3.4 Water Resources

The I-70 Corridor winds through stream valleys that have been used for transportation since the 1800s, when wagon roads and railroads were constructed to access the rich ore deposits of the Colorado Mineral Belt. Historic impacts on water quality and streams are associated with these transportation routes. Existing I-70 is located primarily in stream valleys due to the steep terrain and rugged nature of the mountainous environment in the Corridor area.

The Corridor's mountain climate is a major factor in the operation and maintenance of I-70 during the winter months, when ice and snow accumulation is prevalent. This has an effect both on travel safety and on water quality; winter mountain conditions require snow removal and highway winter maintenance using sand or deicers, which can discharge to waterways. Another important element of Colorado's climate is the heavy rainfall events that occur in the mountains, which can cause sediment to collect on highway surfaces, as well as causing sedimentation of streams.

This section addresses historic and existing water quality and stream issues along the Corridor, based on major watersheds traversed by the I-70 footprint, and assesses impacts of the project alternatives on these water resources.

Water Resources Issues

Direct Impacts

- Impact of highway runoff and winter roadway maintenance activities on water quality
- Disturbance of historic mine waste materials due to construction activities of the project alternatives that might cause the release of contaminants (such as heavy metals) to streams
- Potential additional impacts on water quality impaired streams and streams with classifications and standards requiring special consideration
- Effect on stream stability, hydrologic function, system health, and riparian system

Indirect Impacts

- Spills and hazardous materials transport possibly releasing contaminants into nearby waterways
- Development and urbanization possibly resulting in impacts on water quality and streams
- Channelization and other changes to stream morphology

3.4.1 Regulations and Coordination

Water resources issues within the Corridor area were identified by collecting available data and information, and through public and agency coordination (see Appendix A, Environmental Analysis and Data). In particular, CDOT established a program entitled Stream and Wetland Ecological Enhancement Program (SWEEP) to identify these issues, with immediate attention given to the Clear Creek portion of the Corridor. Appendix K, Overview of Water Availability and Growth, and Forest Service Land Management, provides forest plan standards and guidelines related to water quality issues.

3.4.1.1 Regulations

Although several statutes are applicable to the water resources of the Corridor area, the Clean Water Act (CWA) of 1977 and its various regulatory sections probably have the greatest influence on the activities taking place within the Corridor. Applicable CWA Sections that set out specific provisions and protection of water resources, include Sections 208, 303(d), 314, 319, 402(p), and 404. General explanations of these regulations are provided in Table 3.4-1 and detailed descriptions are provided in Appendix G. Other regulations applicable to the water resources of the Corridor include the State Water Quality Standards (CRS 1973, 25-8-101, as amended), regulated by the Colorado Department of Public Health and Environment (CDPHE) and the Water Quality Control Commission (WQCC); the Safe Drinking Water Act (SDWA) of 1974, as amended in 1984 and 1996; and the Source Water Assessment and Protection (SWAP) program (amendment to the SDWA). Table 3.4-1, Appendix A, and Appendix G, Water Resources, provide further information on these regulations.

3.4.1.2 Methods and Coordination

Water resource information and data were acquired generally through federal, state, and local agency coordination and through the development of various programs (see Appendix G) designed to assemble the data necessary for describing existing conditions and evaluating potential impacts, but which were not available through other sources. In addition, three water resource-related programs were established to gather information on water resources within the Corridor. These programs included the Sediment Control Action Plan (SCAP) for Black Gore Creek and Straight Creek, the SWEEP, and the I-70 PEIS Storm Water Quality Monitoring Program.

Supporting Documentation

- Appendix A, Environmental Analysis and Data
- Appendix G, Water Resources
- Appendix H, Fisheries
- Appendix K, Overview of Water Availability and Growth, and Forest Service Land Management

In 2000, for the PEIS, CDOT established the I-70 Storm Event/Snowmelt Water Quality Monitoring Program to define highway-related baseline water quality conditions in Corridor streams. This program was designed to monitor stream water quality during periods of I-70 stormwater and snowmelt runoff. The monitoring network includes automated sampling in the Black Gore Creek watershed (two stations), West Tenmile Creek, Straight Creek, and Clear Creek watersheds (four stations). Two automated I-70 culvert runoff monitoring stations are also operated to measure highway runoff water quality. Snowmelt runoff from I-70 is sampled at selected locations during the spring to provide diagnostic information on water quality conditions. This monitoring program provides site-specific water quality data related to I-70 for use in establishing the instream effects of I-70 runoff. The monitoring program is limited by the frequency of highway runoff from rainfall or snowmelt events. As such, it is anticipated that several years of event monitoring will be required to determine stream water quality effects and to measure water quality changes in relation to sediment control measures implemented on I-70. The monitoring program is ongoing and more data will be available for Tier 2 studies.

Table 3.4-1. Water Resources Regulations

Regulation		Explanation	Governing Entity
Clean Water Act (CWA)	Section 208	Provisions for nonpoint source pollution	CDPHE/Water Quality Control Division (WQCD); EPA
	Section 401	Requirement for state certification for water quality protection under the federal CWA	
	Section 303(d)	Identification of water quality threatened or impaired waters; may require establishment of total maximum daily loads (TMDLs)	
	Section 314	Lake protection	
	Section 319	Provision for full disclosure of water quality impacts	
	Section 402(p)	Municipal and industrial stormwater discharge; CDOT construction and operations are covered under industrial discharge	
	Section 404	Requirements for protection of wetlands and other waters of the US (see section 3.6)[a]	US Army Corps of Engineers (COE)
Safe Drinking Water Act (SDWA)		Provision for protection of drinking water sources and human health; CDPHE has established Colorado Primary Drinking Water Regulations (5 CCR 1003-1)	CDPHE/WQCD; EPA
SDWA SWAP program amendment		Provision for state assessment of potential water quality issues for public water supplies	

Regulation		Explanation	Governing Entity
Colorado Standards/ Colorado Water Quality Control Act	CRS 1973, 25-8-101	Specification of classifications and numeric standards for surface water in Colorado in compliance with the CWA	WQCC; WQCD

[a] *Note that for all Section 404 individual permits, CDPHE must issue a water quality certification under Section 401 of the CWA. If a water quality certification is issued, the certification, to include any conditions added by CDPHE, becomes a part of the 404 permit.*

3.4.2 Affected Environment

3.4.2.1 Corridor-Wide Issues

Winter Maintenance and Highway Runoff

CDOT winter maintenance crews apply **sand** and **deicers** to I-70 when necessary to maintain road traction and a safe ice- and snow-free road surface. Snow accumulates at higher elevations in the Corridor throughout the winter and must be removed from the highway to maintain safe mobility.

These winter maintenance activities contribute to highway runoff pollutants. Table 3.4-2 lists the highway runoff pollutants from Driscoll (1990) that are of concern in the Corridor. FHWA has identified each of these constituents/pollutants, except chloride, as typical pollutants in highway runoff.

Table 3.4-2. Highway Runoff Pollutants of Concern in the Corridor

Pollutant	Source
Total suspended solids (TSS)	Pavement wear, slope erosion, vehicle and tire wear deposition, the atmosphere (air), and maintenance activities (sand and highway structural erosion)
Phosphate phosphorus	Atmosphere, particulates (sediment from sand and erosion associated with the transportation system), and fertilizer application
Chloride (sodium chloride, magnesium chloride)	Sodium chloride rock salt mixed with traction sand and liquid magnesium chloride deicers applied directly to the highway to melt snow and ice
Copper	Metal plating, bearing and brushing wear, moving engine parts, brake lining wear, fungicides, and insecticides
Zinc	Tire wear, motor oil, and grease

Source: Driscoll 1990

Highway maintenance activities are known to increase sediment (from traction sand application) and contaminants from deicers (such as sodium chloride and magnesium chloride) in runoff to adjacent waterways. This occurs when snowmelt and runoff from precipitation events are drained from the highway and shoulder areas into waterways and streams.

Sediment is transported in Corridor streams as both "suspended load" and "bed load." Bed load (the sediment that moves along the bottom of a stream bed) represents a smaller percentage of the sediment in streams than suspended load (the sediment carried by the relatively shallow, high velocity streams in the Corridor). As such, the suspended component is the primary focus of the environmental consequences evaluation (section 3.4.3). However, because bed load can result in sediment being deposited locally rather than being transported downstream, impacts on aquatic habitat can be caused by areas of streambed becoming covered with fine sediment.

To assess the impacts of highway runoff on receiving streams, a monitoring program has been conducted since 2000 for direct snowmelt or stormwater runoff from I-70, as well as runoff-impacted streams (see Appendix G for the full list of highway runoff pollutants and their sources). Most of the pollutants studied are related to winter highway maintenance.

The pollutant constituents in Table 3.4-2—**suspended solids, phosphorus, chloride, copper,** and **zinc**—have been identified in water quality monitoring as priority pollutants associated with the operation of I-70 due to their potential toxicity or threat to aquatic habitat or public water supplies. (Although there are other constituents/pollutants identified in urban highway runoff, they are considered secondary pollutants in the Corridor and were not studied for this PEIS; Appendix G, Water Resources, contains a further explanation of these secondary pollutants.)

Two major constituents of deicers—**sodium** and **magnesium**—also have been monitored. There are no listed water quality standards for sodium and magnesium because these chemicals are not known to affect water quality and water uses at levels generally found in streams. Trace metals **copper** and **zinc** are primary metals of concern in Corridor streams, due to the sensitivity of coldwater aquatic life to these metals. **Manganese**, while not a significant highway runoff pollutant, was included in the monitoring program because it is identified as a concern associated with historic mining in specific areas of the Corridor. Water quality in the Eagle River, Tenmile Creek, and Clear Creek has been affected to varying degrees by historic mining.

Measurements of highway runoff from I-70 show a dilution of 600 to 47,000 times before the runoff is 35 feet from the roadway (and generally before the runoff would enter a nearby stream) (CDOT 1999). Table 3.4-3 summarizes the average instream concentrations for snowmelt/storm events for streams along the Corridor and for snowmelt/storm runoff directly from I-70.

Estimates of the average annual volume of traction sand/salt mixture and liquid deicers used during I-70 winter maintenance are listed for each I-70 watershed in Table 3.4-4. Tabular information in Appendix A provides an indication of sand and deicer usage by watershed in tons per mile and gallons per mile, respectively.

Table 3.4-3. Mean Concentrations of Constituents from Storm Event or Snowmelt 2000–2003 (mg/L)

Stream	Suspended Solids	Phosphorus Total	Chloride	Sodium (Dissolved)	Magnesium (Dissolved)	Copper (Dissolved)	Manganese (Dissolved)	Zinc (Dissolved)
Standard	N/A	0.10–1.0[a]	250-860[b]	N/A	N/A	0.011–0.026	0.05[b]	0.097–0.211
Clear Creek (CC-1)	195	0.18	44.8	17.5	5.0	<0.005	0.027	0.009
Clear Creek (CC-2)	11	0.03	12.2	6.7	5.3	<0.005	0.007	0.078
Clear Creek (CC-3 and CC-4)	293	0.48	10.1	13.8	5.0	0.008	0.216	0.119
Straight Creek (SC-2)	191	0.14	41	18.3	4.6	<0.005	0.009	<0.010
West Tenmile Creek (WTM-2)	31	0.05	16.9	7.3	2.6	<0.010	0.005	0.012
Black Gore (BG-2)	345	0.27	57	28.5	6.3	<0.005	0.017	<0.010
Polk Creek (PC-2)	42	0.04	1.0	1.5	3.4	<0.005	0.016	<0.010
Miller Creek	<5	<0.01	1.0	1.9	1.8	<0.001	<0.005	<0.005
I-70 Runoff (undiluted)	1,067	0.90	202	93	23.1	0.012	0.481	0.162

[a] *Range from level recommended by EPA for flowing streams to prevent eutrophication to wastewater effluent limitation*
[b] *Drinking water standard for chloride and manganese; aquatic life criteria for chloride are 860 mg/L (acute) and 230 mg/L (chronic); copper and zinc standards are acute and are based on hardnesses for Corridor streams ranging from 58 to 92 mg/L; monitoring locations are shown on Figure G-1 in Appendix G*
Reference: Clear Creek Consultants, Inc. 2004

Table 3.4-4. Impervious Surface Area and Sand and Deicer Usage

Watershed[a]	Beginning Milepost	Ending Milepost	Existing Road Width (Feet)	Acres Road Surface	Existing Sand Usage (Tons/Year)	Application Rate Sand Tons Per Acre of Road Surface	Existing Deicer Usage (Gal/Year)	Application Rate Deicer Gallons per Acre of Road Surface
Eagle River	169	171	48	12	1500	129	1,641	141
Gore Creek	171	182	48	64	8,250	129	117,000	1,828
Black Gore Creek	182	190	48	47	12,000	258	85,000	1,826
Eagle River Total				**122**	**21,750**		**203,641**	
West Tenmile	190	195	48	29	5,000	172	53,000	1,822
Tenmile Creek	195	201	48	35	6,000	172	64,000	1,833
Blue River	201	205	48	23	3,000	129	62,000	2,664
Straight Creek	205	213	66	64	10,800	169	112,000	1,750
Blue River Total				**151**	**24,800**		**291,000**	
Clear Creek (upper)	216	228	48	70	13,000	186	264,000	3,781
Clear Creek (middle)	228	233	48	29	4,000	138	64,000	2,200
Clear Creek (lower)	233	246	48	76	5,500	73	88,000	1,163
Clear Creek Total				**175**	**22,500**		**416,000**	
Beaver Brook	246	255	72	79	4,500	57	123,000	1,566
Mount Vernon Creek	255	260	72	44	2,500	57	67,000	1,535
Upper South Platte				**122**	**7,000**		**190,000**	
Total				**570**	**76,050**		**1,100,641**	

a "Watershed" is used as a general term to refer to specific stream segment drainage areas along I-70 but does NOT necessarily coincide with stream segments referred to in regulatory water quality designations (for example, Table 3.4-6), nor with watersheds given the same name in other tables (for example, Table 3.4-8). See Figure 3.4-1, Corridor Watersheds.

Comparison of Deicers

CDOT began using liquid road treatments in the winter of 1995/1996 and has been increasing their use as a result of their widespread benefits. The resulting reduction in the use of sand (reduced by an average of 50 percent) creates cleaner air and decreases the amount of sediment (from sand) in runoff to nearby streams. CDOT uses **magnesium chloride** liquid deicer due to its effectiveness and reasonable cost. Magnesium chloride deicers generally consist of up to 30 percent magnesium chloride in water and a corrosion inhibitor to reduce the likelihood of metal corrosion. Deicers used by CDOT are required to meet strict nutrient and metals concentrations to minimize these potential contaminants (CDOT 2003). Laboratory tests indicate that magnesium chloride is less corrosive than **calcium chloride** or **sodium chloride** for steel and concrete (HITEC 1999). Other studies show mixed results (Baroga 2004, Xi and Xie 2002). CDOT-funded research (see the summary of references in Table 3.4-5) suggests that, in dry climates like Colorado, magnesium chloride is less corrosive than sodium chloride, while the opposite is true in humid climates (Xi and Xie 2002).

CDOT uses magnesium chloride as its main chemical deicer for several reasons. In addition to reducing sand use, it has a lower freezing point than salt (sodium chloride); thus less is needed to keep roads from freezing at lower temperatures (FHWA 1996, Blackburn et al. 2004). Magnesium chloride also tends to stick to the road better than salt and to have a longer-lasting deicing effect. The California Department of Transportation reports that magnesium chloride can last several days, but salt must be reapplied daily (Xi and Xie 2002). Calcium chloride, which is used for colder climates such as Ontario, Canada, is reported to have a slimier consistency, to be more corrosive, and to be harder to mix and spread than magnesium chloride.

The chloride ions in deicers increase the salinity of soils near the roadways where they are applied and have the potential to increase the salinity of rivers, streams, and lakes. Background concentrations of chloride in Colorado streams are generally low (2 to 3 mg/L). However, concentrations may increase by as much as five times during snowmelt runoff events in streams adjacent to roadways where winter maintenance activities have occurred. Concentrations in flowing streams will generally decrease substantially due to dilution, and most aquatic animals can tolerate exposures exceeding normal levels by 10 to 100 times or more without any harmful effects (Lewis 1999). The acute standard for chloride in Corridor streams is 860 mg/L for protection of aquatic life.

Toxicity studies indicate that chloride associated with magnesium is more toxic to aquatic life than chloride associated with sodium (EPA 1988). However, several factors offset this effect. As temperatures drop from freezing (32^{o} F) to 20^{o} F (common in Colorado), less magnesium chloride relative to sodium chloride achieves the same results (Blackburn et al. 2004). The level of dilution has been calculated at 500-fold and measured at 600 to 47,000 for I-70, and these deicers do not have adverse impacts on aquatic life in streams at existing application levels and stormwater conditions (Lewis 1999). Additionally, use of sodium chloride increases the potential for animal-vehicle collisions when birds or mammals try to lick the salt off the roads. Magnesium chloride and calcium chloride are not attractive to animals and are less likely to cause animal-vehicle collisions (Environment Canada 2000).

Several CDOT-funded studies (Lewis 1999 and 2001) focused on the environmental effects of magnesium chloride liquid deicers. Another CDOT study (Fischel 2001) evaluated and compared general deicer classes (chloride-based, acetate-based, and sand) based on their environmental effects and cost. The organic corrosion inhibitors present in some liquid deicers have the potential to cause oxygen depletion of streams near the roadways where the deicers are applied, and can result in mortality of fish and other aquatic organisms. Unlike magnesium chloride, which has a low biological oxygen demand (BOD), deicers with a high organic content (nitrogen, phosphorous, or carbon) have the potential to reduce oxygen levels. Dilution reduces the likelihood of oxygen depletion from deicers. Details regarding deicers and studies relating to deicer effects on water quality and aquatic life are included in Appendix G, Water Resources.

CDOT is funding ongoing deicer studies (Peterson and Trahan 2004) that focus on five objectives:

1. To assess the extent and mode of roadside vegetation exposure to deicers in areas with sand/salt and/or liquid applications
2. To evaluate impacts of deicer applications on photosynthesis and leaf level gas exchange in the field over time and in relation to road treatment type
3. To expand current laboratory studies to investigate and compare the effects of various sand/salt mixtures and liquid deicers on plant growth, photosynthesis, and seed germination
4. To quantify leaf water status in conifer trees within designated plots to account for the presence of drought stress before onset of treatments and during the treatment period
5. To assess several other factors potentially harmful to roadside vegetation including pollution, nutrient availability, disease, and insect impacts in areas where deicer stress may be a concern

Table 3.4-5. References for Deicers

Studies Funded by, Action Plans for, or Operating Guides for the Colorado Department of Transportation

CDOT. 2002a. *Sediment control action plan, Straight Creek I-70 corridor.* Prepared in cooperation with Clear Creek Consultants, Inc., and J.F. Sato and Associates. May.

CDOT. 2002b. *Sediment control action plan, Black Gore Creek I-70 corridor.* Prepared in cooperation with Clear Creek Consultants, Inc., and J.F. Sato and Associates. May.

CDOT. 2003. *Colorado Department of Transportation anti-icing and deicing standard operating guide, part II.*

Clear Creek Consultants, Inc. 2001b. *Data summary report—2000, I-70 PEIS storm water quality monitoring.* Prepared for CDOT in cooperation with J.F. Sato and Associates. February.

Clear Creek Consultants, Inc. 2002a. *Data summary report—2001, I-70 PEIS storm water quality monitoring.* Prepared for CDOT in cooperation with J.F. Sato and Associates. December.

Fischel, M. 2001. *Evaluation of selected deicers based on a review of the literature.* Report No. CDOT-DTD-R-2001-15. October.

Lewis, W.M., Jr. 1999. *Studies of environmental effects of magnesium chloride deicer in Colorado.* Report No. CDOT-DTD-R-99-10. November.

Lewis, W.M., Jr. 2001. *Evaluation and comparison of three chemical deicers for use in Colorado.* Report No. CDOT-R-2001-17. August.

Peterson, C., and N. Trahan. 2004. *Factors impacting the health of roadside vegetation, Study No. 41.70.* Progress Report for 4/01/04-6/30/04.

Xi, Y., and Z. Xie. 2002. *Corrosion effects of magnesium chloride and sodium chloride on automobile components.* Report No. CDOT-DTD-R-2002-4. May.

Other Studies and Publications

Baroga, E.V. 2004. Washington State Department of Transportation's 2002-2003 Salt Pilot Project. Transportation Research Circular No. C063. June 2004.

Blackburn, R.O., D.E. Amsler, Sr., and K.M. Bauer. 2004. Guidelines for Snow and Ice Control Materials and Methods. Transportation Research Circular No. E-C063. June 2004.

Environment Canada. 2000. Canadian Environmental Protection Act, 199 Priority Substance List Assessment Report—Road Salts, draft for public comments. August 2000. URL: http://www.ec.gc.ca/ceeb1/eng/public/road_salts.html

FHWA. 1996. Manual of Practice for an Effective Anti-icing Program: A Guide for Highway Winter Maintenance Personnel. Publication No. FHWA-RD-95-202.

