RECLAMATION

Managing Water in the West

Windy Gap Firming Project

Stream Water Quality Technical Report

U.S. Department of the Interior
Bureau of Reclamation
Great Plains Region

May 2008

Stream Water Quality Technical Report

Windy Gap Firming Project

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Abbreviations

AF	Acre-feet
BOD	Biological oxygen demand
BTWF	Big Thompson Watershed Forum
C-BT	Colorado-Big Thompson Project
CDPHE	Colorado Department of Public Health and Environment
cfs	cubic feet per second
ch	chronic
CWCB	Colorado Water Conservation Board
cm	centimeter
dis	dissolved
DO	Dissolved Oxygen
DW	Denver Water
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ft	feet
GCWIN	Grand County Water Information Network
HSS	Hot Sulphur Springs
ISDS	Individual Sewage Disposal Systems
L	liter
m	meter
mg	milligram
MPWCD	Middle Park Water Conservancy District
MWAT	Maximum Weekly Average Temperature
N	Nitrogen
NCWCD	Northern Colorado Water Conservancy District
NWCOG	Northwest Council of Governments
P	Phosphorus
PACSM	Platte and Colorado Simulation Model
RMNP	Rocky Mountain National Park
QUAL2K	Water quality model
sp	spawning
SSTEMP	Stream Segment Temperature Model
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
µg	micrograms
µS	microSiemens
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WGFP	Windy Gap Firming Project
WQCC	Water Quality Control Commission
WQCD	Water Quality Control Division
WWTP	Wastewater treatment plant

WINDY GAP FIRMING PROJECT
STREAM WATER QUALITY TECHNICAL REPORT

1.0 INTRODUCTION

The Bureau of Reclamation (Reclamation) has received a proposal from the Municipal Subdistrict, Northern Colorado Water Conservancy District, acting by and through the Windy Gap Firming Project Water Activity Enterprise (Subdistrict) to improve the firm yield from the existing Windy Gap Project water supply by constructing the Windy Gap Firming Project (WGFP). The proposal includes a connection of WGFP facilities to the Colorado-Big Thompson Project. For more information on the background and purpose of the WGFP see the Windy Gap Firming Project Purpose and Need Report (ERO 2005a). This technical report was prepared to address the potential environmental effects on stream water quality associated with the alternatives described below and will be used in the preparation of the EIS. Separate technical reports address surface and ground water hydrology, stream morphology and sediment transport and ground water quality (ERO and Boyle 2007), lake water quality (AMEC 2008) and effects to aquatic life (Miller 2007).

Section 2 describes the Windy Gap Firming Project alternatives that are being evaluated in the EIS. Section 3 describes which streams may be affected by the Project alternatives. Section 4 lists the data sources used for this report. Section 5 discusses water quality standards, regulations and classifications pertinent to the streams listed in Section 3. Section 6 describes the potentially affected environment, which summarizes the existing water quality of the West and East Slope streams that could be affected by the WGFP alternatives. Section 7 provides an analysis of the direct effects of the WGFP alternatives on the streams described in previous sections and Section 8 provides an analysis of cumulative effects on these streams.

2.0 ALTERNATIVES

The Windy Gap Firming Project Alternatives Report (ERO 2005b) identified four action alternatives in addition to the No Action alternative for evaluation in the EIS. All action alternatives include development of 90,000 AF of new storage in either a single reservoir on the East Slope or a combination of East and West Slope reservoirs. The Subdistrict's Proposed Action is the construction of a 90,000 AF Chimney Hollow Reservoir with prepositioning. The alternatives are:

- Alternative 1 (No Action) – Continuation of existing operations and agreements between Reclamation and the Subdistrict for conveyance of Windy Gap water through the Colorado-Big Thompson facilities, including the enlargement of Ralph Price Reservoir by the City of Longmont
- Alternative 2 (Proposed Action) – Chimney Hollow Reservoir (90,000 AF) with prepositioning

- Alternative 3 – Chimney Hollow Reservoir (70,000 AF) and Jasper East Reservoir (20,000 AF)
- Alternative 4 – Chimney Hollow Reservoir (70,000 AF) and Rockwell/Mueller Creek Reservoir (20,000 AF)
- Alternative 5 – Dry Creek Reservoir (60,000 AF) and Rockwell/Mueller Creek Reservoir (30,000 AF)

Prepositioning, under the Proposed Action, involves the storage of Colorado-Big Thompson (C-BT) water in Chimney Hollow Reservoir. Windy Gap water pumped into Lake Granby would then be exchanged for C-BT water stored in Chimney Hollow. Windy Gap water stored in Chimney Hollow would be delivered and allocated to the WGFP Participants. This arrangement ensures temporary space in Lake Granby to introduce and store Windy Gap water. Total allowable C-BT storage would not change and the existing C-BT water rights and diversions would not be expanded. To prevent the C-BT Project from expanding their diversions through prepositioning, total modeled C-BT storage in Lake Granby and Chimney Hollow was limited to the capacity of Lake Granby, which is 539,758 AF. If this capacity limitation is reached, the model forces the C-BT Project to bypass water at Lake Granby. This water is then available for diversion at Windy Gap. Therefore, under prepositioning, C-BT diversions would not be expanded with respect to their current water rights and capacity limitations.

In addition to the action alternatives, a No Action alternative was identified based on what is reasonably likely to occur if Reclamation does not approve the connection of the new WGFP facilities to C-BT facilities. Under this alternative, the existing contractual arrangements between Reclamation and the Subdistrict for storage and transport of Windy Gap water through the C-BT system would remain in place. All Project Participants in the near term would maximize delivery of Windy Gap water according to their demand, Windy Gap water rights, and C-BT facility capacity constraints including availability of storage space in Lake Granby, and the Adams Tunnel conveyance constraints. The City of Longmont would develop storage independently for firming Windy Gap water if the WGFP is not implemented. Most Participants indicate that in the long term, they would seek other storage options, individually or jointly, to firm Windy Gap water because of their need for reliable Windy Gap deliveries and the substantial investment in existing infrastructure.

Those Participants that do not have a currently defined storage option would take delivery of Windy Gap water whenever it is available within the capacity of their existing water systems and delivery points under the terms of the existing Carriage Contract with Reclamation and the Northern Colorado Water Conservancy District (NCWCD). Participants that would operate under this scenario include Broomfield, Central Weld County Water District, Erie, Evans, Fort Lupton, Greeley, Little Thompson Water District, Louisville, Loveland, Platte River Power Authority, and Superior. The City of Lafayette anticipates that it would withdraw from participating in the WGFP and dispose of existing Windy Gap units and not pursue acquisition of future units if the Firming Project is not constructed.

Longmont indicates that it would develop storage facilities for Windy Gap water independently if Reclamation does not approve a connection of WGFP facilities to C-BT facilities. The City would evaluate the enlargement of the existing Ralph Price Reservoir (Button Rock Dam) located on North St. Vrain Creek or Union Reservoir located east of the City. The enlargement of Ralph Price by 13,000 AF would be the City's preferred option because Union Reservoir would not have sufficient capacity for Windy Gap water and conveyance and distribution would be more efficient from a higher elevation reservoir.

Middle Park Water Conservancy District (MPWCD), under No Action, would continue to use Windy Gap water to provide augmentation flows for other water diversions in a manner similar to current operations. MPWCD can store up to 3,000 AF of Windy Gap water in Lake Granby each year if Windy Gap water can be diverted and storage space is available.

Detailed descriptions of the components and operation of the alternatives is included in the Draft Windy Gap EIS Alternatives Descriptions report (Boyle and NCWCD 2005; NCWCD 2005).

3.0 STUDY AREA

The study area is a large one, including tributaries to the South Platte River in northeast Colorado where East Slope Participants are located (Figure 1), and the Upper Colorado River basin on the West Slope where Windy Gap water is diverted and where the MPWCD is located (Figure 2). Potential effects to stream water quality on the East and West Slopes from the alternative actions are related primarily to changes in streamflow volume and may include:

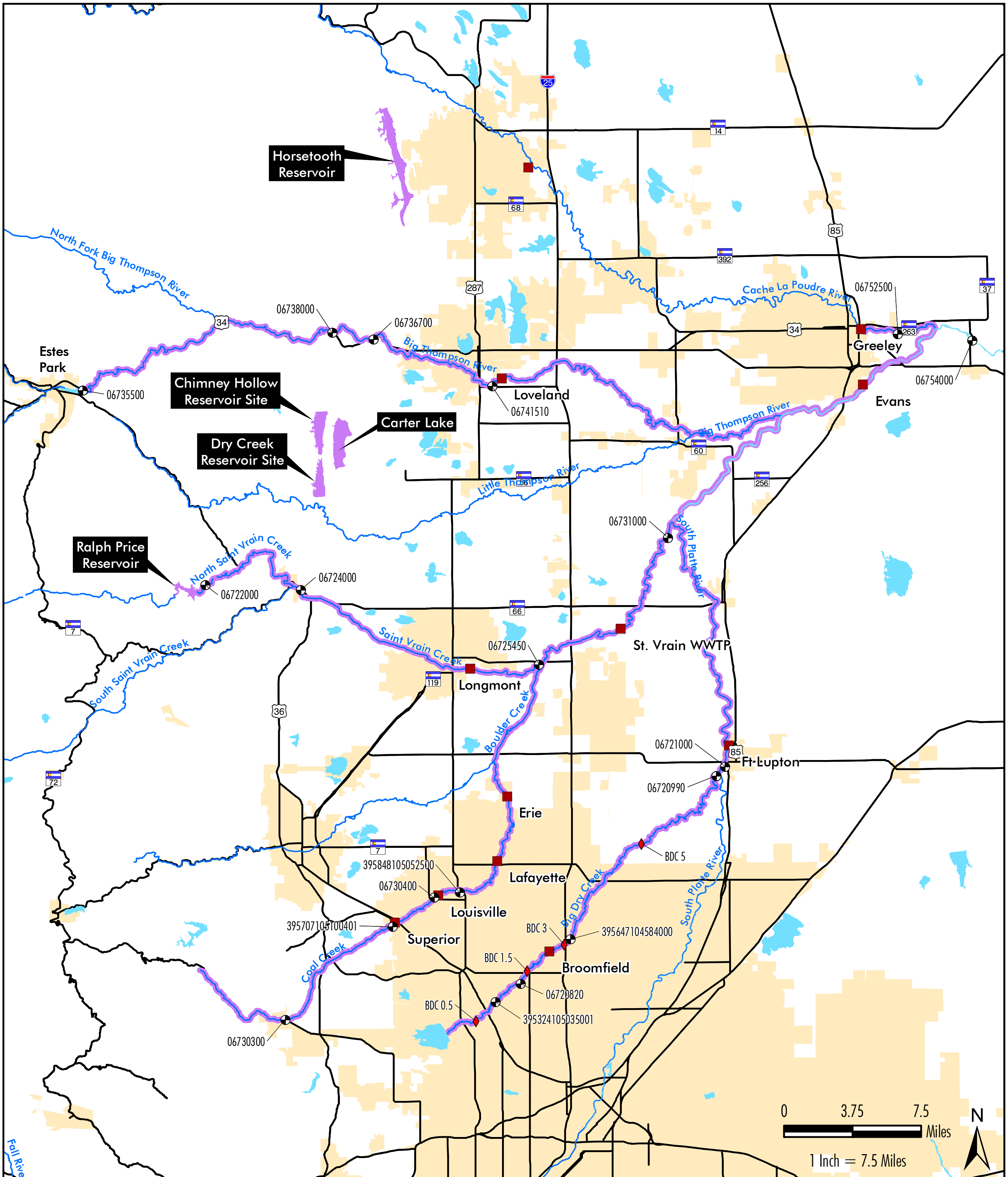
- Reductions or increases in streamflows, resulting in changes to temperature;
- Reductions or increases in streamflows, resulting in changes to water quality parameters due to increased or decreased dilution;
- Changes in stream water quality due to increased return flows from Participants' waste water treatment plants (WWTPs);
- Changes in stream water quality due to decreased streamflows at WWTP discharge points; and
- Changes in existing reservoir water quality due to reservoir re-operation that changes the water quality of streams to which the reservoirs discharge.

This report provides information on the affected environment and environmental consequences of the potentially affected streams. The report is divided into two study areas — the South Platte River basin (East Slope) and Upper Colorado River basin (West Slope). Specific locations where changes in stream water quality are expected to occur were determined based on operational characteristics for each alternative and hydrologic modeling. Locations where potential effects have been identified are provided in Table 1.

Willow Creek Reservoir is a part of C-BT's West Slope water collection and distribution system, but the storage and water quality of this reservoir would not change from existing conditions for any of the alternatives under consideration. The amount of water discharged to Willow Creek would change, but not the water quality released from the reservoir. Although potential new reservoirs are located on ephemeral streams, the existing downstream flows of these streams would be maintained by bypassing native flows. The water quality of the streamflow could change due to releases or seepage from the new reservoirs, which would contain imported water. A substantial change in streamflow below new reservoirs is unlikely, although seepage below dams could result in slightly increased flows or more consistent flow. The WGFP would not affect the flows or water quality of any tributary to the Colorado River other than Willow Creek. On the East Slope, Windy Gap Participants Evans' and Fort Lupton's wastewater treatment plants are on the South Platte River. There would be increases in WWTP effluent flows to the river in November through March; however, the increases would be less than 1% of the total average streamflow measured at nearby USGS gages. Measurable changes in the water quality of the South Platte River are not expected downstream of Evans' or Fort Lupton's WWTPs.

Table 1. Stream locations potentially affected by the WGFP.

Location	Possible Effects
East Slope	
Big Dry Creek, below Broomfield's WWTP	Increased WWTP discharges.
Coal Creek, below Superior, Louisville, Lafayette and Erie WWTPs	Increased WWTP discharges.
North St. Vrain Creek, below Ralph Price Reservoir	Changes to stream water quality due to change in Ralph Price Reservoir water quality. Changes in temperature and stream water quality due to increases or decreases in discharge from Ralph Price Reservoir and stream flows.
St. Vrain Creek, in Lyons above St. Vrain Supply Canal/below Longmont WWTP and St. Vrain Sanitation District WWTP (serves Little Thompson Water District)	Changes to stream water quality due to change in Ralph Price Reservoir water quality, changes in temperature and stream water quality due to changes in stream flows/decreased dilution of WWTP effluent.
Big Thompson River, between Lake Estes and Hansen Feeder Canal/below Loveland WWTP	Changes to temperature and stream water quality due to increased diversion of Windy Gap water to river and increases in stream flows/decreased dilution of WWTP effluent.
Chimney Hollow Creek	Changes to water quality due to releases or seepage from new reservoir.
Dry Creek	Changes to water quality due to releases or seepage from new reservoir.
Cache la Poudre River	Changes to water quality due to increased effluent flows to the river from Greeley's WWTP.
West Slope	
Colorado River below Lake Granby	Changes to water quality due to changes in Lake Granby water quality, changes in temperature due to changes in spills from Lake Granby, increased temperature and changes to water quality due to decreases in stream flows below Windy Gap, and decreased dilution of WWTP effluent at Hot Sulphur Springs.
Willow Creek below Willow Creek Reservoir	Changes in temperature and water quality due to changes in stream flows, decreased dilution of WWTP effluent.
Unnamed tributary through Jasper East Reservoir site	Changes to water quality due to releases or seepage from new reservoir.
Rockwell and Mueller Creeks	Changes to water quality due to releases or seepage from new reservoir.



