives (including possible induced development) to past, present, and reasonable foreseeable future impacts on wetlands along the Corridor. These impacts were calculated within a 200-foot area of potential effect surrounding wetlands within each watershed along the Corridor. Cumulative impacts on wetlands focus on the following major causes and effects:

- Direct loss of wetlands and other waters of the US caused by development activities and roadway construction
- Encroachment/impacts on wetland functions caused by development activities, increased recreation, and roadway construction
- Degradation of wetland water quality and wildlife habitat caused by development activities, roadway construction, and winter maintenance activities (increased sedimentation and runoff)

The magnitude of cumulative effects on wetlands is derived by taking into account historic and existing impacts, planned development impacts, and direct and indirect I-70 impacts on water resources features. The Tier 2 level of analysis will include further considerations of cumulative effects in terms of alternative footprints and possible monitoring activities.

It was estimated that winter maintenance would require an increase (from existing conditions to project alternative conditions) in sand from 8 to 32 percent (range for project alternatives) and in deicer from 8 to 55 percent (range for project alternatives). Increased winter maintenance use of sand and deicer might cause sedimentation and water quality effects on wetlands and other waters of the US.

Action alternatives, however, are expected to have a negligible impact contribution (up to 0.3 percent of the developed area) when compared to potential impacts from future development. The greatest impacts on wetlands from project alternatives would be the result of possible induced growth and development (indirect impacts). The formula used to calculate indirect impacts is provided below.

total planned & current development (GIS overlay of water features area*) - current development (GIS overlay of water features area*) (acres) / 2025 DOLA population - 2000 DOLA population	X	induced population prediction (alternative specific **)	X	land use growth impact factor - acreage (alternative specific***)

Cumulative impacts on wetlands (water resources features) are shown on the following charts:

- Chart 4-18, Cumulative Impacts on Water Resources Features
- Chart 4-19, Eagle River Watershed Cumulative Impacts on Water Resources Features
- Chart 4-20, Blue River Watershed Cumulative Impacts on Water Resources Features

Transit, Combination Highway/Transit alternatives, and to a lesser extent Highway alternatives, all would have the potential to induce growth and development in the Eagle River watershed (increasing acreage impacts by approximately 300 to 4,000 acres). Combination Highway/Transit alternatives would have the potential to induce growth and development in the Blue River watershed (increasing acreage impacts by approximately 1,000 acres). Cumulative impacts on wetlands (wetland loss and degradation) could be substantial for Transit and Combination Highway/Transit alternatives unless county and community planning efforts include water resources buffer zones, open space zoning, and

* see Figure 4-9
** see section 3.9
*** Table 4-2

other controls. The combined impacts of the Eagle River and Blue River watersheds provide the total Corridor cumulative impacts by alternative as shown on Chart 4-18.

Chart 4-18. Cumulative Impacts on Water Resources Features

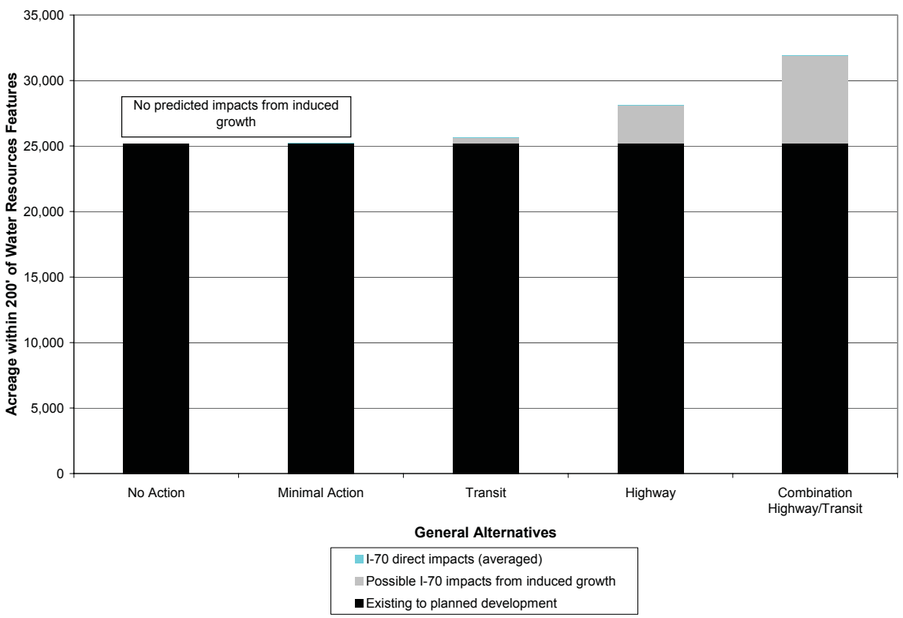


Chart 4-19. Eagle River Watershed Cumulative Impacts on Water Resources Features

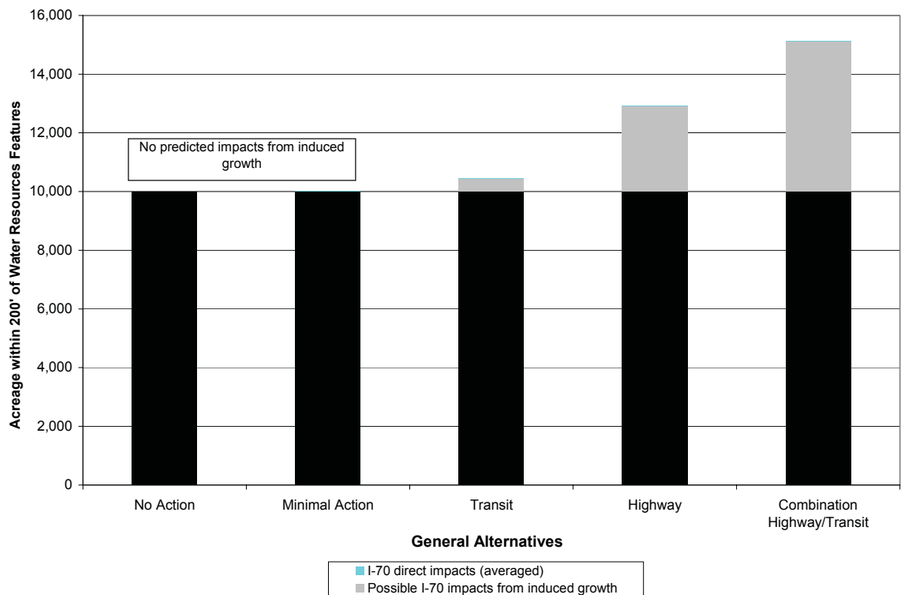
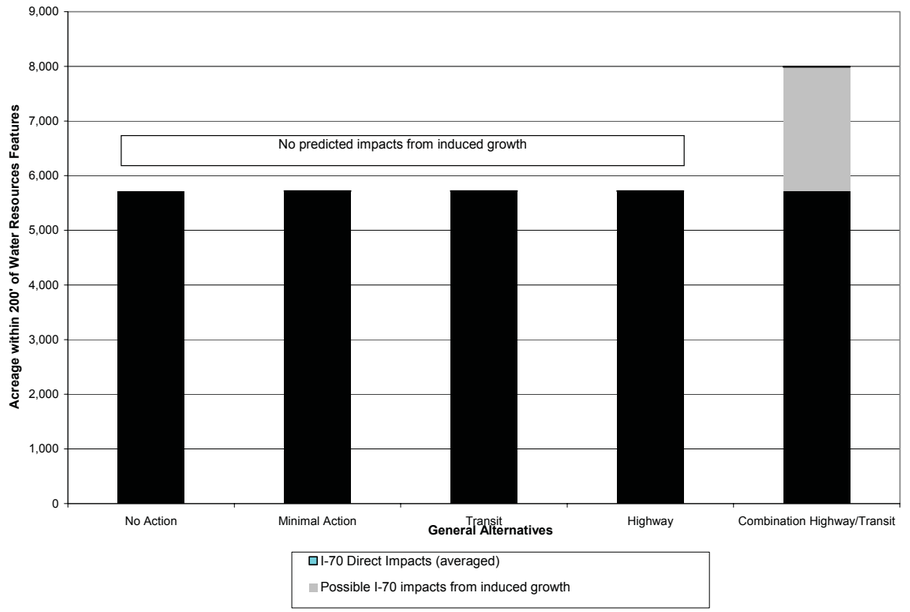


Chart 4-20. Blue River Watershed Cumulative Impacts on Water Resources Features



4.4.3 Water Resources

4.4.3.1 Affected Environment: Water Resources

Historic Mining

The affected environment for historic mining cumulative impacts includes a portion of the Eagle River watershed and the entire Clear Creek watershed. Existing conditions represent impacts on water quality from runoff from historic mining waste materials, placer mining, mine drainage into streams, mineralized rock, and disturbance of mining materials from urbanization and highway construction.

Cumulative impacts from historic mine waste materials are represented by existing conditions combined with direct impacts reflected in zinc and copper from highway runoff. Zinc and copper contributions from I-70 were evaluated for each alternative using the FHWA model (see section 3.4, Water Resources). Water quality monitoring results indicate that metals loading occurs only in highly mineralized or historic mining areas. Corridor streams affected by metals include Tenmile Creek and Clear Creek. Heavy metals in runoff are primarily the result of historic mining activities, and impacts from highway runoff sources are minimal in comparison. However, disturbance of historic mining materials and mineralized rock has occurred as a result of I-70 construction, allowing dissolution and transport of heavy metals in stormwater runoff.

Blue River Watershed

The source of metals in Tenmile Creek is primarily upstream of the Corridor at the Climax Mine. I-70 does not intercept appreciable amounts of mine waste materials in lower Tenmile Creek and, therefore, does not substantially influence metals loading in the Blue River watershed.

Clear Creek Watershed

In the Clear Creek watershed, I-70 was constructed through mineral deposits and mine waste residuals using cut-and-fill methods. In these areas, I-70 runoff has the potential to contribute metals loading to Clear Creek through the process of erosion and sediment transport, as well as dissolution of soluble metal salts. These mechanisms have the potential to increase metal loads in Clear Creek and can be directly related to I-70 disturbance. Water quality sampling results indicate increased metals concentrations in runoff from I-70 and its associated shoulders and median areas between Idaho Springs and Dumont. This is also likely to be the case in the Georgetown Hill and Silver Plume areas that were heavily mined, although no data are yet available to support this contention.

The cumulative effects of land use changes on metals loading in Clear Creek are not likely to change appreciably from existing conditions. Instead, development of residential, commercial, and urban areas may create a landscape that reduces metal mobility in heavily mined areas such as Clear Creek. For example, mine waste may be removed or covered with impervious materials (such as in parking lots) or vegetation. In Central City and Black Hawk (in Gilpin County), much of the mine waste residual has been removed and disposed offsite, used as structural fill, or paved for parking lots and roads. This land cover change results in a net reduction in metals transport when compared to formerly exposed mine waste piles. In addition, the construction of I-70 has effectively "capped" mine waste in situ with pavement throughout many areas of Clear Creek County. This has likely resulted in reduced metal transport from many of the formerly exposed mine waste piles.

Streams

An analysis of stream encroachment and channelization due to I-70, as well as other developments, was conducted by overlaying the current I-70 footprint and adjacent roadside cut-and-fill slopes on historic (1956) aerial photography, as illustrated on Figure 4-16 through Figure 4-31 at the end of this chapter for select locations along the I-70 corridor.

GIS layer data (locations of existing and planned development; streams, open water, wetlands) were used to estimate disturbance to these water resources within the watershed areas. A conservative 200-foot impact zone is used in the analysis. The 200-foot zone was selected to generally represent impacts from encroachment, direct loss of the resource, and indirect impacts such as increased sedimentation, increased recreational use, and habitat and water quality degradation. Existing and historic impacts on water resources are provided for comparison with planned development impacts and I-70 impacts. Impacts on streams from planned development are shown on Chart 4-18, Cumulative Impacts on Water Resources Features, and Figure 4-9, Regional Impacts on Surface Water and Wetlands, located at the end of this chapter. Existing and planned development would account for 46 percent of the evaluated watershed area of Eagle River. Planned development is expected to increase stream/open water/wetlands impacts by more than three times the existing acreage (comprising 32 percent of the evaluated area) in the Blue River watershed. Impacts on streams/open water/wetlands are expected to increase by more than four times existing conditions due to planned development in the Clear Creek watershed. This area amounts to 85 percent of the evaluated watershed area.

Water Quality

Phosphorus was selected to represent overall cumulative water quality impacts due to its ability to reflect sediment/suspended solids in runoff. Stream total phosphorus concentrations are influenced by roadway runoff, as well as other nonpoint sources (including sources from planned development) that contribute sediment loading. Point source discharges from wastewater treatment plants also contribute to phosphorus loading in receiving waters. The BASINS model was used to determine water quality impacts in terms of phosphorus loads and is further described in Appendix G, Water Resources. Water quality impacts from stormwater runoff reflect possible increased sediment and contaminants from development and roadways. Note that the I-70 highway area was modeled to include all disturbance areas, not just the road surface. Therefore, I-70 contributions generally represent existing conditions, as well as contributions by the project alternatives themselves. This land use scale model is not sensitive enough to differentiate among project alternatives. Existing phosphorus loads were modeled for comparison with model predictions for future phosphorus loads from planned development and are illustrated on the following charts and figures:

- Chart 4-21, Water Quality Affected Environment, Phosphorus Load
- Chart 4-22, Water Quality Affected Environment, Planned Development Impacts
- Figure 4-10, Total Phosphorous Load from Existing Land Use Values, Through Eagle River Analysis Area
- Figure 4-11, Total Phosphorous Load from Future Land Use Values, Through Eagle River Analysis Area
- Figure 4-12, Total Phosphorous Load from Existing Land Use Values, Through Blue River Analysis Area
- Figure 4-13, Total Phosphorous Load from Future Land Use Values, Through Blue River Analysis Area
- Figure 4-14, Total Phosphorus Load from Existing Land Use Values, Through Clear Creek Analysis Area
- Figure 4-15, Total Phosphorus Load from Future Land Use Values, Through Clear Creek Analysis Area

Planned development in the Corridor is expected to increase phosphorus loads by 23 percent from existing conditions. I-70 contributes 6 percent of the total existing/planned development phosphorus load. The greatest impacts on water quality from planned development are indicated in the Eagle River watershed.