Highway Innovative Technology Evaluation Center (HITEC). 1999. Summary of Evaluation Findings for the Testing of Ice Ban®: Technical Evaluation Report for the Civil Engineering Research Foundation, Report No. 40410. September 1999.

Stidger, R.W. 2002. The State of the State's Anti-Icing Technology, Better Roads. Vol. 72, No. 4.

United States Environmental Protection Agency. 1988. Ambient Water Quality Criteria for Chloride-1988. Office for Research and Development, Environmental Research Laboratory, Duluth, MN. EPA 440588001.

Upper Clear Creek Watershed Association. 2003. Total Phosphorous Loadings Comparisons, Upper Clear Creek Watershed. Project No. 9622-98. Technical memorandum to Rick Fendel, UCCWA Chairman, from Tim Steele, TDS Consulting. October 24, 2003 (revised November 12, 2003).

Historic Mining

The discovery of gold in the mid-1800s brought an onslaught of human activity to the Corridor area, particularly east of the Continental Divide. Many of these activities occurred along rivers and streams. Placer mining (removal of alluvial or glacial deposits and associated metals from streams) was the original type of mining that occurred within these drainages and has resulted in the **removal of stream substrate** and the **relocation of stream channels.** Most of the former mining operations have produced mine waste, including mill tailings. Although there is little mining activity in the area today, precipitation is still leaching residual metals out of old tailings/wasterock piles and from bedrock exposed in the mine drainage tunnels.

Historic mining activities have affected streams in the Eagle River, Blue River, Clear Creek, and South Platte Headwaters sub-basins. Some of the most substantial impacts have occurred along Clear Creek immediately adjacent to I-70. In addition, I-70 construction activities have played a role in the exposure and disturbance of mine waste and mineralized rock. Historic mining in the Clear Creek watershed is discussed in section 3.8, Regulated Materials and Historic Mining.

Water Quality Impaired Streams, Stream Classifications, and Standards

The WQCC has identified **water quality impaired streams, classified streams,** and developed **standards** to protect these resources. With the exception of Mount Vernon Creek and Clear Creek below Idaho Springs, all of the streams in the Corridor are classified for water supply, aquatic life, recreation, and agricultural uses. Numeric water quality standards apply for protection of these designated uses. These stream segments require special consideration for potential additional impacts from transportation alternatives. Segments identified as impaired are those in which one or more classification or standard is not, or may not be, fully achieved. As necessary for the protection of the water resource, **total maximum daily loads** (TMDLs) are established to set the maximum amount of pollutant that may be allowed while still complying with water quality standards.

The TMDL is an estimate of the greatest amount of a specific pollutant that a water body or stream segment can receive without violating water quality standards. TMDLs are implemented and regulated through the issuance of permits for point sources (such as wastewater treatment plants) and the use of best management practices (BMPs) for nonpoint sources (such as highway runoff). Clear Creek and the Eagle River are undergoing TMDL analysis for metals related to historic mining or geologic sources. The TMDLs analyzed for Black Gore Creek and Straight Creek were established based on sedimentation from I-70 runoff (CDPHE 2002). Stream segments within the Corridor that have been listed on 303(d) of the CWA as water quality limited are subject to TMDL analysis and are listed in Table 3.4-6.

Table 3.4-6. Listed Corridor Streams

Stream Segment Description	Pollutant or Condition	Priority Ranking	TMDL Process Status	Completion Date
Clear Creek from Silver Plume to Argo Tunnel (Segment 2)	Copper, zinc	Medium	Draft TMDL	June 2002
Clear Creek from Argo Tunnel to Golden (Segment 11)	Zinc, cadmium	Medium	Iron and manganese delisting, copper standard in attainment as of 2004	June 2004
Straight Creek (entirety; Blue River Segment 18)	Sediment	Medium	Final	June 2000
Black Gore Creek (entirety; Eagle River Segment 6)	Sediment	Unknown	Data collection	Unknown; listed September 2002
Eagle River from Gore Creek to Colorado River (Segment 9)	Manganese	Low	Pending	June 2006

Source: CDPHE 2002 (with 2004 updates)

Hazardous Materials Spills and Transport

The National Response Center (NRC) data show that every stream in the I-70 Corridor has received a major hazardous waste spill from I-70 within the last 10 years. The greatest number of large petroleum spills has occurred in the Colorado River, followed by Mount Vernon Creek. Spills in each of these areas have occurred within a 2-mile segment of I-70, indicating highly accident-prone areas for trucks. Other areas within the Corridor that had at least three large petroleum spills were Black Gore Creek, Straight Creek, and Lower Clear Creek. The streams in these areas are immediately adjacent to I-70, resulting in very high potential for **transport of hazardous substances into waterways** from spill incidents. It is also noted that a large percentage of spill incidents occur on US 6 at Loveland Pass, for which the receiving waters are Upper Clear Creek on the east and the Snake River/Dillon Reservoir on the west. Section 3.8, Regulated Materials and Historic Mining, contains a more detailed discussion of hazardous materials transport and spills.

Water Resource Changes Due to Development

The Corridor area has undergone considerable growth and development since the construction of I-70, primarily during the 1960s. Continued growth in area population and in tourism is expected in the future. These influences have resulted in increased sedimentation, alterations in the water quality, and changes in the morphology (form and structure) of rivers, streams, reservoirs, and wetlands within the Corridor. Development factors that affect water resources include **runoff, eutrophication,** and **water supply/drinking water.**

Runoff

As a stream basin becomes more urbanized and natural vegetation is replaced by impervious cover such as parking lots, roadways, driveways, and buildings, the volume of stormwater runoff is likely to increase, ultimately affecting the stability and characteristics of the nearby stream channel. In addition, runoff from urban/developed areas is likely to contain pollutants that can affect the water quality of streams. The most common pollutants are fertilizers, pesticides, oil and grease, toxic chemicals, and sediments. Sediment from construction sites is by far the predominant contributor of runoff pollutants from development and urbanization, according to the EPA Nonpoint Source Pollution Control Program.

Eutrophication

Eutrophication is a complex degradation of a water resource (including streams and lakes) triggered by an excess of nutrients. Typically, the controlling nutrient for plant growth is phosphorus. When phosphorus levels increase, there is a corresponding increase in aquatic plant growth. When this increased aquatic plant biomass dies, it decays and consumes dissolved oxygen in the water, causing decreased oxygen in the water and a negative impact on other types of aquatic life. Eutrophication is the disruption of the natural capacity of a water resource to balance the chemical and biological processes occurring within it.

Phosphorus loads occur in stormwater runoff (including runoff from highways) and can, with other natural and anthropogenic sources of phosphorus, contribute to eutrophication. Stormwater runoff occurs as periodic spikes, where phosphorus and other pollutants increase dramatically for a few hours or days and then decrease to ambient levels. The nature of the receiving water can determine the potential for eutrophication. In fast-moving streams, the peak in phosphorus passes before the resident aquatic life can absorb it and experience an increase in biomass. In lakes, however, phosphorus can take months to dissipate. The eutrophication risk to these lakes and reservoirs can be quantified based on total volume, surface area, depth, and residence time of the water, as well as the total nutrient loading to the lake. As appropriate, Tier 2 studies will include an analysis of the eutrophication risk for possible impacts on lakes and reservoirs. Lake Dillon has been affected by nutrients from point and nonpoint sources in the watershed, causing eutrophication concern and the need for wastewater treatment facility phosphorus effluent limits.

Water Supply and Drinking Water

Additional water use to accommodate population growth and recreation (snowmaking and golf course irrigation) might decrease stream flows and groundwater reservoirs, creating conditions that could cause greater concentrations of pollutants and disturb the aquatic environment.

Intakes for public water supplies in the immediate vicinity of I-70 might be affected by sediment, deicers, and other constituents contained in I-70 runoff. Alluvial wells associated with Corridor streams might also be affected by deicers and other constituents in I-70 runoff.

Fifty-four drinking water entities are located within the PEIS study area. Of these, 17 have surface water intakes, 6 have groundwater intakes that are under the influence of surface water (alluvial aquifers), and 31 have groundwater intakes. Intake locations are not shown on Tier 1 maps for security reasons. Impacts on these intakes and appropriate mitigation will be considered in Tier 2 studies.

Watersheds in the Corridor area are the predominant suppliers of municipal water to the Front Range area. These diversions can affect local streams by decreasing their ability to dilute contaminants and by threatening instream flows that support aquatic habitat and recreational use.

Wastewater treatment plants (WWTPs) discharge treated water to streams. Although the treated water must meet standards for pollutants, these standards are partially based on a stream's capacity to dilute a certain amount of these pollutants. Decreased stream flow and nonpoint source contaminants have the potential to increase the impacts of wastewater discharges. Corridor population growth requires facility capacity planning to ensure that future facility needs can be met. Nutrient loading (phosphorus and ammonia) from various sources, including WWTPs, manicured lawns, and golf courses, can affect Corridor streams and reservoirs and possibly be a factor in lake eutrophication.

All of the water in Corridor streams has been appropriated for use by various entities under Colorado's Prior Appropriation Doctrine. Because of the variations in timing and magnitude of stream flow, dams and reservoirs have been constructed in the Corridor area to store water during periods of relative abundance for later release to meet demands. Water demands are dominated by agricultural, municipal, or industrial uses but also include environmental and recreational uses for instream flows and to sustain aquatic life.

Channelization and Stream Flow

Several areas of localized channel disturbances related to construction and operation of I-70 have affected the local morphology of streams. These areas are located along Clear Creek, Straight Creek, Black Gore Creek, and to a lesser extent Tenmile and Gore creeks. Up to 35 percent of the channelization caused by construction of I-70 occurs in the Clear Creek watershed (see Table 3.4-7). Most of Lower Clear Creek (Clear Creek from Empire Junction to US 6 interchange) is constrained naturally in a narrow valley or canyon environment with bedrock control. However, the construction of US 6/US 40 and I-70 has resulted in additional channel constriction/channelization, and many areas where Clear Creek is constricted on both banks exist today between the US 6 or US 40 highway fill embankment and the I-70 highway fill embankment.

Review of historical photographs indicates that Lower Clear Creek once exhibited sinuosity (meandering) between the sides of the canyon and within the narrow valley areas. However, historical photographs also indicate that heavy sediment loads, likely caused by excessive deposition of mine waste, once caused "braided" channel conditions in the Idaho Springs area. Thus, on a localized level, the morphology of Lower Clear Creek has changed both spatially and temporally as a result of human activities in the basin.

Temporary and permanent impacts on stream flow and channels require CWA 404 permitting by the US Army Corps of Engineers (COE) as waters of the US. Section 3.6, Wetlands, Other Waters of the US, and Riparian Areas, addresses 404 permitting issues for wetlands and other waters of the US.

Table 3.4-7 shows total linear feet of stream segments moved or narrowed as a result of I-70 construction. The estimates are based on comparison of 2000 photography against historic photography from 1937, 1938, 1956, 1957, and 1962. The table also shows the approximate length of stream located in the immediate vicinity of I-70, along with the percentage of the total stream length located in the immediate vicinity of I-70. Approximately 17 percent of the streams in the evaluated area have been channelized or disturbed by I-70 construction.

Table 3.4-7. I-70 Construction Stream and Channel Disturbance

Corridor Watershed/Stream	Approximate Stream Length Adjacent to I-70 (Miles / % of Entire Stream Length)	Stream Length Channelized or Disturbed (Miles/Ft)
Eagle River (partial only)[a]	38 / 69%	0.2 / 1,043
Gore Creek	11 / 65%	1.3 / 6,581
Black Gore	8 / 100%	0.3 / 1,686
Blue River	0.1/0%	0/0
West Tenmile Creek	5 / 83%	0.7 / 3,468
Tenmile Creek	6 / 35%	3.8 / 20,119
Straight Creek	9 / 100%	0.3 / 1,557
Clear Creek	28 / 69%	10.4 / 54,803
Mount Vernon Creek	5 / 40%	1.4 / 7,577
Total	**110 miles**	**18.4 miles/96,834 ft.**

Up to year 2000, as estimated from aerial photography
[a] *Available historic aerial photography runs only a few miles west of Dowd Canyon*

3.4.2.2 Watershed Issues

Existing water resources issues and conditions in the Corridor area are discussed in this section by the major watershed in which they occur. Watersheds are areas of land that drain rainfall and snowmelt into a common stream, stream network, body of water, or closed basin. The USGS developed the hydrologic unit code (HUC) system to divide watersheds into a series of progressively smaller nested levels. For example (see Table 3.4-8), the Colorado River Headwaters (HUC 3) drainage area comprises three smaller HUC 4 watersheds (or drainage areas); and the Eagle River (HUC 4) drainage area comprises numerous smaller HUC 6 watersheds (or drainage areas).

The HUC 4 sub-basins and stream segments in HUC 6 designation adjacent to I-70 are shown in Table 3.4-8 and illustrated on Figure 3.4-1. The term "watershed" is used throughout this section to refer to drainage areas (as defined by name and/or area). Note that Table 3.4-8 is intended to emphasize Corridor streams and that not all HUC-6 watersheds are provided in the table or shown on Figure 3.4-1. Figure 3.4-2 shows major streams, rivers, and creeks along the Corridor, along with mileposts and landmarks, to provide an orientation for the discussion of water resources.

Table 3.4-8. Basins and Watersheds

HUC 3	HUC 4 (Sub-Basin)	HUC 6	Stream Segments Adjacent to I-70	County (HUC 4)
Colorado River Headwaters	Colorado River Headwaters	Numerous (not listed)	Colorado River	Garfield, Eagle, Grand
	Eagle River	Numerous (not listed)	Eagle River	Eagle, Pitkin
		Gore Creek around West Vail	Gore Creek	Eagle
		Middle Gore Creek		
		Black Gore Creek	Black Gore Creek	
	Blue River	West Tenmile Creek	West Tenmile Creek	Summit, Grand
		Lower Tenmile Creek	Tenmile Creek	
		North Tenmile Creek		
		Dillon Reservoir	Blue River	
		Blue River in Dillon		
		Straight Creek	Straight Creek	
South Platte River	Clear Creek	Numerous (not listed)	Clear Creek	Clear Creek, Gilpin
	Upper South Platte	Bear Creek – Evergreen Lake to Kerr Gulch	None	Park, Jefferson
		Bear Creek – Kerr Gulch to Morrison	Mount Vernon Creek	Jefferson

Water Resources Planning and Projects

The Northwest Colorado Council of Governments (NWCCOG) has been the designated Regional Water Quality Planning Agency (208 Planning Agency) for Eagle, Grand, Jackson, Pitkin, and Summit counties since February 1976. The region includes the Upper Colorado watershed (the Upper Colorado River watershed is defined by CDPHE Water Quality Control Regulation #33 and includes the Eagle River and Blue River HUC-4 watersheds). The 1996 208 Plan was recently updated in 2002 and received WQCC, Governor, and EPA Region VIII approval. The Upper Clear Creek Watershed Association (UCCWA) is the 208 Planning Agency for Clear Creek from the headwaters to the city of Golden. Numerous existing water quality projects primarily focus on issues in the upper portion (Grand County) of the basin as summarized in Appendix G, Water Resources.

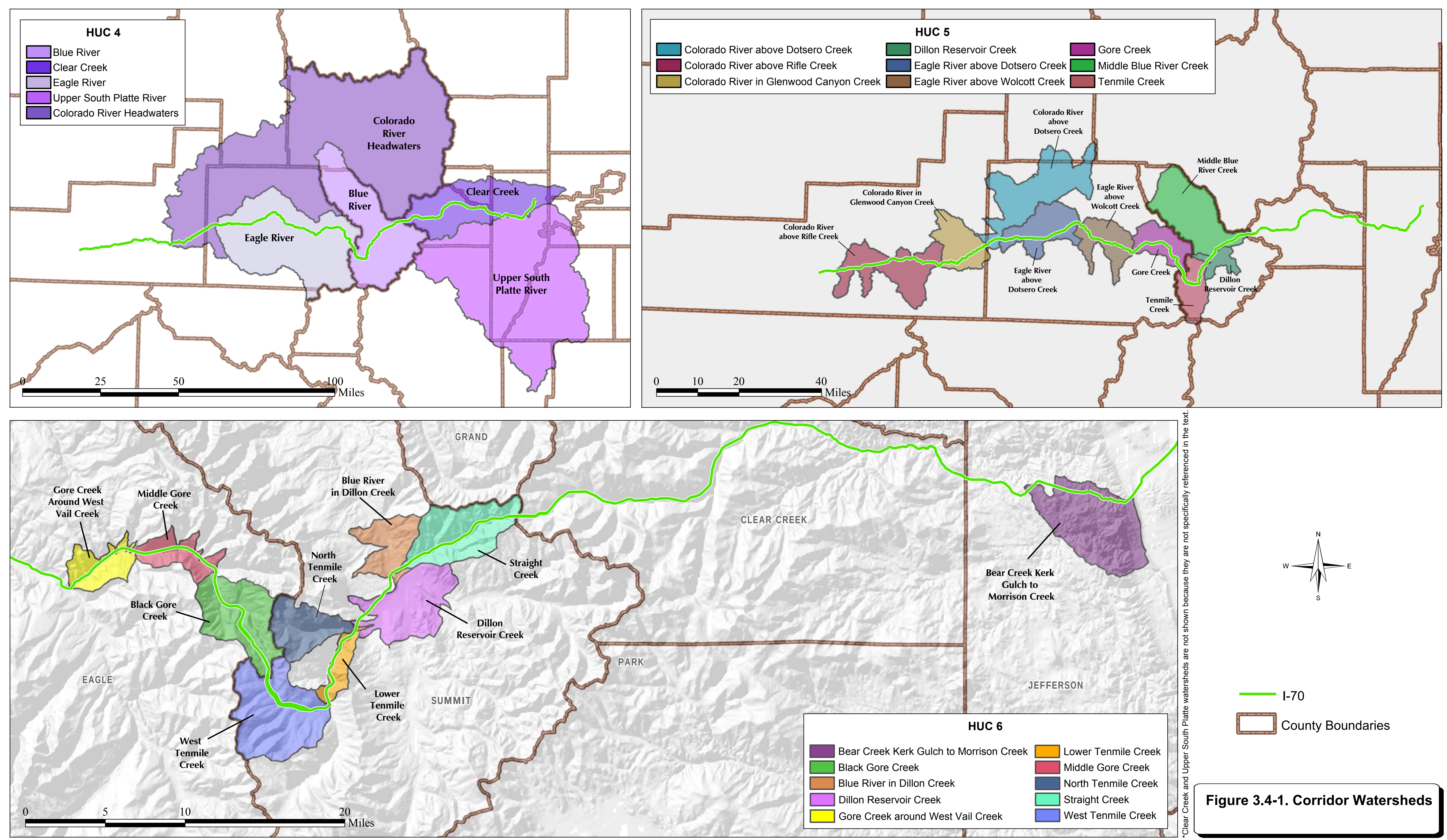


Figure 3.4-1. Corridor Watersheds

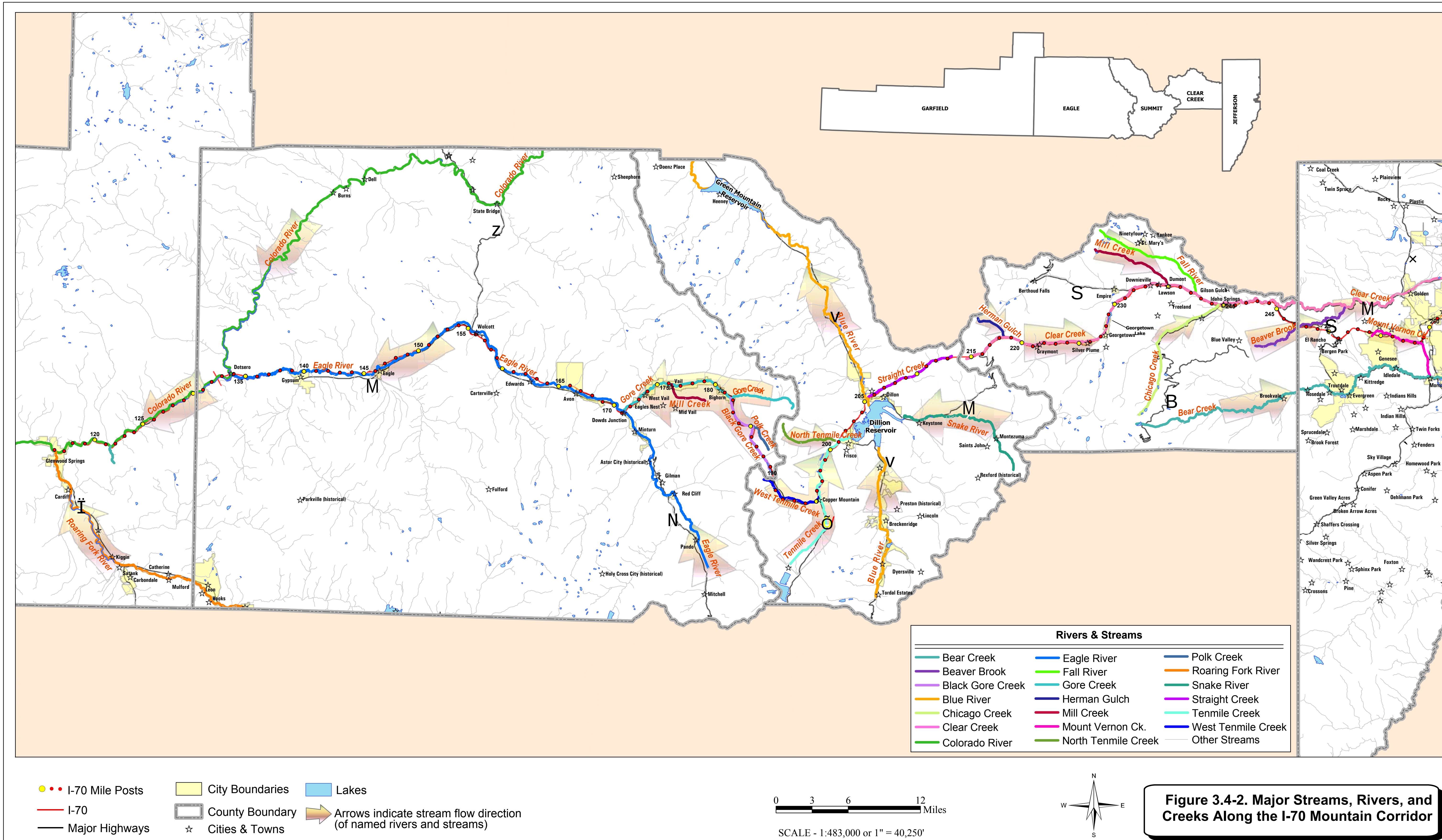


Figure 3.4-2. Major Streams, Rivers, and Creeks Along the I-70 Mountain Corridor

Colorado River Headwaters Sub-Basin

Watershed Characteristics

Figure 3.4-1 shows the Colorado River Headwaters sub-basin. Note that the Blue River and Eagle River sub-basins drain into the Colorado River within the Headwaters sub-basin. The Eagle River joins the Colorado River at Dotsero and the Blue River joins the Colorado River upstream at Kremmling (over 50 miles north of I-70). The Colorado River Headwaters sub-basin includes a large area in Grand/Routt/Eagle counties that is outside the immediate Corridor. However, the watershed is addressed due to the potential downstream effects in the segment along I-70 in the Corridor. In the immediate vicinity of I-70, the Colorado River channel changes from a meandering stream near Dotsero to a confined channel within the Glenwood Canyon. The dominant stream slope is generally less than 2 percent with substrate consisting predominantly of gravel near Glenwood Springs and boulder and cobble further upstream nearer its confluence with the Eagle River. The establishment of I-70 through the Glenwood Canyon has minimally affected the morphology of the Colorado River. Operation of the Shoshone pumpback storage facility located within Glenwood Canyon, however, has resulted in dramatic stream flow fluctuations in the canyon. Appendix G, Water Resources*,* provides representative stream flow data for the watershed.