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- USGS Stream Gaging Station and Water Quality Monitoring Location
- BDCWA Water Quality Monitoring Location
- Waste Water Treatment Plant
- Lake or Reservoir
- Study Area Reservoir
- Highway
- Study Area Stream
- Major Streams
- City

Figure 1
East Slope Water Resource Study Area

Prepared for: Windy Gap Firming Project
File: 2390 EIS\WR_EastSlopeWaterResource.mxd (JP)
May 2008

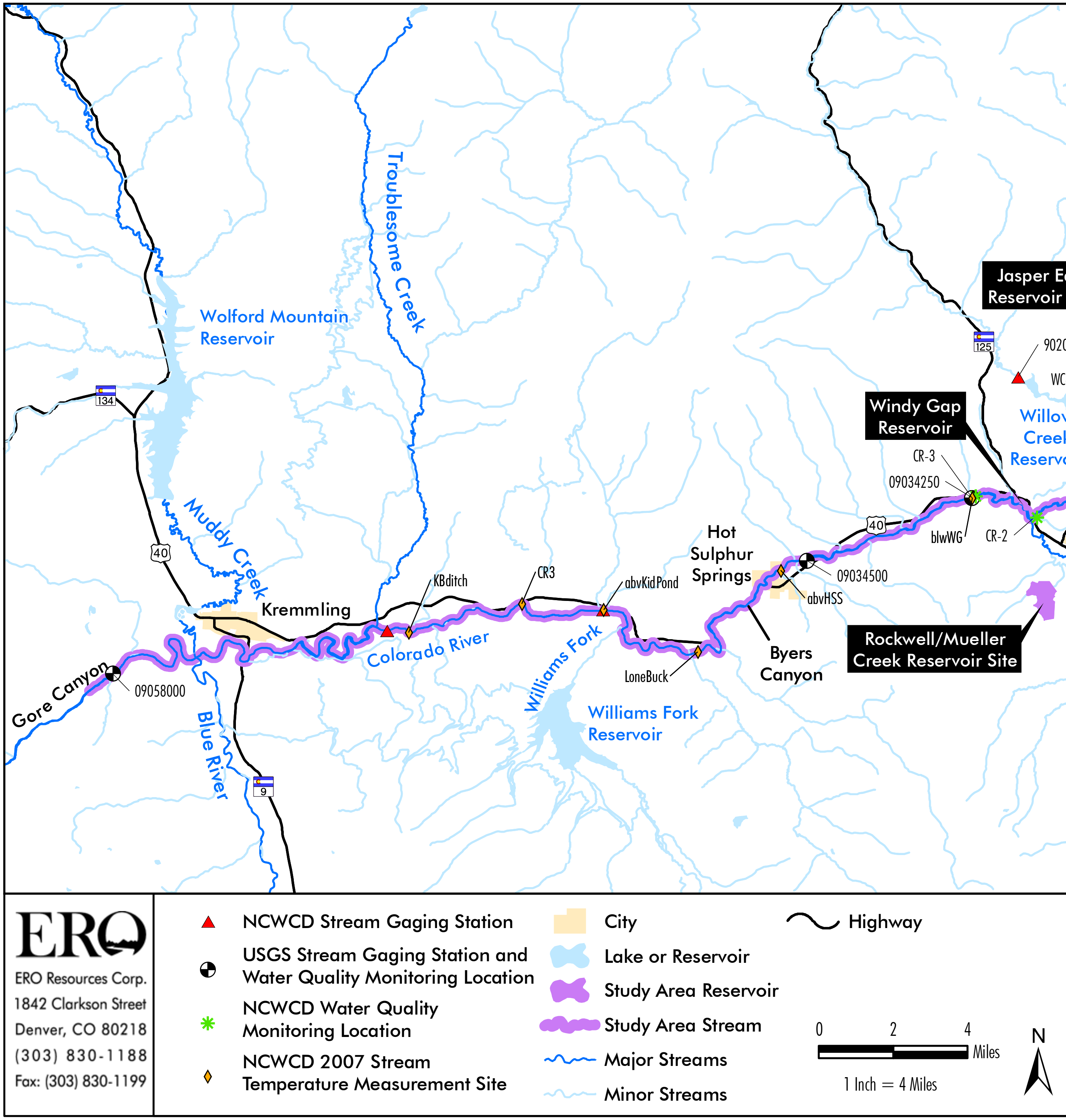


Figure 2
West Slope Water Resource Study Area

Prepared for: Windy Gap Firming Project
File: 2390 EIS\WR_WestSlopeWaterResource.mxd (JP)
November 2007

4.0 EXISTING DATA SOURCES AND REVIEW

This report provides an evaluation of the possible effects of the project alternatives to stream water quality. It also evaluates cumulative effects of other reasonably foreseeable activities that may impact the same surface water resources. The Lake and Reservoir Water Quality Technical Report addresses potential water quality effects to existing reservoirs and likely conditions in new reservoirs (AMEC 2008).

Data used in this report and in the models used to analyze the Windy Gap Firming Project alternatives were obtained from the NCWCD, U.S. Geological Survey (USGS), U.S. Bureau of Reclamation (U.S. Bureau of Reclamation 2006), Big Thompson Watershed Forum (BTWF 2007), Big Dry Creek Watershed Association (BDCWA 2007), Colorado Department of Public Health and Environment (CDPHE), U.S. Weather Service and WGFP Participants. The data included:

- Water quality data
- Meteorological data
- Reservoir discharge data
- Historical streamflows

5.0 WATER QUALITY STANDARDS, REGULATIONS, AND CLASSIFICATIONS

The Colorado Water Quality Control Commission (WQCC) has adopted water use classifications for streams, lakes, and reservoirs that identify the uses to be protected on a stream segment or in a lake or reservoir and adopted numerical standards for specific pollutants to protect these uses.

The Colorado River from the outlet of Lake Granby to the Roaring Fork River and Willow Creek below Willow Creek Reservoir are designated "reviewable water" by the WQCD, meaning that these streams must be maintained and protected at their existing quality unless it is determined that poorer water quality is necessary to accommodate important economic or social development. Water quality impacts from regulated activities including 401 Certification, which would be required for a 404 permit issued by the U.S. Army Corps of Engineers for construction of new reservoirs. The Colorado Department Health and Public Environment will determine the need for antidegradation review of the Colorado River and Willow Creek for the selected alternative.

All of the streams on the East Slope with predicted changes in flow under the WGFP are designated by the WQCD as Use Protected, meaning that due to existing water quality degradation; these stream segments do not warrant an antidegradation review process.

5.1. Upper Colorado River Basin

The Colorado River and its tributaries from below Lake Granby to the confluence with the Roaring Fork River are classified by the CDPHE (2006a) for the following uses:

- Aquatic Life Cold 1 (currently capable of sustaining a wide variety of cold water biota, including sensitive species).

- Recreation 1a (existing primary contact, where the ingestion of small quantities of water is likely to occur, such as swimming or kayaking).
- Water Supply (suitable or intended to become suitable for potable water supplies after receiving standard treatment).
- Agriculture (suitable or intended to become suitable for irrigation of crops and not hazardous for livestock drinking water).

Numeric standards established by the CDPHE (2006a) for the Colorado River mainstem and its tributaries from the outlet of Lake Granby to the Roaring Fork River are provided in Table 2. In June 2005, CDPHE adopted new aquatic life acute and chronic criteria for total ammonia (CDPHE 2005). The new ammonia criteria became enforceable standards in all river basins in Colorado on July 1, 2007.

The stream use classifications and the numeric standards do not apply to the mainstem of Church Creek from its headwaters to the confluence with Willow Creek. Due to existing water quality degradation in Church Creek, the creek is classified as not capable of sustaining a wide variety of cold water biota, not suitable for primary contact recreation use and not suitable for water supply (CDPHE 2006a). Church Creek is designated as Use-Protected, meaning that it is not subject to the antidegradation review process. There are numeric standards for Church Creek above the Willow Creek Reservoir road, but not for ammonia, chlorine, chloride, sulfate, or iron; metal numeric standards are not hardness-based. Below the Willow Creek Reservoir road to Willow Creek, numeric standards for Church Creek are the same as those shown in Table 2, except that there is no standard for nitrate.

Table 2. Numeric standards for the Upper Colorado River and its tributaries, from below Lake Granby to the Roaring Fork River.

Parameter	Standard	Parameter	Standard
Physical		**Metals[1] (µg/L)**	
Dissolved oxygen (mg/L)	6.0	Arsenic (acute, total)	50
Dissolved oxygen, spawning (mg/L)	7.0	Cadmium (acute, trout, dissolved)	0.9
pH	6.5-9.0	Cadmium (chronic, dissolved)	0.25
Temperature[2] (chronic, maximum, ºC) where not gold-medal fishery	20	Chromium III (acute, total rec.)	50
Temperature[2] (chronic, maximum ºC), gold medal fishery (Colorado River from Fraser River to Troublesome Creek), interim standard	18.2	Chromium VI (acute/chronic, dissolved)	11
Temperature[3] (chronic, maximum, ºC, first, second or third order streams above 7000 feet)	17	Copper (acute/chronic, dissolved)	7/5
Inorganic (mg/L)		Iron (chronic, diss., water supply)	300
Total ammonia[4] (acute/chronic for early life stages/chronic without early life stages present)	7.02/2.87/3.87	Iron (chronic, total rec., aquatic)	1,000
Chlorine (acute)	0.019	Lead (acute, chronic, diss)	30/1.2
Chlorine (chronic)	0.011	Manganese (chronic, water supply)	50
Cyanide	0.005	Manganese (acute/chronic, aquatic)	2,370/1,310
Sulfide as H_2S	0.002	Mercury (chronic, total)	0.01
Boron	0.75	Nickel (acute/chronic, dissolved)	260/29
Nitrite	0.05	Selenium[5] (acute/chronic, dissolved)	18.4/4.6
Nitrate (water supply)	10	Silver (acute/chronic-trout, dissolved)	0.62/0.02
Chloride (water supply)	250	Zinc (acute/chronic, dissolved)	79/69
Sulfate (water supply)	250		

[1] Most metal standards are hardness dependent; values provided in Table 2 assume a hardness of 50 mg/L, based on hardness data collected from the Colorado River near the Windy Gap diversion. At distances farther downstream where hardness is greater, metal standards would be higher.

[2] Temperature standard is the maximum weekly average temperature (MWAT) defined as "the mathematical mean of multiple, evenly spaced, daily temperatures over a 7-day period." (EPA 1977).

[3] This temperature standard applies to Willow Creek.

[4] The aquatic life ammonia standards are pH and temperature dependent; an average pH of 7.88 was used and an average stream temperature of 9.9° C was used based on data collected from the Colorado River near the Windy Gap diversion. Ammonia standards are lower when stream temperature and/or pH is higher.

[5] Selenium is a bioaccumulative metal, subject to a range of toxicity values depending on numerous site-specific variables.

Source: CDPHE 2006a.

The Colorado River Basin Salinity Control Program is designed to reduce salt loadings to the Colorado River Basin in order to maintain standards established in 1976. The WQCC adopted Colorado River Salinity Standards in 1980. Colorado is participating in the multi-state basin-wide approach for salinity management. The salinity flow-weighted average annual standard is 723 mg/L below Hoover Dam.

Mitigation for the impact of the Windy Gap Project, assuming full use of Windy Gap's diversion rights from the Colorado River, was implemented prior to construction and operation of the project in 1985. The proposed WGFP would not increase diversions from the Colorado River above the amount included in the original Windy Gap Project or substantially change the timing of the diversions.

Section 208 of the Clean Water Act requires plans for coordinated regional approaches to water quality management. The Northwest Colorado Council of Governments (NWCCOG) is the designated regional water quality management agency responsible for water quality planning in Grand and surrounding counties. When a federal 401/404 permit is required for a Hydrologic Modification, which would be the case for construction of a new reservoir on the West Slope, NWCCOG is authorized to review and comment on the federal permit. The Proposed Action would not require a 404 permit on the West Slope because there would be no new physical disturbances.

The goal of Colorado's Hydrologic Modification Nonpoint Source Management Program is to identify and develop programs to minimize adverse nonpoint source water quality impacts associated with hydrologic modifications (CDPHE 2000). Implementation of Best Management Practices to correct identified nonpoint source water quality problems is voluntary in Colorado. Hydrologic modifications are defined by the WQCD as reservoirs, releases from reservoirs, diversions, and other spatial and temporal changes in the movement and/or circulation of the flow of water. The Windy Gap diversion from the Colorado River is a hydrologic modification. The state lists the following potential nonpoint source water quality impacts below diversions:

- Change in chemical concentrations
- Change in temperature
- Change in dissolved oxygen concentration
- Change in turbidity
- Reduction in water available to dilute downstream pollutants
- Increased streambank erosion or scour
- Increased sediment deposition
- Degradation of aquatic habitat

Releases from reservoirs (i.e., Granby Reservoir) are hydrologic modifications, for which the state lists the following potential nonpoint water quality impacts:

- Increase or decrease in organic or inorganic chemical concentrations below the diversion
- Increase or decrease in nutrient concentrations below the diversion
- Change in temperature below the diversion
- Change in dissolved oxygen concentration below the diversion
- Increase or decrease in turbidity below the diversion
- Increased streambank erosion or scour below the diversion
- Increased deposition of sediment below the diversion

- Degradation of aquatic habitat below the diversion

The State's Hydrologic Modification Program assists in identifying adverse nonpoint source water quality impacts and determining a reasonable and cost-effective mitigation to achieve water quality improvement.

5.2. East Slope Streams

The tributaries to the South Platte River that may be affected by the WGFP include Big Dry Creek, Coal Creek, North St. Vrain Creek, St. Vrain Creek, the Cache la Poudre River and the Big Thompson River. These streams, with the exception of the Big Thompson River upstream of Big Barnes Ditch and North St. Vrain Creek, are classified for the following uses:

- Aquatic Life Warm 2 (currently not capable of sustaining a wide variety of warm water biota, including sensitive species, due to physical habitat, flows, or water quality conditions).
- Recreation 1a or 1b (existing or potential primary contact, where the ingestion of small quantities of water is likely to or might occur, such as swimming or kayaking)
- Agriculture (suitable or intended to become suitable for irrigation of crops and not hazardous for livestock drinking water).
- Water supply (suitable or intended to become suitable for potable water supplies after receiving standard treatment), applies only to St. Vrain Creek above Hygiene Road (west of Longmont) and the Big Thompson River above the Greeley-Loveland Canal.

North St. Vrain Creek and the Big Thompson River from the boundary of Rocky Mountain National Park to the Home Supply Canal near Loveland are classified for the following uses:

- Aquatic Life Cold 1 (currently capable of sustaining a wide variety of cold water biota, including sensitive species).
- Recreation 1a (existing primary contact, where the ingestion of small quantities of water is likely to occur, such as swimming or kayaking).
- Water Supply (suitable or intended to become suitable for potable water supplies after receiving standard treatment).
- Agriculture (suitable or intended to become suitable for irrigation of crops and not hazardous for livestock drinking water).

The Big Thompson River from the Home Supply Canal near Loveland to its confluence with the South Platte River has different use classifications above and below the Greeley-Loveland Canal diversion. Above the Greeley-Loveland Canal diversion, it is classified as Aquatic Life Cold 2 (currently not capable of sustaining a wide variety of cold water biota, including sensitive species, due to physical habitat, flows, or water quality conditions), while below the Greeley-Loveland Canal diversion it is classified as Aquatic Life Warm 2 (currently not capable of sustaining a wide variety of warm water biota, including sensitive species, due to physical habitat, flows, or water quality conditions). Below the Greeley-Loveland Canal diversion, the river loses its Water Supply classification. Below Big Barnes Ditch in Loveland, the classification of Recreation 1a throughout the year changes to Recreation 2 (not suitable for primary contact uses, but suitable for secondary contact, such as wading or fishing) from mid-October through April 30th.