Chart 4-21. Water Quality Affected Environment, Phosphorus Load

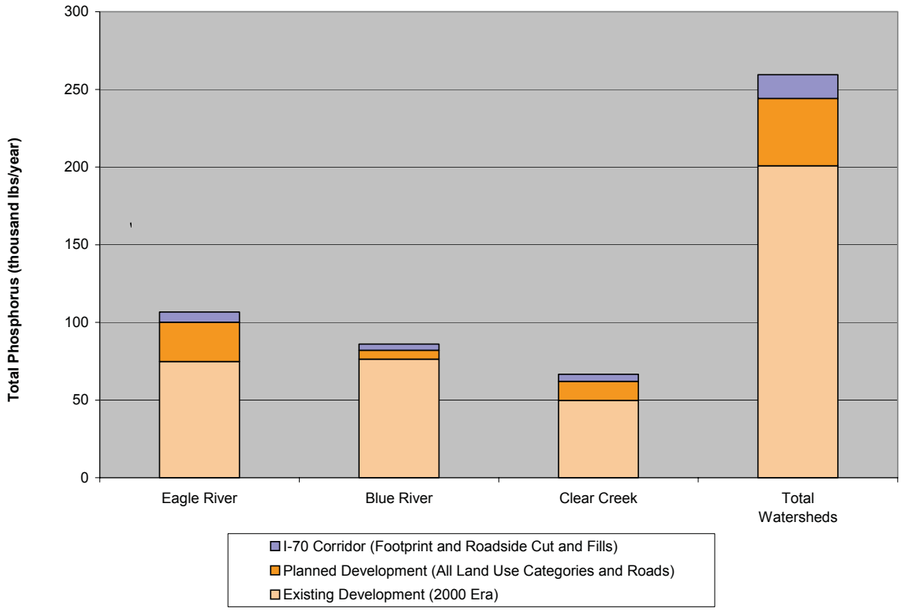
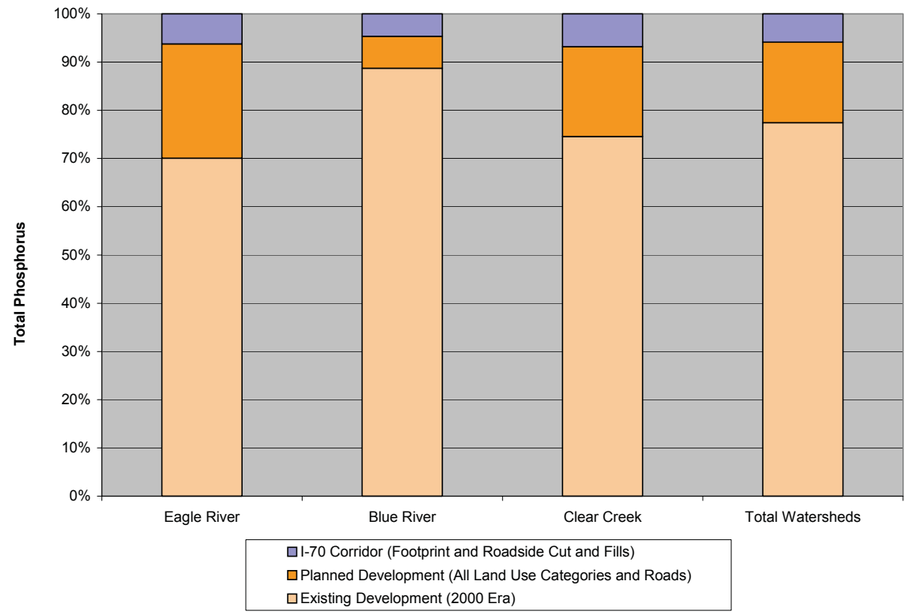


Chart 4-22. Water Quality Affected Environment, Planned Development Impacts



Corridor water quality can also be affected by water supply issues. Water supply diversions can decrease stream flows (and the ability of a stream to dilute potential contaminants) and increase concentrations of potential pollutants. Corridor growth and development are expected to increase water supply demands.

Eagle River Watershed

The total phosphorus load was computed using the BASINS model for each of 84 HUC-6 drainage sub-basins. Planned development is estimated to increase phosphorus loads by 34 percent. I-70 contributes 7 percent of the total existing/planned development phosphorus load. See Figure 4-10, Total Phosphorous Load from Existing Land Use Values, Through Eagle River Analysis Area, and Figure 4-11, Total Phosphorous Load from Future Land Use Values, Through Eagle River Analysis Area, located at the end of this chapter.

To facilitate comparison of principal areas, the watershed was divided into the Upper Eagle River (above Dowd Canyon), Gore Creek, Middle Eagle River (above Wolcott), and Lower Eagle River basins. In addition, separate model runs were executed to calculate the total phosphorus for each drainage sub-basin intersected by I-70 to isolate the relative percent contribution of loading from the highway. I-70 follows Gore Creek through the Vail Valley and the middle and lower Eagle River to Dotsero. Drainage sub-basins indicating high phosphorus loads under existing conditions include Gore Creek, Mill Creek, and Middle Eagle River. Results indicate that the total annual contribution of phosphorus loading from I-70 runoff to Gore Creek is 24 percent. The I-70 phosphorus contribution to Middle Eagle River is 11 percent, and lower Eagle River is 8 percent.

Blue River Watershed

The Blue River watershed encompasses Summit County. The total phosphorus load for the watershed was computed using the BASINS model for each of 63 HUC-6 drainage sub-basins. Planned development is estimated to increase phosphorus loads by 7 percent. I-70 contributes 5 percent of the total existing/planned development phosphorus load. See Figure 4-12, Total Phosphorous Load from Existing Land Use Values, Through Blue River Analysis Area, and Figure 4-13, Total Phosphorous Load from Future Land Use Values, Through Blue River Analysis Area, located at the end of this chapter.

To facilitate comparison of principal hydrologic units, the watershed was divided into major tributary areas including the Snake River, Tenmile Creek, Blue River mainstem above Dillon Reservoir, Middle Blue River above Green Mountain Reservoir, and lower Blue River below Green Mountain Reservoir. HUC-6 level results indicate I-70 to have high impacts in localized watersheds. The principal drainage basins showing the largest overall increase in total annual phosphorus loading between existing and future planned development conditions include the Blue River above Dillon and the Blue River at Silverthorne. Drainage sub-basins indicating greater than 0.40 lb/ac/yr total phosphorus load include the Blue River at Breckenridge, Blue River at Gold Hill, and Blue River at Silverthorne (indicative of a high level of development).

I-70 follows Tenmile Creek to Wheeler Junction and West Tenmile Creek to the summit of Vail Pass. Tributary streams in this area that can be directly affected by runoff from I-70 include West Tenmile Creek, Lower Tenmile Creek, Officers Gulch, Uneva Lake, North Tenmile Creek, and Meadow Creek. Results indicate that the total contribution of annual phosphorus loading from I-70 runoff to Tenmile Creek above Dillon Reservoir is 11 percent. I-70 intersects the Blue River at Silverthorne. Tributary streams in this area that are directly affected by runoff from I-70 include Straight Creek and Salt Lick Gulch. Results indicate that the total annual contribution of phosphorus loading from I-70 runoff to a 3-mile stretch of the Blue River in this area is 24 percent (between Dillon Dam and Bushee Creek).

Clear Creek Watershed

The Clear Creek watershed encompasses Clear Creek County, along with portions of Gilpin and Jefferson counties. The total phosphorus load for the watershed was computed using the BASINS model for each of 23 HUC-6 drainage sub-basins. Planned development is estimated to increase phosphorus loads by 28 percent. Existing I-70 contributes 4 percent of the total existing/planned development phosphorus load. See Figure 4-14, Total Phosphorus Load from Existing Land Use Values, Through Clear Creek Analysis Area, and Figure 4-15, Total Phosphorus Load from Future Land Use Values, Through Clear Creek Analysis Area, located at the end of this chapter.

To facilitate comparison of principal hydrologic units, the watershed was divided into major tributary areas including Upper Clear Creek, West Fork Clear Creek, Middle Clear Creek above Idaho Springs, Lower Clear Creek through Idaho Springs, North Fork Clear Creek, and Lower Clear Creek from US 6 to Golden. Drainage sub-basins indicating greater than 0.40 lb/ac/yr total phosphorus load include Clear Creek mainstem from South Fork to North Fork, and Eureka Gulch (indicative of a high level of development). The principal drainage basins showing the largest overall increase in total annual phosphorus loading between existing and future planned development conditions include Middle and Lower Clear Creek, North Fork Clear Creek, and Lower Clear Creek US 6 to Golden. HUC-6 level results indicate I-70 to have high impacts in localized watersheds. I-70 bisects or parallels tributaries or the mainstem of Clear Creek throughout the Corridor. Model results indicate that the total annual contribution of phosphorus loading from I-70 runoff to Upper Clear Creek is 30 percent, I-70 contributions to Middle Clear Creek are 14 percent, and I-70 contributions to Lower Clear Creek are 7 percent.

Stream Morphology and Habitat

The cumulative effects of stream channelization from highway construction and development within the Corridor have resulted in urbanized waterways and changes in stream morphology including loss of riparian vegetation and aquatic habitat. Stream morphology is altered as the stream channel is constricted and floodplain areas are eliminated by highway fill material. As a result, riparian vegetation is often confined to narrow areas along the stream bank. In addition, these areas are subject to annual flooding that can destroy any riparian vegetation that becomes established. Several streams along I-70 have these characteristics, especially as they pass through urbanized areas.

Stream hydrology is also affected by stream channel constriction and less surface area, generally causing water velocity to increase. This increase in velocity can result in erosion of streambed and bank material, which is deposited further downstream in lower gradient areas where the stream energy gradient is lower. Although stream bank/bed erosion also occurs as a natural process in Corridor streams, stream channelization for the construction of I-70 and US 6 and US 40 has exacerbated the degradation and aggradation of areas of stream channel.

There are two examples within the Corridor where stream aggradation appears to be occurring as a result of past channel disturbances:

- Clear Creek is heavily constricted and channelized along I-70 upstream of the town of Silver Plume. The stream appears to be depositing material in a lower gradient section on the upstream end of Silver Plume.
- The Gore Creek channel was rerouted to accommodate construction of the Vail Golf Course in the 1960s. This section of Gore Creek appears to be aggrading as evidenced by the deposition of large volumes of sand and gravel material.

The consequences of changes to stream channel morphology are generally long term and can translate into long-term potential cumulative impacts on aquatic and riparian habitat, water conveyance, flooding, infrastructure, and roadway and urban development in these areas. Any of the transportation alternatives that would result in further stream constriction or channelization would likely have long-term cumulative impacts.

Clear Creek Watershed

A detailed study of existing habitat conditions and I-70 disturbance was available for the Clear Creek watershed. The study allowed cumulative impacts on stream habitat in this watershed to be assessed based on existing habitat conditions. Comparable information was not available for the Eagle River and Blue River watersheds, and these issues are addressed qualitatively for these watersheds.

A *Catalog of Stream Habitat Quality for Clear Creek and Tributaries* was completed in 2001 by the Colorado School of Mines (CSM), Division of Environmental Sciences and Engineering (CSM 2002). This project was to catalog habitat quality of Clear Creek stream reaches along the Corridor. The catalog documents the existing physical habitat conditions of Clear Creek and its major tributaries to identify stream reaches in key need of restoration, and characterizes major constraints on habitat quality in the watershed. The assessment evaluated 10 habitat parameters applying a systematic (EPA) numeric scale from 0 to 20 to rate each parameter. The following habitat parameters were evaluated:

- Epifaunal substrate cover
- Substrate embeddedness
- Velocity/depth regimes
- Sediment deposition

- Channel flow status
- Channel alteration
- Pool percentage
- Bank stability
- Vegetative protection
- Riparian width

The CSM study indicated that I-70 construction/operation and Corridor urbanization are major causes for poor habitat conditions in many reaches of Clear Creek under existing conditions.

4.4.3.2 Cumulative Impacts: Water Resources

Cumulative impacts on water quality from historic mining waste materials and mineralized rock include the following:

- Runoff from historic mining waste materials
- Disturbance of placer mining areas by stream flow
- Mine drainage into streams
- Runoff from mineralized rock
- Disturbance of mining materials from urbanization and highway construction

Cumulative impacts on water quality from historic, existing, and planned development include the following:

- Stormwater runoff from roadways, urban and rural areas (various land use types) reflected in phosphorus loads impacting water quality and associated resources (such as wildlife and recreation)
- Sand and deicer loads from roadway winter maintenance

Physical impacts on streams and from historic, existing, and planned development include the following:

- Encroachment/impacts on stream functions (hydrology and aquatic/riparian habitat caused by development activities, increased recreation, and roadway construction)
- Direct disturbance or channelization of streams caused by development activities and roadway construction

The magnitude of impacts on water resources from historic mining is based on existing metals loading and identified impaired segments in Corridor streams. Contributing impacts from I-70 roadway disturbance of mining materials are considered minimal in comparison. The magnitude of cumulative impacts on water quality from existing and planned development is determined using the BASINS stormwater runoff model. I-70 impacts on water quality are determined based on the FHWA stormwater runoff model (see section 3.4, Water Resources). Continued water quality monitoring activities will address possible cumulative effects of alternatives and are coordinated by the SWEEP committee.