Major reservoirs in the watershed include Shadow Mountain, Lake Granby, Windy Gap, Willow Creek, Williams Fork, and Wolford Mountain. These reservoirs are primarily located in northeastern Grand County upstream of the Corridor.

Water Quality

The Colorado WQCD has classified 10 segments within the Colorado River basin. The natural quality of water in the high mountain headwaters is extremely good with portions designated as *Outstanding Waters*. The only WQCC classified segment in the immediate vicinity of I-70 is Segment 3, the Colorado River from its confluence with the Eagle River at Dotsero to its confluence with the Roaring Fork at Glenwood Springs.

The Colorado River between the towns of Glenwood Springs and Dotsero represents the largest single source of dissolved solids in the Upper Colorado River basin (NWCCOG et al. 1996). This area contributes 17 percent of the dissolved sodium and 38 percent of the chloride loads leaving the Upper Colorado River basin. Most of this dissolved solids load is contributed by very saline thermal springs between Glenwood Springs and Dotsero.

Summary of Existing Issues and Conditions

Table 3.4-9 summarizes existing Colorado River Headwaters sub-basin issues both in the immediate vicinity of I-70 and for the overall watershed.

Table 3.4-9. Issues and Conditions, Colorado River Headwaters Sub-Basin

Issue	Existing Conditions/Location of Issue	Pollutant or Potential Problem
Issues in Immediate Vicinity of I-70 (mp 116–133, Glenwood Springs to Confluence with Eagle River)		
Water quality issues from winter maintenance activities and impact of stormwater runoff	Traction sand and deicer application is infrequent due to relatively low elevation adjacent to I-70	None
Identified water quality impaired streams and TMDLs	No impaired streams are in the area	None
Identified drinking water sources	No public water supply intakes were identified in the area	None
Issues associated with stream stability, hydrologic function, and stream health	Transbasin diversions (decreased flows)	Decreased dilution capacity and instream flows, impacts on aquatic life and recreation use
Issues associated with spills or release of hazardous materials associated with transport on I-70	18 spills from mp 116–133 (1990–2002); high truck accident area from mp 122–125	Various contaminants, primarily petroleum
Identified antidegradation standards, nonpoint, and point sources	1 segment is classified for intermediate water quality protection and specified uses; 1 wastewater discharge point below Dotsero	Maintain nutrient standards
Overall Watershed Issues		
Water use	High quantity of transbasin diversion	Decreased dilution capacity and instream flows, temperature, aquatic habitat
Wastewater discharge	Willow Creek Segments 6b and 6c	Nutrients, bacteria, iron
Highway runoff	US 40	Sediment
Recreational use	Snowmaking (upper watershed in Grand County), golf course irrigation, increased visitors, wastewater discharge	Sediment, bacteria, decreased dilution capacity and instream flows
Agricultural use	Agricultural activities and logging	Sediment, nutrients

Eagle River Sub-Basin

Watershed Characteristics

The Eagle River sub-basin is located almost entirely in Eagle County and encompasses 944 square miles (604,160 acres). The watershed includes several stream segments that come in close proximity to I-70. Black Gore Creek (Black Gore Creek sub-watershed) flows from its headwaters near the Summit County line (and Vail Pass) to its confluence with Gore Creek near the eastern edge of Vail. Gore Creek (Gore Creek watershed) flows through Vail to its confluence with the Eagle River at Minturn. The Eagle River flows west through the Corridor from Minturn to its confluence with the Colorado River near Dotsero.

The Eagle River channel from Minturn downstream to its confluence with the Colorado River is of low sinuosity, low gradient, and generally exhibits a wide, shallow, entrenched channel with a bed consisting predominantly of cobble and gravel. The Eagle River differs from other rivers and streams within the Corridor because of its lower gradient and entrenched nature in most areas. The lower gradient tends to facilitate long-term deposition of sediment conveyed from tributaries to the Eagle River (for example, Milk Creek, Muddy Creek, Alkali Creek, and Ute Creek).

The Gore Creek channel from its confluence with the Eagle River upstream to East Vail is of low sinuosity, low gradient, and has an entrenched channel (predominantly of cobble) and narrow floodplain. Gore Creek has experienced localized channel disturbance related to the construction and development within the town of Vail. Gore Creek stream discharge is augmented by an estimated 500 acre-foot/year from the Eagle River for snowmaking. The Black Gore Creek channel is of very low sinuosity (nearly straight), narrow, and confined. The streambed is steep (4 to 10 percent slope) with cascading step pools and substrate consisting predominantly of bedrock, boulders, and cobble.

Reservoirs in the Eagle River watershed include several small storage reservoirs and one larger reservoir. Homestake Reservoir is located high in the southern portion of the watershed and has a storage capacity of 44,360 acre-feet and a surface area of 300 acres. Climax Molybdenum Company owns and operates two smaller reservoirs on their property. The Black Lake Reservoirs are located at the headwaters of Black Gore Creek. These two reservoirs have a combined capacity of 300 acre-feet and are used by the town of Vail to augment stream flows in Gore Creek and replace water diverted for snowmaking. Nottingham Lake in Avon has a storage capacity of 100 acre-feet.

Water Quality

Eagle River. The Colorado WQCC has classified four segments in the Corridor project area (see Table 3.4-10) as impaired due to sediments or manganese contamination from historic mining. Temporary modifications to the manganese standard are in effect in Segment 9 as a water supply goal qualifier (CDPHE 2001). Segment 5 (immediately upstream) is also listed as impaired due to acid mine drainage from the Eagle Mine Superfund site near Gilman, although remediation has significantly decreased metal loads over the last several years.

More recently, water quality and morphology of the Eagle River have been affected by various influences related to residential and commercial development in the areas of Vail, Eagle-Vail, Avon, Edwards, and Eagle. The Eagle River *Water Quality Management Plan* (NWCCOG 2002) states that water quality in the Eagle River from Gore Creek to its confluence with the Colorado River is affected by wastewater discharges, irrigation return flows, mineralized groundwater seepage, and runoff from highly erodible soils.

Two wastewater facilities discharge into the Eagle River downstream from Avon and Edwards. This portion of the river is water quality limited with load allocations requiring advanced wastewater treatment for ammonia removal for discharge at the Upper Eagle Valley. CDOW (1996) indicated that effluent from existing WWTPs discharge nitrogen and phosphorus to the Eagle River and that too much nutrient enrichment will result in degradation of the aquatic community and a gradual decline in the fishery value of the river.

A major source of chloride in groundwater exists from geology immediately downstream of Edwards, and a significant source of sediment and dissolved solids comes from Milk, Alkali, and Ute creeks near Wolcott (NPS 1996). The BLM has measured suspended sediment concentrations as high as 12,000 milligrams per liter (mg/L) during spring runoff, and the 1987 NPS Assessment implicated these creeks are significant sources of sediment to the Eagle River (NWCCOG 1998).

Table 3.4-10. Impaired Waters, Eagle River Sub-Basin

Water Body	Segment/ID	Pollutant or Condition	Sources	TMDL Project Status	Projected Completion Date
Eagle River – Belden to Gore Creek	5 (COUCEA05)	Zinc, manganese, copper	Mining	Cadmium delisted; zinc and manganese pending	June 2006
All tributaries – bridge at Belden to Lake Creek – Black Gore Creek	**6 (COUCEA06)**	**Sediment**	**Road runoff**	**TMDL development**	**Unknown**
Cross Creek – source to Eagle River	7 (COUCEA07)	Zinc, manganese, copper	Mining, natural sources	Cadmium delisted; zinc and manganese pending	June 2006
Eagle River – Gore Creek to Colorado River	**9 (COUCEA09)**	**Manganese**	**Mining**	**Pending**	**June 2006**

Bold *indicates segments in immediate vicinity of I-70.*

Gore Creek. The Colorado WQCC has established classifications and standards for Gore Creek (Segment 8 – Black Gore Creek to the Eagle River).

The lower 4 miles of Gore Creek have been designated a Gold Medal fishery in recognition of high recreational value and a productive brown trout fishery.

Water resource-related issues within the Gore Creek drainage include sedimentation from construction of residential and commercial developments within the Vail Valley and winter maintenance activities associated with I-70. Although I-70 runoff has contributed suspended solids to the stream, suspended sediment is not considered a major water quality concern in Gore Creek (USGS 2001), and nutrient and trace metal concentrations in stream loads are generally attributed to commercial and residential runoff (NWCCOG 1995). However, rock salt and magnesium chloride associated with I-70 maintenance are primary sources for some of the dissolved solids affecting specific conductance in Black Gore Creek, upstream of Gore Creek.

Aquatic life standards have been exceeded for trace metals such as cadmium, copper, and manganese and are attributed to natural sources in the Gore Creek watershed (NWCCOG 2002c). Gore Creek is a water quality limited segment with load allocations requiring advanced wastewater treatment for ammonia removal for discharge at Vail. Other issues related to water quality include the application of fertilizers within the Vail Valley.

Black Gore Creek. Black Gore Creek is protected for water supply and aquatic life uses and is part of Colorado WQCC Segment 6 of the Eagle River watershed. Black Gore Creek is classified as impaired for sediment and was listed for TMDL development in September 2002 due to sediment loads in I-70 runoff. Sedimentation from I-70 traction sand has resulted in impacts on water quality, aquatic life, and the water supply reservoirs. Approximately 15,000 tons per year of traction sand (1990/2001) are applied to the 8-mile section between the top of Vail Pass and the Black Gore Creek and Gore Creek confluence. Runoff from the highway along this segment of I-70 contributes approximately 5,000 tons of sand/salt mixture into Black Gore Creek (CDOT 2001b).

Specific conductance is generally three to five times higher in Black Gore Creek than in Gore Creek, and water quality standards for manganese and copper have been exceeded in the past. These metal contaminants are associated with local rock mineralogy (Lorch 1998). However, land disturbance from I-70 construction during the early 1970s is also likely to have contributed to manganese concentrations.

CDOT completed a SCAP for the Black Gore Creek I-70 corridor in May 2002. The SCAP provides an analysis of existing sediment conditions and presents options for sediment control improvements and long-term structural controls (further discussed in section 3.4.4). Portions of the SCAP are being implemented, as funding will allow. Thus far, approximately 40 sediment basins have been constructed, and a covered sand storage structure was recently installed at the CDOT maintenance facility on Vail Pass to control sediment runoff in this area. For the most part, these have not been integrated into a revised drainage design, which is the most important and costly aspect of the SCAP. When fully implemented, the SCAP measures should mitigate future sediment loading from I-70.

Recent Data and Trends

Eagle River. Ambient (nonstormwater runoff) water quality data from 14 samples collected from the Eagle River at Gypsum throughout 2000 indicate that concentrations of all regulated parameters were either at or below established water quality standards (USGS 2000). The Eagle River Watershed Plan (developed in 1994), however, states that dissolved solids and nutrient concentrations have increased in Gore Creek between 1979 and 1991 due to development in the Vail area and that these trends are most likely occurring in all the urbanizing areas of the Eagle River watershed (NPS 1996).

Gore Creek. Since the 1970s, ammonia concentrations have decreased and nitrate concentrations have increased in Gore Creek because of changes in wastewater treatment methods. However, recent total phosphorus concentrations were elevated when compared to the EPA-recommended level of 0.1 mg/L for control of eutrophication (process of oxygen depletion) in flowing water. Increases in nutrients and dissolved and suspended solids in Gore Creek are due to the increases in pollutants from stormwater runoff. There is concern that water quality standards in Gore Creek could be exceeded, resulting in impacts on the aquatic community and the Gold Medal fishery.

Black Gore Creek. In September 2000, CDOT began collecting snowmelt and rainfall-runoff water quality data in Black Gore Creek above Timber Creek. Results from this monitoring program are provided in Appendix G, Water Resources. The maximum chloride concentration measured in 2001 was 250 mg/L, which is equivalent to the drinking water standard. The aquatic life criteria for chloride are 860 mg/L for acute and 230 mg/L for chronic exposure (EPA 2002). The maximum total phosphorus concentration was 3.2 mg/L, while the mean total phosphorus concentration in Black Gore Creek under storm runoff conditions was 0.27 mg/L.

Summary of Existing Issues and Conditions

Table 3.4-11 summarizes existing water resources issues and conditions in the Eagle River sub-basin for both the immediate vicinity of I-70 and the overall watershed.

Table 3.4-11. Issues and Conditions, Eagle River Sub-Basin

Issue	Existing Conditions/Location of Issue	Pollutant or Potential Problem
Issues in Immediate Vicinity of I-70 (mp 133–190, Confluence with Colorado River to Summit County Line and Vail Pass)		
Water quality issues from winter maintenance activities and impact of stormwater runoff	Black Gore Creek watershed	Sediment, suspended solids, phosphorus, sodium, chloride
Identified water quality impaired streams and TMDLs	Eagle River Segment 9, Black Gore Creek Segment 1	Manganese, sediment
Identified water supply sources (including drinking and public water supplies)	Gore Creek, Black Gore Creek (Black Gore Lakes)	Sediment
Issues associated with stream stability hydrologic function, and stream health	Gore Creek supports a Gold Medal trout fishery, Eagle River world-class kayaking course near Minturn, snowmaking at ski areas; sediment impacts on aquatic life in Black Gore Creek	Instream flow requirements, sediment
Issues associated with spills or release of hazardous materials associated with transport on I-70	High accident area located on west side of Vail Pass – Black Gore Creek mp 185–190	Various spills: petroleum, sulfuric acid, hydrogen peroxide
Identified antidegradation standards, nonpoint, and point sources	1 segment outstanding waters; 2 segments intermediate; residential and commercial development impacts – notably in the Vail area; wastewater discharge, Gore Creek; natural sources downstream of Edwards and in the Wolcott area; point and nonpoint impacts on Gore and Black Gore creeks	Nutrients, ammonia, phosphorus, suspended sediment, instream flows, dissolved metals, chloride, dissolved oxygen, temperature
Overall Watershed Issues		
Water use	Important source for agricultural, industrial, and municipal use. Substantial transbasin diversion. Inbasin diversions. Black Gore Lake No. 1 and 2 provide water storage for Vail Ski Area.	Decreased dilution capacity and instream flows
Urbanization and development	Population growth, increased development, and increase in visitors associated with population centers and recreational developments; increase in septic systems	Nutrients, suspended sediment
Wastewater discharge	Upper Eagle River – Red Cliff facility; future growth	Ammonia, instream flows
Natural sources	Milk and Alkali creeks – impacts on Eagle River aquatic resources	Sediment, salt
Recreational use	Snowmaking, golf course irrigation, increased visitors – erosion in riparian areas	Sediment, decreased dilution capacity, and instream flows
Historic mining	Eagle Mine Superfund site near Gilman	Metals, acid mine drainage

Blue River Sub-Basin

Watershed Characteristics

The Blue River sub-basin drains an area of 680 square miles (435,200 acres) from elevations reaching 14,270 feet along the southeastern perimeter to its confluence with the Colorado River south of Kremmling (elevation 7,400 feet).

West Tenmile Creek flows entirely within the immediate vicinity of I-70 from its headwaters near Vail Pass to its confluence with Tenmile Creek, where it has been channelized by the development of the Copper Mountain Resort. The West Tenmile Creek is a high-gradient (2 to 4 percent), low sinuosity, narrow mountain stream with coarse substrate consisting primarily of boulders and cobble. Land use in West Tenmile Creek drainage is dominated by the White River National Forest (WRNF), I-70, and Copper Mountain Resort.

Tenmile Creek (Tenmile Creek and Dillon Reservoir watersheds) flows into Dillon Reservoir at Frisco. Tenmile Creek is a high-gradient (2 to 4 percent), low sinuosity, narrow mountain stream with coarse substrate consisting primarily of boulders and cobble. Tenmile Creek has been channelized locally, particularly in areas near Wheeler Junction, by the construction of I-70. Land use in Tenmile Creek is dominated by mining, the WRNF, and I-70 in the lower portion only.

Straight Creek originates at an elevation of 12,000 feet and flows west for 8 miles along I-70 before its confluence with the Blue River in the town of Silverthorne. Straight Creek is a generally high-gradient stream with coarse substrate consisting primarily of bedrock, boulders, and cobbles. However, the natural substrate has been heavily modified as a result of sand and fine gravel from highway sanding materials and erosion of fill slopes. As the name implies, its channel is of very low sinuosity with a dominant slope of 4 to 10 percent. Straight Creek has been channelized locally by the construction of I-70 and development within the town of Dillon.

Major reservoirs in the Blue River watershed include Dillon and Green Mountain reservoirs. Dillon Reservoir is immediately adjacent to the existing I-70 footprint between Dillon and Frisco. Areas of I-70 contribute runoff upstream of Dillon Reservoir. West Tenmile and Tenmile creeks flow into Dillon Reservoir at Frisco. The Blue River (Blue River in Dillon sub-watershed) flows from the Dillon Reservoir under I-70 northward toward Green Mountain Reservoir. Dillon Reservoir has a capacity of 254,000 acre-feet and a surface area of 3,220 acres. The reservoir was constructed and is operated by the Denver Water Department as a municipal water supply. Green Mountain Reservoir has a storage capacity of 154,645 acre-feet and a surface area of 2,100 acres. Its primary purpose is to provide compensatory water storage for the Western Slope and augmentation water for the Colorado-Big Thompson project.

Water Quality

The Colorado WQCD has classified 20 segments within the Blue River sub-basin for protected use (see Appendix G, Water Resources). Segments 14, 17, and 18 include portions of streams in the immediate vicinity of I-70. Dillon Reservoir and its tributaries are designated as Segment 3.
Table 3.4-12 lists impaired waters in the Blue River watershed. Only one impaired segment (Segment 18 denoted in bold text) is adjacent to I-70.