Numeric standards for stream segments on Colorado's East Slope classified for use as Aquatic Life Warm 2, Recreation 1a or 1b and Agriculture are provided in Table 3. Numeric standards for North St. Vrain Creek and the Big Thompson River to Big Barnes Ditch in Loveland are provided in Table 4. The new ammonia criteria were adopted as enforceable standards in all river basins in Colorado on July 1, 2007.

Table 3. Numeric standards for the East Slope streams (except for North St. Vrain Creek and the Big Thompson River above Home Supply Canal) affected by the WGFP.

Parameter	Standard	Parameter	Standard
Physical		**Metals[1] (µg/L)**	
Dissolved oxygen (mg/L)	5.0	Arsenic (acute, total)	100
pH	6.5-9.0	Cadmium (total, agriculture)	10
Temperature[2] (chronic, maximum, ºC)	30	Cadmium (acute/chronic, dissolved)	9.1/1.2
		Chromium III (total, chronic, agriculture)	100
		Chromium VI (acute/chronic, total)	16/11
Inorganic (mg/L)		Copper (acute/chronic, dissolved)	50/29
Total ammonia[3] (acute/chronic Apr 1 to Aug 31/chronic Sep 1 to Mar 31)	5.6/2.43/2.86	Iron (chronic, total rec., aquatic)	1,000
Chlorine (acute)	0.019	Lead (acute/chronic, dissolved)	281/11
Chlorine (chronic)	0.011	Lead (total, agriculture)	100
Cyanide	0.005	Manganese (agriculture, total, chronic)	200
Sulfide as H_2S	0.002	Mercury (chronic, total)	0.01
Boron	0.75	Nickel (aquatic, chronic, dissolved/agriculture, chronic, total)	168/200
Nitrite	4.5/0.5/2.7[4]	Selenium[5] (acute/chronic, dissolved)	18.4/4.6
		Selenium[5] (agriculture, chronic, total)	20
		Silver (acute/chronic, dissolved)	22/3.5
		Zinc (acute/chronic, dissolved)	464/405

[1] Most metals standards are hardness dependent; values provided in Table 3 assume a hardness of 400 mg/L, based on hardness data collected from affected East Slope streams.

[2] Chronic temperature standard is the maximum weekly average temperature (MWAT) defined as “the mathematical mean of multiple, equally spaced, daily temperatures over a 7-day consecutive period.” (EPA 1977)

[3] The aquatic life ammonia standards are pH and temperature dependent; an average pH of 8 was used and an average stream temperature of 12°C was used based on data collected from affected East Slope streams. Ammonia standards are lower when stream temperature and/or pH is higher.

[4] Nitrite standard of 4.5 mg/L is for Big Dry Creek, 0.5 mg/L is for Coal Creek, St. Vrain Creek and Big Thompson River, 2.7 mg/L is 30-day average for the Poudre River.

[5] Selenium is a bioaccumulative metal, subject to a range of toxicity values depending on numerous site-specific variables.

Source: CDPHE 2006b.

Table 4. Numeric standards for North St. Vrain Creek and the Big Thompson River above Home Supply Canal affected by the WGFP.

Parameter	Standard	Parameter	Standard
Physical		**Metals[1] (μg/L)**	
Dissolved oxygen (mg/L)	6.0	Arsenic (water supply, acute, total)	50
Dissolved oxygen, spawning (mg/L)	7.0	Cadmium (acute/chronic, dissolved)	0.5/0.15
pH	6.5-9.0		
Temperature[2] (chronic, maximum, °C)	20	Chromium III (water supply, acute, total)	50
		Chromium VI (acute/chronic, dissolved)	16/11
Inorganic (mg/L)		Copper (acute/chronic, dissolved)	3.6/2.7
Total ammonia[3] (acute/chronic for early life stages/chronic Without early life stages present)	17.5/5.08/7.73	Iron (chronic, diss., water supply)	300
Chlorine (acute)	0.019	Iron (chronic, total rec., aquatic)	1,000
Chlorine (chronic)	0.011	Lead (acute, chronic, dissolved)	14/0.5
Cyanide	0.005	Manganese (water supply, total)	50
Sulfide as H_2S	0.002	Manganese (agriculture, total)	200
Nitrite	0.05	Mercury (chronic, total)	0.01
Nitrate	10	Nickel (chronic, dissolved, aquatic/chronic, total, water supply)	16/100
Chloride	250	Selenium[4] (acute/chronic, dissolved)	18.4/4.6
Sulfate	250	Silver (acute/chronic, dissolved)	0.01/0.03
		Zinc (acute/chronic, dissolved)	44/38

[1] Most metals standards are hardness dependent; values provided in Table 4 assume a hardness of 25 mg/L, based on hardness data collected from the Big Thompson River and St. Vrain Creek.

[2] Chronic temperature standard is the maximum weekly average temperature (MWAT) defined as "the mathematical mean of multiple, equally spaced, daily temperatures over a 7-day consecutive period." (EPA 1977)

[3] The aquatic life acute ammonia standard is pH and temperature dependent; an average pH of 7.3 was used and an average stream temperature of 8° C was used based on data collected from affected East Slope streams. Ammonia standards are lower when stream temperature and/or pH is higher.

[4] Selenium is a bioaccumulative metal, subject to a range of toxicity values depending on numerous site-specific variables.

Source: CDPHE 2006b.

6.0 AFFECTED ENVIRONMENT

6.1. West Slope Streams Water Quality Setting

6.1.1. Colorado River from Lake Granby to Gore Canyon

Water quality data have been collected for many years by the USGS and NCWCD from below Lake Granby to above Gore Canyon (Earthinfo 2006, NCWCD 2006). Major water quality monitoring sites include:

- Colorado River below Baker Gulch, near Grand Lake (1980 to 2004)

- Colorado River near Granby (1976 to 2004)
- Colorado River above the Fraser River (1991 to 2004)
- Colorado River at Windy Gap (1981 to 2004)
- Colorado River at Hot Sulphur Springs (1980 to 1994)
- Colorado River near Kremmling (1976 to 2004)

The monitoring locations are shown on Figure 2. A summary of historical water quality data is provided in Table 5 to Table 10.

Table 5. Historical water quality values for the Colorado River below Baker Gulch, near Grand Lake (USGS gage 09010500).

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov to Mar, warmest mid-July to late Aug	0 to 19.5	5	5.2	266
Discharge (cfs)	lowest Dec to Mar, highest June	39 to 843	94	153	230
Specific conductivity (µS/cm)	lowest in June, highest in low flow	37 to 127	68	14.4	264
Suspended sediment (mg/L)	highest at high flow	0 to 217	11.5	29.2	63
Dissolved oxygen (mg/L)	lowest Jul-Aug	7.5 to 10.6	9.2	0.8	56
pH	-	6.8 to 7.9	7.3	0.275	64
Ammonia (mg/L)	-	<0.002 to 0.06	0.02	0.01	57
Ammonia and organic N (mg/L)	-	<0.1 to 0.2	0.17	0.04	57
Nitrate and nitrite (mg/L)	lowest at high flow, highest at low flow	<0.05 to 0.14	0.08	0.03	57
Total phosphorus (mg/L)	-	0.004 to 0.11	0.014	0.015	57
Ortho-phosphate (mg/L)	-	0.001 to 0.02	0.01	0.003	57
Calcium (mg/L)	lowest at high flow, highest at low flow	4.23 to 10	7.5	1.6	56
Magnesium (mg/L)	lowest at high flow, highest at low flow	1.01 to 2.5	1.85	0.44	56
Sodium (mg/L)	lowest at high flow, highest at low flow	0.87 to 2.2	1.6	0.3	56
Chloride (mg/L)	-	0.1 to 0.8	0.18	0.1	56
Sulfate (mg/L)	lowest at high flow, highest at low flow	2.7 to 7.4	5.2	1.5	56
Hardness (mg/L)	-	-	-	-	0
Iron, dissolved (µg/L)	-	47 to 370	134	66	56
Manganese, dissolved (µg/L)	-	4 to 44	19.3	11.8	56
Selenium, dissolved (µg/L)	-	<1	-	-	5
Copper, dissolved (µg/L)	-	<1 to 4	1.5	1.2	6

Table 6. Historical water quality values for the Colorado River near Granby (USGS gage 09019500).

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest April, warmest Jul-Aug	0.5 to 20	9.85	4	139
Discharge (cfs)	lowest Sept-Oct, highest Apr-June	13 to 1,520 cfs	109	206	117
Specific conductivity (µS/cm)	-	38 to 250	73	24	137
Suspended sediment (mg/L)	-	3 to 13	-	-	2
Dissolved oxygen (mg/L)	-	8.7 to 10	-	-	2
pH	-	7.3 to 8.4	-	-	2
Ammonia (mg/L)	-	-	-	-	0
Nitrate and nitrite (mg/L)	-	<1	-	-	2
Total phosphorus (mg/L)	-	0.025 to 2.9	0.5	0.5	24
Ortho-phosphate (mg/L)	-	-	-	-	0
Calcium (mg/L)	-	-	-	-	0
Magnesium (mg/L)	-	-	-	-	0
Sodium (mg/L)	-	-	-	-	0
Chloride (mg/L)	-	-	-	-	0
Sulfate (mg/L)	-	-	-	-	0
Hardness (mg/L)	-	-	-	-	0
Iron, total/dissolved (µg/L)	-	230/70	-	-	2
Manganese, total/dissolved (µg/L)	-	50/<10	-	-	2
Selenium, total/dissolved (µg/L)	-	<1/<1	-	-	2
Copper (µg/L)	-	-	-	-	0

Table 7. Historical water quality values for the Colorado River Upstream of Fraser River (NCWCD site CR-2).

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	data collected 4/21-10/6	3.1 to 17.6	9.3	3.35	38
Discharge (cfs)	data collected April-June	43 to 1,162	268	373	8
Specific conductivity (µS/cm)	data collected 4/21-10/6	85 to 239	146	37.6	42
Suspended sediment (mg/L)	data collected 4/21-9/24	3.2 to 46.4	14.8	10.2	36
Dissolved oxygen (mg/L)	data collected 4/21 to 10/6	3.3 to 12.1	8.9	1.9	37
pH	data collected 4/21-10/6	6.6 to 8.51	7.68	0.5	40
Ammonia (mg/L)	data collected 4/21-6/17	0.02 to 0.11	0.06	0.035	5
Nitrate and nitrite (mg/L)	data collected 4/21-9/25	0.019 to 0.2	0.08	0.07	5
Total phosphorus (mg/L)	data collected 4/21-10/6	0.03 to 0.76	0.08	0.1	42
Ortho-phosphate (mg/L)	data collected 4/21-10/6	0.02 to 0.47	0.05	0.08	27
Calcium (mg/L)	data collected 4/21-10/6	12 to 32	22	5.3	44
Magnesium (mg/L)	data collected 4/21-10/6	2.2 to 5.8	4	1	44
Sodium (mg/L)	data collected 4/21-10/6	3.3 to 9.9	6.4	1.4	44
Chloride (mg/L)	data collected 4/21-10/6	1 to 5.4	3.1	1.4	24
Sulfate (mg/L)	data collected 4/21-10/6	2.7 to 15	6.3	2.5	30
Hardness (mg/L)	data collected 4/21-10/6	39 to 103	70	18	39
Iron, total (µg/L)	data collected 4/21-10/6	32 to 1,100	709	246	17
Manganese, dissolved (µg/L)	data collected 4/21-10/6	6 to 200	79	41	34
Cadmium (µg/L)	-	-	-	-	0
Lead, total (µg/L)	data collected Apr and May	1 to 2	1.5	-	4
Silver, diss (µg/L)	data collected Apr to June	0.3 to 0.7	0.5	-	5
Zinc, total (µg/L)	data collected 4/30-10/6	3.2 to 15	7.2	-	11
Selenium (µg/L)	-	-	-	-	0
Copper, diss (µg/L)	data collected 4/26-10/6	0.28 to 2	1.1	0.6	10

Table 8. Historical water quality values for the Colorado River at Windy Gap, below Windy Gap Reservoir (USGS gage site 09034250 and NCWCD site CR-3).

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Mar, warmest July	0 to 22	7.7	6	265
Discharge (cfs)	highest late May to mid-July	37 to 3,720	262	434	225
Specific conductivity (µS/cm)	highest Apr, lowest June-July	61 to 277	129	25	263
Suspended sediment (mg/L)	data collected 4/21-9/19	2.8 to 26	12.4	6.5	32
Dissolved oxygen (mg/L)	lowest Aug, highest Oct-April	4.3 to 12.1	9.1	1.9	68
pH	-	6.56 to 9.5	8.2	0.43	67
Ammonia (mg/L)	-	0.005 to 0.14	0.04	0.03	38
Ammonia and organic N (mg/L)	-	0.13 to 0.43	0.225	0.07	30
Nitrate and nitrite (mg/L)	highest at low flow	0.03 to 0.85	0.14	0.18	38
Total phosphorus (mg/L)	-	0.01 to 0.99	0.14	0.18	75
Ortho-phosphate (mg/L)	-	0.01 to 0.84	0.05	0.09	600
Calcium (mg/L)	-	0.03 to 19.6	15.4	3.7	74
Magnesium (mg/L)	-	0.01 to 3.55	2.7	0.7	74
Sodium (mg/L)	-	0.2 to 8.72	5.8	1.6	69
Chloride (mg/L)	-	0.1 to 8.1	2.97	1.5	53
Sulfate (mg/L)	-	0.1 to 7.8	4.5	1.6	57
Hardness (mg/L)	data collected 4/21-10/6	26.6 to 61	44.5	10	40
Iron, total (µg/L)	data collected 4/30-9/25	210 to 1,600	682	332	36
Iron, dissolved (µg/L)	-	3 to 260	154	68	30
Manganese, total (µg/L)	data collected 4/30-9/25	32 to 88	63	23	18
Manganese, dissolved (µg/L)	-	1 to 92	38	20	51
Cadmium, total and dissolved (µg/L)	-	<0.04 to <1	-	-	62
Lead, total (µg/L)	-	0.04 to <1	-	-	31
Lead, dissolved (µg/L)	-	0.09 to 1	0.9	0.3	31
Silver, total and diss (µg/L)	-	<0.2 to <1	-	-	62
Zinc, total (µg/L)	-	<1 to <40	-	-	44
Zinc, dissolved (µg/L)	-	0.7 to 26	-	-	35
Selenium, total and dissolved (µg/L)	-	0.2 to <3	-	-	61
Copper, total (µg/L)	-	<0.6 to 10	-	-	45
Copper, dissolved (µg/L)	-	0.6 to 4	1.3	0.4	44

Table 9. Historical water quality values for the Colorado River at Hot Sulphur Springs (USGS site 09034500).