Impacts from Historic Mine Waste Materials

Cumulative impacts on metals loading in the Clear Creek watershed from project alternatives are considered to be minimal because I-70 associated mitigation activities are expected to decrease metals loading in stormwater runoff. Because the construction of existing I-70 has effectively "capped" mine waste in situ with pavement throughout many areas of Clear Creek County, as noted above, metal transport from many of the formerly exposed mine waste piles has been reduced. This will continue to be the case for any of the proposed alternatives, particularly where more pavement is used. However, new or substantially larger rock cuts that intercept highly mineralized zones or surface mine wastes that remain exposed might create additional metal transport and loading in Clear Creek. Mitigation of such impacts will be addressed during Tier 2 studies and during the construction and operation of I-70. Mitigation activities are expected to improve existing water quality conditions in relation to runoff and metals leaching from historic mine waste materials. Construction and operational details in these specific areas will be required before any predictions of water quality impacts can be made.

Impacts on Water Quality

Most of the cumulative impacts on water quality in Corridor streams will be the result of planned urban and rural development, which increases both point and nonpoint source loads of total phosphorus (see Chart 4-23, Cumulative Impacts on Water Quality). As noted earlier, direct impacts from I-70 are generally included in the changes from existing to planned development in the BASINS modeling study. The formula used to calculate indirect impacts on water quality from possible induced growth is provided below.

total current & planned development (BASINS Model phosphorus load*) - current development (BASINS Model phosphorus load*) (lbs/year)		induced population prediction (alternative specific**)		land use growth impact factor - water quality (alternative specific***)
2025 DOLA population - 2000 DOLA population	X		X	

Secondary water quality impacts from possible induced growth (as associated with specific alternatives) would be more localized to areas of Eagle and Summit counties. Transit alternatives are expected to possibly induce growth in urban areas with transit centers including Eagle, Avon, Vail, Dillon, and Silverthorne. Highway and Combination Highway/Transit alternatives are expected to possibly induce some amount of dispersed growth in rural areas, possibly leading to the greatest cumulative impacts on water quality from new development activities (including possible induced growth). Induced growth associated with Combination alternatives would have the potential to increase phosphorus loads by an additional 50 percent beyond the expected change due to planned development.

* see Figure 4-10 through Figure 4-15
** see Section 3.9
*** see Table 4-2

Chart 4-23. Cumulative Impacts on Water Quality

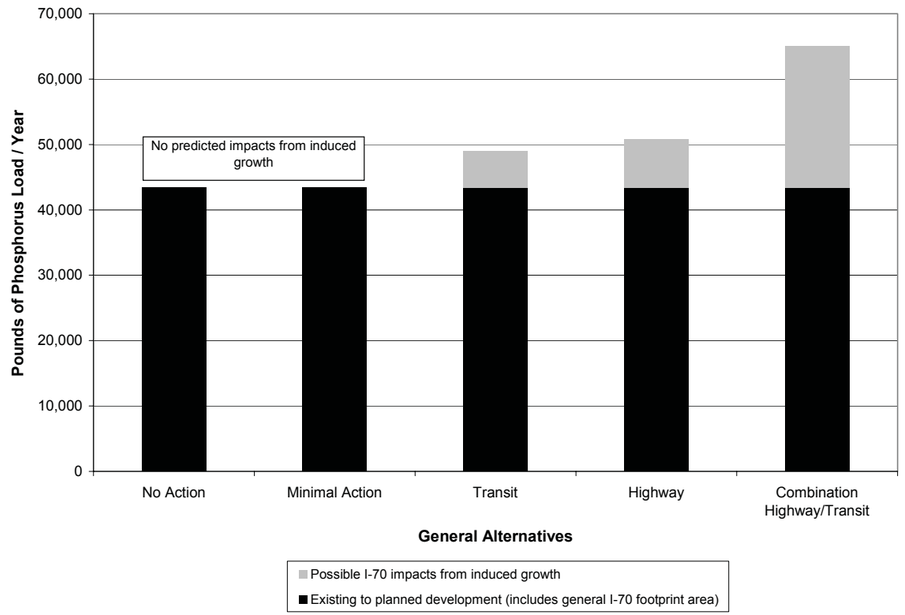
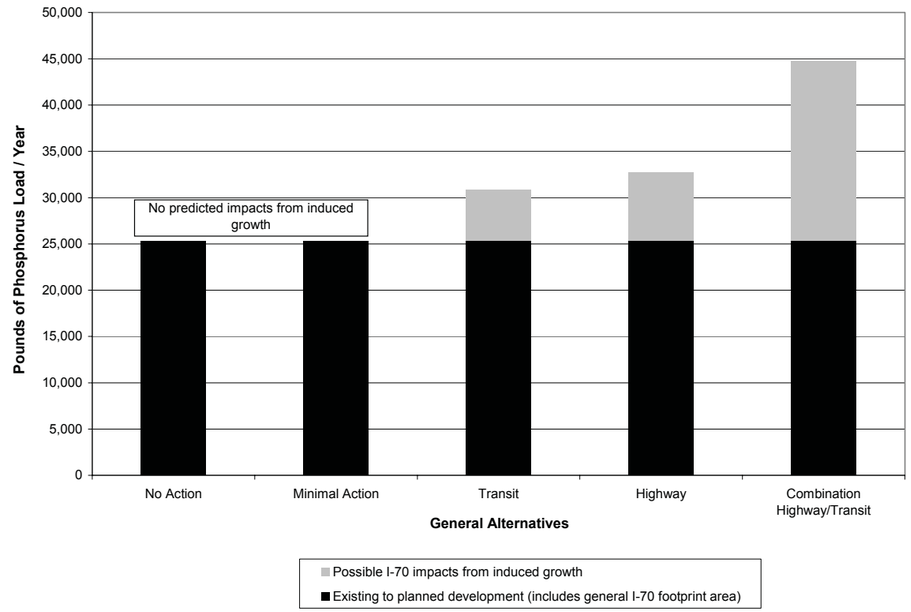


Chart 4-24. Eagle River Watershed Cumulative Impacts on Water Quality



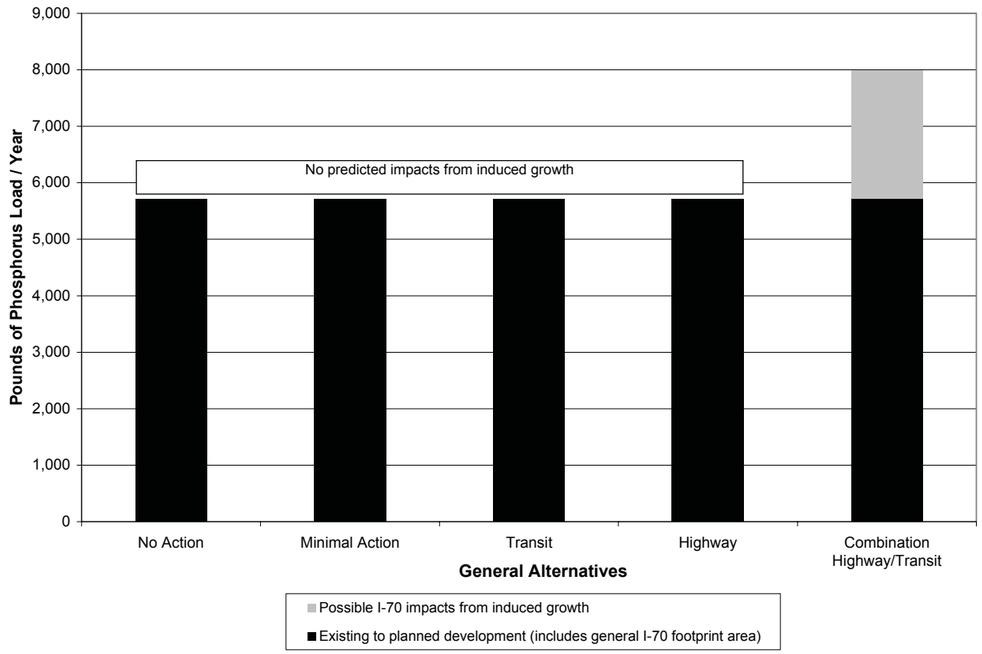
Eagle River Watershed

HUC-6 level modeling results indicate I-70 to have high impacts in localized Eagle River basins. The principal drainage basins showing the largest increase in total annual phosphorus loading between existing and future planned development conditions are Gore Creek and Middle Eagle River. The greatest impacts on stormwater quality from project alternatives would be the result of possible induced growth and development. Transit, Combination Highway/Transit alternatives, and to a lesser extent Highway alternatives would have the potential to induce growth and development in the Eagle River watershed and might cause additional impacts on water quality as shown on Chart 4-24, Eagle River Watershed Cumulative Impacts on Water Quality. Transit alternatives are expected to concentrate induced growth in existing urban areas and around transit centers. This type of growth may increase wastewater treatment plant discharges and/or create the need for additional facilities. Alternatives that would include highway improvements would be more likely to affect water quality through more dispersed development activities.

Blue River Watershed

The principal drainage basins showing the largest overall increase in total annual phosphorus loading between existing and future planned development conditions include the Blue River above Dillon and the Blue River at Silverthorne. Localized impacts from I-70 runoff are greatest for Tenmile Creek above Dillon Reservoir and a 3-mile stretch of the Blue River (between Dillon Dam and Bushee Creek). The greatest cumulative impacts on stormwater quality from project alternatives would be the result of possible induced growth and development in the Blue River watershed associated with the Combination Highway/Transit alternatives (an additional 42 percent over the expected change due to planned development) (see Chart 4-25, Blue River Watershed Cumulative Impacts on Water Quality). Localized cumulative impacts are expected to be greatest in basins associated with Dillon and Silverthorne based on previous trends and transit center locations.

Chart 4-25. Blue River Watershed Cumulative Impacts on Water Quality



Clear Creek Watershed

The principal drainage basins showing the largest overall increase in total annual phosphorus loading between existing and future planned development conditions include Middle and Lower Clear Creek, North Fork Clear Creek, and Lower Clear Creek (US 6 to Golden). No impacts from induced growth are predicted for the Clear Creek watershed. Cumulative impacts in Clear Creek watersheds are expected to be greatest for alternatives with impacts in the Middle and Lower Clear Creek basins. Although all action alternatives would affect these basins, the greatest impacts on streams would be associated with the Combination Six-Lane Highway with Rail and IMC, Six-Lane Highway, and Rail with IMC alternatives.

Impacts on Streams and Stream Habitat and Morphology

Eagle River Watershed, Eagle County

Direct impacts from project alternatives could increase impacts on streams by 0.8 to 1.0 percent. The greatest impacts on streams, wetlands, and open waters from project alternatives would be the result of possible induced growth and development. Transit, Combination Highway/Transit alternatives, and to a lesser extent Highway alternatives would have the potential to induce growth and development in the Eagle River watershed. Alternatives with Transit components are expected to have the greatest cumulative impacts on basins associated with Eagle, Avon, and Vail. Because the Gore Creek and Middle Eagle River basins are associated with the greatest increases in planned development, these basins would be most affected by cumulative effects from Transit, Highway, and Combination alternatives.

Blue River Watershed, Summit County

Existing I-70 impacts 1.3 percent of the evaluated area. Although Rail with IMC and AGS alternatives would have minor direct impacts on streams, all alternatives are indicated to negligibly contribute to cumulative impacts (area impacts are approximately the same as existing conditions). The greatest impacts on streams, wetlands, and open waters from project alternatives would be the result of possible induced growth and development. Combination Highway/Transit alternatives would have the potential to induce growth and development in the Blue River watershed. Induced growth pressure and possible impacts on streams and stream morphology are indicated to be greatest in basins associated with Dillon and Silverthorne.

Clear Creek, Clear Creek County

Project alternative impacts were evaluated to determine which stream reaches (as defined according to a 2001 CSM study) had the potential for additional channel disturbance and related stream morphology impacts based on historic I-70 impacts discussed in section 3.4, Water Resources. Existing I-70 impacts account for 3.4 percent of the existing/planned development area. Action alternatives are expected to increase the area of watershed disturbance by a very small amount (0.1 to 1.3 percent). Clear Creek stream reach impacts are evaluated by alternative in the following text. The information is provided to give a sense of localized cumulative impacts from project alternatives.