Table 3.4-12. Impaired Waters, Blue River Sub-Basin

Water Body	Segment/ID	Pollutant or Condition	Sources	TMDL Project Status	Projected Completion Date
Blue River – French Gulch to Swan River	2a (COUCBL02a)	Cadmium, copper, zinc	Mining	Data collection ongoing	June 2004
Blue River – ½ mi. below SCR3 to Swan River	2b (COUCBLO2a)	Copper	Mining	Data collection ongoing	Unknown
Snake River – source to Dillon Reservoir	6 (COUCBL02)	Cadmium, copper, lead, zinc, pH	Mining	Data collection ongoing	June 2006
Peru Creek – source to Snake River	7 (COUCBL07)	Cadmium, copper, lead, zinc, pH	Mining	Data collection ongoing	June 2006
French Gulch – below Lincoln to Blue River	11 (COUCBL11)	Cadmium, zinc, pH	Mining	Data collection ongoing	June 2004
Straight Creek – source to Blue River (this segment includes all tributaries to Blue River – Dillon Reservoir to Green Mountain Reservoir – however, Straight Creek is specified as impaired)	**18 (COUCBL18)**	**Sediment**	**Road runoff**	**TMDL available**	**August 2000**

HUC 14010002; ***Bold*** *indicates segments in immediate vicinity of I-70.*

Blue River. The Blue River from Dillon Dam to the confluence with the Colorado River below Kremmling (Segment 17) is designated a Gold Medal trout fishery. The segment passes under I-70 near milepost 205.

Dillon Reservoir and tributaries. Dillon Reservoir and its tributaries (Blue River Segment 3) have been classified for aquatic life, recreation, and water supply use. Phosphorus loads from WWTPs and nonpoint sources are cited as major problems affecting Dillon Reservoir, resulting in accelerated eutrophication conditions in the lake. Phosphorus wasteload allocations have been in place for the upper Blue River watershed since 1984 (WQCC Regulation No. 71). The control regulation established a phosphorus load allocation for the dischargers upstream of Dillon Reservoir. WWTPs located upstream of Dillon Reservoir include the Snake River WWTP, the Frisco Sanitation District WWTP, and numerous facilities operated by the Breckenridge Sanitation District.

The WQCD has indicated that discharges to Dillon Reservoir will be evaluated for effluent limits for ammonia when permits are renewed. The concern with respect to ammonia is its un-ionized form, due to its toxicity to fish. Initial concentrations, temperature, pH, and mixing are the key elements in determining the amount of un-ionized ammonia, which could be toxic to fish.

West Tenmile Creek and Tenmile Creek. The WQCC has established classifications and standards for one segment (14) of Tenmile Creek in the immediate vicinity of I-70, which includes West Tenmile Creek (see Appendix H, Fisheries).

Straight Creek. Straight Creek (Segment 18) is a tributary to the Blue River in Silverthorne and is classified for drinking water supply and aquatic life uses. Straight Creek provides the primary drinking water supply for the town of Dillon. Straight Creek is listed impaired for sediment due to more than 20 years of erosion of cut-and-fill slopes, primarily as a result of ineffective surface runoff disposal, as well as annual application of 10,000 to 20,000 tons of sand and fine gravel for winter sanding operations on I-70 (RCE et al 1993). Sedimentation has affected the morphology of Straight Creek in localized areas where excessive deposition has occurred. Other sources of pollution in the

Straight Creek watershed are associated with urban development in the towns of Dillon and Silverthorne.

In response to a US Forest Service 1990 Environmental Assessment, CDOT initiated the Straight Creek Erosion Control Project and installed sediment basins, concrete valley pan drains, and culvert rundowns in the Straight Creek watershed to control highway runoff during 1993. A Sediment Pond Maintenance Plan was also developed that specified pond sizes, locations, and inspection and cleanout frequency (CDOT 1993).

In 1993, the Summit Water Quality Committee investigated highway-related sediment effects in the upper 5.7 miles of Straight Creek. An analysis of the sediment basins constructed as part of the Straight Creek Erosion Control Project was conducted to determine the volume of sediment captured and the sediment removal efficiency of the sediment basins in 1995 (CDOT 1996). The results indicated that for the period 1993–1994, 5,337 tons of road sand was applied to I-70 between the EJMT and Silverthorne, and 587 tons (435 cubic yards) were collected by the seven basins that were operational during that period (CDOT 1996). Assuming all sediment collected was originally road sand, an estimated 11 percent of the road sand is collected in the existing seven sediment basins (CDOT 2002). Based on more recent analyses (CDOT 2001), this efficiency has remained relatively constant since 1994. These sediment and drainage control measures have addressed only a relatively small portion of the Straight Creek watershed, and full implementation of the SCAP is expected to result in much higher reductions (up to 80 percent).

CDOT completed a SCAP for the Straight Creek I-70 corridor in May 2002. The SCAP provides an analysis of existing sediment conditions and controls and presents options for sediment control improvements and long-term structural controls. Numerous sediment basins and sediment control structures exist along this segment of I-70. Most of these structures require maintenance (removal of accumulated sediment) to function properly.

Recent Data and Trends

West Tenmile Creek and Tenmile Creek. Baseline snowmelt-runoff, water quality conditions were measured in both West Tenmile and Tenmile creeks on April 18, 2001, as part of the CDOT stormwater monitoring program. Early snowmelt water samples were collected from West Tenmile and Tenmile creeks at their confluence and from Tenmile Creek downstream at Frisco. Sample results from April 2001 indicate that Tenmile Creek water quality is influenced by upstream sources unrelated to I-70. Stormwater monitoring results are presented in greater detail in Appendix G, Water Resources.

Straight Creek. Stormwater quality data representing runoff conditions include diurnal snowmelt during April and May and rainfall-runoff from July through September. CDOT collected runoff samples as part of the I-70 runoff event baseline water quality monitoring. The maximum chloride concentration measured was 145 mg/L. The aquatic life criteria for chloride are 860 mg/L for acute and 230 mg/L for chronic exposure (EPA 2002). The maximum total phosphorus concentration was 1.68 mg/L, while the mean total phosphorus concentration in Straight Creek under storm runoff conditions was 0.14 mg/L. The maximum TSS concentration was 3,550 mg/L. These water quality data are discussed in greater detail in Appendix G, Water Resources.

Summary of Existing Issues and Conditions

Table 3.4-13 summarizes existing issues and conditions in the Blue River sub-basin for the immediate vicinity of I-70 and for the overall watershed.

Table 3.4-13. Issues and Conditions, Blue River Sub-Basin

Issue	Existing Conditions/Location of Issue	Pollutant or Potential Problem
Issues in Immediate Vicinity of I-70 (mp 190–214, Eagle County Line/Vail Pass to EJMT)		
Water quality issues from winter maintenance activities and impact of stormwater runoff	Straight Creek watershed	Sediment, suspended solids, phosphorus, sodium chloride
Identified water quality impaired streams and TMDLs	Straight Creek Segment 18	Sediment
Identified water supply sources (including drinking and public water supplies)	Town of Dillon, Dillon Reservoir, Straight Creek, West Tenmile Creek	Sediment, phosphorus, chloride
Issues associated with stream stability hydrologic function, and stream health	Blue River supports a Gold Medal trout fishery, ammonia toxicity from wastewater treatment discharge	Instream flow requirements, ammonia, sediment, temperature, dissolved oxygen
Issues associated with spills or release of hazardous materials associated with transport on I-70	19 spills (1990–2002), high accident areas located west of Frisco and east of Silverthorne to west of EJMT from mp 208–212	Various spills, petroleum dominated
Identified antidegradation standards, nonpoint, and point sources	3 segments intermediate; residential and commercial development impacts, notably upstream of Dillon Reservoir; wastewater discharge upstream of Dillon Reservoir and into lower Blue River; historical mining impacts on Tenmile Creek	Nutrients, ammonia, phosphorus, suspended sediment, instream flows, dissolved metals, chloride
Overall Watershed Issues		
Water use	Substantial transbasin diversion. Inbasin diversions and area growth; Straight Creek is used for Dillon municipal water supply and EJMT facilities	Decreased dilution capacity and instream flows
Urbanization and development	Population growth, increased development, and increase in visitors associated with population centers and recreational developments; increase in septic systems	Nutrients, phosphorus, suspended sediment
Wastewater discharge	Dillon Reservoir and tributaries	Phosphorus, instream flows, lake eutrophication
Recreational use	Snowmaking, golf course irrigation, increased visitors – erosion in riparian areas	Sediment, decreased dilution capacity and instream flows
Historic mining	Upper Blue River, Snake River, French Gulch, Tenmile Creek	Trace elements, acid mine drainage

Clear Creek Sub-Basin

Watershed Characteristics

I-70 enters the Clear Creek drainage at the east portal of the EJMT at milepost 215 and stays within the Clear Creek sub-basin to the Genesee area at milepost 254, a distance of 40 miles. More than 10 miles of Clear Creek has been channelized as a result of highway development, ski area and urban development, and historic mining. Most of the development is confined to the middle and lower portions of the watershed, whereas the upper portion of the watershed is located in relatively undisturbed national forest (ARNF) land. I-70 construction has caused the major portion of these channelization impacts. Channelization has reduced the overall meandering or sinuosity of the stream, which is an essential element in providing aquatic habitat and dissipating the stream's energy. Attempts to mitigate the effects of channelization have occurred over time by the addition of boulders and drop structures in the stream channel. The channelization of Clear Creek, however, has eliminated the floodplain and, as a result, contributes to the area of flooding in various municipalities such as Silver Plume, Georgetown, and Idaho Springs. Loss of floodplain area has also altered the groundwater conditions adjacent to the stream by limiting seasonal flooding and potentially affecting groundwater recharge. Historical photographs indicate that heavy sediment loads, likely caused by excessive deposition of mine waste, once caused braided channel conditions in Idaho Springs.

Water from Clear Creek has been put to many uses over the past 140 years. Historically, it was used for mining, agriculture, drinking water supply, and industries such as flour mills, breweries, and manufacturing. Today, it provides drinking water for more than 350,000 people and recreational opportunities for rafters, kayakers, and fishermen (CDPHE 1997). The demand for Clear Creek water makes it one of the most overappropriated streams in Colorado. Forty-six reservoirs are involved in the diversion and storage of Clear Creek water, the most notable within the Corridor being Georgetown Reservoir. Only about 20 percent of Clear Creek flows ever reach the mouth of Clear Creek at the South Platte River due to heavy demand in the Denver metropolitan area. Public water supply intakes operated on Clear Creek adjacent to I-70 or immediately downstream include the Loveland Basin and Loveland Valley facilities, town of Silver Plume, city of Black Hawk, and city of Golden. Other surface water sources in the watershed supply water to the town of Empire, city of Idaho Springs, and town of Georgetown.

Water Quality

The Colorado WQCD has separated the mainstem of Clear Creek into three segments for regulatory purposes (see Appendix G, Water Resources; these segments differ from the sub-basins defined below). The boundaries of these mainstems are related to major changes in water quality related to mining impacts but also reflect changes in land use. Mainstem 1 (Segment 1, from EJMT to Silver Plume) is within the ARNF and is upstream of most mining impacts and other widespread development with the exception of I-70 and Loveland Ski Area. Mainstem 2 (Segment 2, from Silver Plume to the Argo Tunnel in Idaho Springs) incorporates major changes in land use and water quality related to mining, urban development, and I-70. Mainstem 3 (Segment 11, from the Argo Tunnel to Golden) was created at the Argo mine tunnel discharge in Idaho Springs because of its major influence on metal chemistry in Clear Creek. Stream Segment 11 has been designated "use-protected" for aquatic life, recreation, water supply, and agricultural uses.

The lower segments of Clear Creek within the Corridor have myriad land use conditions and contaminant sources that contribute to water quality changes. Numerous tributaries and mine waste piles contribute substantial metal loads to Clear Creek, particularly during local snowmelt and rainfall-runoff conditions. Superfund remedial actions, along with implementation of the Clear Creek Watershed Management Agreement, have resulted in improvements in Clear Creek water quality. Nonpoint sources, however, remain the top priority for cleanup in the Superfund study area (UCCWAG 2000). EPA and CDPHE have yet to complete all of the remedial actions planned for the Superfund site, some of which are planned for areas within these affected stream segments.

WWTPs that discharge nutrients directly to Clear Creek adjacent to I-70 are located at the EJMT, Loveland Ski Area, Georgetown, Dumont, and Idaho Springs. Three municipal WWTPs discharge to Clear Creek in the lower portion of the project area. CDOT operates a wastewater treatment facility at the east portal of the EJMT facility under CDPS Permit No. CO-0026069. This permit allows discharge of treated wastewater to Clear Creek at the design capacity of 0.072 million gallons per day.

Table 3.4-14 lists four stream segments in the Clear Creek watershed that have been designated as impaired. Two segments (2 and 11) are in the immediate vicinity of I-70 and are listed due to historic mining impacts.

Table 3.4-14. Impaired Waters, Clear Creek Sub-Basin

Water Body	Segment/ID	Pollutant or Condition	Sources	TMDL Project Status	Projected Completion Date
Clear Creek – I-70 bridge at Silver Plume to Argo Tunnel	**2 (COSPCL02)**	**Copper, zinc**	**Mining**	**Draft TMDL**	**June 2002**
South Fork Clear Creek	3a (COSPCL03)	Zinc	Mining	Pending	
West Fork Clear Creek	5 (COSPCL05)	Copper	Mining	Pending	
Fall River and tributaries	9 (COSPCL09)	Copper, zinc	Mining	Pending	—
Clear Creek – Argo Tunnel to Farmers Highline Canal	**11 (COSPCL11)**	**Zinc, cadmium**	**Mining**	**Iron and manganese delisted**	**June 2004**
North Clear Creek and tributaries – lowest water supply intake to Clear Creek	13b (COSPCL13b)	Cadmium, manganese, zinc, aquatic life	Mining	Pending CERCLA cleanup; copper and iron delisted in Nov. 2000	June 2006

HUC 1019004; ***Bold*** *indicates segments in immediate vicinity of I-70; CDPHE 2002 (2004 updates)*

Recent Data and Trends

As part of the Clear Creek/Standley Lake Watershed Agreement (see Appendix G, Water Resources, for further discussion), the UCCWA developed and implemented an ambient water quality monitoring program for Clear Creek since 1994 (CDOT is a party to the agreement). One of the goals established for the monitoring program was to evaluate nutrient loading from point and nonpoint sources in the watershed. The monitoring program includes multiple stream sampling locations and four WWTPs on mainstem Clear Creek in the Corridor area. Sampling is conducted 8 months each year for nutrients and metals. EPA and the UCCWA have also been conducting joint monitoring of Clear Creek since 1994 in association with Superfund activities. As part of the joint monitoring effort, an analysis of trace metals data was conducted and reported in 2001 (UCCWA 2001).

A summary analysis of recent Clear Creek water quality data is provided in the following sections. For discussion purposes, data are separated into ambient data, which generally represents nonstormwater runoff data collected by UCCWA from 1994 to 2001, and diurnal snowmelt/stormwater runoff data collected by CDOT in 2000 and 2001 as part of the I-70 PEIS Storm Water Quality Monitoring Program.

Metals (ambient and stormwater data). In September 2000, CDOT began collecting stormwater quality data representing runoff conditions, diurnal snowmelt during April and May, and rainfall-runoff from June through September, as part of the I-70 runoff event baseline water quality monitoring. Appendix G, Water Resources, provides a more detailed discussion of the water quality results.

Upper Clear Creek (Clear Creek mainstem above Bakerville). The most widespread land disturbances in the watershed above Bakerville are I-70, the EJMT, US 6, and Loveland Ski Area. Dissolved zinc is typically the principal indicator of water quality changes in streams affected by mining in the Clear Creek watershed. Because very few mining sources are located above Bakerville, dissolved zinc concentrations in stream samples are generally low and meet drinking water standards. Existing data, however, indicate an increasing trend in zinc and magnesium concentrations in Upper Clear Creek starting in 1997.

As might be expected due to the higher elevations and the associated increase in winter maintenance activities, the highest sodium, chloride, and magnesium concentrations were measured in Upper Clear Creek (Station CC-1). Sodium, chloride, and magnesium trends include high concentrations in April and May and lower concentrations in summer and fall. The high concentrations of sodium chloride and magnesium chloride are believed to be associated with snowmelt runoff from I-70. The maximum chloride concentration measured at CC-1 was 210 mg/L. The aquatic life criteria for chloride are 860 mg/L for acute and 230 mg/L for chronic exposure (EPA 2002). High concentrations in the upper watershed reflect the influence of winter highway maintenance activities, whereas concentrations in the lower watershed reflect the influence of historic mining (in addition to winter maintenance activities).

Middle Clear Creek (Clear Creek mainstem – Bakerville to Empire Junction). Dissolved zinc data in the middle (Clear Creek above West Fork) and lower (Clear Creek below Idaho Springs) segments show a strong seasonal fluctuation in dissolved zinc related largely to changes in stream flow (dilution). The October data for Middle Clear Creek appear to indicate a decreasing trend in dissolved zinc concentrations since 1995. This improving trend in Middle Clear Creek may be transferred downstream through the system, as shown in the data for Lower Clear Creek that indicate a similar decreasing trend since 1995.

A water quality study of Georgetown Lake, immediately downstream from the town of Georgetown, was conducted in 1998 by the USGS in cooperation with the EPA (USGS 2000). This study concluded that the lake effectively removes certain metals and sediment from Clear Creek. Average concentrations of dissolved sodium, magnesium, and manganese were lower in Clear Creek below the lake as compared to Upper Clear Creek. Chloride concentrations also were lower below Georgetown Lake compared to Upper Clear Creek at Herman Gulch. Concentrations of dissolved copper and zinc, however, increase with distance downstream as a result of historic mining influences. Georgetown Lake does not currently have high nutrient levels.

Lower Clear Creek (Clear Creek mainstem – Empire Junction to US 6 interchange with I-70). Dramatic increases in average trace metal concentrations occur in Lower Clear Creek between Empire Junction and Idaho Springs. Stormwater results indicate large increases in dissolved copper, manganese, and zinc concentrations in this area, which is consistent with ambient data collected for the Superfund site.

Stormwater results from a paired set of stations, designed to monitor I-70 runoff effects between Twin Tunnels and Floyd Hill (Hidden Valley segment), indicate that average dissolved metal concentrations remain approximately the same in this segment of Clear Creek during stormwater runoff conditions. Considering multiple point and nonpoint metal source contributions in Lower Clear Creek, the concentrations of dissolved sodium, magnesium, and chloride are higher in Upper Clear Creek near Herman Gulch (CC-1) during runoff conditions. Metal concentrations in Lower Clear Creek are dominated by historic mining influences, and it is difficult to segregate any influence I-70 runoff may have on metals (Clear Creek Consultants, Inc. 2000).

Suspended solids and phosphorus (ambient and stormwater data). Clear Creek at Bakerville (CC-05) includes wastewater discharges from plants at the EJMT and Loveland Ski Area. Clear Creek above West Fork (CC-25) includes discharge from Georgetown's wastewater plant, whereas Clear Creek below Idaho Springs (CC-40) includes discharges from the Dumont and Idaho Springs plants. These ambient data show generally low phosphorus concentrations (<0.04 mg/L) in Clear Creek since UCCWA monitoring began in 1994.

However, stream samples collected during stormwater runoff events indicate generally higher total phosphorus and suspended solids concentrations in Clear Creek when compared to ambient data. The maximum total phosphorus concentration at Upper Clear Creek Station CC-1 was 1.9 mg/L, while the mean total phosphorus concentration under storm runoff conditions was 0.11 mg/L.

Total phosphorus and suspended solids concentrations are highest below the Twin Tunnels sampling point and lowest at the West Fork sampling point. As previously discussed, Georgetown Lake apparently captures sediment and influences concentrations at the West Fork sampling point. The maximum total phosphorus concentration at Middle Clear Creek Station CC-2 was 0.18 mg/L, while the mean total phosphorus concentration under storm runoff conditions was 0.04 mg/L. The highest concentration of total phosphorus was 5.2 mg/L while the mean was 0.6 mg/L (out of 28 samples collected between 2000 and 2001) at the Kermitt's sampling point (near the I-70/US 6 intersection; Clear Creek Consultants, Inc. 2002a). These results will require additional evaluation and confirmation based on a longer monitoring period. Specific sources of suspended solids and phosphorus in Lower Clear Creek are likely to include nonpoint runoff from I-70, commercial facilities, historic mining, and natural sources.

Summary of Existing Issues and Conditions

Table 3.4-15 summarizes existing water resources issues and conditions in the Clear Creek sub-basin.