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Feb	0 to 23	7.8	6.4	92
Discharge (cfs)	lowest Oct-Feb, highest mid-May to mid-July	48 to 4,310	370	605	93
Specific conductivity (µS/cm)	highest at low flow, lowest at high flow	59 to 182	131	25	92
Suspended sediment (mg/L)	-	-	-	-	0
Dissolved oxygen (mg/L)	highest in Dec-Apr, lowest in June-Sept	7.2 to 13.2	9.65	1.5	53
pH	-	7.1 to 8.9	8	0.45	57
Ammonia (mg/L)	highest in March	0.01 to 0.14	0.04	0.04	16
Ammonia and organic N (mg/L)	-	0.2 to 1.2	0.4	0.2	59
Nitrate and nitrite (mg/L)	-	0 to 0.55	0.14	0.11	58
Total phosphorus (mg/L)	-	0.01 to 0.13	0.05	0.03	58
Ortho-phosphate (mg/L)	high at low flow	0.01 to 0.05	0.02	0.01	16
Calcium (mg/L)	low at high flow	7.5 to 21	16	3.2	57
Magnesium (mg/L)	lowest at high flow, highest at low flow	1.4 to 3.8	2.8	0.5	57
Sodium (mg/L)	-	2.5 to 8.9	6	1.5	57
Chloride (mg/L)	lowest at high flow, highest at low flow	0.8 to 4.5	1.9	1	57
Sulfate (mg/L)	high at low flow	0.8 to 14	6.6	2.5	57
Hardness (mg/L)	-	27 to 63	52	10.5	11
Iron, total (µg/L)	-	450	-	-	1
Iron, dissolved (µg/L)	-	35 to 280	112	52	57
Manganese, diss (µg/L)	highest in Mar	9 to 76	24.3	14.5	55
Selenium, total and diss (µg/L)	-	0 to 1	<1	-	116
Copper, total (µg/L)	-	1 to 50	5	8.2	35
Copper, dissolved (µg/L)	-	0 to 8	2	1.7	37

Table 10. Historical water quality values for the Colorado River near Kremmling (USGS site 09058000).

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Mar, warmest mid-June to Aug	0 to 22	9.85	5.2	172
Discharge (cfs)	lowest mid-May to mid-June, highest mid-May to early July	220 to 4,460	1,074	777	138
Specific conductivity (µS/cm)	-	150 to 428	238	51.5	167
Suspended sediment (mg/L)	-	-	-	-	-
Dissolved oxygen (mg/L)	highest Nov, Mar-Apr	5.3 to 11.4	8.3	1.1	94
pH	-	7.4 to 8.6	8.15	0.2	94
Ammonia (mg/L)	-	0.003 to 0.11	0.02	0.02	94
Ammonia and organic N (mg/L)	-	-	-	-	0
Nitrate and nitrite (mg/L)	highest at low flow, lowest at high flow	0.01 to 0.236	0.09	0.05	94
Total phosphorus (mg/L)	highest Mar-May	0.01 to 0.27	0.04	0.05	94
Ortho-phosphate (mg/L)	highest in low flow	0.002 to 0.07	0.012	0.009	94
Calcium (mg/L)	lowest at low flow, highest at high flow	19.3 to 55.5	30.4	6.8	94
Magnesium (mg/L)	-	3.1 to 20.2	6.1	2.6	94
Sodium (mg/L)	-	5 to 25	9.7	3.6	94
Chloride (mg/L)	-	0.1 to 7.25	3.4	1.2	94
Sulfate (mg/L)	-	22 to 148	42	18.9	94
Hardness (mg/L)	-	74 to 130	101	28	3
Iron, total (µg/L)	-	360 to 2,500	-	-	2
Iron, dissolved (µg/L)	high at low flow	10 to 195	55	41	93
Manganese, diss (µg/L)	high at low flow	10.8 to 143	37.3	29.4	93
Selenium, total (µg/L)	-	<1 to 1	<1	-	2
Copper (µg/L)	-	-	-	-	0

The underlying bedrock in the Upper Colorado River basin consists of crystalline and sedimentary rocks (Spahr et al. 2000). Alluvium in the valleys consists of stream, landslide, terrace, and glacial deposits. Weathering of the different geologic units affects stream water quality; in particular, this adds salts and trace elements to streams. Table 5 shows that the Colorado River is generally of good quality throughout the study area. Phosphorus concentrations in natural water are normally no more than a few tenths of a milligram per liter (Hem 1992), as has been typically measured from above the Three Lakes to near Kremmling. Total phosphorus and ortho-phosphate concentrations have occasionally been somewhat elevated in the Colorado River upstream of the Fraser River, at Windy Gap and at Hot Sulphur Springs, indicative of phosphorus sources such as

WWTPs, septic systems or a natural source such as hot springs. Iron concentrations are elevated from the monitoring site above the Three Lakes, in the Colorado River upstream of the Fraser River and at Windy Gap, but decrease downstream. In the Kremmling area, the river water becomes more mineralized, as shown by higher specific conductivity and sulfate concentrations. The source of dissolved minerals is the underlying Mancos Shale, some of which is easily weathered (NWCOG 2002).

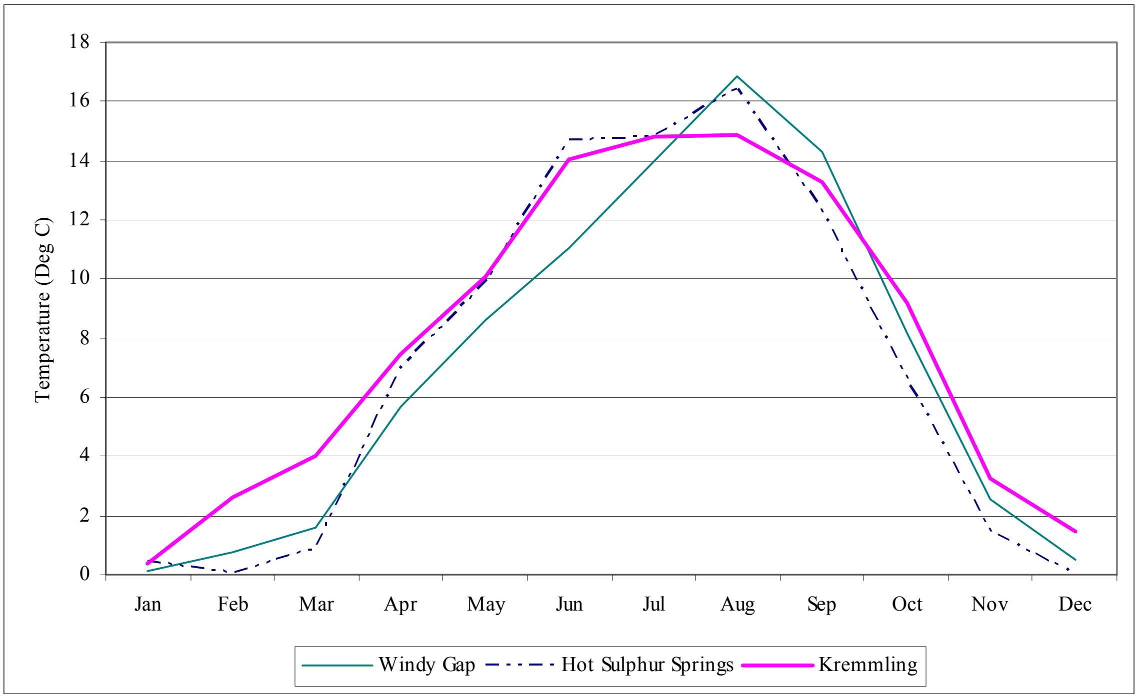
Table 11 provides a summary of water quality standard exceedances observed in the Colorado River between the monitoring site below Baker Gulch to the site near Kremmling.

Table 11. Colorado River water quality standard exceedances, 1980 to 2004.

Parameter	Standard	Location	Measured Value/Date	Number of Samples Above Standard
Dissolved Oxygen	6.0 mg/L, 7.0 mg/L during spawning	Colo. R. at Windy Gap	6.7/June 1994, 6.2/Sept 1995	3
		Colo. R near Kremmling	5.3/June 1989, 6.2/Oct 1994, 6.3/July 1992, 6.6/May 2004, 6.7/May 2003, 6.8/Aug 1996, 6.9/June 1976 and 2001	8
Iron, dissolved	300 µg/L, water supply, chronic	Colo. R below Baker Gulch	370/Apr 1995	1
Temperature, weekly mean	18.2ºC between Fraser River and Troublesome Ck, 20ºC below Troublesome Ck	Colo. R at Windy Gap	18.5 to 22ºC on single dates in Aug or Sep 1982, 1983, 1990, 1991, 1994, 1996, 1998, 2001, 2002	no weekly mean temperatures measured
		Colo. R at HSS	19 to 23ºC on single dates in July or Aug 1980, 1990, 1991	no weekly mean temperatures measured
		Colo. R near Kremmling	21.5 to 22ºC June 1981, 1990	no weekly mean temperatures measured

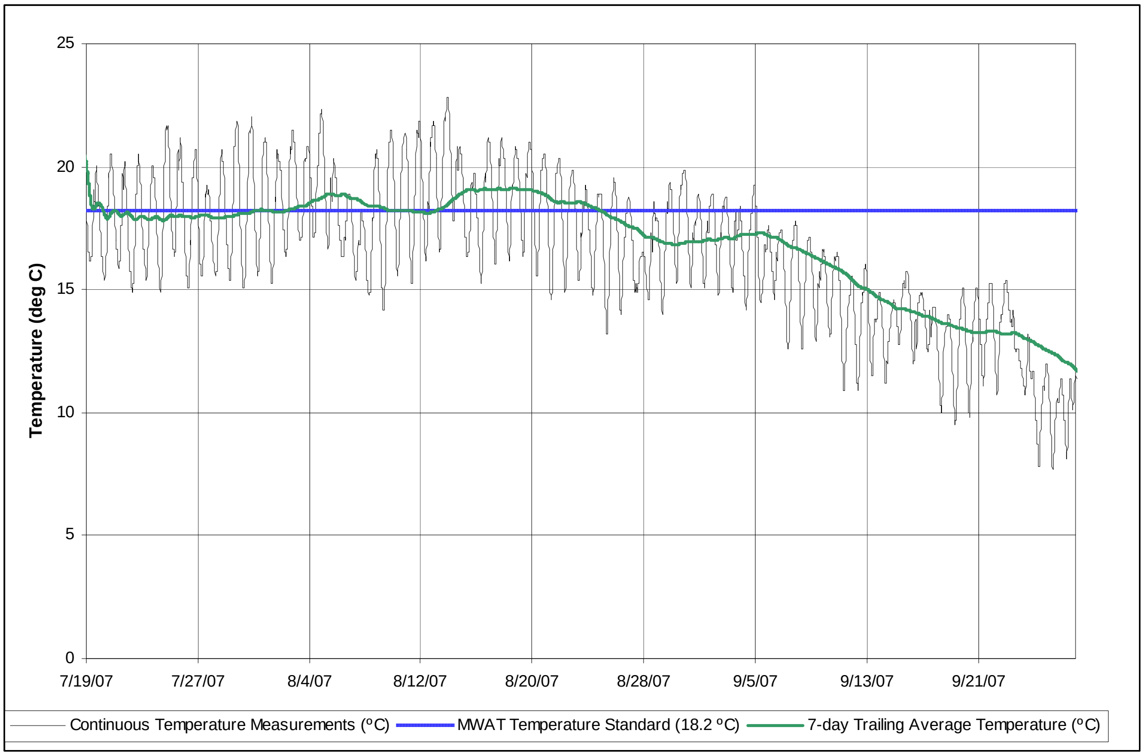
Average monthly temperatures on the Colorado River at Windy Gap, Hot Sulphur Springs, and Kremmling are provided in Figure 3. Although the USGS has collected grab temperature samples for many years at these locations, usually once or twice a month and less frequently during the winter, it is not possible to determine if there is a temperature trend over time or if the chronic temperature standards were exceeded in the river based on the USGS data. However, in 2007, Grand County collected stream temperatures every 15 minutes during July, August, and September at six fairly evenly spaced locations (Clements 2007). The most upstream location was below Windy Gap Reservoir and the most downstream location was just west of KB Ditch above the confluence with Troublesome Creek (Figure 2). Temperatures exceeding 18.2ºC were recorded in late July and/or in August 2007 at every site except for the site below the Williams Fork near Parshall and the most downstream site near KB Ditch. At KB Ditch, temperatures were collected starting on July 18, 2007, so it is possible that some of the highest temperature days earlier in July were missed. Temperature data collected in the summer of 2007 by Grand County at the Lone Buck site below Byers Canyon and above the Williams Fork are shown in Figure 4. The 7-day trailing average temperature is a calculated average temperature of all continuous temperature data collected during the previous week up to a particular point in time. The figure shows that in the summer of 2007, the average weekly temperature of the Colorado River exceeded the temperature standard during much of the period between mid-July and late August.

Figure 3. Average monthly temperature of the Colorado River at the USGS gages at Windy Gap, Hot Sulphur Springs, and Kremmling.



Note: Data collected by USGS from 1976-2004.

Figure 4. Colorado River temperatures at Lone Buck in 2007.



Source: Clements 2007

The community of Hot Sulphur Springs' wastewater treatment facility is a 90,000-gallon per day (0.14 cfs) aerated lagoon that discharges to the Colorado River. From July 2005 to July 2006, the average monthly discharge to the river ranged from 45,000 to 87,000 gpd (EPA 2006). During that period, the following average monthly water quality parameters measured ranged from (EPA 2006):

- 5-day BOD, 8 to 179 lbs/day
- pH, 6.7 to 7.3
- total suspended solids, 12 to 71 mg/L
- ammonia, 3 to 21.7 mg/L
- chlorine, 0.12 to 0.3 mg/L
- total dissolved solids, 332 to 508 mg/L

The hot springs at Hot Sulphur Springs discharge about 50 gallons per minute (0.1 cfs) to the Colorado River at a temperature of about 105ºF and a total dissolved solids concentration of 1,200 mg/L (Barrett and Pearl 1978). No other point source discharges directly to the Colorado River within the study area. The Kremmling WWTP discharges to Muddy Creek, a tributary to the Colorado River, and the Three Lakes Water & Sanitation District WWTP discharges to Church Creek, a tributary to Willow Creek (see Section 6.1.2). Nonpoint source discharges include ground water accretion to the river and return flows from irrigated fields. As discussed in the Water Resources Technical

Report (ERO and Boyle 2007), alluvial ground water is generally of good quality—low in nutrients, dissolved solids, and inorganic compounds such as calcium bicarbonate, chloride, sodium, and sulfate. Ground water connected to underlying bedrock is also a nonpoint source to the Colorado River and is higher than alluvial ground water in total dissolved solids, calcium, sulfate, iron, and manganese (ERO and Boyle 2007). Irrigation return flows may be higher in temperature, sediment, nutrients and pesticides, as well as minerals leached out of the irrigated soils (Spahr et al. 2000). Livestock are likely another source of increased sediment and nutrients in the Colorado River.

Tributaries to the Colorado River with water quality that is poorer than the Colorado River include the Fraser River and Troublesome Creek. The Fraser River has elevated sediment and nutrient concentrations due to human activities in that basin. WWTPs that discharge to the Fraser River include:

- Fraser Sanitation District, permitted for up to 2 million gallons per day
- Granby Sanitation District, permitted for up to 0.995 million gallons per day
- Winter Park Water & Sanitation District, permitted for up to 0.45 million gallons per day
- Tabernash Meadows Water & Sanitation District, permitted for up to 0.2 million gallons per day.