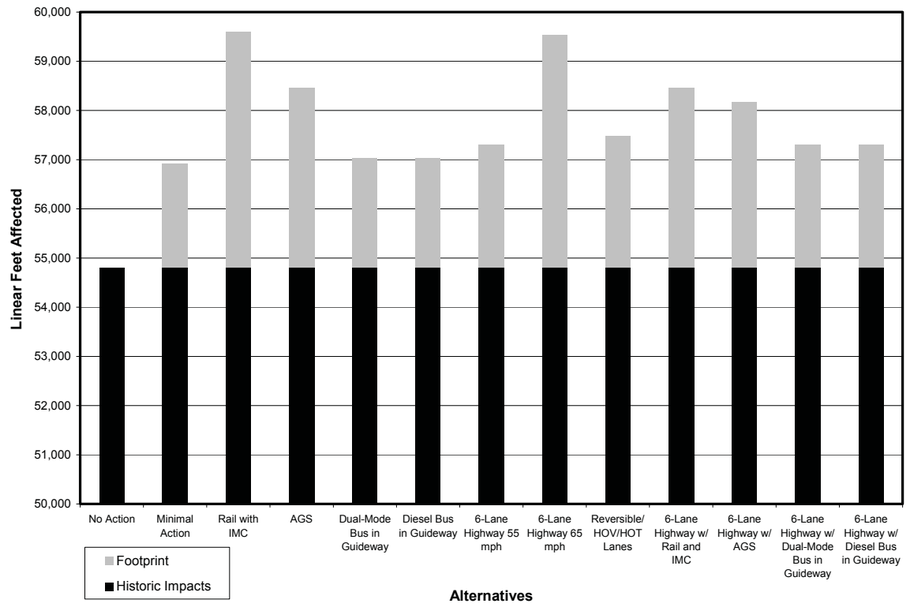
Stream Habitat and Channelization

- **Mainstem 1 (milepost 221 to Georgetown/milepost 227.5).** In Clear Creek Mainstem 1, stream reaches 3, 4, 6, and 9 indicate additional encroachment from project alternative footprints. Reaches 3, 6, and 9 are already heavily modified by I-70, whereas reach 4 is only slightly modified. Reaches 3 and 6 are heavily affected by existing I-70 channelization and winter maintenance activities. The cumulative impacts from the Combination alternatives could be detrimental in these reaches, especially in the higher quality reach 4. In addition, construction disturbance zone impacts from Combination alternatives are indicated for reach 2, which is categorized as pristine. Footprint impacts are indicated for reach 9 for all alternatives, except the AGS and Bus in Guideway alternatives. Reach 9 has been channelized for I-70 construction, and riprap was used on both banks. The Transit alternatives would have the least cumulative impacts on Mainstem 1 of Clear Creek.
- **Mainstem 2 (Georgetown/milepost 227.5 to milepost 237).** In Clear Creek Mainstem 2, eight stream reaches would be affected by project alternative footprints. Reach 3 is categorized as slightly modified (highest habitat score for Mainstem 2), and footprint impacts are indicated for the Reversible/HOV/HOT Lanes and Combination Highway/Transit alternatives. I-70 encroachment has constricted reach 5 into a straight channel, and additional footprint impacts are indicated for all alternatives, except the Bus in Guideway alternatives. Reach 9 (moderately modified) is shown to have the greatest footprint impacts from the Combination Six-Lane Highway with Rail and IMC and Combination Six-Lane Highway with AGS alternatives. The greatest impacts on Mainstem 2 would be from the Combination alternatives, followed by the Rail with IMC and Reversible/HOV/HOT Lanes alternatives. The least impacts would be from the AGS and Bus in Guideway alternatives.
- **Mainstem 3 (milepost 237 to milepost 245).** Twelve reaches of Clear Creek Mainstem 3 indicate impacts from project alternatives. The greatest footprint impacts are indicated for the Rail with IMC alternative. Stream reaches 2, 3, and 12B (moderately modified) are footprint-affected by all action alternatives. Reach 2 begins at the bridge next to the Idaho Springs Visitor Center and is constricted by I-70 and the mountainside. Sand from winter maintenance is causing sedimentation in the channel. Reach 3 begins at the I-70 overpass in Idaho Springs and ends at the upstream corner of the Argo Mine property. The reach has been channelized through Idaho Springs and riprap is used to stabilize banks. High footprint impacts on reach 12A (slightly modified) are indicated for the Rail with IMC and Six-Lane Highway 65 mph alternatives. The

least impacts on Mainstem 3 would be from the Bus in Guideway alternatives, followed by the AGS alternative.

Although the eastern Corridor area (Clear Creek watershed) would not be subject to possible induced growth from project alternatives, historic impacts and footprint/construction disturbance impacts associated with project alternatives are associated with possible substantial cumulative effects. Chart 4-26, Clear Creek Watershed Cumulative Impacts on Streams, illustrates historic impacts in relation to direct impacts from project alternatives. The greatest footprint impacts of more than 1,000 feet to segments of Clear Creek are indicated for the Rail with IMC and Six-Lane Highway 65 mph alternatives. Footprint impacts on stream segments of 500 to 1,000 feet are indicated for the Rail with IMC, Six-Lane Highway 65 mph, and Combination Six-Lane Highway with Rail and IMC alternatives. Footprint impacts on slightly modified habitat reaches are indicated for the Rail with IMC, AGS, Six-Lane Highway 65 mph, Reversible/HOV/HOT Lanes, and all Combination alternatives. The footprints of the Combination alternatives would affect four slightly modified habitat reaches. Construction disturbance zone impacts on one pristine habitat reach are indicated for the Combination alternatives. The cumulative impacts from the Combination alternatives would be most critical in the slightly modified and pristine reaches of the Clear Creek watershed.

Chart 4-26. Clear Creek Watershed Cumulative Impacts on Streams



Impacts on Fisheries/Riparian and Aquatic Habitat

Impacts from planned development are estimated for aggregated water features including streams, wetlands, and open waters as shown in Figure 4-9, Regional Impacts on Surface Water and Wetlands, located at the end of this chapter. Acreage impacts on streams/open water/wetlands would increase fourfold due to planned development. This would amount to 49 percent of the evaluated area. Impacts on fisheries, and riparian and aquatic habitats are reflected in these impacts from planned development and possible induced growth associated with project alternatives. Development activities and increased urbanization would be associated with increased sedimentation, stormwater runoff contaminants, and discharge levels to streams. These factors could cause degradation of water quality and fishery value, and changes to stream flow characteristics and aquatic habitat. Encroachment from development could cause disturbance and loss of riparian habitat. Cumulative effects on fisheries would include urban and rural growth and planned development/possible induced development and subsequent effects on stream encroachment, water quality, and fish habitat. Increased population would have a corresponding recreational demand on fisheries. The greatest cumulative impacts on fisheries and riparian/aquatic habitat would be associated with the Highway and Combination alternatives in the western Corridor (Eagle River and Blue River watersheds) due to possible induced growth. Direct impacts on streams from project alternatives could have high cumulative impacts on fisheries and riparian/aquatic habitat in the Clear Creek watershed (see section 3.5, Fisheries, for more detailed discussion of fisheries and fish species in the Corridor). However, alternative mitigation would also offer opportunities for habitat restoration.

4.4.4 Social and Economic Values

4.4.4.1 Affected Environment: Social and Economic Values

Historic Impacts from I-70 Construction

An overlay of the current I-70 footprint and adjacent roadside cut-and-fill slopes on historic aerial photography (1956 and 1962) was completed to analyze and quantify historic losses of developed areas due to initial construction of I-70. Before I-70 communities in the Corridor (west of the Continental Divide) have predominantly grown around the I-70 footprint and have not been directly disturbed by the footprint except for areas of historic mining activity located in Clear Creek County. Photographic analysis for developed areas disturbed by I-70 construction for select locations are presented on the maps located at the end of this chapter (see Figure 4-16 through Figure 4-31).

Historic losses of developed town areas and historic structures are documented only for communities in Clear Creek County. Approximately 35 acres of Clear Creek County developed lands were lost due to the original I-70 construction (based on 1956 and 1957 photography). The following losses were identified for Clear Creek County communities:

- Idaho Springs: approximately 8 acres lost within 161 acres of developed land
- Dumont: approximately 4 acres lost within 45 acres of developed land
- Downieville: approximately 6 acres lost within 16 acres
- Lawson: approximately 2 acres lost within 23 acres
- Georgetown: approximately 3 acres lost within 65 acres
- Silver Plume: approximately 12 acres lost within 65 acres
- Historic structures lost to I-70: approximately 80
- Historic loss of forest due to the I-70 construction: approximately 175 acres

Population Growth

As discussed in section 3.9, Social and Economic Values, the Corridor counties (nine-county Corridor area) are projected to grow by 100 percent from 2000 to 2025. The Corridor growth rate is more than twice the growth rate expected along the Front Range. This growth will be reflected in planned development, as well as infrastructure needs, job growth, increased recreational use, and increased commuting. Past trends in Corridor population growth and I-70 traffic are demonstrated in section 3.9 and Appendix J, Social and Economic Values. Eagle and Summit counties are shown to be most sensitive to population growth in relation to I-70 traffic growth. Baseline conditions for evaluation of cumulative effects include 2025 Colorado Department of Local Affairs (DOLA) population projections and 2025 Baseline peak I-70 trips/AADTs. The *Gaming Area Access EIS* (CDOT 2003)

indicates that Gilpin County's 2025 DOLA population is projected to increase by 4,000 due to gaming access improvements.

Water Supply

Population growth is associated with numerous possible infrastructure expansions such as roads, schools, emergency services, and utilities. Tier 1 studies have focused on water supply as a critical issue for the Corridor. The water supply in the Corridor and in the Front Range (which gets much of its supply from Corridor sources) is a major concern in terms of both availability and quality (see Appendix K, Overview of Water Availability and Growth, and Forest Service Land Management). The additional Corridor population projected for 2025, along with the estimated peak seasonal population (tourism, recreation, second homes) is estimated to increase Corridor water demand by almost 100 percent (or double the existing demand). See Table 4-4, Growth in Water Demand.

Table 4-4. Growth in Water Demand

County	Estimated 2000 Water Demand (acre-feet)	Estimated 2025 Water Demand (acre-feet)	Estimated Additional Annual Water Demand (acre-feet)
Clear Creek	2,161	3,942	1,780
Eagle	11,063	20,028	8,964
Garfield	10,402	19,026	8,624
Summit	8,365	15,018	6,653
Total	31,991	58,075	26,084
Gilpin	2,019	3,034	1,015
Grand	3,370	6,882	3,512
Lake	1,863	4,394	2,531
Park	3,659	13,982	10,324
Pitkin	3,913	6,211	2,298
Total all counties	46,814	93,496	46,681

Includes consideration of peak seasonal population

Economic Growth

According to 2025 DOLA projections, several economic indicators of the Corridor economy are expected to grow by 53 to 220 percent as shown in Table 4-5 and the following charts:

- Chart 4-27, Eagle County Growth Cumulative Impacts
- Chart 4-28, Summit County Growth Cumulative Impacts
- Chart 4-29, Corridor Regional Growth Cumulative Impacts

As discussed in section 3.9, Social and Economic Values, the Corridor economy is driven by tourism and second homes. DOLA projections do not consider the influence of I-70 traffic, although I-70 access is integral to the delivery of goods and services, commuters, tourists, and local business. Continued I-70 congestion during peak weekends and at localized commuting areas is expected to suppress DOLA economic projections as assumed in the REMI economic model for the No Action alternative, further described in section 3.9 and Appendix J, Social and Economic Values. In addition, economic benefits from project alternatives (except construction benefits) would not begin until completion of the alternative as assumed in 2025. Therefore, cumulative effects are based on economic conditions in Design Year (2025) +10, and DOLA 2025 projections were extrapolated to 2035 to provide a baseline condition.

Table 4-5. Growth of Corridor Economic Indicators

Economic Indicator	Percent Increase (2000–2025)
Employment	53
Personal Income	220
Gross Regional Product (GRP)	215

4.4.4.2 Cumulative Impacts: Social and Economic Values

Cumulative effects on social and economic values are generally the same as the impacts evaluated in section 3.9 and include the following:

- Impacts on population growth from induced or suppressed I-70 peak traffic associated with alternatives (induced/suppressed growth)
- Impacts on communities and regional populations (housing, commuting patterns, infrastructure) from changes in growth and economic conditions
- Impacts on community and county plans from changes in expected growth and economic conditions
- Impacts on economic conditions (economic indicator parameters: employment, personal income, and GRP) from alternatives and from projected growth

The magnitude of cumulative effects is based on projections for population and economic growth in relation to alternative indirect impacts.

Growth Impacts

Corridor Localized Impacts

Induced growth associated with the Transit and Combination Highway/Transit alternatives in Eagle County could increase these growth pressures and lead to substantial cumulative impacts as shown in Chart 4-27, Eagle County Growth Cumulative Impacts. The Combination alternatives could possibly double growth pressure in Eagle County. Alternatives with Transit components are expected to concentrate growth in urban areas with transit centers including Eagle, Avon, and Vail. Highway and Combination alternatives are expected to allow some amount of dispersed growth in rural areas and might cause increased pressure for community and county planning. In addition, induced growth in Eagle County could translate into increased commuting and cause induced growth impacts on adjacent counties such as Garfield County.