Table 3.4-15. Issues and Conditions, Clear Creek Sub-Basin

Issue	Existing Conditions/Location of Issue	Pollutant or Potential Problem
Issues in Immediate Vicinity of I-70 (mp 213–255, EJMT to Genesee Area)		
Water quality issues from winter maintenance activities and impact of stormwater runoff	Road traction sand and deicers; runoff from Loveland Ski Area; parking areas; urban development and parking areas: Silver Plume, Georgetown, Idaho Springs	Sediment, suspended solids, phosphorus, sodium chloride
Identified water quality impaired streams and TMDLs	Clear Creek Segments 2 and 11	Iron, manganese, zinc, copper
Identified drinking water sources	Intakes along I-70 for Loveland Basin and Loveland Valley facilities, Silver Plume, Black Hawk, Golden; major supply to Denver metropolitan area	Phosphorus, chloride
Issues associated with stream stability hydrologic function, and stream health	Channelization near Silver Plume; Brownsville Slide area; eroded slopes from previous I-70 construction; natural debris flows: Georgetown Lake to Empire Junction	Sediment
Issues associated with spills or release of hazardous materials associated with transport on I-70	20 spills (1990–2002); high accident area at Twin Tunnels to Hyland Hills; maintenance/cleaning activities at EJMT; accidents on Loveland Pass, Dumont, Fall River, Hidden Valley, base of Floyd Hill mp 242–244	Various spills, petroleum dominated
Issues associated with mineralized rock and historic mining along I-70	Exposed mineralized rock (Big Five, Burleigh Tunnel, and other areas); excavated mineralized rock associated with highway construction and urbanization; roadcuts through active mineral belt and draining adits; I-70 roadway built on mill tailings, Idaho Springs area	Heavy metals, sediment, acid rock, and acid mine drainage
Identified antidegradation standards, nonpoint, and point sources	2 segments intermediate; 1 segment use-protected; residential and commercial development impacts: Silver Plume, Georgetown, Idaho Springs; direct wastewater discharge from CDOT at EJMT, Loveland Ski Area, Georgetown Sewage Treatment Facility, Dumont, Idaho Springs; copper standards	Suspended sediment, phosphorus, dissolved metals, chloride
Overall Watershed Issues		
Water use	Substantial source of water for municipal and agricultural use	Decreased dilution capacity and instream flows
Urbanization and development	Population growth, increased development, and increase in visitors associated with population centers and recreational developments	Nutrients, phosphorus, suspended sediment
Wastewater discharge	Numerous direct discharges	Maintain standards
Recreational use	Ski area runoff, kayaking, increased visitors and erosion in riparian areas	Sediment, decreased dilution capacity, and instream flows
Historic mining	Entire watershed	Trace elements, heavy metals, sediment, acid rock/mine drainage, sediment

Existing projects. The UCCWA is the designated water quality management agency (208 planning agency for Clear Creek from the headwaters to Golden) and is responsible for implementing point and nonpoint source controls throughout the watershed.

An agreement was developed between 23 entities in the Clear Creek basin to adopt a narrative phosphorus standard for Standley Lake, establishing a total phosphorus effluent limitation of 1.0 mg/L (for example, Bear Creek Reservoir Regulation) to reduce the nutrient loading to Clear Creek (Clear Creek/Standley Lake Watershed Agreement) and protect water quality in Standley Lake. A desired total phosphorous goal for the prevention of plant nuisances in streams or other flowing waters not discharging to lakes or impoundments is 0.1 mg/L (USEPA 1986). Because CDOT operates a wastewater treatment facility at the east portal of the EJMT facility under permit, which allows discharge of treated wastewater to Clear Creek, CDOT is party to the agreement. The agreement served as the basis of the formation of the UCCWA. The agreement remains in effect as the trophic (nutrient and clarity level) status of the lake is continually evaluated.

As part of this agreement, an ambient water quality monitoring program for Clear Creek was adopted. The program monitors four surface water and WWTPs on Clear Creek. Sampling is conducted 8 months each year for nutrients and metals. Results from this program represent the most current and comprehensive ambient water quality database for nonstormwater conditions in Clear Creek (UCCWA 2001). In the March 1999 *Five-Year Review Report*, the EPA identified areas of continued noncompliance in the Corridor: Clear Creek from Silver Plume to the Argo Tunnel for copper and zinc, and from the Argo Tunnel to the Farmer's High Line Canal in Golden for iron, manganese, and zinc (EPA 1999).

Upper South Platte River Sub-Basin

Watershed Characteristics

Upper South Platte River. The Upper South Platte River sub-basin (HUC 4) includes the Bear Creek sub-watershed (HUC 6). The Bear Creek watershed includes Mount Vernon Creek, which flows parallel to I-70 from near Genesee Park east to near US 40. Land use consists of mixed rural residential and commercial development, and open space. Mount Vernon Creek is a high-gradient, narrow mountain stream with coarse substrate consisting primarily of bedrock, boulder, and cobble. Its channel has a low sinuosity with a dominant slope of 4 to 10 percent.

Mount Vernon Creek is not used as a municipal or an industrial water supply source. The stream, however, flows to Bear Creek, a major tributary to Bear Creek Reservoir and the South Platte River, and as such provides surface water for downstream irrigation and industrial use.

Water Quality

Bear Creek watershed. I-70 passes through the central and headwaters area of Mount Vernon Creek, and Colorado WQCD water quality regulations and standards apply to this area (see Segment 4a in Appendix H, Fisheries). Although there are no point source discharges to Mount Vernon Creek in this area, it is designated as “use-protected” due to its aquatic life classification. The Bear Creek watershed does not have any listed impaired waters. Possibly the most relevant water quality regulation in the context of I-70 is the Bear Creek Watershed Control Regulation No. 74 (5-CCR-1002-74, 1998). This control regulation covers all tributaries in the Bear Creek watershed including Mount Vernon Creek. Bear Creek Reservoir has a high level of nutrients that cause “algal blooms” in the growing season, and the reservoir is characterized as eutrophic to “hypertrophic.”

The total wasteload allocation for all point source dischargers of phosphorus in the Bear Creek watershed is 5,255 pounds per year, and point source discharge of total phosphorus cannot exceed 1.0 mg/L (CDPHE 1998). Nonpoint sources of phosphorus to Bear Creek Reservoir are estimated to be 50 percent or more of the annual load to the reservoir.

Summary of Existing Issues and Conditions

Table 3.4-16 summarizes existing water resources issues and conditions for the Upper South Platte and South Platte Headwaters sub-basins.

Table 3.4-16. Issues and Conditions, Upper South Platte River and Headwaters Sub-Basins

Issue	Existing Conditions	Pollutant or Potential Problem
Issues in Immediate Vicinity of I-70 (mp 255–260, Genesee Area to C-470 Along Mount Vernon Creek)		
Water quality issues from winter maintenance activities and impact of stormwater runoff	Road traction sand and deicers; runoff from urban development and parking areas	Sediment, suspended solids, phosphorus, chloride, sodium, magnesium
Identified water quality impaired streams and TMDLs	None	None
Identified drinking water sources	No intakes along Mount Vernon Creek; water supply uses downstream	Phosphorus and dissolved oxygen levels downstream in Bear Creek Reservoir
Issues associated with stream stability hydrologic function, and stream health	Nonpoint sources: erosion, urbanization, roadway runoff	Nutrients, sediment
Issues associated with spills or release of hazardous materials associated with transport on I-70	18 spills (1990–2002); high accident areas: Evergreen to east of Lookout Mountain, east of Lookout Mountain to C-470 mp 257–259	Various spills, petroleum dominated, 1 sulfuric acid spill
Issues associated with mineralized rock and historic mining along I-70	None	None
Identified antidegradation standards, nonpoint, and point sources	1 segment use-protected; nonpoint discharge	Nutrients, aquatic life protection

3.4.3 Environmental Consequences

3.4.3.1 Direct Impacts – Method and Summary

Direct impacts on water resources related to the project alternatives would include increases in impervious surface area/roadbed expansion, new construction disturbances including stream channelization and the impedance or blockage of cross-slope streams, possible impacts from disturbance of historic mine waste materials, and possible impacts from transportation system operations (see Table 3.4-17). Changes in impervious surface and roadbed expansion are considered permanent impacts, whereas construction impacts are usually temporary. Increased impervious surface could lead to increased runoff, affecting stream water quality and associated TMDLs, public water supplies, fisheries, stream morphology, and WWTP discharge permits. Any project alternative that would result in a potential increase in stream exceedance of water quality target goals, even if relatively minor, could be in direct conflict with established TMDLs. Areas of potential concern include existing impaired segments resulting from I-70 runoff (Black Gore Creek, Straight Creek, and Upper Clear Creek), and impaired segments resulting from historic mining in Lower Clear Creek that could be affected by construction disturbance of mining waste and mineralized rock, and the long-term operation of the transportation corridor.

Impacts from highway runoff are estimated (see Appendix G for a discussion of the FHWA stormwater model) in terms of increased impervious surface for winter maintenance (increases in sand and liquid deicer) and stormwater runoff (increases in water quality pollutant concentrations and loads in stream segments). Stream disturbance impacts are estimated quantitatively in terms of alternative footprints, construction disturbance zones, and sensitivity zones. Although construction impacts are discussed, Tier 2 studies will be necessary to identify more specific impacts on water resources (including impacts on specific water supplies, wastewater facilities, fisheries, and TMDLs), as well as specific associated mitigation activities. Possible disturbance of historic mine waste is discussed in terms of water quality impacts. However, Tier 2 studies will be necessary to identify possible water quality impacts from disturbance of historic mine waste and associated avoidance/mitigation measures. Impacts would result from transportation operations activities (such as mowing, sand removal, and cleanout of sediment control structures) and structures (for example, sediment control, stormwater treatment, bridge drains, and tunnels) required for the continued operation of the transportation system. The magnitude of these transportation operations would differ based on the alternative. Tier 2 studies will evaluate transportation operations impacts. Direct impacts on water resources are discussed by alternative in section 3.4.3.2. Although reservoirs/lakes exist in the Corridor area, and lake water quality could potentially be affected by project alternatives, such impacts are addressed qualitatively and will not be modeled for quantitative impacts during Tier 1 studies.

The FHWA highway runoff model has been used as a screening tool for various transportation alternatives. Instream concentration estimates are based, in part, on the following assumptions:

- The model uses precipitation in the form of rainfall, not snow.
- The road surface drains to one point in the stream; there are no intervening features, natural or constructed, between the highway runoff and natural waterways that might decrease impacts on stream water quality.
- Any intervening soils between the highway discharge culvert and the stream are saturated, causing all of the highway runoff to flow to the receiving stream.
- The receiving streams are chemically the equivalent of distilled water.
- All dissolved metals that are in highway runoff remain dissolved in the receiving waterway.

Sediment control structures that have been or will be built are expected to remove significant amounts of total metals and particulate phosphorous. While the FHWA model may predict mixing of runoff volumes with receiving streams well, a more rigorous assessment of the geochemical behavior of metals and phosphorous may be necessary at the Tier 2 level of study. The current analysis focuses on the relative impacts of project alternatives and in different watersheds, not on the prediction of stream concentrations.

For highway discharges to flowing streams, which are the most common water body receiving highway discharges in the Corridor, the potential toxic effect on aquatic biota in mountain streams is more properly associated with dissolved phosphorous, especially orthophosphorous. The average dissolved phosphorous in highway runoff from I-70 is less than 5 percent of the total phosphorous (0.04 mg/L versus 0.90 mg/L; Clear Creek Consultants, Inc. 2002; update 2004).

Table 3.4-17. Direct Impacts, Water Quality and Streams

Direct Impact Issue	Evaluation Method	Possible Resources Affected or Regulatory Issues
Winter maintenance	Quantitative evaluation of increase in sand and deicer usage	Stream water quality, TMDLs, stream classification standards, public water supplies, wastewater treatment plant discharge permits, fisheries, stream hydrology and morphology, riparian areas
Stormwater runoff	Quantitative evaluation of increases in major highway pollutant parameters, concentrations, and loads using FHWA model	
Construction of alternatives	Qualitative discussion of possible construction impacts	
Historic mine waste/ materials disturbance	Qualitative discussion of possible water quality impacts from disturbance of mine waste materials and mineralized rock	
Stream disturbance/ channelization	Quantitative evaluation of possible stream disturbance in linear feet	
Transportation operations	Qualitative discussion of possible impacts from the operation and maintenance activities associated with alternatives	

Impacts on water resources features from Preservation alternatives are considered to be equivalent to their corresponding “build” components. For example, the impacts of the Six-Lane Highway 65 mph alternative would be the same as those of the Combination Six-Lane Highway with AGS alternative if the Highway portion were built first with preservation for AGS.

Winter Maintenance

Winter maintenance calculations incorporate an assumption that the average application rate per unit area for sand and chemical deicers would remain the same as the existing condition. Although No Action projects would include some additional sand and deicer usage, such amounts are considered minimal in comparison with the action alternatives. The increase in material usage would reflect the increase in the number of highway lanes and quantity of impervious surface in the guideway for the Dual-Mode or Diesel Bus in Guideway alternatives. Traction sand would be applied for the Rail with IMC; however, the amount used would be very minimal because it would be applied on the rail directly in front of the wheels as needed. No traction sand would be required for the AGS because it would be powered by a magnetic levitation system. Both the Rail with IMC and AGS alternatives are estimated to use the same amount of sand and deicer as their Minimal Action components. Table 3.4-18 summarizes winter maintenance impacts by alternative and watershed.

Table 3.4-18. Summary of Winter Maintenance Impacts

Alternative	Minimal Action	Rail with IMC/AGS	Dual-Mode or Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	Combination 6-Lane Highway/Rail or AGS	Combination 6-Lane Highway with Dual-Mode or Diesel Bus in Guideway
Eagle River Watershed (Eagle County Airport to Summit County Line, mp 133–190)								
Sand	19%	8%	4%	19%	17%	19%	19%	19%
Deicer	18%	11%	5%	18%	15%	18%	18%	18%
Blue River Watershed (Eagle County Line to EJMT, mp 190–213)								
Sand	6%	6%	6%	7%	7%	7%	7%	7%
Deicer	6%	6%	24%	8%	8%	8%	8%	24%
Clear Creek Watershed (EJMT to Genesee, mp 213–255)								
Sand	44%	8%	8%	62%	58%	72%	62%	62%
Deicer	28%	8%	73%	45%	41%	54%	45%	103%
Upper South Platte River Watershed (Genesee to C-470, mp 255–260)								
Sand	14%	3%	3%	14%	14%	14%	14%	14%
Deicer	14%	3%	44%	14%	14%	14%	14%	50%
Corridor Total								
Sand	23%	8%	7%	28%	27%	32%	28%	29%
Deicer	19%	8%	39%	26%	24%	30%	26%	55%

Denotes percentage increases from existing I-70 impervious surface and sand and deicer application amounts. The Rail with IMC alternative would use minimal amounts of sand and is estimated to be the same as its Minimal Action components. The AGS alternative would not require the use of sand or deicer and would be the same as its Minimal Action components.

Stormwater Runoff

A water quality model developed and supported by FHWA has been used in the Corridor impact assessment to determine potential changes in stream water quality related to impervious surface area for the project alternatives. This model is the software implementation of FHWA-RD-006/009, Pollutant Loadings and Impacts from Highway Stormwater Runoff (Driscoll et al 1990) and is further described in Appendix G, Water Resources.

The parameters required in the model include drainage areas, highway right-of-way, stream flow for the watershed, rainfall characteristics, pollutant concentrations in the runoff, and the instream target concentrations to be used for comparison. The principal water quality input associated with existing conditions and project alternatives is the GIS-calculated impervious surface area and the total existing I-70 disturbance area. The additional effective impervious surface associated with action alternatives would result in greater winter maintenance requirements and associated traction sanding volumes, as well as additional runoff and transport of chemical constituents. Runoff flow rates and volumes, mass loading, and the ratio of runoff to stream flow are calculated by the FHWA model. The chemical parameters used in the impact analysis include TSS, total phosphorus, chloride, and the dissolved forms of copper and zinc. TSS and phosphorus are related to winter maintenance (traction sand) and slope erosion and represent potential impacts on fish habitat and lake eutrophication. Phosphorus is also related to liquid deicers and cut-and-fill slope erosion. Chloride represents potential impacts from deicers. Copper and zinc are the dominant toxic pollutants from highway runoff.

Suspended sediment is the primary focus of predictive water quality modeling efforts, although bed load is acknowledged to comprise a small portion of sediment impacts. In areas of excessive sedimentation, bed load can be retained rather than being transported downstream, resulting in sediment deposition in the stream channel. Areas of excessive sedimentation from I-70 winter maintenance activities have been identified in the Black Gore and Straight Creek watersheds. Implementation of SCAPs (see section 3.4.4) will reduce the source of sediment and the affected streambeds to recover over time.

Stormwater runoff model results are reported in terms of 3-year storm event stream concentrations of total suspended solids (TSS), phosphorus, chloride, and dissolved copper and zinc. Results are also reported in terms of 3-year storm event loads of these constituents. Note that these results do not include any mitigation for runoff impacts. Tables in Appendix A, Environmental Analysis and Data, compare existing stream loads to yield the percentage change for each alternative. As described in Appendix G, Water Resources, the emphasis of the FHWA model study is to evaluate overall changes (from existing conditions) in stormwater concentrations and loads associated with project alternatives. Because of various limitations to the model associated with the assumptions made for dissolved metals (cited in Appendix G and the paragraph below), the numerical values of these parameters in relation to water quality standards are not provided for existing conditions results or project alternative results. In addition, it is important to differentiate between the percent increases reported for specific watershed areas of project alternative effects in Appendix A, Environmental Analysis and Data, and the summarized results by major watershed and the entire Corridor. The summary percentage increases were specifically calculated for use in the comparison of alternatives and are weighted according to I-70 mileage within the sub-watersheds. Specific calculation methods are further described in Appendix G. The tables in Appendix A are summarized for each alternative in section 3.4.3.2.

It is important to note that the FHWA model does not take into account the background levels of pollutants in subject streams. The percentage increases shown in Table 3.4-19 and Appendix A are only the increase in pollutant loading directly due to the alternative presented. In areas where mining has historically occurred, highway runoff concentrations of copper and zinc are often quite small compared to the background levels found in the streams. The model cannot effectively evaluate the complex mechanisms that govern the chemical and physical interactions between highway runoff pollutants and the receiving water. For this and other reasons discussed above, the FHWA model is intended to act only as a screening model. In the Tier 2 studies for this project, it is expected that a more detailed analysis will be considered to evaluate impacts on areas where water quality concerns require increased scrutiny.

Table 3.4-19 provides the Corridor summary of water quality impacts by alternative. No mitigation actions are included in any of the alternatives shown in the table. The FHWA model used the footprint and construction disturbance zones to evaluate impacts on streams from highway stormwater runoff. Because the Combination Six-Lane Highway with Rail with IMC alternative would have the greatest footprint area, stormwater runoff impacts would be greatest for this alternative from a Corridor-wide perspective. The Combination Six-Lane Highway with Rail and IMC, Reversible/HOV/HOT Lanes, and Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives would have the greatest impacts on stream water quality in the Clear Creek watershed.

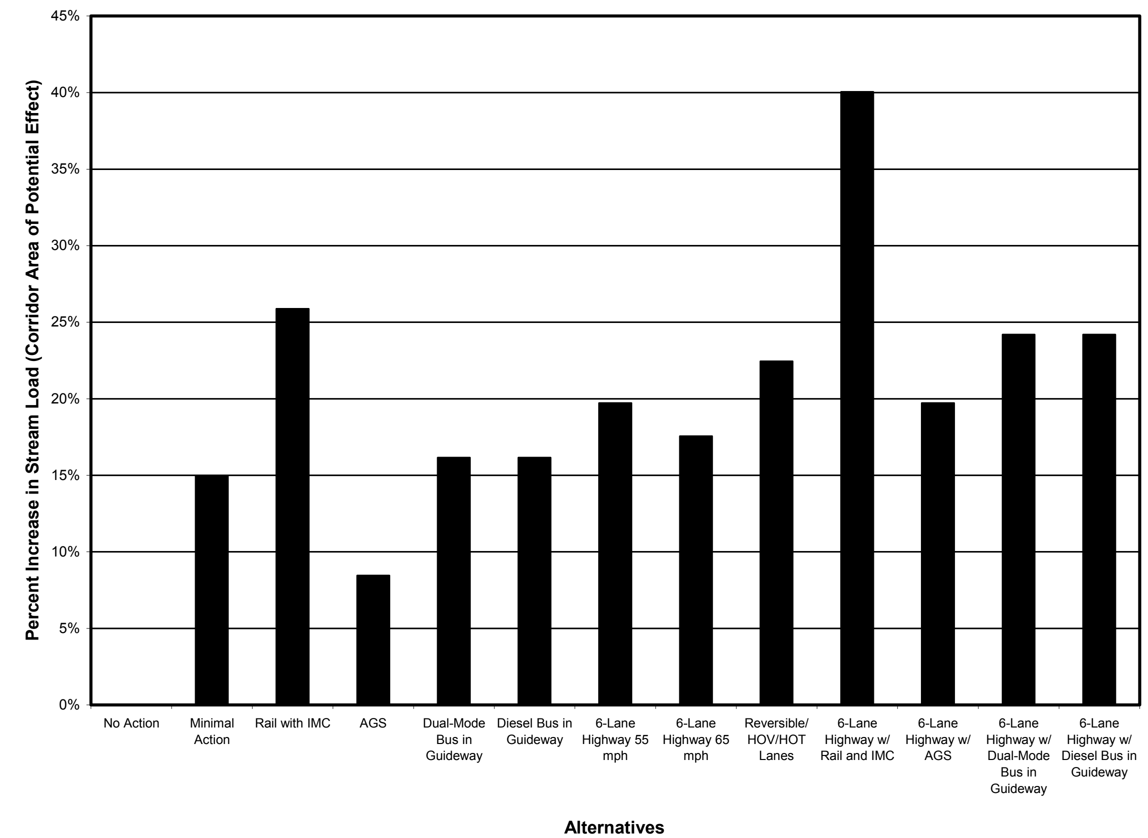
Table 3.4-19. Direct Impacts Summary, Stormwater Runoff (3-year storm event)

	No Action	Minimal Action	Rail with IMC	AGS	Dual-Mode or Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/ HOT Lanes	Combination 6-Lane Highway with Rail and IMC	Combination 6-Lane Highway with AGS	Combination 6-Lane Highway with Dual-Mode or Diesel Bus in Guideway
Total Suspended Solids	No Change	15%	26%	8%	16%	19%	17%	22%	41%	19%	20%
Phosphorus	No Change	15%	26%	8%	16%	20%	18%	22%	40%	20%	24%
Chloride	No Change	15%	28%	9%	17%	20%	19%	23%	42%	20%	26%
Dissolved Copper	No Change	15%	26%	9%	17%	19%	18%	22%	40%	19%	24%
Dissolved Zinc	No Change	15%	26%	9%	16%	20%	18%	23%	41%	20%	25%

Percent increase from existing conditions in 3-year storm event stream loads (J.F. Sato and Associates/Clear Creek Consultants, Inc. 2004). Note that the Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives have been combined because they would have the same impervious surface. Preservation alternatives are assumed to correspond with the initially implemented alternatives.