During the past few years, the following average monthly water quality parameters for each of the 4 WWTPs ranged from (EPA 2006):

- 5-day BOD, 0 to 37 lbs/day
- pH, 6.5 to 9.8
- total suspended solids, 0 to 57 mg/L
- ammonia, 0 to 19.2 mg/L
- chlorine, 0 to 0.04 mg/L
- total dissolved solids, 160 to 468 mg/L

Troublesome Creek contributes elevated concentrations of iron and suspended sediment to the Colorado River due to the presence of iron rich and easily erodible geologic formations in the basin (NWCOG 2002).

The establishment of the diatom *Didymosphenia germinate* (didymo) in the Colorado River has been a concern because of the potential affect on nutrient cycling, food web dynamics, and invertebrate populations (Velarde, pers. comm. 2008). Didymo is a nonnative single-celled organism (algae) that can create thick mats of biomass that grow on rock and plants with the potential for periodic nuisance blooms (Spaulding 2007). Its spread is not well understood, but the transfer of cells from fishing equipment, boots, and waders is thought to be one mechanism (Id.). Historically, didymo was restricted to low nutrient waters, but apparently it is tolerant of a broad range of conditions. Didymo has been found in streams with temperatures from about 4°C to 27°C, at pH values above 7, at conductivity generally below 400 μmhos/cm, at total phosphorus concentrations <2 μg/L, and nitrate concentrations <1 mg/L (Spaulding 2007). Didymo also is found in streams with a wide range of flows (Id).

6.1.2. Willow Creek below Willow Creek Reservoir

The USGS and NCWCD have historically collected water quality data in Willow Creek at a point 0.5 mile above its confluence with the Colorado River. USGS data, which includes only temperature and specific conductivity data, were collected from 1956 to 1982. NCWCD data were collected from April through early October from 1991 to 2002. Table 12 provides a summary of the data. There are no algae or chlorophyll data for Willow Creek below the reservoir.

Table 12. Willow Creek historical water quality values (USGS site 09021000).

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Jan, warmest Aug	0 to 27	7.2	4.7	155
Discharge (cfs)	highest in May and June, lowest Sep-Feb	0.07 to 488	28	24	>10,000
Specific conductivity (µS/cm)	highest at low flow, lowest at high flow	65 to 240	124	33	92
Suspended sediment (mg/L)	-	3.2 to 50	20.7	13.2	38
Dissolved oxygen (mg/L)	-	3.7 to 12	8.7	1.8	36
pH	-	6.3 to 8.8	7.7	0.5	39
Ammonia (mg/L)	-	0.01 to 0.44	0.1	0.13	12
Nitrate and nitrite (mg/L)	highest in Sept	0.025 to 2.9	0.5	0.8	24
Total phosphorus (mg/L)	-	0.03 to 0.59	0.14	0.12	40
Ortho-phosphate (mg/L)	highest in Sept, lowest in May-June	0.02 to 0.39	0.11	0.09	33
Calcium (mg/L)	-	9.9 to 44.9	23.5	7	43
Magnesium (mg/L)	lowest in June	1.8 to 4.6	2.9	0.55	43
Sodium (mg/L)	lowest in June, highest in Sept	3.9 to 17	8.7	2.8	43
Chloride (mg/L)	highest in Sept	0.8 to 7.4	2.2	1.8	17
Sulfate (mg/L)	highest in Apr to early May, lowest in June	3.3 to 17	8.3	3.4	35
Hardness (mg/L)	-	33 to 131	70	18	38
Iron, total (µg/L)	-	62 to 1,600	775	317	37
Iron, dissolved (µg/L)	-	3 to 160	92.5	36	32
Manganese, dissolved (µg/L)	-	38 to 180	100	43	28
Copper, dissolved (µg/L)	-	1 to 12	3.4	3	14

Willow Creek stream temperatures have sometimes exceeded the standard of 17°C in August. Stream pH values were below the standard on one occasion and concentrations of ammonia, total iron, and copper have exceeded standards. The Three Lakes Water and Sanitation District's wastewater treatment facility is a 2,000,000 gallon per day (3.1 cfs) sequence batch reactor that discharges to Church Creek, a tributary to Willow Creek. Prior to March 2003, the District operated a 1,300,000 gpd (2 cfs) aerated lagoon facility (NWCOG 2002). From October 2001 to February 2003, actual average monthly discharge to the river ranged from 219,000 to 725,000 gpd (0.34 to 1.12 cfs) (EPA 2006). From April 2003 to July 2006, the average monthly discharge to the river ranged from 299,000 gpd to 863,000 gpd (0.46 to 1.34 cfs). Average monthly water quality parameters were measured in the WWTP discharge to Church Creek (EPA 2006) (Table 13).

Table 13. Three Lakes WWTP discharge quality to Church Creek.

Parameter	10/01 to 2/03	3/03 to 8/06
5-day BOD (lbs/day)	2.3 to 26.2	1.6 to 45
pH	6.3 to 7.4	6.5 to 7.1
total suspended solids (mg/L)	7.5 to 25.9	2.2 to 110
ammonia (mg/L)	2.32 to 19.9	0.04 to 34.9
chlorine (mg/L)	0.13 to 0.24	0 to 0.15
iron, dissolved (µg/L)	0.27 to 380	0 to 140
manganese, dissolved (µg/L)	0.1 to 85	0.025 to 110
copper, dissolved (µg/L)	0.03 to 27	0 to 19
total dissolved solids (mg/L)	0 to 260	0.12 to 2,300.

It appears that the Three Lakes WWTP effluent is the primary source of ammonia in Willow Creek; however, other nutrient sources may include natural erosion, ground water, roads, recreation, and agriculture, as well as timber harvesting in the watershed above Willow Creek Reservoir.

6.1.3. Streams Located at New Reservoir Sites

There are no water quality data available for the unnamed tributary that flows through the proposed Jasper East reservoir site, nor for Rockwell and Mueller Creeks, which flow through the Rockwell/Mueller Creek reservoir site.

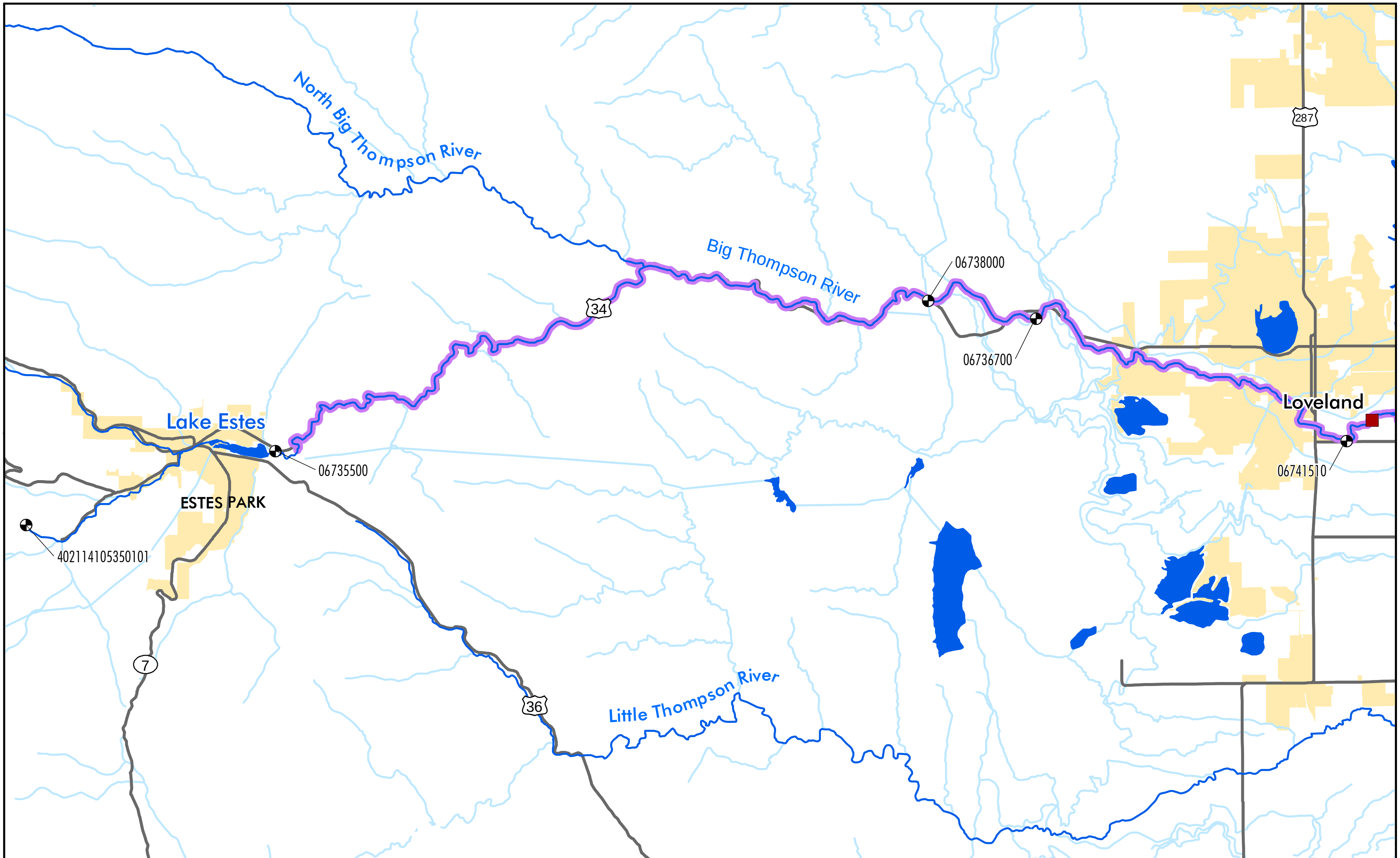
6.2. East Slope Streams Water Quality Setting

6.2.1. Big Thompson River

Water quality data have been collected from the Big Thompson River for many years by the USGS and the Big Thompson Watershed Forum from Rocky Mountain National Park to the confluence of the Big Thompson and South Platte rivers. Major water quality monitoring sites include:

- Big Thompson River below Moraine Park in RMNP (1995 to 2006)
- Big Thompson River above the Dille Tunnel (2000 to 2006)
- Big Thompson River at Loveland (2000 to 2006)
- Big Thompson River below Loveland (2000 to 2006)
- Big Thompson River at Mouth, near La Salle (1980 to 2001)

The monitoring locations are shown on Figure 5. A summary of the water quality data is provided in Table 14.



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USGS Stream Gaging Station and Water Quality Monitoring Location
Waste Water Treatment Plant
Lake or Reservoir
Major Stream
Minor Stream
Study Area Stream
Highway
City

Figure 5
Upper Big Thompson River Study Area

Prepared for: Windy Gap Firming Project
File: 2390 EIS\WR_BT_River_Lake_Estes.mxd (JP)
November 2007

Table 14. Big Thompson River historical water quality values.

Big Thompson River below Moraine Park, near Estes Park (USGS gage 402114105350101)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec to early Mar, warmest Jul-Aug	1 to 19	9	5.5	91
Discharge (cfs)	lowest flow Jan through Mar, highest June	20 to 737	106	112	91
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	9.6 to 107	45.7	16.75	91
Suspended sediment (mg/L)	highest in high flow, lowest in low flow	0 to 27	4.5	3.9	86
Total dissolved solids (mg/L)	lowest in high flow, highest in low flow	18 to 62	38	10.4	27
Dissolved oxygen (mg/L)	lowest Jul-Sep, highest Jan-Mar	7.1 to 12	9.4	1.2	89
pH	-	7.1 to 9.1	7.87	0.5	90
Ammonia (mg/L)	-	0.003 to 0.293	0.04	0.05	121
Ammonia and organic N (mg/L)	-	0.09 to 0.52	0.24	0.07	91
Nitrate and nitrite (mg/L)	-	<0.003 to 0.53	0.06	0.07	61
Total phosphorus (mg/L)	-	0.004 to 0.055	0.01	0.008	91
Ortho-phosphate (mg/L)	-	0.001 to 0.007	0.003	0.001	61
Calcium (mg/L)	highest in low flow, lowest in high flow	1.99 to 9.7	5.3	2	82
Magnesium (mg/L)	highest in low flow, lowest in high flow	0.47 to 2.6	1.1	0.4	82
Sodium (mg/L)	highest in low flow, lowest in high flow	1.1 to 5.9	2.1	0.8	81
Chloride (mg/L)	-	0.38 to 10.8	1.24	1.4	110
Sulfate (mg/L)	highest in low flow, lowest in high flow	1.4 to 6.6	3	1.1	81
Hardness (mg/L)	highest in low flow, lowest in high flow	8.2 to 24	17.6	4.4	18
Iron, dissolved (µg/L)	-	17 to 224	70	40	82
Manganese, diss (µg/L)	highest in low flow	2.1 to 20	8.8	4.8	41
Copper, diss (µg/L)	-	<1 to <2	-	-	13
Selenium, diss (µg/L)	highest in low flow, lowest in high flow	0.05 to <0.4	-	-	3

Big Thompson River above Dille Tunnel (USGS gage 06736700)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Feb, warmest Jul-Aug	0 to 20	8.8	6.1	92
Discharge (cfs)	lowest Nov-Mar, highest June	13 to 803	145	137	91
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	27 to 151	57	21	92
Suspended sediment (mg/L)	-	-	-	-	0
Total dissolved solids (mg/L)	lowest in high flow, highest in low flow	26 to 64	43	9.7	28
Dissolved oxygen (mg/L)	lowest July-Aug, highest Dec-Feb	7.5 to 13.9	10.09	1.7	89
pH	-	7.1 to 9.1	7.8	0.4	92
Ammonia (mg/L)	highest in Dec-Mar	0.001 to 1.77	0.1	0.2	121
Ammonia and organic N (mg/L)	-	0.12 to 1.08	0.3	0.13	91
Nitrate and nitrite (mg/L)	highest in low flow	0.015 to 0.62	0.23	0.17	61
Total phosphorus (mg/L)	-	0.011 to 0.155	0.05	0.03	91
Ortho-phosphate (mg/L)	highest at low flow, lowest at high flow	0.004 to 0.11	0.03	0.02	61
Calcium (mg/L)	highest at low flow, lowest at high flow	2.79 to 13.1	5.7	2	84
Magnesium (mg/L)	highest at low flow, lowest at high flow	0.58 to 3.17	1.28	0.5	84
Sodium (mg/L)	highest at low flow, lowest at high flow	1.6 to 9.27	3.5	1.4	82
Chloride (mg/L)	highest Mar-May, lowest June-July	0.6 to 13.8	2.7	2	78
Sulfate (mg/L)	highest in Mar-May, lowest in June-July	1.8 to 12	3.7	1.65	84
Hardness (mg/L)	highest in low flow, lowest at high flow	10 to 25	18.4	4.3	20
Iron, dissolved (µg/L)	lowest in low flow	5 to 130	57.6	24.3	84
Manganese, dissolved (µg/L)	-	0.75 to 10.4	3.7	1.9	85
Copper, dissolved (µg/L)	lowest at low flow, highest at high flow	0.7 to 1.7	1.15	0.6	55
Selenium, dissolved (µg/L)	-	0.3 to 0.4	-	-	2