Chart 4-27. Eagle County Growth Cumulative Impacts

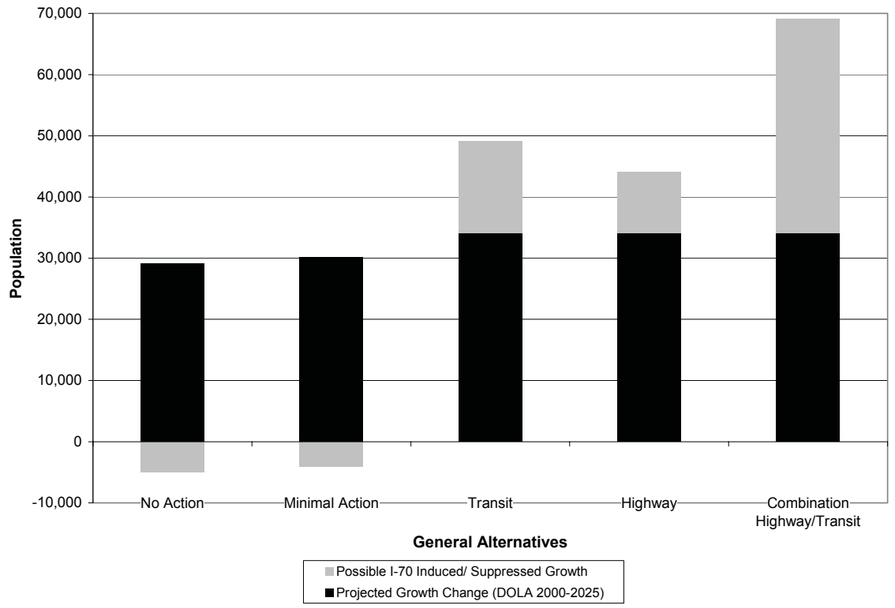
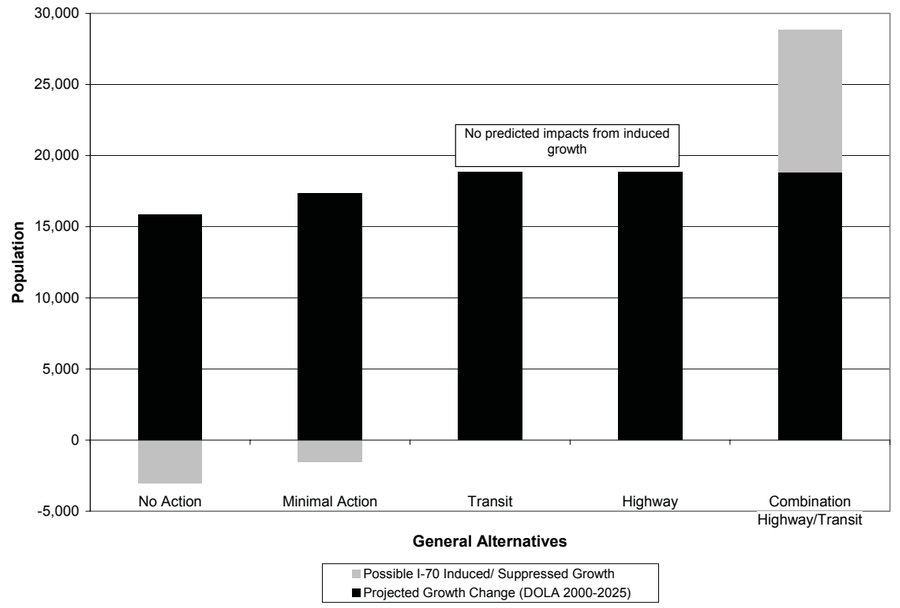


Chart 4-28. Summit County Growth Cumulative Impacts



Induced growth associated with the Combination Highway/Transit alternatives in Summit County could increase these growth pressures and lead to substantial cumulative impacts as shown in Chart 4-28, Summit County Growth Cumulative Impacts. The Combination Highway/Transit alternatives could possibly increase growth pressure by more than 30 percent. Alternatives with Transit components are expected to concentrate growth in urban areas with transit centers including Dillon and Silverthorne. Highway and Combination alternatives are expected to allow some amount of dispersed growth in rural areas and might cause increased pressure for community and county planning.

Regional Impacts

Induced growth associated with the Combination Highway/Transit alternatives in the Corridor area could increase existing growth pressures and lead to substantial cumulative impacts as shown in Chart 4-29, Corridor Regional Growth Cumulative Impacts. The Combination Highway/Transit alternatives could possibly increase growth pressure by 25 percent. Alternatives with Transit components are expected to concentrate growth in urban areas with transit centers. As stated for "Localized Impacts," Highway and Combination alternatives are expected to allow some amount of dispersed growth in rural areas and might cause increased pressure for community and county planning. Corridor induced growth pressure could have secondary impacts on numerous resources and could extend impacts on areas outside the Corridor due to employment needs and commuting. Projected growth in Gilpin County from gaming access improvements according to the *Gaming Area Access EIS* (CDOT 2003) is also shown on the chart. DOLA 2025 projections indicate a population that is 4,000 less than the gaming access projections.

Chart 4-29. Corridor Regional Growth Cumulative Impacts

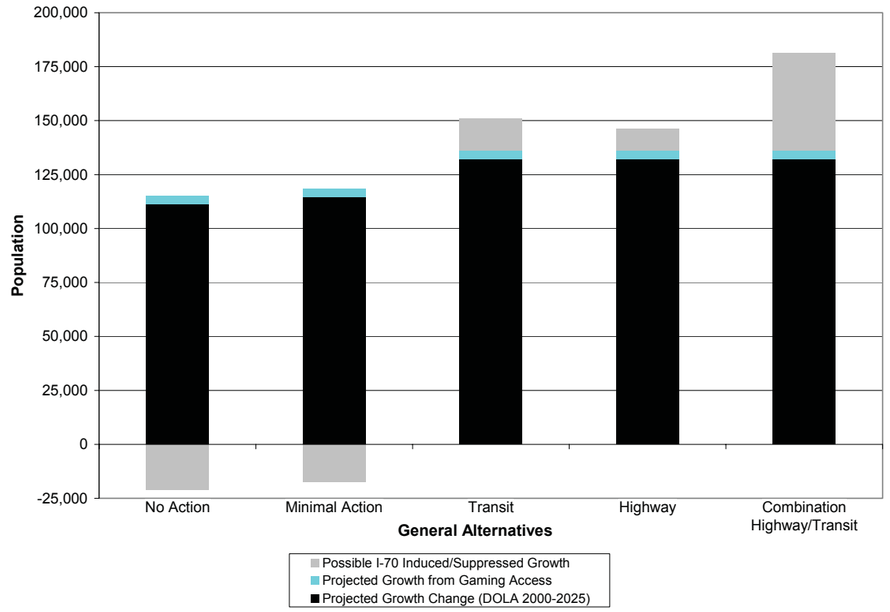
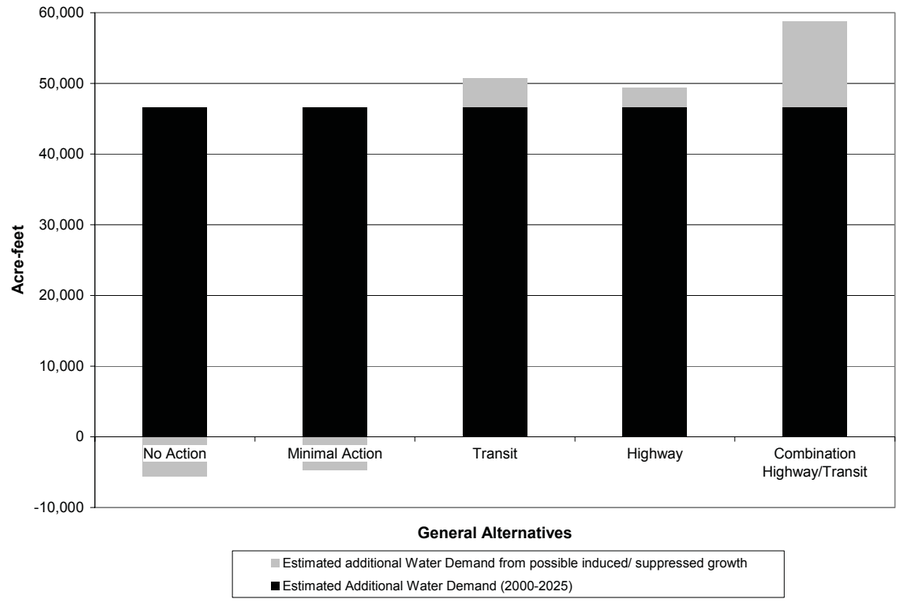


Chart 4-30. Cumulative Impacts on Corridor Water Supply



Water Supply

Suppressed or induced population growth would have direct impacts on water supply demand in the Corridor area. Chart 4-30, Cumulative Impacts on Corridor Water Supply, illustrates possible impacts on water supply demand.

Economic Impacts

Cumulative impacts are shown for major economic indicators by alternative on the following charts:

- Chart 4-31, Cumulative Impacts on Regional Employment
- Chart 4-32, Cumulative Impacts on Regional Personal Income
- Chart 4-33, Cumulative Impacts on Regional GRP

The greatest cumulative impacts on economic indicators are predicted for the No Action and Minimal Action alternatives. These alternatives might suppress regional employment projections by half of the projected change. The No Action and Minimal Action alternatives might suppress regional personal income and GRP by 25 percent of the projected changes. Counties with resort destinations that contribute the most to the existing tourism economy (Eagle, Pitkin, Summit, and Grand) would have the greatest cumulative impacts from the No Action and Minimal Action alternatives. Although induced growth is not indicated for Clear Creek County, the cumulative economic effects of alternative construction associated with Highway and Combination Highway/Transit alternatives could be substantial, as discussed in section 3.9. Additional effects might be reflected in the state economy through state taxes, also as discussed in section 3.9.

Chart 4-31. Cumulative Impacts on Regional Employment

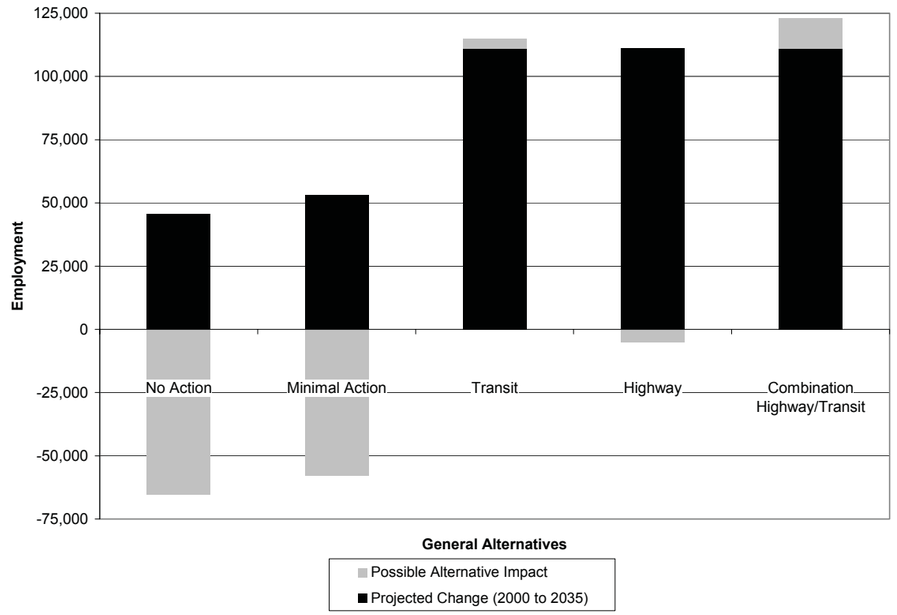


Chart 4-32. Cumulative Impacts on Regional Personal Income

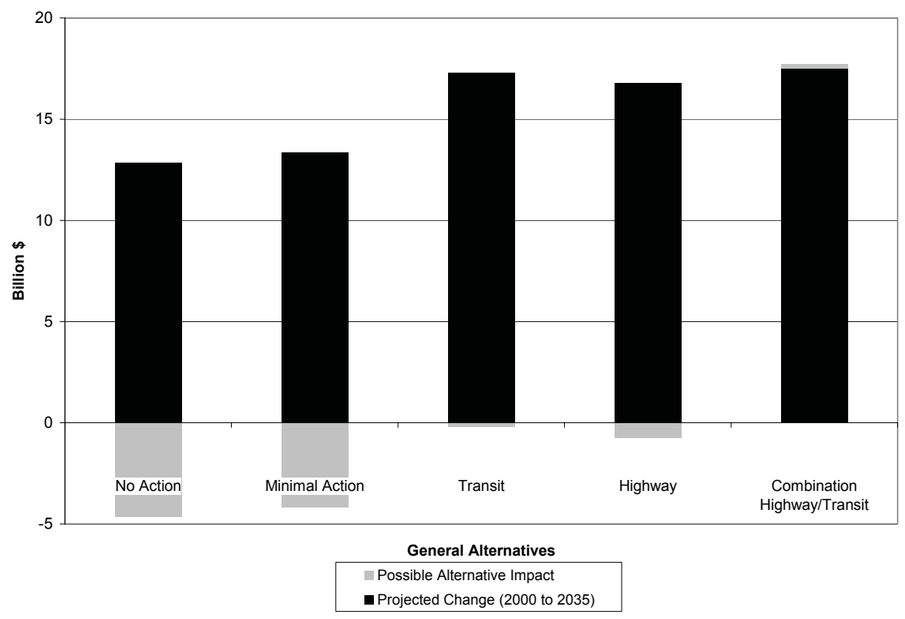
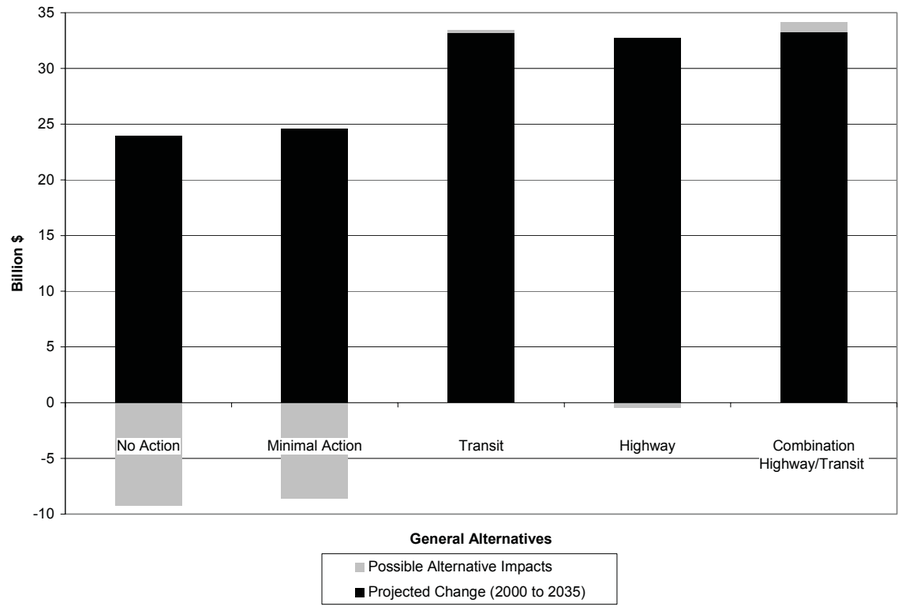


Chart 4-33. Cumulative Impacts on Regional GRP



4.4.5 Noise

4.4.5.1 Affected Environment: Noise

At one point in time, the entire Mountain Corridor was wilderness. Ambient sounds included those from wind blowing through the trees, rushing rivers, and animals. Based on measurements conducted recently in an undeveloped area on the Western Slope of Colorado, background sound levels were likely in the 20 to 30 dB(A) range.