Chart 3.4-1 illustrates percentage increases in stream load (based on existing I-70 stormwater loads) for the parameters listed in Table 3.4-19 by alternatives. Because the percentage increases are roughly the same for all the parameters, one chart can represent them all. The greatest increases would be associated with the Rail with IMC and Combination Six-Lane Highway with Rail and IMC alternatives.

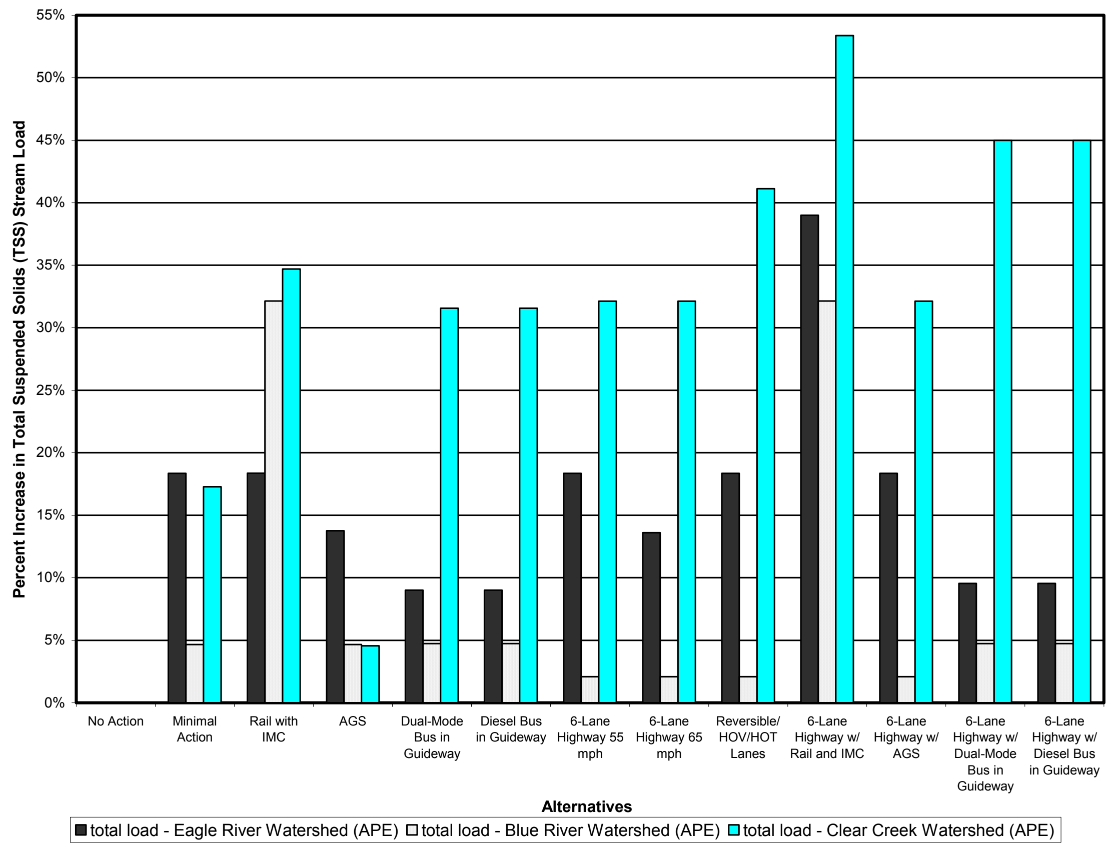
Chart 3.4-1. Stream Load Increases – Corridor Area of Potential Effect (3-year storm event)



Watershed Summary

Chart 3.4-2 illustrates percentage increases in TSS stream load for project alternatives by the three major Corridor watersheds. These summary increases have been weighted according to mileage in the modeled sub-watershed areas of the Corridor (see Appendix A). The Clear Creek watershed would indicate the greatest increases in all alternatives. Impacts on the Blue River watershed would be notable only for the Rail with IMC and Combination Six-Lane Highway with Rail and IMC alternatives. The Eagle River watershed would indicate intermediate impacts for all alternatives, except the Combination Six-Lane Highway with Rail and IMC alternative where there would be the greatest impacts.

Chart 3.4-2. Stream Load Increases by Watershed – Total Suspended Solids



Construction of Alternatives

A 15-foot buffer zone on the outside edge of the footprint was used to evaluate construction-related impacts. Tier 2 studies will include more specific quantification of waste rock volumes, identification of waste rock staging and disposal sites, and identification of tunnel construction areas. Tier 1 studies are included in section 3.7, Geologic Hazards.

Tunnel construction will generate large quantities of process/wastewater that has the potential to affect water quality in adjacent streams or to drain adjacent aquifers and affect associated water wells. Tier 2 studies will identify and evaluate impacts on water quality and water availability from tunnel construction and dewatering. The original construction of EJMT included the capture of wastewater in detention basins to allow sediment to settle out. Water was then discharged to Clear Creek and Straight Creek. A third EJMT tunnel would be part of all action alternatives, except Minimal Action.

Residential water wells in the area of Floyd Hill tap an aquifer characterized by fractured-flow. These wells are relatively deep and have the potential to be affected by the Floyd Hill tunnel drainage system, as well as by tunnel construction blasting that might create more fractures. Tunnel drainage and blasting would have the potential to draw down area water levels in wells and/or completely dry up the wells (and cut off resident water supplies). Additional technical research (Tier 2) would be required to evaluate the possibility of the Floyd Hill tunnel to affect area groundwater flows, which are important today for individual water well owners. Permitting and coordination under CWA Regulation 404 and under water rights and appropriations considerations with the Colorado Division of Water Resources (DWR) might be necessary. The Floyd Hill tunnel would be part of the Six-Lane Highway 65 mph alternative.

Historic Mine Waste/Materials Disturbance

The primary mining-related water resource impacts associated with I-70 occur in the Lower Clear Creek watershed and to a lesser extent in Middle Clear Creek watershed. Other areas of the Corridor have not been subject to enriched mineralization or extensive mining. Mining-related impacts are defined as the water quality effects of runoff from exposed rock cuts, historic mine waste piles, and to a lesser extent, from mine waste residuals used as fill for I-70. In Clear Creek County, many of the ephemeral tributaries intercepted by I-70 drain land disturbed by mining, including mine waste rock or tailings piles. Disturbance of historic mining wastes and materials caused by construction activities of any action alternative may cause the release of sediment and metals into adjacent waterways at levels of concern unless appropriate mitigation actions are taken. Exposure of mineralized rock for construction of alternatives may also create such conditions. Water quality impacts resulting from disturbance of mine waste/materials have not been quantified as a part of the PEIS and will be evaluated during Tier 2 studies.

Stream Disturbance/Channelization

Disturbance and possible channelization of streams is quantified by alternative. Impact evaluation is based on project alternative proximity to streams that might result in channelization or impacts on the hydrologic function, stream health, and riparian system. Footprint impacts specifically would encroach into stream channels and streams. Comparison of alternatives is based on linear feet of encroachment for the footprint and construction zones. Construction disturbance would constitute temporary impacts, while project alternative footprints could require permanent impacts such as channelization or pier placement for bridges. Tier 2 studies will include specific identification of stream disturbance during construction, including construction disturbance areas, channelized segments, pier placement, and structural modifications such as embankment walls or elevated structural segments and bridges. Note that temporary and permanent impacts on stream flow and channels require CWA 404 permitting by the COE as waters of the US. Section 3.6, Wetlands, Other Waters of the US, and Riparian Areas, addresses 404 permitting issues for wetlands and other waters of the US.

Stream impacts would be greatest for the Rail with IMC and Combination Six-Lane Highway with Rail and IMC alternatives (see Table 3.4-20 and Chart 3.4-3). The Combination Six-Lane Highway with AGS and Combination Six-Lane Highway with Dual-Mode and Diesel Bus in Guideway alternatives also would be associated with high impacts on streams. The Minimal Action alternative would have the least impacts on streams (except the No Action alternative).

Table 3.4-20. Direct Impacts – Corridor-Wide Summary, Stream Disturbance (linear feet)

No Action	Minimal Action	Rail with IMC	AGS	Dual-Mode or Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	Combination 6-Lane Highway with Rail and IMC	Combination 6-Lane Highway with AGS	Combination 6-Lane Highway with Dual-Mode or Diesel Bus in Guideway
0	21,090	32,434	24,870	23,111	30,501	32,375	33,708	43,758	41,320	37,173

Linear feet in footprint, construction disturbance, and sensitivity zones

Chart 3.4-3. Corridor-Wide Summary of Direct Impacts on Streams

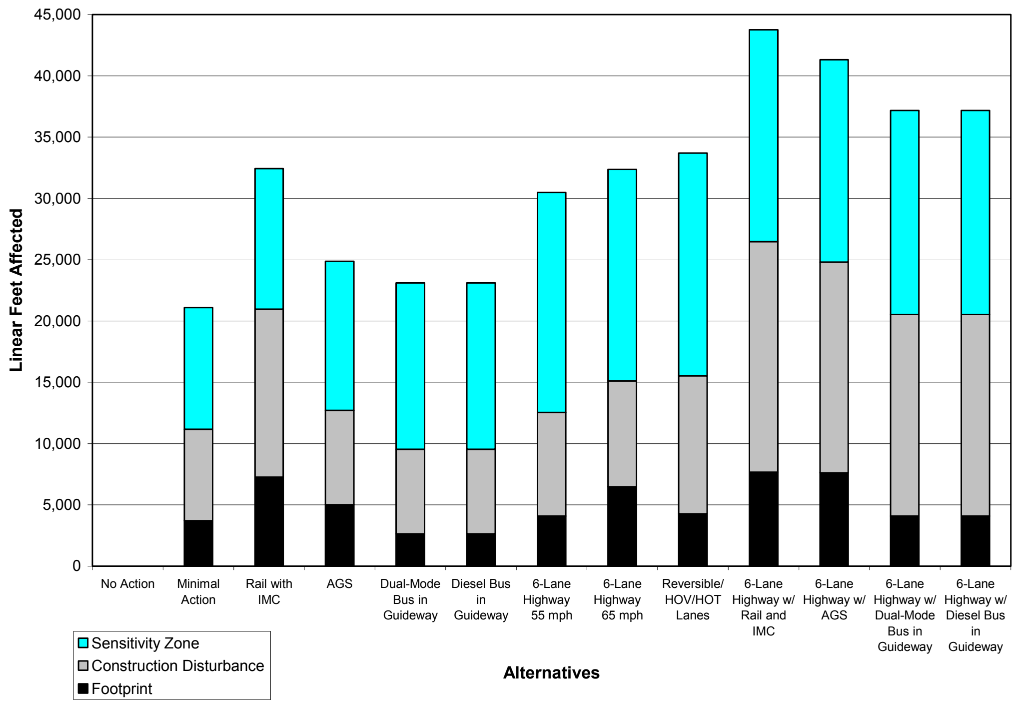
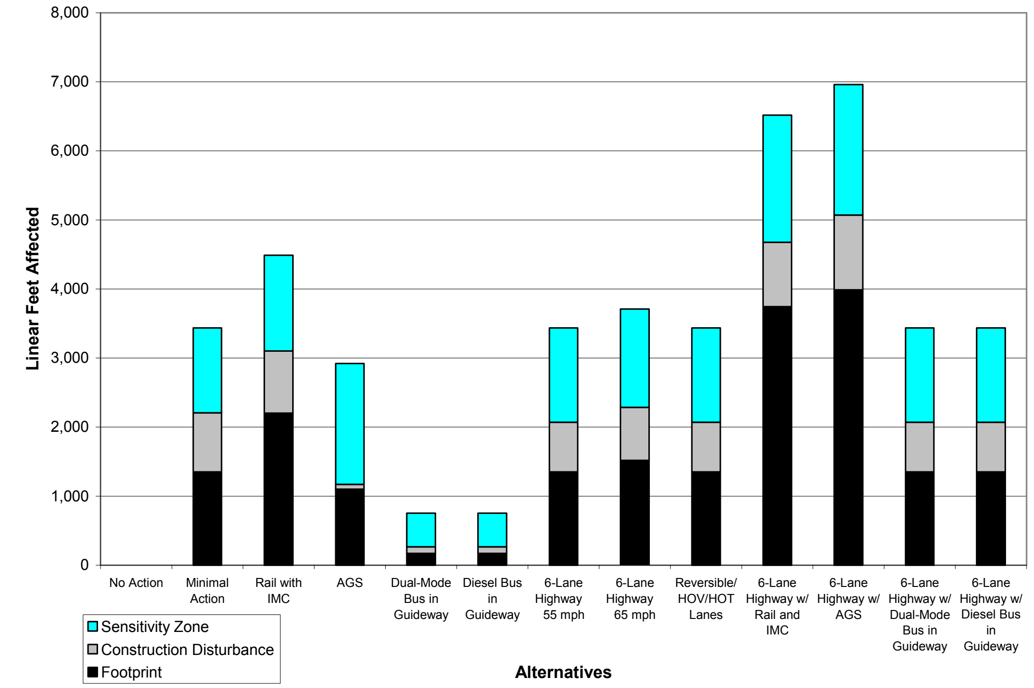


Chart 3.4-4 Impacts on Eagle River Watershed



Stream impacts are also shown by watershed in Chart 3.4-4 through Chart 3.4-6. Footprint impacts associated with Rail with IMC and Combination alternatives would be substantial in the Eagle River and Clear Creek watersheds. Impacts on streams would be the least in the Blue River watershed.

Table 3.4-21 through Table 3.4-23 further illustrate footprint impacts on streams by watershed and indicate specific milepost areas affected. Impacts in the Eagle River watershed would be greatest in the vicinities of Dowd Canyon (Rail with IMC, AGS, and Combination alternatives) and Vail Pass (Rail with IMC, AGS, Combination Six-Lane Highway with Rail and IMC, and Combination Six-Lane Highway with AGS alternatives). Impacts in Dowd Canyon would be associated with efforts to avoid a major landslide area. Vail Pass is an area of steep grades, vertical road cuts, and wetland/fen resources, which have resulted in impacts on Black Gore Creek in the Vail Pass area. Impacts in the Blue River watershed would be greatest in the Dillon/Silverthorne area (all action alternatives). These impacts would be associated with bridge/crossing widening over the Blue River and a tributary downstream of Dillon Reservoir. Impacts in the Clear Creek watershed would be greatest in the areas of Empire (Rail with IMC, AGS, Combination Six-Lane Highway with Rail and IMC, and Combination Six-Lane Highway with AGS alternatives); Lawson, Downieville, and Dumont (all action alternatives); Idaho Springs (all action alternatives); and Fall River (all action alternatives with the greatest impacts from the Six-Lane Highway 55 mph alternative). Near Empire, impacts would result from steep canyon walls, a constrained valley area, and several crossings of Clear Creek. Impacts in the Lawson, Downieville, and Dumont area would be primarily due to Minimal Action components involving interchange improvements that would include widening of ramps. Clear Creek encroachment in the area of Idaho Springs would be associated with avoidance of community areas and steep canyon walls. Because all alternatives would be elevated through Idaho Springs, most impacts on Clear Creek would involve shadowing of the stream. Impacts east of Idaho Springs would be associated with "S" curve safety modification that would affect Clear Creek.

Table 3.4-21. Footprint Impacts on Streams (linear feet) – Eagle River Watershed

Milepost	Vicinity	No Action	Minimal Action	Rail with IMC	AGS	Dual-Mode or Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway w/ Rail and IMC	6-Lane Highway w/ AGS	6-Lane Highway w/ Dual-Mode Bus in Guideway	6-Lane Highway w/ Diesel Bus in Guideway
147		0	25	25	25	25	25	25	25	25	25	25	25
154		0	0	0	72	0	0	0	0	0	72	0	0
159		0	0	0	77	0	0	0	0	0	77	0	0
163		0	37	37	37	37	37	37	37	37	37	37	37
169		0	0	0	84	0	0	0	0	0	84	0	0
170	Dowd Canyon	0	92	0	0	0	92	168	92	92	92	92	92
171		0	980	304	155	107	980	0	980	1,372	1,387	980	980
172		0	0	1,244	229	0	0	0	0	1,504	1,521	0	0
180		0	0	32	0	0	0	0	0	32	0	0	0
182	Vail Pass	0	74	82	71	0	74	74	74	141	94	74	74
183		0	59	359	254	0	59	59	59	365	455	59	59
184		0	83	118	96	0	83	83	83	156	143	83	83
187		0	0	0	0	0	0	0	0	23	0	0	0
Total		**0**	**1,350**	**2,201**	**1,100**	**169**	**1,350**	**446**	**1,350**	**3,746**	**3,987**	**1,350**	**1,350**

Figure 3.4-3. Stream Impacts within the Eagle River Watershed

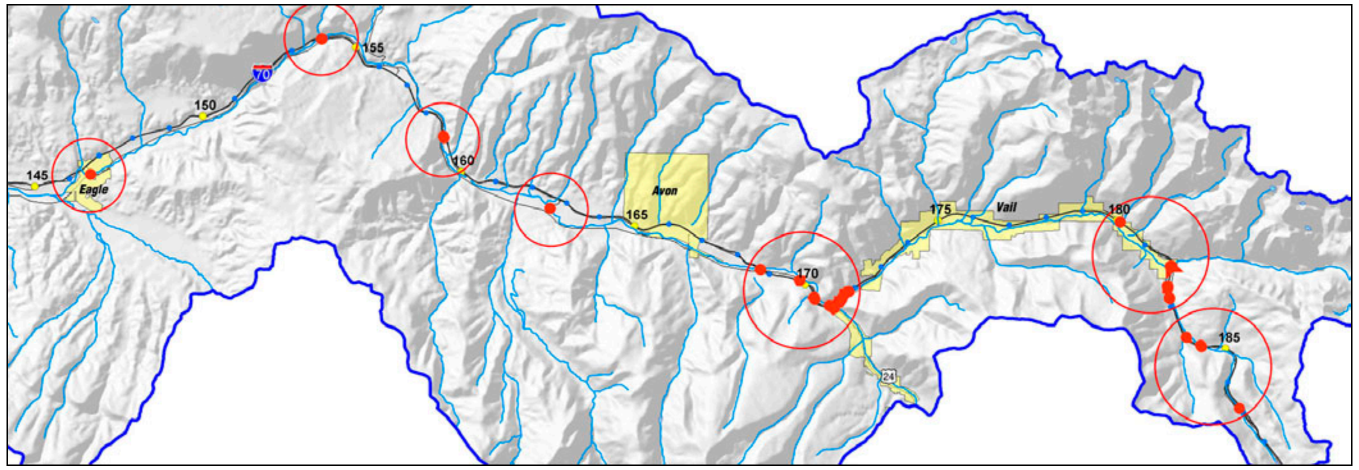


Chart 3.4-5. Impacts on Blue River Watershed

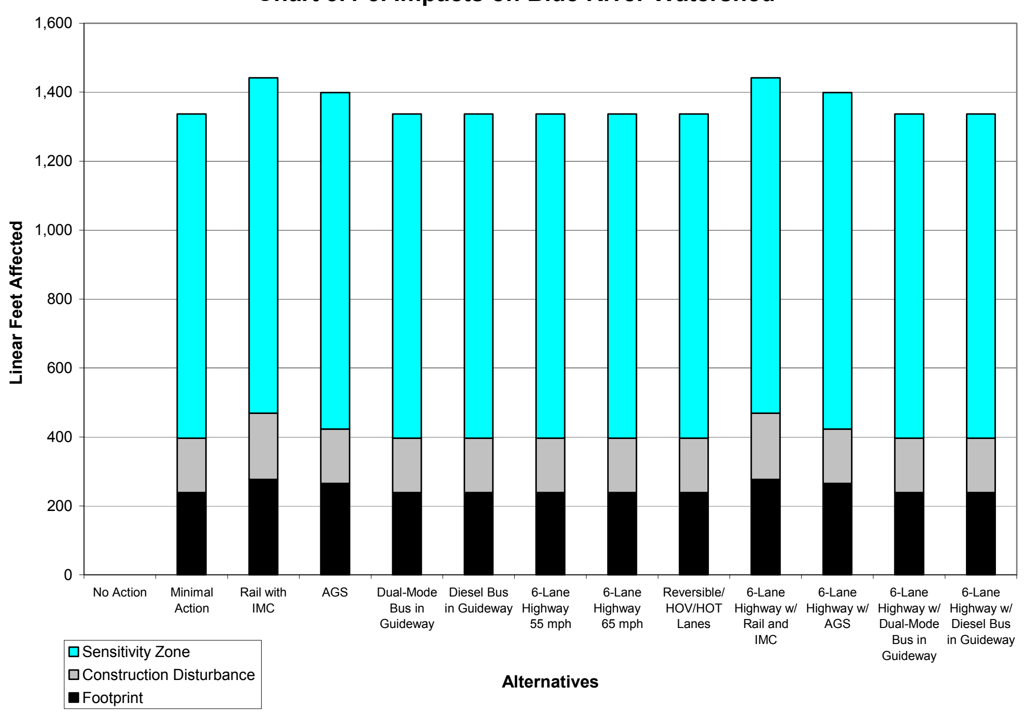


Table 3.4-22. Footprint Impacts on Streams (linear feet) – Blue River Watershed

Milepost	Vicinity	No Action	Minimal Action	Rail with IMC	AGS	Dual-Mode or Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway w/ Rail and IMC	6-Lane Highway w/ AGS	6-Lane Highway w/ Dual-Mode Bus in Guideway	6-Lane Highway w/ Diesel Bus in Guideway
191		0	0	38	27	0	0	0	0	38	27	0	0
201		0	4	4	4	4	4	4	4	4	4	4	4
205	Dillon,	0	207	207	207	207	207	207	207	207	207	207	207
206		0	28	28	28	28	28	28	28	28	28	28	28
Total		**0**	**239**	**277**	**266**	**239**	**239**	**239**	**239**	**277**	**266**	**239**	**239**