Big Thompson River at Loveland (USGS gage 06741510)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Mar, warmest Jun-Sep	0.5 to 22.5	12.4	6.3	83
Discharge (cfs)	lowest Jan-Apr, highest Jun-Jul	2.3 to 222	52.7	50	83
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	60 to 1,950	857	515	326
Total dissolved solids (mg/L)	lowest in high flow, highest in low flow	120 to 1,200	529	371.6	26
Dissolved oxygen (mg/L)	lowest in high flow, highest in low flow	6.1 to 14.2	9.6	1.6	81
pH	-	7.5 to 8.7	8.1	0.3	82
Ammonia (mg/L)	-	<0.002 to 0.75	0.11	0.17	113
Ammonia and organic N (mg/L)	lowest in low flow	0.15 to 1.1	0.36	0.19	83
Nitrate and nitrite (mg/L)	highest in low flow	<0.05 to 0.72	0.22	0.19	53
Total phosphorus (mg/L)	lowest in low flow	0.004 to 0.19	0.03	0.03	83
Ortho-phosphate (mg/L)	-	<0.003 to 0.024	0.004	0.003	53
Calcium (mg/L)	highest at low flow, lowest at high flow	12.5 to 350	95	75	81
Magnesium (mg/L)	highest at low flow, lowest at high flow	3.84 to 88	33	26	76
Sodium (mg/L)	highest at low flow, lowest at high flow	5 to 132	37.3	31.6	74
Chloride (mg/L)	highest at low flow, lowest at high flow	1.2 to 147	11.8	18.8	106
Sulfate (mg/L)	highest at low flow, lowest at high flow	29.2 to 769	297	240	76
Hardness (mg/L)	lowest at low flow	68 to 590	276	197	11
Iron, total (µg/L)	-	20 to 7,100	528	1,003	185
Iron, dissolved (µg/L)	-	5 to 550	56	71	147
Manganese, dissolved (µg/L)	highest in low flow, lowest Jun-Aug	9.1 to 159	35	30	52
Copper, dissolved (µg/L)	-	0.7 to 7.5	1.8	1.1	209
Selenium, dissolved (µg/L)	-	0.77 to 1.5	-	-	3

Big Thompson River below Loveland (USGS gage 06741520)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, warmest mid-July to mid-Aug	1.5 to 24.5	13	5.7	83
Discharge (cfs)	lowest Nov-Apr, highest Jun	7.1 to 253	65	52.6	83
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	244 to 1,460	782	378	83
Suspended sediment (mg/L)	-	-	-	-	0
Total dissolved solids (mg/L)	highest at low flow, lowest at high flow	219-800	520	222	26
Dissolved oxygen (mg/L)	-	5.7 to 16.5	9.4	2.3	82
pH	-	7.2 to 8.8	8.1	0.3	82
Ammonia (mg/L)	highest at low flow	0.001 to 13.6	1.44	2.7	111
Ammonia and organic N (mg/L)	highest at low flow, lowest at high flow	0.1 to 8.5	1.25	1.5	82
Nitrate and nitrite (mg/L)	highest in low flow	0.0065 to 12.7	3.4	3.1	51
Total phosphorus (mg/L)	highest in low flow	<0.0037 to 2.82	0.88	0.78	82
Ortho-phosphate (mg/L)	highest in low flow	<0.007 to 2.1	0.66	0.6	50
Calcium (mg/L)	highest at low flow, lowest at high flow	20 to 152	73	38.7	76
Magnesium (mg/L)	highest at low flow, lowest at high flow	8.1 to 76.5	30.4	16.8	76
Sodium (mg/L)	highest at low flow, lowest at high flow	14.5 to 122	49	30.3	74
Chloride (mg/L)	highest at low flow, lowest at high flow	1.5 to 59.7	15.4	14.6	106
Sulfate (mg/L)	highest at low flow, lowest at high flow	63.5 to 592	259	148	76
Hardness (mg/L)	lowest at high flow	130 to 490	295	116	11
Iron, total (µg/L)	-	90 to 8,000	706	1,284	93
Iron, dissolved (µg/L)	-	8 to 740	63	94	146
Manganese, diss (µg/L)	highest at low flow, lowest at high flow	10.9 to 105	36.2	23	76
Copper, diss (µg/L)	-	1 to 7.3	2.94	1.4	46
Selenium, diss (µg/L)	-	1.1 to 1.7	-	-	2

Big Thompson River at Mouth (USGS gage 06744000)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-early Mar, warmest Jul-early Sep	0 to 29	12.5	7.2	58
Discharge (cfs)	highest mid May-June	7 to 2,340	184	414	42
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	355 to 3,000	1,813	578	42
Suspended sediment (mg/L)	-	-	-	-	0
Dissolved oxygen (mg/L)	lowest Jul-Aug	6.5 to 12.5	9.06	1.7	41
pH	-	7.7 to 8.4	8.04	0.16	41
Ammonia (mg/L)	-	0.22 to 4.6	1.66	1.8	5
Ammonia and organic N (mg/L)	-	0.6 to 6.2	2.5	2.3	5
Nitrate and nitrite (mg/L)	lowest in high flow, highest in low flow	0.51 to 5	2.9	1	39
Total phosphorus (mg/L)	-	0.16 to 0.68	0.44	0.2	5
Ortho-phosphate (mg/L)	-	0.11 to 0.37	0.27	0.1	5
Calcium (mg/L)	highest at low flow, lowest at high flow	25 to 220	153	48	34
Magnesium (mg/L)	-	12 to 160	102	36	34
Sodium (mg/L)	highest at low flow, lowest at high flow	17 to 220	137	34	34
Chloride (mg/L)	highest at low flow, lowest at high flow	3.9 to 37	21.7	8.3	34
Sulfate (mg/L)	highest at low flow, lowest at high flow	100 to 1,300	801.5	284	34
Hardness (mg/L)	highest at low flow, lowest at high flow	110 to 1,200	803	270	34
Iron, total (µg/L)	-	20 to 50	30	14	5
Iron, dissolved (µg/L)	-	0 to 460	52	57	144
Manganese, dissolved (µg/L)	-	10 to 510	144	111.5	34
Copper (µg/L)	-	-	-	-	0

The quality of the Big Thompson River in Rocky Mountain National Park is typical of high altitude mountain streams. Iron concentrations are somewhat elevated during higher flows, indicating a natural source within the upper drainage area. Specific conductivity increases downstream near Loveland and nitrogen, phosphorus, calcium, magnesium, sodium, chloride, and sulfate concentrations also are somewhat higher, although the water is still fairly soft. As the river flows through Loveland and east to its confluence with the South Platte, the water quality continues to decline, with specific conductivity and hardness values indicative of increasing salt concentrations and increased concentrations of ammonia, nitrate, phosphorus, calcium, magnesium, sodium, chloride, sulfate, and metals. Potential sources of these parameters to the river below Rocky Mountain National Park include natural erosion, runoff from roads and developed areas, septic systems, WWTP return flows, irrigation return flows, and ground water (especially bedrock sources).

For the two highest sites on the Big Thompson River that have numeric standards provided in Table 4, there have been pH values below the lower standard (on only one occasion in May at the site in Rocky Mountain National Park and twice in June and July at the lower site above Dille Tunnel in the lower canyon).

For the two Big Thompson River sites used in this analysis located downstream of Loveland that have numeric standards provided in Table 3, the acute ammonia standard has occasionally been exceeded during winter months. The chronic ammonia standard has also occasionally been exceeded, nearly always between December and March.

Discharges from the Loveland WWTP and other WWTPs are a likely source of at least some of the elevated ammonia concentrations in the river. A summary of average monthly effluent discharge and water quality for August 2002 through August 2006 (EPA 2006) for Loveland's WWTP is provided:

- Discharge, 4.8 to 6.9 million gallons per day (7.4 to 10.7 cfs)
- 5-day BOD, 3 to 77 mg/L
- pH, 6.5 to 7.2
- ammonia, 0.05 to 9.4 mg/L
- total suspended sediments, 3 to 62 mg/L
- chlorine, 0 mg/L
- copper, dissolved, 3.8 to 14.85 mg/L

6.2.2. North St. Vrain Creek and St. Vrain Creek at Lyons

Water quality data were collected from North St. Vrain Creek at Longmont Reservoir during the 1970s and in St. Vrain Creek for many years by the USGS from Lyons to the confluence of St. Vrain Creek and the South Platte River. Major water quality monitoring sites include:

- North St. Vrain Creek at Longmont Dam (1971 to 1978)
- St. Vrain Creek at Lyons (1980 to 2002)
- St. Vrain Creek below Longmont (1980 to 2004)
- St. Vrain Creek at mouth, near Platteville (1980 to 2001)

A summary of the water quality data is provided in Table 15. The monitoring locations are shown on Figure 1 and Figure 6.

Table 15. North St. Vrain Creek and St. Vrain Creek historical water quality values.

North St. Vrain at Longmont Dam (USGS gage 06722000)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, warmest late July to Sept	0 to 17.5	7.7	4.5	84
Discharge (cfs)	highest June to early Aug	6 to 175	35	39	61
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	18 to 73	29	10	84
Suspended sediment (mg/L)	-	-	-	-	0
Dissolved oxygen (mg/L)	highest in winter, lowest Aug-Sept	7.6 to 11.4	9.5	1	84
pH	-	5.4 to 8.3	7.3	0.4	84
Ammonia (mg/L)	-	-	-	-	0
Ammonia and organic N (mg/L)	-	-	-	-	0
Nitrate and nitrite (mg/L)	-	0 to 0.45	0.07	0.06	83
Total phosphorus (mg/L)	-	-	-	-	0
Ortho-phosphate (mg/L)	-	0 to 0.08	0.01	0.01	83
Calcium (mg/L)	lowest in high flow, highest in low flow	2 to 5.8	3.3	0.76	83
Magnesium (mg/L)	lowest in high flow, highest in low flow	0.1 to 2.9	0.655	0.36	83
Sodium (mg/L)	lowest in high flow, highest in low flow	1 to 4	1.9	0.6	83
Chloride (mg/L)	-	0.1 to 1.7	0.7	0.36	83
Sulfate (mg/L)	lowest in high flow, highest in low flow	1.5 to 16	4	2.2	82
Hardness (mg/L)	-	7 to 26	10.9	2.9	83
Iron, dissolved (µg/L)	-	30 to 270	104	51	83
Manganese, diss (µg/L)	-	0 to 160	16.6	19.3	79
Copper (µg/L)	-	-	-	-	0

St. Vrain Creek at Lyons (USGS gage 06724000)

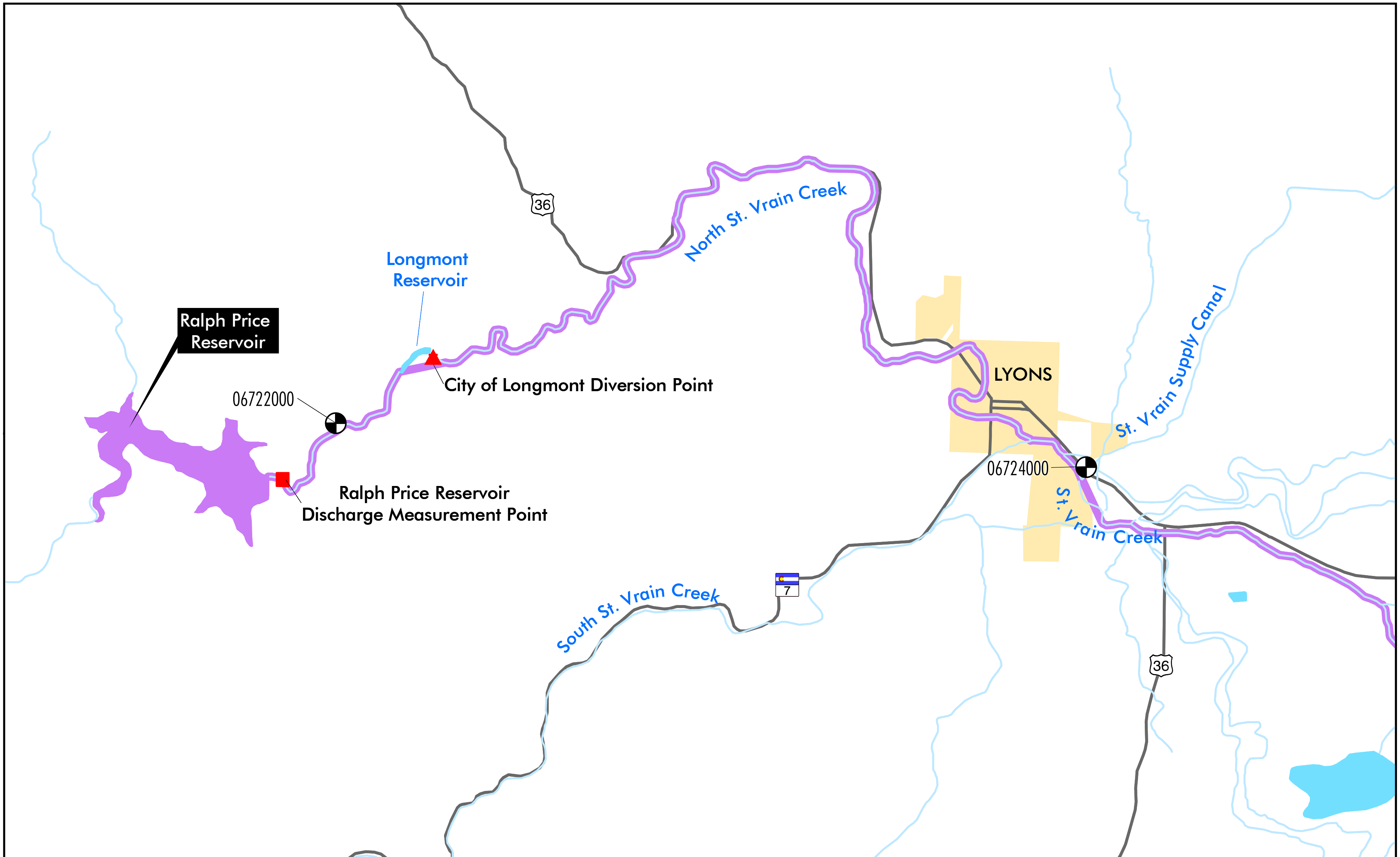
Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Feb, warmest late July-mid Sept	0 to 22	8.9	5.1	62
Discharge (cfs)	low in winter, highest in May to July	15 to 966	155	277	17
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	34 to 140	76	32.5	17
Suspended sediment (mg/L)	-	1 to 48	8.7	9.8	37
Dissolved oxygen (mg/L)	-	7.3 to 13.5	10	1.9	17
pH	-	6.6 to 7.6	7.1	0.3	17
Ammonia (mg/L)	lowest in high flow, highest in low flow	0 to 0.12	0.037	0.04	14
Ammonia and organic N (mg/L)	-	0.29 to 2.5	0.64	0.6	14
Nitrate and nitrite (mg/L)	-	0.07 to 0.5	0.27	0.14	14
Total phosphorus (mg/L)	-	0.02 to 0.67	0.1	0.17	14
Ortho-phosphate (mg/L)	highest in low flow	0.01 to 0.63	0.07	0.1	34
Calcium (mg/L)	lowest in high flow, highest in low flow	3.5 to 11	7.2	2.2	14
Magnesium (mg/L)	lowest in high flow, highest in low flow	0.8 to 2.6	1.7	0.56	14
Sodium (mg/L)	lowest in high flow, highest in low flow	1.7 to 5.8	3.6	1.3	14
Chloride (mg/L)	lowest in high flow, highest in low flow	0.3 to 3.5	1.5	0.75	39
Sulfate (mg/L)	lowest in high flow, highest in low flow	1.4 to 13	7.4	4	15
Hardness (mg/L)	lowest in high flow, highest in low flow	13 to 38	25	7.8	14
Iron, dissolved (µg/L)	-	20 to 200	69	32.5	38
Manganese, diss (µg/L)	-	<10 to 20	10.3	1.8	29
Copper (µg/L)	-	-	-	-	0