The first major change to the acoustic environment of the Mountain Corridor came in the mid-1800s when mining was introduced in Clear Creek County. Mining ushered in noise from steam trains, mills, blasting, and other mining-related activities. In contrast, Vail and the Dillon Valley were still largely wilderness at this time.

The next major change to the acoustic environment of the Mountain Corridor came in mid-1930s to the early 1950s, when US 6 was constructed through Clear Creek Canyon. Traffic volumes and speeds on the highway were not nearly as great as those on I-70 today, though. Nonetheless, the highway created a somewhat constant source of noise. The greatest traffic volumes were likely in Clear Creek County, and average noise levels may have been in the 40 to 50 dB(A) range along the highway in Clear Creek County.

The biggest change came in the 1970s when I-70 was completed from Denver to the Western Slope. Initial noise levels along the highway were likely in the 50 to 60 dB(A) range along the highway in Clear Creek County. Average noise levels have increased to the 60 to 70 dB(A) range as a result of increases in traffic volume, speed, and truck percentage.

4.4.5.2 Cumulative Impacts: Noise

The proposed transportation improvements would increase the capacity of the highway and/or add train and bus facilities. If left unmitigated, noise levels are predicted to increase anywhere from 3 to 5 dB(A) under the project alternatives. Localized increases of 10 dB(A) could occur.

4.4.6 Recreation Resources

4.4.6.1 Affected Environment: Recreation Resources

Recreation resources have been characterized based on Arapaho and Roosevelt National Forest (ARNF) and White River National Forest (WRNF) skier visits and winter and summer recreation visitor days (RVDs). Consideration of developed and dispersed recreation activities and Corridor resident and nonresident visitation is also included in the analysis. Corridor resident growth, increased visitation from nonresidents (primarily Front Range visitors), and possible induced Corridor growth and increased forest destination trips on I-70 could cause impacts on forest recreation resources. Existing conditions associated with 2000 visitation, forest plan projections, and 2025 projections are used to form a baseline for the evaluation of project alternative impacts. ARNF and WRNF forest plan projections are presented in section 3.14, Recreation Resources.

4.4.6.2 Cumulative Impacts: Recreation Resources

Cumulative effects on recreation resources are defined below:

- Increased winter USFS visitation (impacts on skier visits and winter RVDs) due to increased winter forest destination trips from project alternative peak travel
- Increased summer USFS visitation (impacts on summer RVDs) due to increased summer forest destination trips from project alternative peak travel
- The change (2000 to 2025) in skier visits and winter and summer RVDs for the I-70 districts of WRNF and ARNF (in relation to forest plan projections)

The actual magnitude of cumulative effects on USFS recreation resources would be tempered by forest management activities as discussed in section 3.14, Recreation Resources. However, possible visitation changes have been quantified to provide a gauge of pressure on recreation resources. A more detailed discussion of the methodology for visitation changes is contained in Appendix M, Recreation Resources.

ARNF Impacts

Possible cumulative impacts on recreation resources are summarized in Table 4-6. Note that RVDs (measured per 12-hour continuous activity in the forest) are not directly comparable with forest destination trips (which could reflect very short site visits) and are, therefore, not shown together in chart form. 2025 projections indicate that ARNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 0.6 million, 0.9 million, and 2.6 million, respectively, from 2000 levels. Alternative impacts from the No Action and Minimal Action alternatives might decrease these projections, while the Combination alternatives could increase visitation levels by 0.4 million winter forest destination trips and 0.4 million summer forest destination trips in 2025.

Table 4-6. Cumulative Impacts, Arapaho and Roosevelt National Forests[a]

	Winter Impacts			2025 Summer Impacts	
Alternative	2025 Annual Change in Winter Forest Destination Trips (millions)	Projected Change in Skier Visits from 2000 to 2025 (millions)	Projected Change in Winter RVDs from 2000 to 2025 (millions)	2025 Annual Change in Summer Forest Destination Trips (millions)	Projected Change in Summer RVDs from 2000 to 2025 (millions)
No Action	-0.35	0.58	0.88	-0.39	2.57
Minimal Action	-0.26			-0.29	
Transit	0.21			0.23	
Highway	0.04			0.04	
Combination	0.39			0.43	

[a] *Includes Clear Creek and Sulphur districts.*

WRNF Impacts

Possible cumulative impacts on recreation resources are summarized in Table 4-7. Note that RVDs (measured per 12-hour continuous activity in the forest) are not directly comparable with forest destination trips (which could reflect very short site visits) and are, therefore, not shown together in chart form. 2025 projections indicate that WRNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 1 million, 0.8 million, and 3 million, respectively, from 2000 levels. Alternative impacts from the No Action and Minimal Action alternatives might decrease these projections, while the Combination alternatives could increase visitation levels by 1.3 million winter forest destination trips and 1 million summer forest destination trips in 2025.

Table 4-7. Cumulative Impacts, White River National Forest[a]

	2025 Winter Impacts			2025 Summer Impacts	
Alternative	2025 Annual Change in Winter Forest Destination Trips (millions)	Projected Change in Skier Visits from 2000 to 2025 (millions)	Projected Change in Winter RVDs from 2000 to 2025 (millions)	2025 Annual Change in Summer Forest Destination Trips (millions)	Projected Change in Summer RVDs from 2000 to 2025 (millions)
No Action	-0.94	0.99	0.85	-0.76	3.04
Minimal Action	-0.71			-0.57	
Transit	0.66			0.53	
Highway	0.15			0.12	
Combination	1.32			1.04	

[a] *Includes Sopris, Aspen, Eagle, Holy Cross, and Dillon districts.*

Forest Service Considerations and Management Issues

The above estimates were intended to provide an indication of possible forest visitation pressure. Recreational use of forest lands and other recreational lands is not infinite. As recreation use has grown, so have pressures on the financial and environmental resources that define and support the recreation infrastructure throughout the ARNF and WRNF. The USFS has already instituted some controls along I-70 to both recreational use and recreational opportunities available to the public. Quality recreation depends on access, resource condition, facilities, and the ability to disperse and manage use across the forests.

Water Supply and Recreational Use

Water quality and quantity are essential requirements for many recreational activities such as rafting, fishing, and boating. Cumulative impacts on water quality and water supply demand from Corridor growth might affect stream flows, reservoir levels, and aquatic habitat used for recreational activities.

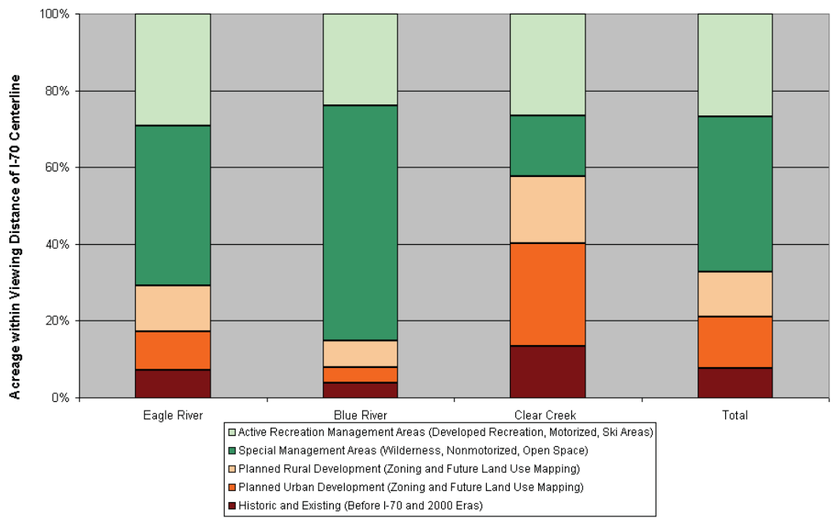
4.4.7 Visual Resources

4.4.7.1 Affected Environment: Visual Resources

Cumulative stresses to visual resources are general changes that would affect the rural character of the Corridor setting. Existing and historic development is used as a baseline for comparison of future impacts from planned development and possible induced growth associated with alternatives. Corridor-wide impacts on visual resources from development are indicated to increase from 7.5 percent to 32 percent of the total acreage visible along I-70 (see Chart 4-34, Visual Resources Affected Environment). The remainder of the watershed area within visibility would continue as forest management, recreation, and open space uses, which would protect wetland resources within the watershed study area. This percentage increase is reflected in all the watersheds.

The transition from current to planned development would result in more contiguous urbanized areas outside forest lands, especially within Eagle, Summit, and Jefferson counties, resulting in a visual change to landscape settings in these areas.

Chart 4-34. Visual Resources Affected Environment



4.4.7.2 Cumulative Impacts: Visual Resources

Visual resources cumulative effects include the following:

- Effects on the I-70 viewshed from planned development and induced growth associated with alternatives
- Effects on Corridor residents, recreational users, and I-70 travelers from planned development, induced growth associated with alternatives, and visual characteristics of project alternatives
- Effects on rural character from increased development densities possibly conflicting with local planning goals

The magnitude of cumulative effects on visual resources is determined based on the increase in development impacts on the I-70 viewshed, impacts on Corridor rural character, impacts from induced growth, and impacts from specific visual characteristics of project alternatives. The formula used to calculate indirect impacts on visual resources from possible induced growth is provided below.

$$\frac{\text{total current \& planned development (GIS overlay on I-70 viewshed) - current development (GIS overlay on I-70 viewshed) (acres)}}{\text{2025 DOLA population - 2000 DOLA population}} \times \text{induced population prediction (alternative specific)} \times \text{land use growth impact factor - visual resources (alternative specific)}$$

Additional cumulative impacts could result from indirect impacts associated with increased growth pressure in Eagle County (Transit and Combination Highway/Transit alternatives) and Summit County (Combination Highway/Transit alternatives), beyond planning goals.

As described previously in section 3.13, Visual Resources, each alternative would include various components that could affect the visual setting along the Corridor. The degree to which alternatives would affect the setting would depend primarily on the level of visual contrast associated with proposed elements and the proximity from which they are viewed. Alternative elements with the greatest potential for contrast would include the addition of structures that are large in size, numerous in quantity, and/or of high diversity in shape. The Rail with IMC and AGS alternatives are anticipated to result in the greatest direct impacts on visual resources. Indirect impacts on visual resources would center on the potential for changes in the rural Corridor setting associated with possible induced growth and development associated with project alternatives. Currently 13 percent of the viewshed from I-70 is developed, and community plans indicate that much more of the Corridor area will be developed in the future. Planned future development (in addition to past and present development) will consume 32 percent of the Corridor viewshed area. Pressures for additional increased development from alternatives might alter the highly valued Corridor character from a rural mountain character to an urban character.

While methods of deriving cumulative impacts on visual resources prevent a direct comparison of the relative impacts, some general conclusions can be drawn. Additive impacts from planned development and possible induced growth would produce cumulative visual impacts. The Combination alternatives, which would have the greatest potential for inducing growth (in the Eagle River and Blue River watersheds), would, therefore, have the greatest cumulative visual impacts of all the alternatives. The Transit alternatives would have intermediate impacts on visual resources due to increased urbanization around transit centers in the Eagle River watershed. The Highway alternatives would also have intermediate impacts on visual resources due to distribution of induced growth based on existing trends in urban and rural development in the Eagle River watershed.

Chart 4-35, Cumulative Impacts on Visual Resources, Chart 4-36, Eagle River Watershed Cumulative Impacts on Visual Resources, and Chart 4-37, Blue River Watershed Cumulative Impacts on Visual Resources show the cumulative impacts on visual resources.