Figure 3.4-4. Stream Impacts within the Blue River Watershed

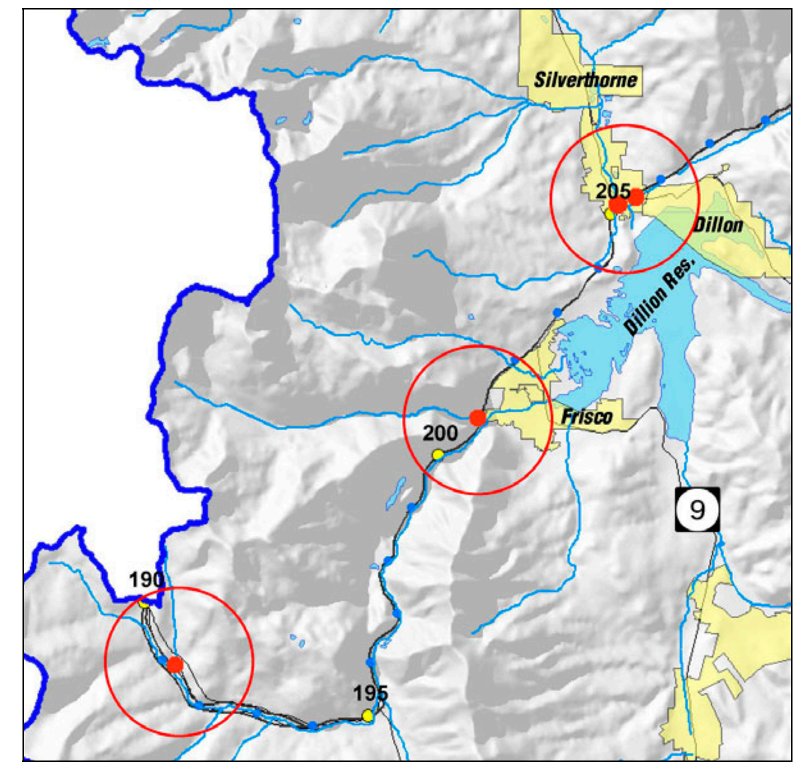


Chart 3.4-6. Impacts on Clear Creek Watershed

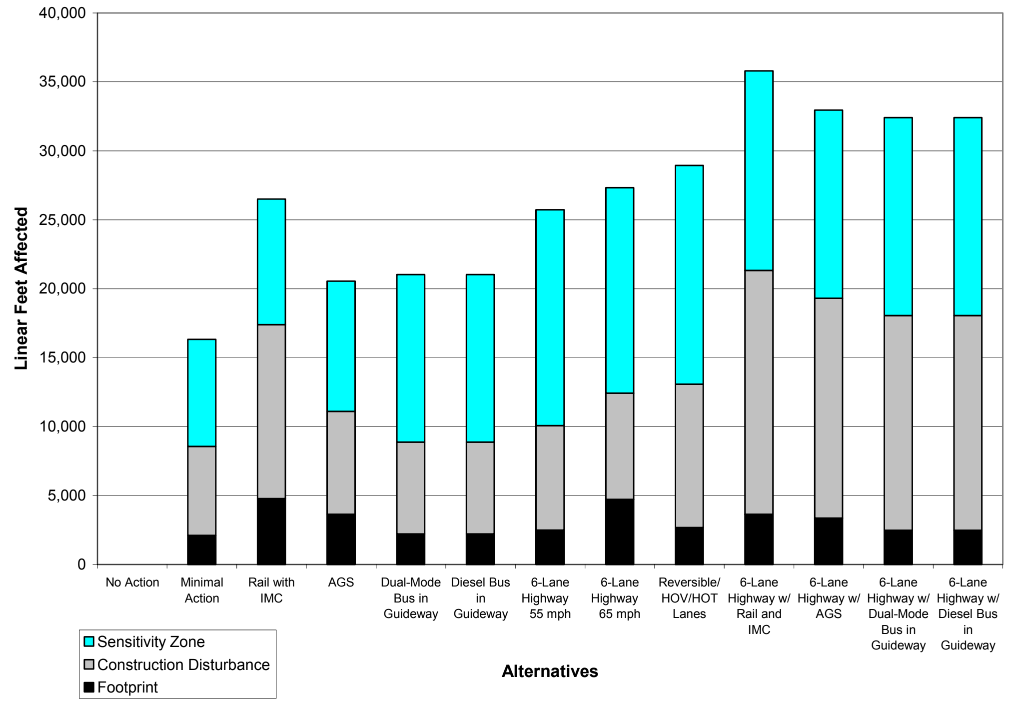


Figure 3.4-5. Areas of Impacts on Streams within the Clear Creek Watershed

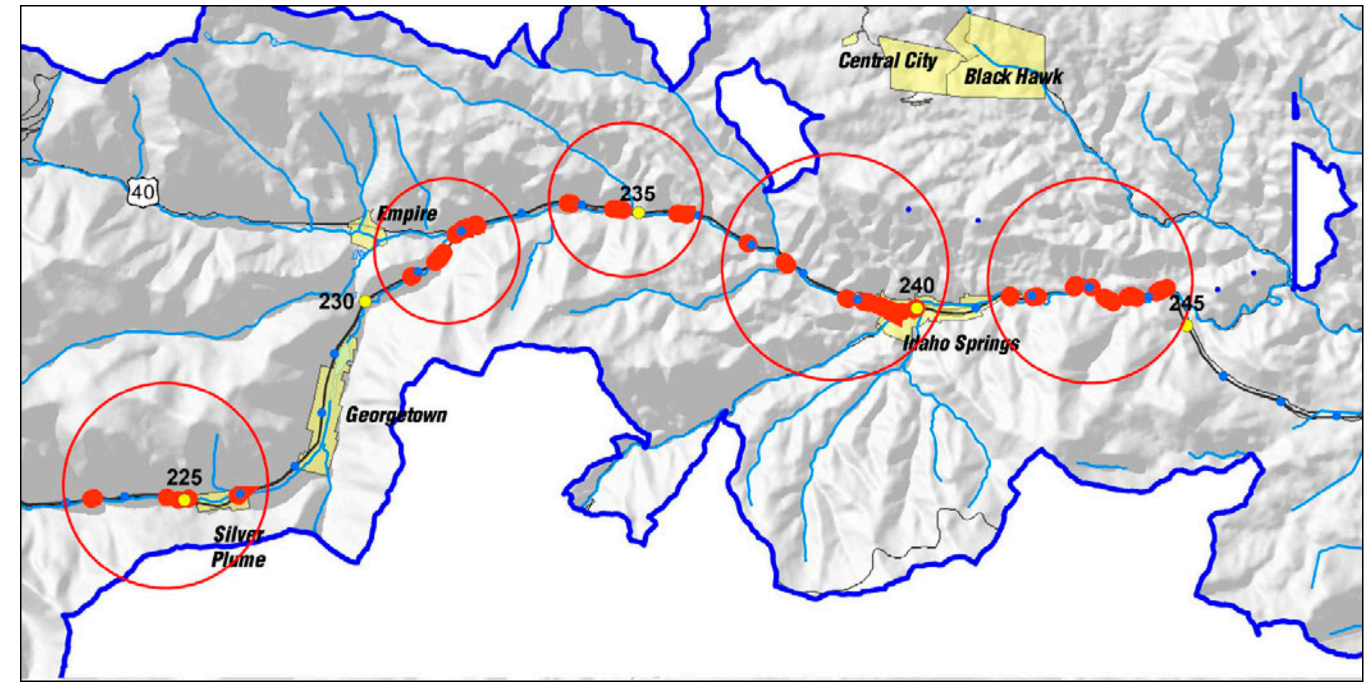


Table 3.4-23. Footprint Impacts on Streams (linear feet) – Clear Creek Watershed

Milepost	Vicinity	No Action	Minimal Action	Rail with IMC	AGS	Dual-Mode or Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway w/ Rail and IMC	6-Lane Highway w/ AGS	6-Lane Highway w/ Dual-Mode Bus in Guideway	6-Lane Highway w/ Diesel Bus in Guideway
223		0	0	0	0	0	0	0	0	80	37	0	0
224		0	0	0	0	0	0	0	0	103	25	0	0
225	Silver Plume	0	31	31	31	31	31	31	31	56	43	31	31
226		0	0	51	0	51	94	78	78	96	93	78	78
231	Empire	0	30	260	314	30	142	30	30	214	210	30	30
232		0	48	745	73	48	57	48	48	150	50	48	48
234	Lawson, Downieville, and Dumont	0	362	362	362	362	362	362	362	362	362	362	362
235		0	61	61	61	61	135	61	61	226	177	61	61
236		0	0	256	0	0	0	0	0	176	118	0	0
237		0	0	106	0	0	0	0	0	0	0	0	0
238	Fall River Road	0	118	293	118	118	118	118	118	118	118	118	118
239	Idaho Springs	0	443	865	825	443	443	443	443	443	443	443	443
240		0	463	785	770	591	591	593	591	591	591	593	593
242		0	129	443	458	129	129	418	590	503	465	479	479
243		0	121	386	498	224	253	1,200	187	386	498	121	121
244		0	139	139	139	139	139	1,343	139	139	139	139	139
Total		**0**	**1,945**	**4,784**	**3,649**	**2,227**	**2,494**	**4,725**	**2,678**	**3,643**	**3,369**	**2,503**	**2,503**

Transportation Operations

Transportation operations would include maintenance and operations activities not included in the winter maintenance activities described above. These activities could include maintenance/operation of sediment control structures, bridge runoff discharge systems, or tunnel discharge systems. Existing EJMT seepage flows into Clear Creek indicate the presence of arsenic, cadmium, copper, lead, mercury, and zinc; and tunnel components of the alternatives that would result in drainage to streams could result in permanent water quality impacts unless the discharge is treated (CDOT 2001). Tier 2 studies will provide additional evaluation of possible tunnel drainage impacts, as well as water quality operations issues associated with bridges, water treatment, and other required structures and systems.

3.4.3.2 Direct Impacts by Alternative

No Action

The No Action alternative would consist of several planned or permitted projects, which are described in detail in Chapter 2, Description and Comparison of Alternatives. Impacts associated with these projects are addressed in other environmental documents, including the *Eagle County Airport Interchange EA*, the *SH 9 EIS,* the *Gaming Area Access EIS*, and the *Hogback Parking Facility EA*. The No Action alternative would include the existing highway condition, as well as improvement projects that have been approved, are currently in the permitting process, and are planned for construction in the next 5 to 20 years. Routine winter maintenance of I-70 would continue under the No Action alternative. Existing winter maintenance results in the deposition of traction sand along the highway shoulders and median and in the accumulation of deicing salts. This material is transported to nearby streams and water bodies in highway runoff. It is anticipated that highway-related contamination of I-70 Corridor streams would continue under the No Action alternative.

The No Action alternative is represented by existing stormwater runoff conditions. FHWA model results of highway runoff impacts on streams show that copper and zinc concentrations and discharge values are highest in the Clear Creek watershed due to the effects of historic mining (these impacts are discussed further in Chapter 4, Cumulative Impacts Analysis). Copper and zinc concentrations associated with I-70 runoff are low in other corridor streams. Suspended sediment, total phosphorus, and chloride concentrations can be high in I-70 runoff, particularly at higher elevations where more sand/salt material is applied. In these areas, streams are impaired from contamination caused by I-70 runoff. Phosphorus discharge values are highest in the Clear Creek watershed due to the extent of land disturbance (mining) in this watershed. For changes in impacts among alternatives, see Table 3.4-19 or the tables in Appendix A.

Historical and existing I-70 stream disturbance/channelization is estimated as shown in Table 3.4-24. Approximately 18 miles (97,000 feet) of stream length would be disturbed/channelized as a result of the existing I-70 footprint, representing the No Action alternative. More than 50 percent of the stream disturbance found in the Corridor would occur in Clear Creek.

Table 3.4-24. I-70 Construction Stream and Channel Disturbance for No Action Alternative

Corridor Watershed/Stream	Stream Length Channelized or Disturbed (Feet)
Eagle River (partial only)[a]	1,043
Gore Creek	6,581
Black Gore Creek	1,686
Blue River	0
West Tenmile Creek	3,468
Tenmile Creek	20,119
Straight Creek	1,557
Clear Creek	54,803
Mount Vernon Creek	7,577
Total	**96,834**

[a] *Based on aerial photography; only available for a few miles west of Dowd Canyon*

Table 3.4-25 summarizes potential water quality impacts from specific No Action projects. These impacts would be minimal and would primarily be associated with small increases in winter maintenance activities. Under the No Action alternative, mitigation of existing impacts would be provided for Black Gore Creek and Straight Creek. These streams would be impaired for sedimentation impacts from I-70. SCAPs have been developed and are being implemented for these watersheds.

Table 3.4-25. Direct Impacts, No Action Alternative

Sub-Basin	Direct Impacts	No Action Component	Mitigation Activities
Upper Colorado River	None	None	None
Eagle River	Construction and runoff impacts on the Eagle River from highway improvements; winter maintenance activities may increase contaminant loads from sand and deicers into the Eagle River	Eagle County Airport interchange, Eagle-Vail Half-Diamond, Post Boulevard	BMPs; deicing measures are specified to use a liquid automated deicing solution, which will be drained to containment facilities to minimize input into the Eagle River and wetlands
Black Gore Creek	None	Mitigation of Existing Impacts	Implementation of SCAP
Blue River	Construction and runoff impacts on the Blue River from highway improvements; winter maintenance activities may increase contaminant loads from sand and deicers into the Blue River	Widening of SH 9	BMPs during construction
Straight Creek	None	Mitigation of Existing Impacts	Implementation of SCAP
Clear Creek	Construction and runoff impacts on Clear Creek and North Clear Creek from highway improvements and tunnel excavation; winter maintenance activities may increase contaminant loads from sand and deicers into Clear Creek and North Clear Creek	Black Hawk Tunnel	BMPs during construction
Upper South Platte	The proposed action will increase the impervious surface area from 3 acres to 13.8 acres (360%); increased runoff from parking area may increase erosion and sediment transport into nearby drainages	Hogback Parking Facility	BMPs during construction; detention pond

Minimal Action

The Minimal Action alternative would include various components: transportation management, a maintenance program, interchange improvements, and climbing and auxiliary lanes. Transportation management is not anticipated to directly affect water resources because no new construction would occur as part of this component. All of the proposed climbing and auxiliary lanes would be located in steep, high elevation zones of the Corridor (Vail Pass, EJMT, areas of Clear Creek County) that receive moderate to high snowfall and require extensive winter maintenance. Substantial impacts on water quality already exist in these areas resulting from the operation of I-70. The addition of climbing lanes in these areas is expected to exacerbate existing water quality issues in these areas unless appropriate mitigation measures are implemented.

Winter Maintenance

Minimal Action improvements would increase sand/deicer usage by 19 percent/18 percent in the Eagle River watershed. This would include impacts from auxiliary lanes at Vail Pass along Black Gore Creek. Black Gore Creek is listed as impaired due to winter maintenance impact and the TMDL may be affected. The Clear Creek watershed would also be affected with increased sand/deicer usage (44 percent/28 percent).

Stormwater Runoff

The Minimal Action alternative would indicate a moderate increase from existing conditions in stream contaminant loads during once in 3-year storm events, with the greatest impacts located in the Black Gore Creek, and Middle and Lower Clear Creek watersheds (20 to 25 percent). Impacts from the Minimal Action alternative would be associated with an auxiliary lane along Black Gore Creek. Black Gore Creek is a public water supply source. Gore Creek is also a public water supply source and a Gold Medal fishery. Impacts on Clear Creek would be associated with interchanges and curve safety modification.

Stream Disturbance

Impacts (footprint and construction disturbance zone) on streams from the Minimal Action alternative would be approximately 11,177 linear feet, an increase of 12 percent from existing I-70 disturbance. Stream impacts would be among the least of the alternatives.

Maintenance Program

Highway maintenance will continue to play an integral role in sediment control and water quality in the Corridor. Excess highway sand is cleaned up according to the availability of labor resources and funding. In the year 2000, CDOT initiated a new Maintenance Management System (MMS), allowing those maintenance activities directly related to sand cleanup to be more closely monitored.

An important aspect of the Minimal Action alternative with respect to water quality impact is the full implementation of the SCAP. The SCAP provides for sediment collection and scheduled inspection and maintenance requirements. Installation of new sediment collection structures will require a routine inspection and maintenance program for the cleanup and removal of accumulated sediment. This program also will require an annual inspection program to assess the integrity and condition of sediment control BMPs and other future drainage treatments.

Rail with IMC

Winter Maintenance

The quantities of sand and deicer are assumed to be the same as existing I-70 for both the Rail with IMC and AGS alternatives, except for their Minimal Action components that would result in increases of 8 and 8 percent. This assumption is based on minimal increases in the need for such materials for the control of snow and ice (see Appendix G, Water Resources*,* for further discussion). However, it should be noted that some minimal increase (not quantified during the PEIS) in impervious surface that requires winter maintenance would be expected as a result of modifications necessary to the highway to accommodate the Rail with IMC alternative and as a result of new transit centers.

Stormwater Runoff

The Combination Six-Lane Highway with Rail and IMC alternative would be associated with a high increase in stream loads (40 to 42 percent) during 3-year storm events due to the substantial increase in footprint area. This alternative also would be associated with increased impervious surface due to incorporation of drainage features into the rail bed design. Increased levels of TSS, phosphorus, chloride, copper and zinc would be a concern in the Clear Creek watershed due to established TMDLs and because the stream is an important public water supply source. Increased TSS and phosphorus levels would be a concern in the Eagle River watershed (Black Gore Creek, Gore Creek) and the Blue River watershed (Dillon Reservoir, Straight Creek, West Tenmile Creek, and Blue River) due to public water supply sources and fisheries.

Stream Disturbance

The Rail with IMC alternative is estimated to affect (footprint and construction disturbance zone) 20,976 linear feet of stream length, an increase of 22 percent from existing I-70 disturbance. This impact would be almost two times the amount of the Minimal Action impact.

AGS

Winter Maintenance

The quantities of sand and deicer are assumed to be the same as existing I-70 for both the Rail with IMC and AGS alternatives, except for their Minimal Action components that would result in increases of 8 and 8 percent. This assumption is based on AGS not requiring the use of winter maintenance materials to control snow and ice. However, it should be noted that some minimal increase (not quantified in this PEIS) in impervious surface would be expected as a result of modifications necessary to the highway to accommodate the AGS alternative and as a result of new transit centers.

Stormwater Runoff

The AGS alternative would not be associated with any increase in stream concentrations/loads because it is assumed to have no increase in impervious surface due to its “open lattice structure” (see Chapter 2, Description and Comparison of Alternatives, for further description). However, AGS Minimal Action components would increase stream loads by 8 to 9 percent.

Stream Disturbance

The AGS alternative is estimated to affect 12,709 linear feet (footprint and construction disturbance zone) of stream length, an increase of 13 percent from existing I-70 disturbance. This impact would be among the least of alternatives. Stream disturbance impact estimates associated with the AGS alternative are very conservative because the AGS elevated alignment would limit direct stream impacts on piers. The actual impacts, however, were estimated based on the entire alternative footprint width and length. Pier impacts on streams associated with the AGS alternative could be avoided/minimized through localized alternative alignment shifts.