St. Vrain Creek below Longmont (USGS gage 06725450)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Jan, warmest Jul-Aug	0 to 25	12.6	6.5	208
Discharge (cfs)	lowest Dec-Apr, highest May to June	20 to 1,530	117	174	198
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	120 to 3,250	1,178	380	206
Suspended sediment (mg/L)	-	3 to 592	109	148	34
Dissolved oxygen (mg/L)	highest Nov-Mar, lowest July-Aug	5.6 to 14	10.7	2.6	14
pH	highest in low flow	7.6 to 8.4	8	0.3	14
Ammonia (mg/L)	lowest in high flow, highest in low flow	0.13 to 5.4	1.3	1	14
Ammonia and organic N (mg/L)	lowest in high flow, highest in low flow	0.74 to 4.5	2.12	1.1	14
Nitrate and nitrite (mg/L)	lowest in high flow, highest in low flow	0.53 to 4	2.6	1.1	14
Total phosphorus (mg/L)	-	0.09 to 0.68	0.29	0.2	14
Ortho-phosphate (mg/L)	-	0.01 to 0.66	0.16	0.16	31
Calcium (mg/L)	lowest in high flow, highest in low flow	28 to 130	95	31	14
Magnesium (mg/L)	lowest in high flow, highest in low flow	16 to 100	68	24	14
Sodium (mg/L)	-	22 to 140	96	35	14
Chloride (mg/L)	lowest in high flow, highest in low flow	2.9 to 36	17.2	6.7	36
Sulfate (mg/L)	lowest in high flow, highest in low flow	100 to 750	497	189	14
Hardness (mg/L)	lowest in high flow, highest in low flow	140 to 910	519	174	14
Iron, dissolved (µg/L)	-	10 to 720	63	116	36
Manganese, diss (µg/L)	-	10 to 200	76	42	36
Copper (µg/L)	-	-	-	-	0

St. Vrain Creek at Mouth (USGS gage 06731000)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, warmest Jul-Aug	0.4 to 24	12.3	7	81
Discharge (cfs)	highest mid-May through June	40 to 2,470	399	588	80
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	261 to 1,900	1,226	354	69
Suspended sediment (mg/L)	high at high flow	15 to 3,370	273	524	50
Dissolved oxygen (mg/L)	lowest July-Aug, highest in winter	6.4 to 14	9.3	2	67
pH	-	7.5 to 8.7	8.03	0.2	68
Ammonia (mg/L)	lowest in high flow, highest in low flow	0.05 to 2.5	0.5	0.6	32
Ammonia and organic N (mg/L)	lowest in high flow, highest in low flow	0.3 to 2.9	0.97	0.7	32
Nitrate and nitrite (mg/L)	lowest in high flow, highest in low flow	0.52 to 5.4	3.1	1.1	66
Total phosphorus (mg/L)	lowest in high flow, highest in low flow	0.22 to 1.5	0.7	0.3	32
Ortho-phosphate (mg/L)	lowest in high flow, highest in low flow	0.06 to 0.88	0.47	0.3	32
Calcium (mg/L)	lowest in high flow, highest in low flow	19 to 113	81	23	65
Magnesium (mg/L)	lowest in high flow, highest in low flow	9.3 to 100	58	21	65
Sodium (mg/L)	lowest in high flow, highest in low flow	15 to 160	99.7	35	65
Chloride (mg/L)	lowest in high flow, highest in low flow	5.7 to 58	30.2	11.5	65
Sulfate (mg/L)	lowest in high flow, highest in low flow	57 to 760	409	155	65
Hardness (mg/L)	lowest in high flow, highest in low flow	110 to 690	509	122	34
Iron, dissolved (µg/L)	highest in low flow	3 to 160	28	30	64
Manganese, diss (µg/L)	highest in low flow	10 to 460	95	80	65
Copper (µg/L)	-	-	-	-	0
Selenium, diss (µg/L)	-	1 to 3	2	0.6	6



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USGS Stream Gaging Station and Water Quality Monitoring Location

Lake or Reservoir

Study Area Reservoir

Study Area Stream

Streams

City

Highway

0 0.5 1 Miles

1 Inch = 1 Mile

N

Figure 6
North St. Vrain and St. Vrain Creek below Ralph Price Reservoir

Prepared for: Windy Gap Firming Project
File: 2390 WR_StVrain_No_Action_Impacts.mxd (JP)
November 2007

North St. Vrain Creek and St. Vrain Creek at Lyons are pristine mountain streams that appear to be little affected by human activities within their watersheds. Values for pH were twice below the low-end standard for pH in North St. Vrain Creek. The manganese concentration was three times greater than the water supply standard in North St. Vrain Creek during one low flow sampling event; this is likely due to ground water from bedrock units high in manganese. Ortho-phosphate concentrations were occasionally elevated above background concentrations in St. Vrain Creek at Lyons during periods of very low flow; this may be due to discharge from Lyons' WWTP to the St. Vrain. From Lefthand Creek to I-25, there is a Total Maximum Daily Load (TMDL) wasteload allocation for ammonia for St. Vrain Creek to help attain ammonia standards. East of Longmont, the water quality of St. Vrain Creek declines substantially, with specific conductivity values that are about 20 times higher than measured at Lyons, and suspended sediment concentrations that are about 25 times higher. The mean ortho-phosphate concentration increases tenfold from Lyons to the creek's mouth. Ammonia concentrations also increase downstream, and have occasionally been above the chronic standard below Longmont. Sulfate concentrations are frequently high east of Longmont, but do not exceed the standard because this section of St. Vrain Creek is not classified for water supply use. Potential sources of these constituents to the creek after it reaches the plains include natural erosion, runoff from roads and developed areas, WWTP return flows, irrigation return flows, and ground water (especially from bedrock sources, such as the Pierre shale, which outcrops at the west edge of the plains).

A summary of average monthly effluent discharge and water quality for February 2003 through September 2006 (EPA 2006) for Longmont's WWTP is provided:

- Discharge, 7.1 to 9.3 million gallons per day (11 to 14.4 cfs)
- 5-day BOD, 7 to 33 mg/L
- pH, 6.7 to 7.4
- ammonia, 1.8 to 12 mg/L
- total suspended sediments, 4 to 30 mg/L
- chlorine, 0 to 0.134 mg/L
- total copper, 0 to 17.1 mg/L
- total iron, 108 to 183 mg/L
- total manganese, 21.2 to 29 mg/L

6.2.3. Other East Slope Streams Affected by Participants' WWTP Return Flows

Big Dry Creek and Coal Creek would have increased WWTP return flows below WGFP Participant's WWTPs (Figure 1). The USGS and the Big Dry Creek Watershed Association (BDCWA) collected water quality data from Big Dry Creek in the vicinity of Broomfield and Westminster down to the confluence of Big Dry Creek and the South Platte River near Fort Lupton. Water quality data were collected by the USGS and the WQCC from Coal Creek at the bottom of Coal Creek Canyon and in the vicinity of WWTPs in Superior, Louisville, and Lafayette. Water quality monitoring sites include:

- Big Dry Creek west of Highway 36 (2000 to 2005)
- Big Dry Creek above Broomfield WWTP (1987 to 2005)
- Big Dry Creek below Broomfield WWTP (1994 to 2005)
- Big Dry Creek downstream of Weld Co. Road 4 (2000 to 2005)
- Big Dry Creek at mouth, near Fort Lupton (1991 to 2003)
- Coal Creek near Plainview and at Highway 93 (1980 to 2003)
- Coal Creek at Louisville and Lafayette (1987 to 2003)

The monitoring locations are shown on Figure 1. A summary of the water quality data for Big Dry Creek is provided in Table 16 and for Coal Creek is provided in Table 17.

Table 16. Big Dry Creek historical water quality values.

Big Dry Creek west of Highway 36 (BDC0.5)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Feb, warmest Jun-Sep	0 to 19.9	9	5.7	76
Discharge (cfs)	highest in June	1 to 93.6	19.6	27	22
Specific conductivity (µS/cm)	high at low flow, low at high flow	214 to 3,794	1,314	927	63
Dissolved oxygen (mg/L)	highest in winter	6.2 to 16.5	9.98	1.7	64
pH	-	6.79 to 8.76	7.74	9.4	64
Ammonia (mg/L)	highest at low flow	<0.01 to 1.4	0.1	0.2	63
Ammonia and organic N (mg/L)	-	-	-	-	0
Nitrate and nitrite (mg/L)	highest at low flow	<0.02 to 3	0.865	0.71	64
Total phosphorus (mg/L)	-	<0.01 to 0.22	0.05	0.04	64
Ortho-phosphate (mg/L)	highest at low flow	<0.004 to 0.09	0.01	0.01	64
Calcium (mg/L)	high at low flow, low at high flow	26.5 to 225.6	94.7	53.5	64
Magnesium (mg/L)	highest at low flow	4.8 to 61.8	28	18.7	64
Sodium (mg/L)	high at low flow, low at high flow	16.3 to 539.4	164	135	64
Chloride (mg/L)	high at low flow, low at high flow	13.1 to 756.8	137	154	64
Sulfate (mg/L)	-	39.5 to 771	330	240	64
Hardness (mg/L)	highest at low flow	86 to 780	352.6	200.6	64
Total Iron (µg/L)	-	5 to 1,044	337	264	62
Manganese (µg/L)	high at low flow, low at high flow	2 to 1,930	300	400	25
Copper (µg/L)	-	<1 to 5	2	1	25
Selenium (µg/L)	highest at low flow	<1 to 15	5	4	38
Total suspended sediments (mg/L)	highest at low flow	1 to 170	13	21.8	64
Total dissolved solids (mg/L)	high at low flow, low at high flow	138 to 2,197	886	613	64

Big Dry Creek above Broomfield WWTP (USGS gage 06720820 and BDC1.5)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Nov-Feb, warmest Jun-Aug	0 to 24	11.2	6.5	227
Discharge (cfs)	lowest Oct to Mar, highest Jun	0.45 to 110	14.65	20	211
Specific conductivity (µS/cm)	high at low flow, low at high flow	150 to 3,664	1,209	734	224
Dissolved oxygen (mg/L)	high in winter	7.8 to 14.9	10.4	1.8	75
pH	-	6.88 to 8.6	7.8	0.3	75
Ammonia (mg/L)	highest at low flow	<0.01 to 2.2	0.13	0.28	74
Ammonia and organic N (mg/L)	-	0.29 to 1.6	-	-	3
Nitrate and nitrite (mg/L)	high at low flow, low at high flow	0.086 to 7.3	1.3	0.7	75
Total phosphorus (mg/L)	-	0.02 to 1.7	0.1	0.06	75
Ortho-phosphate (mg/L)	-	<0.004 to 1.6	0.01	0.015	75
Calcium (mg/L)	high at low flow, low at high flow	20.8 to 211.6	114	49.5	72
Magnesium (mg/L)	high at low flow, low at high flow	6.28 to 67.3	31	15	72
Sodium (mg/L)	high at low flow, low at high flow	26 to 609	204	129	72
Chloride (mg/L)	high at low flow, low at high flow	14.6 to 666	160	142	74
Sulfate (mg/L)	highest at low flow	57.6 to 709	390	203	74
Hardness (mg/L)	high at low flow, low at high flow	92 to 722	412.5	178	72
Total Iron (µg/L)	-	70 to 3,170	809	643	67
Manganese (µg/L)	high at low flow, low at high flow	4 to 482	130	130	28
Copper (µg/L)	-	<1 to 8	2	2	28
Selenium (µg/L)	highest at low flow	<3 to 20	10	6	43
Total suspended sediments (mg/L)	-	4.2 to 134	28.4	28	74
Total dissolved solids (mg/L)	high at low flow, low at high flow	202 to 2,302	1,039	542	72

Big Dry Creek below Broomfield WWTP (USGS gage 395647104584000 and BDC3)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, warmest Jul-Aug	7.3 to 25.3	15	4.6	82
Discharge (cfs)	-	10.3 to 92.3	26.5	12	66
Specific conductivity (µS/cm)	-	407 to 1,460	1,021	227	68
Dissolved oxygen (mg/L)	-	7.5 to 11.7	9.46	0.95	70
pH	-	7.11 to 8.31	7.76	0.24	71
Ammonia (mg/L)	-	0.025 to 8.2	1.05	1.42	73
Ammonia and organic N (mg/L)	-	-		-	0
Nitrate and nitrite (mg/L)	-	2.5 to 20.4	10.85	3.65	73
Total phosphorus (mg/L)	-	0.38 to 3.48	1.98	0.76	71
Ortho-phosphate (mg/L)	-	0.167 to 3.76	1.54	0.7	71
Calcium (mg/L)	-	38 to 136	85	21	71
Magnesium (mg/L)	-	10.2 to 28	19.9	4	71
Sodium (mg/L)	high at low flow, low at high flow	62 to 171	120	26.6	71
Chloride (mg/L)	high at low flow, low at high flow	38 to 200	94	33	71
Sulfate (mg/L)	-	113 to 352	219.5	43.7	71
Hardness (mg/L)	-	157.5 to 433	294	62	71
Total Iron (µg/L)	-	30 to 10,072	1,090	1,700	68
Manganese, diss (µg/L)	-	8 to 221	80	50	27
Copper (µg/L)	highest at low flow	5 to 33	5.2	6.5	27
Selenium (µg/L)	-	2 to 7.2	5	1	31
Total suspended sediments (mg/L)	highest at low flow	8 to 300	41.2	52.4	71
Total dissolved solids (mg/L)	-	346 to 885	660	120	70

Big Dry Creek downstream of Weld County Road 4 (BDC5)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, warmest Jun-Aug	0 to 27.3	13.7	7	86
Discharge (cfs)	-	3 to 44.6	17	9	52
Specific conductivity (µS/cm)	-	367 to 1,904	1,234	261.5	71
Dissolved oxygen (mg/L)	-	7.2 to 17	10.5	2	70
pH	-	7.13 to 9.15	8	0.4	74
Ammonia (mg/L)	-	<0.01 to 12	0.9	2	73
Ammonia and organic N (mg/L)	-	-	-	-	0
Nitrate and nitrite (mg/L)	-	0.77 to 19.3	8.5	3.5	74
Total phosphorus (mg/L)	-	0.22 to 5.3	1.5	0.7	74
Ortho-phosphate (mg/L)	-	0.096 to 2.18	1.1	0.54	73
Calcium (mg/L)	-	44.6 to 186.8	102.6	27	74
Magnesium (mg/L)	-	12.2 to 41.3	26.7	5.6	74
Sodium (mg/L)	high at low flow	69 to 240	149	30	74
Chloride (mg/L)	high at low flow, low at high flow	35 to 236	94	31	73
Sulfate (mg/L)	-	128 to 580	311	68.5	74
Hardness (mg/L)	-	224 to 624	367	79.4	72
Total Iron (µg/L)	-	8.85 to 8,358	1,490	1,740	70
Manganese (µg/L)	-	2 to 168	48.6	41	29
Copper (µg/L)	-	0.5 to 12	3.3	3	29
Selenium (µg/L)	-	2 to 11	6	2	42
Total suspended sediments (mg/L)	-	3.2 to 560	70	95	74
Total dissolved solids (mg/L)	high at low flow, low at high flow	368 to 1,288	823	157	74