Chart 4-35. Cumulative Impacts on Visual Resources

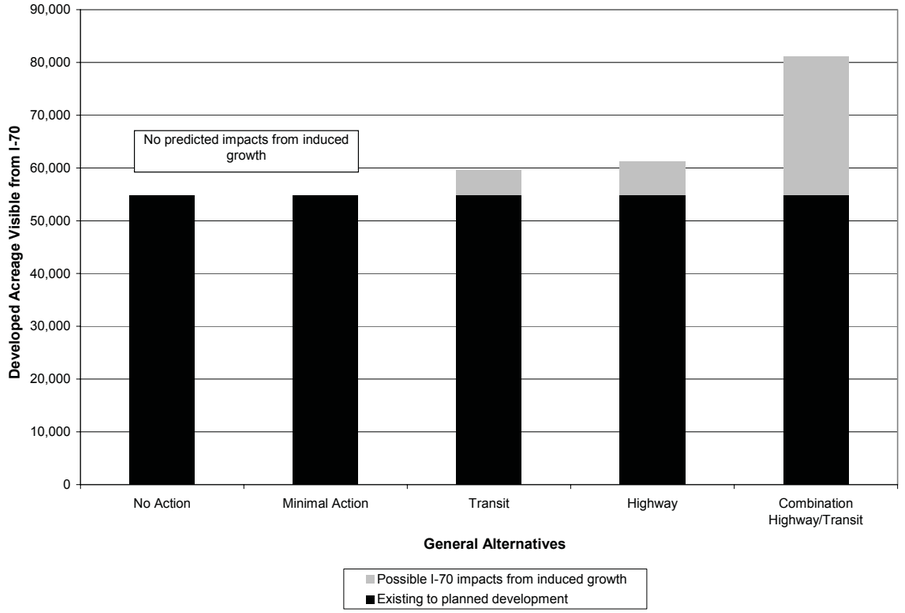


Chart 4-36. Eagle River Watershed Cumulative Impacts on Visual Resources

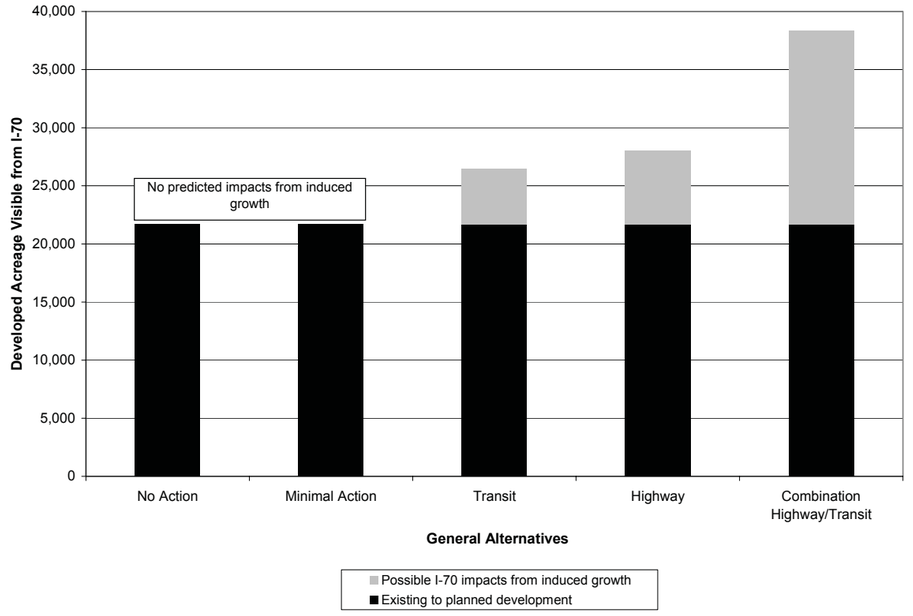
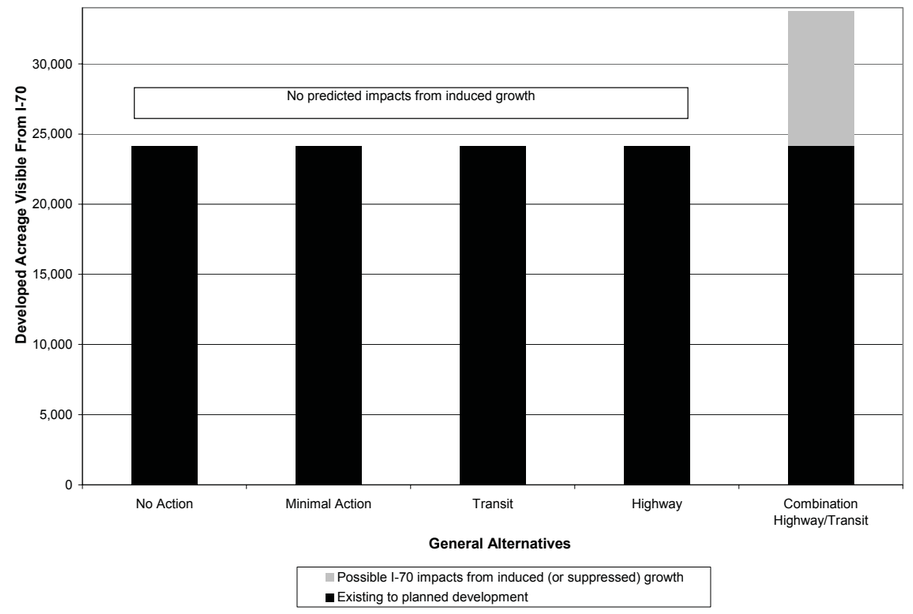


Chart 4-37. Blue River Watershed Cumulative Impacts on Visual Resources



4.4.8 Historic Properties

4.4.8.1 Affected Environment: Historic Communities

The cumulative impact analysis focuses on potential effects on the historic communities identified in the Corridor, including Glenwood Springs (associated Hot Springs Historic District, 5GF.1050, and potential historic commercial district); Silver Plume and Georgetown (Georgetown-Silver Plume National Historic Landmark District, 5CC.3); Lawson, Dumont, and Downieville (potential historic area); and Idaho Springs (Commercial District, 5CC.201, and potential historic area). Appendix N, Historic Property Survey, Native American Consultation, and Paleontological Resources, provides detailed descriptions of each of these historic properties.

More than 200 individual historic properties have been identified within the Area of Potential Effect (APE) shown on Figure 3.15-2. They are located both within and outside these historic communities, and described in section 3.15, Historic Properties and Native American Consultation. While they may also be subject to cumulative impacts, the scope of the cumulative analysis is on the historic communities.

Because only Minimal Action alternative interchange improvement concepts are identified for the Glenwood Springs area in Garfield County (see section 2.2), this community is not included in the cumulative impact discussion. Tier 2 analyses will include an appropriate cumulative impact discussion for this location. All of the remaining community areas are located within the historic mining areas of Clear Creek County, including Silver Plume; Georgetown; Lawson, Downieville, and Dumont: and Idaho Springs. Each community was directly affected by the construction of I-70 in the 1960s and experienced visual and noise impacts as a result of the construction and operation of the interstate adjacent to and through the communities.

The Georgetown-Silver Plume National Historic Landmark (NHL) District is located within a larger area identified as the Silver Mining Heritage Area. This resource is a complex of mining and residential-related resources that dates to the late nineteenth century and is described in Appendix N.

4.4.8.2 Historic Context for Past Actions

Communities in Clear Creek County were established during the Colorado gold and silver rush that began in 1858 with placer mining. Most of the early placer operations, centered on various sand bars and other creek deposits, were mined out in a few years, after which hardrock mining became the dominant form of mining in the County. The change in mining methods led to significant socioeconomic changes, stimulating the development of communities. Prospectors and placer miners became employees rather than independent operators in milling operation facilities, such as stamp mills, arastras, and smelters. Mining and milling activities in the area also led to incredible changes in the natural environment of Clear Creek County. The placer mines tore up the creek bottoms and bars in the creeks while the hardrock mines and mills often dumped waste materials directly into the waterways. The need for fuel led to clear-cutting many of the neighboring forests and, when combined with the mining and milling, caused severe degradation of local water supplies and soils.

Mining continued for the rest of the nineteenth century and into the early twentieth century until rising production costs and decreases in mineable deposits severely curtailed mining activity. Huge mills, such as the Argo in Idaho Springs, sat idle, and the age of gold and silver gave way to the post-mining era for Clear Creek County. As shown on Chart 4-38 and Chart 4-39, county and community populations reached their peak from 1870 to 1900 during the mining boom. The county population declined sharply after 1890 as mineral resources were depleted and economic conditions for the mining industry took a downturn, reaching a low of a little more than 2,000 in 1930. Since then, more of Clear Creek County's economic base has been tied to tourism and recreation.

Chart 4-38. Clear Creek County Population, 1870 to 2000

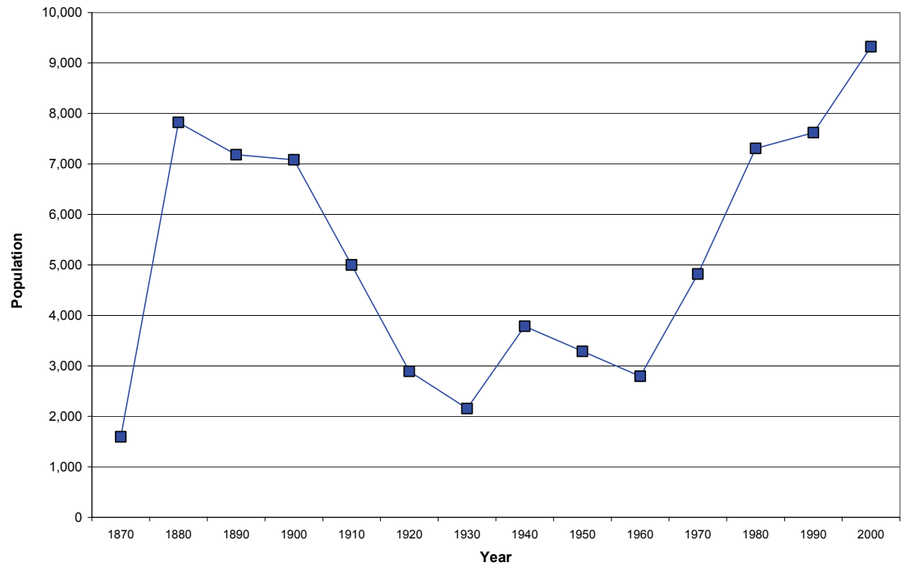
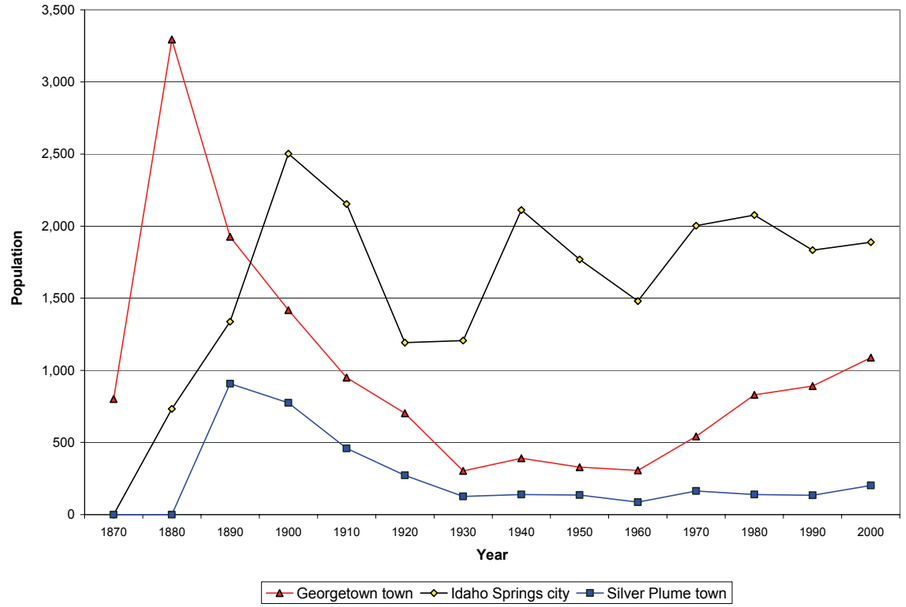


Chart 4-39. Community Populations in Clear Creek County, 1870 to 2000



Corridor transportation before the gold rush consisted of trails and wagon roads. However, with the onslaught of mining activity, railways up Clear Creek Canyon were in place by 1870. Stream valleys, such as Clear Creek, offered the easiest path for rail and roadway construction. Numerous railway lines served the mining industry into the early twentieth century. However, with the decline of the mining industry, most of these lines were abandoned and trains seldom went west of Idaho Springs by the 1930s. Transportation evolution in the I-70 Corridor can be tied to the growth of tourism as early as the 1860s, when rail companies published guides, offered special fares, and tried other ways to get people onto the trains for vacations. One of the highly touted attractions of nineteenth century Colorado was the Georgetown Loop on the Colorado Central Railroad.

As early as 1910, auto travel through Clear Creek County made use of wagon roads linked together and denoted by small route markers. The first Federal Highway Act (signed into law in 1916) provided federal monies to assist Colorado in the construction of US 40, which crossed Clear Creek County as far west as Empire. Later in the 1920s and 1930s, US 6 was designated; for part of its route it paralleled US 40, part of it was co-terminus with US 40, and part of it extended on west, becoming the first US highway to follow the length of the current I-70 Corridor. During the years of the Eisenhower administration, transportation planners and others felt that a system of divided highways would be necessary for national defense in any future war. Corridor developers and chambers of commerce believed such a highway would assist the local economy and lead to more tourism. After extensive lobbying by Coloradoans, the federal government determined that an interstate west out of Denver should be built to improve upon the existing US 6 and US 40 roadways, thus creating Interstate-70.

Clear Creek County and community populations began to swing upward again (although not nearly as dramatically as during the mining boom) during the early 1960s with the completion of I-70 interchanges, tunnels, and highway through Clear Creek County. County population exceeded the mining boom era population in 2000 (see Chart 4-38). Table 4-8 provides a historic succession of I-70 transportation features constructed in Clear Creek County.

Initial construction of I-70 through these historic community areas occurred between the late 1950s and early 1970s. The interstate came to Idaho Springs first and progressed west through Lawson, Downieville, and Dumont and then Georgetown and Silver Plume. The westbound and eastbound bores of the Eisenhower-Johnson Memorial Tunnels (EJMT) were opened in 1973 and 1979, respectively. Approximately 35 acres of Clear Creek County developed lands were lost due to I-70 construction, and an estimated 80 historic structures were lost (based on 1956 photography – see Figure 4-18 to Figure 4-31).