Dual-Mode or Diesel Bus in Guideway

Winter Maintenance

For the Dual-Mode or Diesel Bus in Guideway alternatives, the greatest increase in sand/deicer usage would occur in the Clear Creek and Mount Vernon Creek watersheds. Winter maintenance impacts from deicers associated with the Bus in Guideway alternatives (including Combination alternatives) would be the greatest of all the alternatives. This is partly due to the assumption that the guideways would require more deicer usage to ensure safe bus travel. Note that the guideway is assumed to have no usage of sand due to maintenance and operation issues and that all increased sand usage would be associated with Minimal Action components.

Stormwater Runoff

The Bus in Guideway alternatives are associated with a moderate increase in stream loads (16 to 17 percent). Increased levels of phosphorus, TSS, chloride, copper, and zinc would be a concern in the Clear Creek and Bear Creek watersheds due to TMDLs and public water supply sources.

Stream Disturbance

Because the Bus in Guideway alternatives would primarily be designed in the median, impacts on streams would be minimized and would be among the least of the alternatives (9,545 linear feet of footprint and construction disturbance zone effects).

Six-Lane Highway (55 or 65 mph)

Winter Maintenance

The greatest impacts from sand/deicer usage for the Six-Lane Highway (55 or 65 mph) alternatives would be located in the Clear Creek watershed (62/45 and 58/41 percent). Increased levels of phosphorus and sediment would be a concern in the Clear Creek watershed due to public water supply sources. The decreased impacts associated with the Six-Lane Highway 65 mph alternative would be the result of decreased highway surface area due to curve safety modification and tunnels.

Stormwater Runoff

The Six-Lane Highway 55 mph alternative would be associated with a greater increase in stream loads (19 to 20 percent) than the Six-Lane Highway 65 mph alternative, due to highway widening to six lanes at Dowd Canyon (along the Eagle River). The Six-Lane Highway 65 mph alternative would include a tunnel at Dowd Canyon, which would result in somewhat decreased impervious surface in this area. Increased phosphorus, copper, and zinc levels (Six-Lane Highway alternatives) would be a concern in the Eagle River due to public water supply sources and wastewater treatment facilities. Impacts on Clear Creek would also be a concern for the Six-Lane Highway (55 or 65 mph) alternatives.

Stream Disturbance

The Six-Lane Highway 55 mph alternative would have the least impacts on streams of the Highway alternatives (12,536 linear feet). The Six-Lane Highway 65 mph and Reversible/HOV/HOT Lanes alternatives would follow with 15,114 and 15,541 linear feet of effects on streams, respectively. The Six-Lane Highway 65 mph alternative impacts would be influenced by the Floyd Hill Tunnel and Fall River Road curve alignments, while those of the Reversible/HOV/HOT Lanes alternative would be influenced by wider footprints that would be necessary to accommodate the transportation system platform.

Reversible/HOV/HOT Lanes

Winter Maintenance

Sand/deicer impacts would be slightly greater than those of the Six-Lane Highway (55 or 65 mph) alternatives, with the greatest impacts located in the Clear Creek watershed (72/54 percent increase in sand/deicer usage).

Stormwater Runoff

The Reversible/HOV/HOT Lanes alternative would be associated with moderate increases in stream loads (22 to 23 percent), which would be nominally greater than those of the Six-Lane Highway (55 or 65 mph) alternatives and Bus in Guideway alternatives. The greatest impacts would be located in the Clear Creek watershed (41 to 42 percent increases). The Reversible/HOV/HOT Lanes alternative also would include highway widening at Dowd Canyon and would have similar impacts on the Eagle River watershed to those of the Six-Lane 55 mph alternative. Increased levels of phosphorus, TSS, copper, and zinc would be a concern in the Clear Creek watershed due to TMDLs and public water supply sources.

Stream Disturbance

The Reversible/HOV/HOT Lanes alternative is estimated to affect 15,541 linear feet of streams, a 16 percent increase from existing I-70 disturbance—the greatest stream impacts of the Highway alternatives (along with the Six-Lane 65 mph alternative).

Combination Six-Lane Highway with Rail and IMC

The Combination Six-Lane Highway with Rail and IMC alternative would result in the greatest effective impervious surface area in the Corridor and would have the greatest potential to create additional water quality impacts.

Winter Maintenance

The greatest sand/deicer (winter maintenance) impacts would be located in the Clear Creek watershed (62/45 percent increase), with a 19 percent increase in sand usage in the Eagle River watershed. As discussed earlier, the AGS and Rail with IMC alternatives are not expected to increase sand and deicer usage (except for their Minimal Action components). Increased levels of phosphorus and sediment would be a concern in the Clear Creek watershed due to public water supply sources.

Stormwater Runoff

The Combination Six-Lane Highway with Rail and IMC alternative would be associated with the greatest increase in stream loads (41 to 42 percent) of all the alternatives. Increased levels of TSS, phosphorus, copper, and zinc would be a concern with respect to public water supplies, fisheries, and TMDLs in the Eagle River, Blue River, and Clear Creek watersheds.

Stream Disturbance

The Combination Six-Lane Highway with Rail and IMC alternative is estimated to affect 26,480 linear feet of streams, a 27 percent increase from existing I-70 disturbance. This increase would be the greatest stream impact of all the project alternatives.

Combination Six-Lane Highway with AGS

Winter Maintenance

The greatest sand/deicer (winter maintenance) impacts would be located in the Clear Creek watershed (62/45 percent increase). As discussed earlier, the AGS and Rail with IMC alternatives are not expected to increase sand and deicer usage (except for Minimal Action components). Increased levels of phosphorus and sediment would be a concern in the Clear Creek watershed due to public water supply sources.

Stormwater Runoff

The Combination Six-Lane Highway with AGS alternative would be associated with a moderate increase in stream loads (19 to 20 percent), which is generally equivalent to the Six-Lane Highway 55 mph alternative, because AGS would not contribute impervious surface, except for its Minimal Action components. Increased levels of TSS, phosphorus, copper, and zinc would be a concern with respect to public water supplies, fisheries, and TMDLs in the Eagle River and Clear Creek watersheds.

Stream Disturbance

The Combination Six-Lane Highway with AGS alternative would be associated with the next greatest impact after the Combination Six-Lane Highway with Rail and IMC alternative (24,808 linear feet, an increase of 26 percent from existing I-70 disturbance). It should be noted that stream disturbance impact estimates associated with the AGS alternative are very conservative because the AGS elevated alignment would limit direct stream impacts on piers. The actual impacts, however, were estimated based on the entire alternative footprint width and length. Pier impacts on streams associated with the AGS alternative could be avoided/minimized through localized alternative alignment shifts.

Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway

Winter Maintenance

The Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives would be associated with the greatest increase in deicer usage (103 percent) in the Clear Creek watershed. The Mount Vernon Creek watershed is affected by a 24 percent/44 percent increase in sand/deicer usage. This alternative would be associated with the greatest overall increase in sand/deicer usage of all the project alternatives. This would partly be due to the assumption that the guideways would require more deicer usage to ensure safe bus travel (because the guideway is assumed to have no usage of sand due to maintenance and operation issues). All increased sand usage would be associated with the Six-Lane Highway alternative.

Stormwater Runoff

The Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives would be associated with moderate increases in stream loads (20 to 26 percent). Impacts would primarily be located in the Clear Creek watershed (43 to 45 percent). Impacts would also be associated with highway widening in the area of Dowd Canyon (Eagle River) and from widening along Straight

Creek. Increased TSS, phosphorus, zinc, and copper would be a concern due to public water supplies and TMDLs in these watersheds.

Stream Disturbance

The Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives are estimated to affect 20,526 linear feet of streams, a 21 percent increase from existing I-70 disturbance. This impact would represent the least stream impact of the Combination alternatives.

3.4.3.3 Indirect Impacts

Indirect impacts on water quality and streams would include possible long-term impacts associated with increased traffic and possible induced growth (linked to alternatives). Such impacts might include increased accidental spill incidents or increased sedimentation from growth-induced construction projects. Stream impacts could include encroachment/channelization, and changes in stream hydrology, stream health, and fish habitat. Long-term changes in stream morphology also would be considered indirect impacts.

Minimal Action, Six-Lane Highway (55 or 65 mph), and Combination alternatives would include improvements to the high spill incident area (mileposts 257 to 259) along Mount Vernon Creek. These alternatives would include a greater number of overall highway improvements that would improve mobility and safety for transport of hazardous materials by truck and might be expected to result in fewer spill incidents than Transit alternatives.

Induced Growth

Transit and Combination alternatives would be associated with possible growth inducement and increased development in the Corridor (see section 3.9, Social and Economic Values). Highway alternatives may also induce growth, but to a much lesser extent, and only in Eagle County. Increased development could be associated with an incremental increase in impervious surface and stormwater runoff. Therefore, Transit and Combination alternatives would be affected by possible induced growth impacts on water quality. The greatest impacts would be indicated in the Eagle River watershed. Induced growth impacts from the Combination alternatives would also be indicated in the Blue River watershed. Impacts on water quality from induced growth have not been quantified but are assumed to contribute an incremental amount of water quality impacts on the future planned development impacts, as discussed in the analysis of cumulative impacts (see Chapter 4, Cumulative Impacts Analysis). Induced growth might contribute an additional 20 to 45 percent and 18 percent to the projected 2025 populations of Eagle and Summit counties, respectively. Water quantity issues associated with possible induced growth are addressed in Appendix K, Overview of Water Availability and Growth, and Forest Service Land Management; section 3.10, Land Use; and Chapter 4, Cumulative Impacts Analysis.

Stream Morphology

Stream morphology is affected by numerous factors including development and urbanization. Stream morphology can be affected indirectly by increased stormwater runoff, channelization, and increased sedimentation. These impacts can change stream morphology in terms of the channel stream flow characteristics and shape of the channel. Areas of localized channel disturbances related to construction and operation of I-70 that have affected the local morphology of streams have been documented to occur in Clear Creek, Straight Creek, Black Gore Creek, and to a lesser extent, Tenmile and Gore creeks. By far, the most extensive channelization caused by the construction of I-70 occurs in the Clear Creek watershed. Indirect impacts on stream morphology will be further considered and evaluated in Tier 2 studies.

3.4.4 Mitigation Measures

All action alternatives would require effective drainage of the roadway surface to maintain the integrity of the roadbed and the safety of the traveling public. All water that is captured within the I-70 transportation template must be discharged rapidly through an effective drainage system. Table 3.4-26 summarizes water quality and stream issues, as well as mitigation measures.

Table 3.4-26. Mitigation Summary

Issue	Mitigation
Winter maintenance	CDOT Maintenance Procedures and construction BMPs; SCAPs for Black Gore Creek and Straight Creek; evaluation/implementation of “restoration” and water quality protection measures identified for the Clear Creek watershed (SWEEP); permanent structural controls identified during Tier 2; CDPHE Phase II stormwater requirements; research alternative deicers and traction materials and methods, and their potential impacts on the adjacent environment. Impacts on water supplies due to proximity or configuration of an alternative will be mitigated in consultation with the affected drinking water treatment plants, watershed groups, and CDPHE during Tier 2
Stormwater runoff	
Highway construction	CDOT requirements for BMPs and Stormwater Management Plan (SWMP); CDPHE water quality regulations (dewatering and discharge)
Stream disturbance	CDOT requirements for BMPs and a SWMP; permanent structural controls and/or bioengineering techniques identified during Tier 2
Historic mine waste	CDOT requirements for BMPs and a SWMP; permanent mitigation of disturbed mine waste materials (including water discharge) identified during Tier 2 according to a memorandum of agreement between CDOT, EPA, and CDPHE
Transportation system operations	CDOT Maintenance Procedures and BMPs; CDPHE Phase II stormwater requirements; CDPHE water quality regulations (for example, tunnel discharge)

Local watershed initiatives would be incorporated into project alternative mitigation strategies, and mitigation would consider the goals of the local watershed planning entity. BMPs implemented along the Corridor, for example, can be designed to address individual watershed entity concerns. In some cases, a monitoring program could be implemented to provide timely information needed for ongoing management of the watershed. Any required control regulations, TMDLs, National Pollutant Discharge Elimination System (NPDES) permits, state standards, or other mandatory control measures, as well as voluntary measures, can then be included in the overall program. CDOT will coordinate with local watershed entities during I-70 Tier 2 studies and during design/construction stages to achieve these goals and to ensure consistency in the process. In addition, CDOT will work closely with regulatory and resource agencies and the general public throughout this process to ensure adherence to water quality goals at the local, state, and federal levels.

In Tier 2 studies, steps will be taken to safeguard intakes for public water supplies, including alluvial wells associated with Corridor streams, in the immediate vicinity of I-70 from sediment, deicers, and other constituents contained in highway runoff.

Implementation of a project alternative will be done in conformity with Section 107.25 and Section 208 of the CDOT *Standard Specifications for Road and Bridge Construction*. These specifications also include measures that protect water quality and streams. Tier 2 studies will evaluate and identify permanent mitigation measures for specific issues including structural controls (beyond the Black Gore Creek and Straight Creek SCAPs).

3.4.4.1 Winter Maintenance and Stormwater Runoff

Increased impervious surface would impact winter maintenance activities and stormwater runoff. BMPs, highway maintenance strategies, and drainage/sediment control structures would be implemented as appropriate to minimize impacts from winter maintenance and increased stormwater.

Methods of capturing and reducing the amount of sand/salt applied to the Corridor include structural sediment control and retrieval, automated deicing systems, solar snow storage zones, and porous pavement (CDOT 2002a, 2002b).

Areas requiring the most snowplowing and traction sand use are the higher elevation zones of the Corridor above 9,000 feet that receive greater snowfall. Black Gore Creek and Straight Creek are areas where application of traction sand has resulted in stream water quality impairment.

The SCAPs developed for the Black Gore Creek and Straight Creek I-70 corridors rely extensively on detention basins for collection of sediment (CDOT 2002). These sediment control devices, or structural BMPs, are effective in reducing suspended solids and total phosphorus in highway discharges. Many of the sediment control measures specified in the SCAPs have already been successful in reducing sediment loads from I-70. Reductions have been measured in Straight Creek and Black Gore Creek. When the SCAPs are fully implemented, sediment load reductions of up to 80 percent are possible (CDOT 2002). However, load reductions would be highly variable due to factors such as runoff distribution, drainage control, sand applications, maintenance procedures, and BMP design. Full implementation of SCAP could occur in a more timely fashion with the development of a selected alternative.

3.4.4.2 Construction and Stream Disturbance

Construction impacts would primarily be mitigated through implementation of appropriate BMPs for erosion and sediment control according the CDOT *Erosion Control and Storm Water Quality Guide* (CDOT 2002). According to the guide, a stormwater management plan (SWMP) must be developed before any major construction project that specifies water quality protection BMPs. Both structural and nonstructural control measures are described in the document to reduce water quality impacts from areas disturbed by construction. The SWMP may include monitoring of erosion and water quality during and after construction. Soil stabilization and revegetation measures are commonly employed to reduce long-term impacts from construction disturbance. Drinking water sources and special considerations such as instream flow requirements for fisheries will be evaluated in light of I-70 construction requirements during Tier 2.

The portion of I-70 from C-470 to the Clear Creek County border falls under the designated CDPHE NPDES Phase II regulations (as designated and administered by CDPHE-WQCD). This area includes the Mount Vernon Creek, Soda Creek, and Beaver Brook watersheds. CDOT has an NPDES permit (Permit No. COS-000005) authorizing new or existing discharges composed entirely of stormwater from CDOT's municipal separate storm sewer system (MS4). The Storm Water Management Program included in the permit consists of eight programs, including maintenance of structural controls, industrial facilities, construction sites, and facility runoff control. The permit requires BMPs during construction (including site dewatering) and post-construction permanent BMPs to be considered early in the project development process. This commitment will address right-of-way and design of permanent stormwater quality controls in detail to avoid the necessity of retrofitting the stormwater quality control structures in the future. Classifications and uses of the state waters affected by the ramps and roadways would drive the types of permanent water quality control structures necessary to protect these uses. In addition, CDOT's New Development/Redevelopment MS4 Stormwater Management Program calls for increased protection of waters identified as sensitive. An individual NPDES permit could be required for discharge to streams with TMDLs or other special circumstances.

Implementation of a project alternative would be done in conformity with Section 107.25 and Section 208 of the CDOT *Standard Specifications for Road and Bridge Construction,* and Senate Bill 40 (SB 40) certification. These specifications would also include measures that would protect water quality and streams. Tier 2 studies will evaluate and identify permanent mitigation measures for specific issues including structural controls (beyond the Black Gore Creek and Straight Creek SCAPs). Stream restoration measures might include creation of drop structures and/or bioengineering techniques.

Construction disturbance would constitute temporary impacts on streams, while project alternative footprints could require permanent impacts such as channelization or pier placement for bridges. Tier 2 studies will include specific identification of stream disturbance during construction, including construction disturbance areas, channelized segments, pier placement, and structural modifications such as embankment walls, cantilevered sections, or elevated structural segments and bridges. Temporary and permanent impacts on stream flow and channels would require CWA 404 permitting by the COE (see Section 3.6). Impacts on areas that have previously been disturbed by existing I-70 would provide opportunities for stream restoration measures that might improve stream environments and aquatic habitat. Stream restoration measures might include creation of drop structures (used to create riffle and pool areas) and revegetation of barren areas, or possible realignment in Idaho Springs as part of context sensitive design preferences.

Possible methods to further minimize impacts on streams during Tier 2 are listed for areas with greatest impacts on streams below:

- Dowd Canyon – elevated and/or cantilevered sections
- Vail Pass – rock cuts including vertical or terraced walls, cantilevered sections, localized alignment shifts
- Dillon/Silverthorne area – cannot avoid impacts with widening of stream crossings, could reconsider this Minimal Action component
- Silver Plume area – elevated and/or cantilevered sections, localized shifting of alignments
- Lawson, Downieville, and Dumont – because area already heavily channelized due to I-70, channelization could be a reasonable option, cantilevered sections, localized shifting of alignments
- Idaho Springs – alternatives are already elevated, localized shifting of Minimal Action component alignments
- "S" curves east of Idaho Springs – rock cuts with vertical or terraced walls, cantilevered sections

Impacts from disposal of tunnel waste materials and tunnel construction staging areas would be minimized through rigorous application of SWMPs and BMPs (including site dewatering) that keep construction-originated materials from entering waterways. Tunnel construction would generate large quantities of process/wastewater. CDOT would dispose of process/wastewater according to CDPHE-WQCD requirements. Disposal methods generally would include appropriate treatment for disposal to Corridor streams, temporary construction pond disposal, or transport to a treatment facility. The original construction of EJMT included capture of wastewater in detention basins to allow sediment to settle out. Water was then discharged to Clear Creek and Straight Creek.

Additional technical research (Tier 2) will be required to evaluate the possibility of the Floyd Hill tunnel (part of the Six-Lane Highway 65 mph alternative) to affect area groundwater flows that are important today for individual water well owners. Permitting and coordination under CWA Regulation 404 and under water rights and appropriations considerations with the DWR might be necessary. If resident water wells were affected due to the tunnel, mitigation requirements would most likely consist of drilling deeper wells for the affected area residents. Such mitigation would be considered generally feasible. While unlikely based on Tier 1 information, if deeper wells are found not to be feasible, mitigation with an alternative water supply (that is, not local groundwater) might be unrealistic.

Floodplain analysis, in compliance with 23 CFR 650, will be conducted during Tier 2 studies.

3.4.4.3 Transportation Operations

Hydraulic Disruption of Tributary Streams

The initial construction of I-70 through Corridor valleys resulted in the interception of numerous tributary streams. Many of the tributaries are ephemeral, flowing only after precipitation events. In some areas along the Corridor, these tributaries drain unconsolidated geologic materials that are subject to severe erosion and sediment or debris transport. Typical measures taken to convey tributary flows included installation of cross-drain culverts beneath I-70. Larger streams require box culverts or bridges.

Under conditions of high sediment or debris transport from these tributaries, I-70 can serve as a dam by preventing part or all of the sediment and debris from depositing on the valley floor or in receiving streams and rivers. In these instances, I-70 may reduce the sediment loading to receiving waters. However, significant maintenance of the highway shoulders and culvert drains is required to maintain hydraulic conveyance and to prevent encroachment of debris on the highway. Sediment dikes have been installed in several high debris flow areas along I-70 in the lower Eagle River Valley.

In the Clear Creek watershed where these tributaries drain mine waste, I-70 can serve as an effective sediment dam that reduces metal loading. These tributaries are prevalent along I-70 between Idaho Springs and Silver Plume. If additional sediment control structures were installed and maintained in these areas, net cumulative improvements to water quality through reduced sediment metal loading could be realized.

Effective hydraulic design and maintenance measures would minimize impacts from tributary hydraulic disruption. For some alternatives, it may be possible to mitigate existing hydraulic problems, resulting in overall improvements to the transportation system and decreased environmental impacts.

Tunnel Maintenance and Operation

Tunnel discharges are typically regulated as point source discharges under the Clean Water Act, requiring an NPDES permit. Further study (Tier 2) will be required to identify tunnels that might require water discharge systems, water treatment systems, and/or NPDES permits. Water rights issues must also be considered in the context of Colorado water law for new groundwater discharges.