Table 4-8. Timeline of I-70 Construction in Clear Creek County

Year	Milepost	Location Description
1957	241	E. Idaho Springs interchange
1958	239, 240	W. Idaho Springs interchange, 13th Avenue interchange
1959	244	US 6 interchange
1960	240-241	Idaho Springs bypass
1961	242, 243	Twin Tunnels, Hidden Valley interchange
1964	216	Loveland Pass interchange
1965	232, 233, 234, 235, 238	Empire Junction interchange, Lawson interchange, Downieville interchange, Dumont interchange, Fall River interchange
1966	233-239	Empire to W. Idaho Springs
1968	227-232, 226, 228	Silver Plume to Empire, Silver Plume interchange, Georgetown interchange
1970	242-244	East Idaho Springs to US 6
1971	221, 248	Bakerville interchange, Beaver Brook interchange
1972	217-226, 218	Loveland Basin to Silver Plume, Herman Gulch interchange
1973	247, 214-215, 206-216	Hyland Hills interchange, EJMT westbound, Silverthorne to Loveland Basin westbound
1975	245-252	US 6 to El Rancho
1979	206-216, 214-215	Silverthorne to Loveland Basin eastbound, EJMT eastbound

Historic community photography, together with photography of the existing I-70, and simulations of proposed alternatives provide a perspective on the changes these communities have experienced and may see in the future. See Figure 4-16 through Figure 4-36.

4.4.8.3 Community Overview

While each community area is unique in its history, events, structures, people, and reactions to events, there are common threads of experience when related to the impact of initial construction of I-70. An example of what happened during the original construction of the interstate through Clear Creek County in the 1950s and 1960s is illustrated in an article, “Where the Road Takes You - The Impact of Interstate 70 on Georgetown, Colorado,” written by Robert Autobee, a historian with the Colorado Department of Transportation. The article was published in its entirety in March 2004 in the *Historic Georgetown, Inc. Journal*, compiled for the membership of Historic Georgetown, Inc. A synopsis of this article is provided in the text box below to provide an example of I-70 construction and its past influences on Corridor communities.

The sense of place of the Clear Creek County communities is strongly tied to the landscape setting and historic context. Historic preservation is a central focus of the lifestyle of these communities, and towns take an active stewardship role in the preservation of the local historic heritage. Lifestyle and social economic values are a part of the historic districts in which these people reside. The paragraphs that follow summarize each community and its historic resources that might be affected cumulatively by the project alternatives.

Georgetown and Silver Plume

The Georgetown-Silver Plume NHL District represents one of the most scenic and historic of all of Colorado’s mining districts. The Georgetown-Silver Plume NHL District includes the entire commercial and residential areas of both the Georgetown and Silver Plume communities, as well as the railroad grade connecting them. Major construction of the existing I-70 alignment through these communities was completed during the mid-1960s and early 1970s. The Georgetown-Silver Plume NHL (listed in the NRHP in November 1966) lost the following developed land to the initial construction of I-70: 12 acres in Silver Plume and 3 acres in Georgetown. Since 1960, the population in Silver Plume has grown from less than 100 to a current population of 203, and the population of Georgetown has grown from less than 500 to a current population of 1,111 (see Chart 4-39).

Lawson, Downieville, and Dumont

The communities of Lawson, Downieville, and Dumont were started as the result of the gold and silver rush dating back to the 1860s. With the construction of I-70 in the mid-1960s, there was an estimated loss of 12 acres to these communities, as shown on Figure 4-22 to Figure 4-27. The Mill Creek Valley Historical Society has documented the loss of 30 to 50 percent of their historic structures due to the construction of I-70 in the 1960s. The loss of these structures and the destruction of the former community footprints have resulted in long-term impacts on the historic heritage and sense of place of these communities. Ongoing effects noted by residents include visual and noise impacts. The Mill Creek Valley Historical Society was founded in 1981 with a mission to enrich and

educate citizens about their rich mining heritage while preserving the few buildings that have been spared. The Society currently owns and manages three buildings: the Dumont School (opened 1909), the Coburn Cabin (1870s), and the Mill City House (1860). Existing individually eligible sites within 500 feet of I-70 include the Lawson School and the Dumont School.

This is a complex of domestic, residential, and commercial architectural sites and features. It dates to the late nineteenth century. The resource has the potential to be considered eligible for the NRHP as a historic area. Local parties identified the 38 individual components of this resource.

Idaho Springs

The population of Idaho Springs reached a peak of 2,500 in 1900 and dropped off during the 1920s and 1930s. As shown on Chart 4-39, the town has experienced a sequence of growth cycles since the 1930s. The Idaho Springs Commercial District contains various late nineteenth century commercial buildings focused on Main Street; the entire setting encompassing the town is a historic area that is considered eligible for the National Register of Historic Places. Idaho Springs lost 8 acres of developed land and numerous structures to I-70 construction during the late 1950s and 1960s as shown on Figure 4-28 to Figure 4-31. As with the county and other historic communities, Idaho Springs is oriented around historic preservation, as represented by the Historical Society of Idaho Springs, Inc.

"Where the Road Takes You - The Impact of Interstate 70 on Georgetown, Colorado"

This is a summary of and excerpts from, "Where the Road Takes You - The Impact of Interstate 70 on Georgetown, Colorado," written by Robert Autobee, a historian with the Colorado Department of Transportation. The article was published in its entirety in March 2004 in the *Historic Georgetown, Inc. Journal*, compiled for the membership of Historic Georgetown, Inc. The following discussion focuses on aspects of the article highlighting how the I-70 alignment was influenced by efforts for historic preservation.

I-70 through Georgetown brought with it a series of unlikely circumstances. In 1956, the Eisenhower administration presented its plans to build the largest public works project in the nation's history – the Interstate Highway System. When the news reached Georgetown, the coming of the highway did not inspire its citizens to dream about the future as much as it caused many to reflect on what was important about the town's past.

The idea to preserve Georgetown sprang from a discussion in late 1958. Denver architect Jared B. Morse believed that private purchases of historic lands and structures would lead to a partnership with county and town governments and local businesses. The following year, the Colorado Historical Society secured 80 aces of the valley. Directed by James Grafton Rogers (Chairman of the Historical Society), the Society followed a multipoint strategy that would save Georgetown in advance of the interstate. Working with interested local preservationists, the Society recommended "acquiring all the land possible in the valley from Georgetown to Silver Plume."

As the 1960s began, Georgetown's preservationists awaited the interstate's arrival. The Federal Highway Administration's original plan for I-70 had the multilane highway…cutting Georgetown in half. The preservationists realized that no matter how the interstate entered the valley, it would affect some of Georgetown's and Silver Plume's historic treasures. However, they held the trump card through the Society's ownership of most of the valley between the two towns.

The Society's land grab to save the town sent the Colorado Department of Highways back to the drawing board. Designers and engineers now looked to blasting the mountainside to widen the existing US 6 and US 40 right-of-way to meet interstate standards. A handful of Georgetown's historic structures stood in the path of the interstate. This included ten houses and two city streets. Allowances were made in the highway right-of-way plans to accommodate the Georgetown Loop railbed.

As Chair of the state Historical Society and a resident of Georgetown, Rogers began the work that led to the creation of the Georgetown-Silver Plume National Historic Landmark District in November 1966. This designation from the National Park Service protected the town from federal and state highway authorities intent on building an interstate through town.

However, for most of Georgetown, preparation and preservation prevented the total destruction of the town's heritage by construction. By 1966, the town began to debate what a short strip of asphalt would mean to the town's future.

In October 1966 clearing the right-of-way between Georgetown and Silver Plume began. The Silver Plume to Empire segment of I-70 (mileposts 227 to 232) was completed in 1968.

4.4.8.4 Cumulative Impacts: Historic Communities

Based on the social and economic values analysis of growth effects (see section 3.9, Social and Economic Values) and local input, the historic communities in Clear Creek County are not particularly susceptible to the indirect impacts associated with the growth inducing effects that Eagle and Summit counties would experience by some project alternatives. As a result, due to the lingering past effects of the construction of I-70, and the ongoing influence of I-70 to the historic communities in the corridor, cumulative impacts for historic properties would be driven by any added loss of integrity to the historic properties, including:

- Direct impacts on historic properties including loss of structures and property encroachment in addition to those impacts associated with the initial I-70 construction. Section 3.15, Historic Properties and Native American Consultation, provides an analysis of the direct impacts on historic properties in the Corridor.
- Visual impacts caused by changes to the historic setting within the communities, from construction of project alternatives in addition to those impacts associated with initial I-70 construction. Section 3.15 also provides an analysis of the visual impacts on historic properties in the Corridor. This analysis is presented in context to the sense of place for communities where even a small change would be perceived as detrimental due to sensitivity of the communities as a result of the initial I-70 construction.
- Direct effects from alternatives on historic properties as well as visual impacts on the setting would result in cumulative impacts on the Georgetown-Silver Plume NHL District, Lawson, Downieville, Dumont historic area, and the Idaho Springs historic area.

Conclusions about Cumulative Impacts to Historic Communities

Minimal direct impacts on historic properties (loss of structures and property encroachment) in addition to those impacts associated with the initial I-70 construction are expected to occur within the historic communities. All direct effects to historic properties will occur within existing I-70 right-of-way. Mitigation measures will be identified based on the type of effects identified under Section 106. Minimal cumulative direct effects are anticipated. A summary of anticipated impacts to historic properties associated with project alternatives, all of which are in Clear Creek County, is listed below.

- The Minimal Action alternative is anticipated to result in impacts on up to four historic properties. All of these effects are expected to occur within existing I-70 rights-of-way.
- Transit alternatives: The Transit alternatives (Rail with IMC, AGS, Dual-Mode and Diesel Bus in Guideway) would have additional potential direct effects on up to six properties.
- Highway alternatives: Potential direct effects due to Highway alternatives have been identified for up to five properties.
- Combination Highway/Transit Alternatives: Potential direct effects due to the Combination alternatives have been identified for up to six properties.

Visual impacts caused by changes to the historic setting within the communities, from construction of I-70 alternatives in addition to those impacts associated with the initial I-70 construction are highly variable depending on the existing physical relationship between the community I-70, the type of alternative, and the specific community. All build alternatives are anticipated to result in impacts ranging from low to high depending on the level of visual contrast anticipated within the setting and the proximity in which it is viewed. It is important to note that project/setting contrast is the primary indicator of visual impacts. Because I-70 and, consequently, project alternatives that are closely aligned to I-70 are largely within foreground distance zones from sensitive community and recreation viewpoints, contrast associated with project elements is the primary factor in determining visual impacts. As documented in the bullets below, the AGS and Combination Six-Lane Highway with AGS alternatives are anticipated to result in the greatest visual impacts.

- The Minimal Action alternative would result in localized changes and would primarily result in changes that do not attract attention and are subordinate to the setting (weak contrast). The Minimal Action alternative is anticipated to result in the least visual impacts.
- Elevated portions of the Rail with IMC alternative (30 percent) would result in changes that attract attention and dominate the setting (very strong contrast). On-grade portions (70 percent) would result in changes that are noticeable but subordinate to the setting (moderate contrast). Rail is anticipated to result in among the greatest visual impacts.
- The AGS alternative, which would be a completely elevated system, is anticipated to result in changes that attract attention and dominate the setting (strong contrast). The AGS alternative is anticipated to result in the greatest visual impacts.
- The Bus in Guideway alternatives are primarily on grade in the median and would result in changes that do not attract attention and are subordinate to the setting (weak contrast). In areas where this alternative would be elevated, such as in Idaho Springs and Floyd Hill, they would attract attention and dominate the setting (very strong contrast).
- Changes associated with the Highway alternatives would range from very strong to weak contrast. Areas of large scale retaining walls and major cut and fill slopes would result in changes that attract attention (strong contrast). Areas of elevated structures (Idaho Springs and Floyd Hill) would attract attention and dominate the setting (very strong contrast).
- The Rail portion of the Combination Six-Lane Highway with Rail and IMC alternative would be on grade within the median east of the EJMT and would result in changes that are noticeable but subordinate to the setting (moderate contrast). In areas where this alternative would be elevated, such as Idaho Springs and Floyd Hill, it would attract attention and dominate the setting (very strong contrast). The Combination Six-Lane Highway with Rail and IMC alternative is anticipated to result in among the greatest visual impacts.
- The AGS portion of the Combination Six-Lane Highway with AGS alternative would be elevated within the median, which would result in changes that attract attention and dominate the setting (strong contrast). Similar to the AGS alternative, the Combination Six-Lane Highway with AGS alternative is anticipated to result in the greatest visual impacts.
- Changes associated with the Combination Six-Lane Highway with Dual-Mode and Diesel Bus in Guideway alternatives would range from very strong to weak contrast. In areas where this alternative would be elevated, such as in Idaho Springs and Floyd Hill, they would attract attention and dominate the setting (very strong contrast).

Mitigation measures for visual impacts will focus on structural elements (such as colors, textures, structure profiles) and landform characteristics (including grading technique and revegetation).

Local historic communities will perceive impacts to the historic sense of place, not related to the minimal direct impacts associated with the various alternatives so much as from the visual effects and visual contrast provided by alternatives.

Completion of compliance with Section 106 will take place during subsequent Tier 2 project–level environmental analysis, documentation, and review. A programmatic agreement (PA) for 106 compliance involving FHWA, ACHP, DOI, NPS, BLM, FS, SHPO, CDOT, and other agencies or consulting parties, as appropriate, will be executed for the PEIS before preparation of a Record of Decision. This PA will include the steps for Section 106 agency responsibilities at the Tier 2 level. Guidance for mitigation of identified cumulative impacts can be included in this document.