Big Dry Creek at Mouth (USGS gage 067209900)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Jan, highest mid to late summer	0 to 25.5	12.6	7.3	121
Discharge (cfs)	high mid-April to mid-May	2.3 to 131	37	24	123
Specific conductivity (µS/cm)	lowest at high flow, highest at low flow	415 to 1,800	1,180	276	119
Dissolved oxygen (mg/L)	-	5.3 to 10.2	-	-	4
pH	-	7.7 to 8.3	-	-	4
Ammonia (mg/L)	-	0.16 to 1.8	-	-	3
Ammonia and organic N (mg/L)	-	0.8 to 2.6	-	-	3
Nitrate and nitrite (mg/L)	-	5.8 to 6.2	-	-	3
Total phosphorus (mg/L)	-	1.2 to 1.9	-	-	3
Ortho-phosphate (mg/L)	-	0.96 to 1.8	-	-	3
Chloride (mg/L)	-	-	-	-	0
Sulfate (mg/L)	-	-	-	-	0
Suspended sediments (mg/L)	-	-	-	-	0

Table 17. Coal Creek historical water quality values.
Coal Creek near Plainview and at Highway 93 (USGS gage 06730300)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, hottest mid-July to mid-Aug	0 to 24	9.1	6.5	112
Discharge (cfs)	lowest winter, highest May to early June	0.02 to 82	4.3	12	65
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	95 to 600	233	109	66
Suspended sediment (mg/L)	-	-	-	-	0
Dissolved oxygen (mg/L)	high in winter, lowest in mid-July to mid-Sept	5.9 to 12.2	9.1	1.5	67
pH	-	6.9 to 8.6	7.5	0.3	69
Ammonia (mg/L)	-	<0.02 to 0.13	0.08	-	7
Ammonia and organic N (mg/L)	-	-	-	-	0
Nitrate and nitrite (mg/L)	-	0 to 1.8	0.21	0.3	73
Total phosphorus (mg/L)	-	0 to 0.04	-	-	2
Ortho-phosphate (mg/L)	-	0 to 0.03	0.01	0.006	21
Calcium (mg/L)	highest in low flow, lowest in high flow	7.9 to 35	16.3	5.75	66
Magnesium (mg/L)	highest in low flow, lowest in high flow	2.1 to 12	4.9	2.2	66
Sodium (mg/L)	highest in low flow, lowest in high flow	5.6 to 67	20.4	12.3	66
Chloride (mg/L)	highest in low flow, lowest in high flow	7.7 to 120	37.3	24.5	66
Sulfate (mg/L)	highest in low flow, lowest in high flow	1 to 25	11.3	4.7	66
Hardness (mg/L)	highest in low flow, lowest in high flow	29 to 160	63	23	71
Iron, total (µg/L)	-	34 to 1,200	584	519	5
Iron, dissolved (µg/L)	-	10 to 360	100	76	66
Manganese (µg/L)	-	<4 to 140	23	26	54
Copper (µg/L)	-	<4	-	-	8
Selenium (µg/L)	-	<1	-	-	6

Coal Creek at Louisville and Lafayette (USGS gages 06730400 and 395848105052500)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, hottest July-Aug	0 to 24	12.5	5.6	78
Discharge (cfs)	highest late April to early June	0.03 to 141	9.4	27	76
Specific conductivity (µS/cm)	lowest in high flow, highest in low flow	229 to 2,800	931	436	76
Suspended sediment (mg/L)	-	3 to 4	-	-	2
Dissolved oxygen (mg/L)	-	8.1 to 9.4	-	-	2
pH	-	7.21 to 8.07	7.71	-	5
Ammonia (mg/L)	-	<0.04 to 0.12	0.07	-	5
Ammonia and organic N (mg/L)	-	-	-	-	0
Nitrate and nitrite (mg/L)	-	<0.06 to 1.9	0.6	-	6
Total phosphorus (mg/L)	-	0.016 to 0.018	-	-	2
Ortho-phosphate (mg/L)	-	<0.02 to 1	-	-	3
Calcium (mg/L)	-	50	-	-	1
Magnesium (mg/L)	-	23	-	-	1
Sodium (mg/L)	-	150	-	-	1
Chloride (mg/L)	-	10.7 to 51.6	-	-	3
Sulfate (mg/L)	-	19.3 to 110	-	-	3
Hardness (mg/L)	-	110 to 220	165	-	4
Iron, total (µg/L)	-	34 to 1,200	490	149	8
Manganese, diss (µg/L)	-	10 to 30	16.5	-	4
Copper, diss (µg/L)	-	<4	-	-	3
Selenium, diss (µg/L)		<1 to 1			3

Big Dry Creek and Coal Creek water quality is affected by WWTP return flows, runoff from roads and urban areas, irrigation return flows, and other sources. Specific conductivity values are high, especially at low flows, and nitrogen and phosphorus concentrations are elevated. Coal Creek at the base of the foothills is fairly pristine, although specific conductivity values and iron concentrations have been elevated at times. The average ortho-phosphate concentration in Coal Creek at the base of the foothills is 0.01 mg/L, but is up to 10 times higher downstream in the vicinity of the WWTPs. WGFP Participants Superior, Louisville, Lafayette, and Erie have WWTPs on Coal Creek in Boulder County. There is an ammonia TMDL on Coal Creek. A summary of average monthly effluent discharge and water quality for 2003 through May 2006 (Mason, pers. comm. 2006) for Louisville, as an example, is provided:

- discharge, 1.3 to 2.26 million gallons per day (2 to 3.5 cfs)
- temperature, 15.6 to 17.8ºC
- 5-day BOD, 1.4 to 2.7 mg/L

- pH, 7.15 to 7.22
- hardness, 95 to 118 mg/L
- ammonia, 0.4 to 0.8 mg/L
- nitrate, 1.7 to 2.0 mg/L
- total phosphorus, 0.6 to 0.92 mg/L
- sodium, 60 to 65 mg/L
- dissolved iron, 31 to 75 mg/L
- dissolved manganese, 10 to 18 mg/L

The baseflow of Coal Creek at the USGS gage near Louisville is 2 to 3 cfs throughout much of the year. The baseflow of Coal Creek at Louisville is comprised almost entirely of WWTP return flows (ERO and Boyle 2007), which are warmer than the creek water. Virtually all of the flow lower Coal Creek is diverted to various ditches and reservoirs (CDWR 2006).

The baseflow measured in Big Dry Creek at the USGS gage at Westminster is about 2 to 5 cfs (ERO and Boyle 2007); Broomfield's WWTP is located about 2 miles downstream of the gage. Virtually all of the flow of in lower Big Dry Creek is diverted to various ditches and reservoirs (CDWR 2006).

A summary of average monthly effluent discharge to Big Dry Creek and water quality for 2002 through August 2006 (EPA 2006) for Broomfield is provided:

- Discharge, 0.93 to 5.53 million gallons per day (1.4 to 8.5 cfs)
- 5-day BOD, 0.8 to 10.8 mg/L
- pH, 6.8 to 7.8
- ammonia, 0.02 to 14.89 mg/L
- total suspended sediments, 0.7 to 18.4 mg/L
- chlorine, 0 mg/L
- total iron, 50 to 359 mg/L
- dissolved manganese, 5 to 19.4 mg/L

The Cache la Poudre River would receive increased effluent flows from the Greeley WWTP during the months of November through March. Water quality data were collected by the USGS from the Cache la Poudre River at numerous locations. Two major water quality monitoring sites located east of Fort Collins (Figure 1) include:

- Cache la Poudre River below Fort Collins (1980 to 2004)
- Cache la Poudre River near Greeley (1980 to 2001)

The site located near Greeley is downstream of Greeley's WWTP. A summary of the water quality data for the Poudre River is provided in Table 18.

Table 18. Cache la Poudre River historical water quality values.
Cache la Poudre River below Fort Collins (USGS gage 06752270)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Jan, warmest July-Aug	0 to 25	11	6.4	298
Discharge (cfs)	highest in June	0.86 to 5,000	189	547	297
Specific conductivity (µS/cm)	lowest at high flow, highest at low flow	49 to 1,330	527	298	292
Dissolved oxygen (mg/L)	-	6.5 to 20	11.37	2.2	290
pH	-	7.4 to 9.6	8.36	0.36	295
Ammonia (mg/L)	highest at low flow	0.006 to 2.7	0.2	0.4	293
Ammonia and organic N (mg/L)	highest at low flow	0.08 to 4.6	1.197	0.7	88
Nitrate and nitrite (mg/L)	-	0.005 to 4.4	1.24	1	250
Total phosphorus (mg/L)	highest at low flow	0.01 to 1.5	0.31	0.36	22
Ortho-phosphate (mg/L)	-	0.003 to 0.93	0.11	0.15	167
Calcium (mg/L)	lowest at high flow	5.8 to 180	61.5	37	286
Magnesium (mg/L)	lowest at high flow, highest at low flow	1.33 to 49.7	18.5	11.9	286
Sodium (mg/L)	-	2.6 to 62.4	24.6	15.8	81
Chloride (mg/L)	lowest at high flow, highest at low flow	1.1 to 82.8	17.2	15.4	81
Sulfate (mg/L)	lowest at high flow, highest at low flow	6.9 to 329	93.3	68	81
Hardness (mg/L)	hardest at low flow	36 to 380	226	99	38
Iron, total (µg/L)	highest at low flow	10 to 6,000	416	659	226
Manganese, total (µg/L)	lowest at high flow, highest at low flow	4 to 150	41	26	65
Manganese, diss (µg/L)	lowest at high flow, highest at low flow	4 to 90	24.8	16.5	73
Copper, total (µg/L)	-	1 to 90	6.3	10.2	106
Copper, dissolved (µg/L)	-	0.4 to 12	2	1.8	204
Selenium, total (µg/L)	-	1 to 5	1.55	1.1	29
Selenium, dissolved (µg/L)	-	0.3 to 4.4	1.8	1.2	36

Cache la Poudre River near Greeley (USGS gage 06752500)

Parameter	Observations	Range	Mean	Std Deviation	Number of Data Points
Stream temperature (Deg C)	coldest Dec-Feb, warmest July-Aug	1.5 to 25.5	14	6.5	55
Discharge (cfs)	highest late May through June	5 to 2,200	183	375	42
Specific conductivity (µS/cm)	lowest at high flow, highest at low flow	370 to 2,140	1,599	396	42
Dissolved oxygen (mg/L)	-	4.3 to 15.8	9.15	2.3	41
pH	-	7 to 8.3	7.84	8.3	41
Ammonia (mg/L)	-	0.24 to 1.2	0.66	0.4	5
Ammonia and organic N (mg/L)	-	1 to 2.5	1.7	0.6	7
Nitrate and nitrite (mg/L)	-	0.77 to 8.5	4.8	1.5	41
Total phosphorus (mg/L)	-	0.24 to 1.1	0.6	0.4	6
Ortho-phosphate (mg/L)	-	0.12 to 0.85	0.4	0.3	5
Calcium (mg/L)	highest at low flow, lowest at high flow	32 to 198	144	38	34
Magnesium (mg/L)	lowest at high flow, highest at low flow	12 to 100	76.6	21	34
Sodium (mg/L)	lowest at high flow, highest at low flow	15 to 150	110	30	34
Chloride (mg/L)	lowest at high flow, highest at low flow	5.6 to 49	36	10.4	34
Sulfate (mg/L)	lowest at high flow, highest at low flow	79 to 830	600	177	34
Hardness (mg/L)	hardest at low flow	130 to 890	676	177	34
Iron, dissolved (µg/L)	-	10 to 270	32	45	34
Manganese, diss (µg/L)	-	20 to 540	171	104	34

Water quality standards for the Poudre River from Fort Collins east to the confluence with the South Platte River are the same as those provided in Table 3 except that there are no standards for nitrate, chloride, and sulfate. Water quality decreases downstream from Fort Collins and Greeley to the South Platte River. Average nutrient, specific conductivity and mineral concentrations increase between Fort Collins and Greeley. The river water is very hard at both locations. The dissolved oxygen concentration has been below the standard near Greeley on a couple of occasions in the spring, which can affect warm water biota. The chronic ammonia standard has also occasionally been exceeded below Fort Collins and farther downstream.

A summary of average monthly effluent discharge and water quality for February through August 2006 (EPA 2006) for the City of Greeley is provided:

- Discharge, 6.94 to 7.33 million gallons per day (10.7 to 11.3 cfs)
- 5-day BOD, 2 to 4 mg/L
- pH, 6.8 to 7.4

- ammonia, 4 to 6.2 mg/L
- total suspended sediments, 4 to 11 mg/L

7.0 ENVIRONMENTAL CONSEQUENCES

This section describes the changes in stream water quality for each of the alternatives. Section 7.1 provides a description of methods used to evaluate water quality changes at different locations. Section 7.2 describes the results from the QUAL2K model used for the Colorado River in the study area. Section 7.3 discusses the results from the SSTEMP model used for Willow Creek below Willow Creek Reservoir. Sections 7.4 to 7.8 describe the specific effects for each alternative. Cumulative effects are discussed in Section 8.

7.1. Methods used for Effects Analysis

7.1.1. Colorado River from Lake Granby to Gore Canyon

A calibrated model was used to simulate water quality in the Colorado River reach as influenced by changes in hydrology for each of the alternatives. To determine worst case conditions for aquatic life in the river, the analysis focused on conditions during late July. This is when the Colorado River experiences low-flow, hot and sunny summertime conditions and it is also when diversions could be occurring from Windy Gap Reservoir. These simulations offer a view of the Colorado River during conditions critical for water temperature and other water quality parameters. The model was run under two hydrologic conditions for July 25, one based on average stream discharge for this date (Boyle 2007a), and the second based on the assumption that Windy Gap diversions would reduce streamflow to the minimum streamflow requirement of 90 cfs below the Windy Gap diversion. Reductions in streamflow to 90 cfs in July were predicted to occur in about one year out of 47 years. The second analysis demonstrates the potential bounds of river water quality for lowest-allowable flow conditions. Wet and dry hydrologic conditions for the alternatives were not simulated because WGFP dry year diversions would not change from existing conditions and baseflows would be higher in wet years.

The simulation of water quality in the Colorado River for Existing Conditions, No Action and the action alternatives was performed using the QUAL2K numerical model (Chapra, Pelletier and Tao 2006). The QUAL2K model is a one-dimensional, steady state model that simulates flow, temperature, and water quality along a river reach. The model can predict instream flows, water temperature, conductivity and concentrations of dissolved oxygen, nutrients (organic nitrogen, total ammonia, nitrate, organic phosphorus, and inorganic phosphorus), pH, and alkalinity. Output from the model provides a prediction of the flow and water quality at locations along the river as influenced by upstream flow quality and quantity, water inflows and diversions, meteorological conditions, and chemical reactions that occur as water flows downstream. This modeling tool effectively simulates the water quality in the Colorado River reach below Lake Granby to the top of Gore Canyon as a result of tributary inflows from the Willow Creek, Fraser River, Williams Fork, Troublesome Creek, Muddy Creek and Blue River, municipal withdrawals for drinking water and the wastewater treatment plant outfall at the Town of Hot Sulphur Springs, as well as diversions from the river at Windy

Gap Reservoir. The model extent, segment boundaries and tributaries are shown in Figure 7.

A QUAL2K model application for the Upper Colorado River reach from Lake Granby to the top of Gore Canyon was developed and calibrated using location and channel geometry data, and measured water-quality data. A model calibration process was used to create a model specific to the Colorado River reach that accurately predicted the water-quality constituents of concern. The details of the model calibration process are described in the Stream Water Quality Modeling and Methods Report (AMEC and ERO 2008). The calibrated model was used to simulate Existing Conditions, No Action, and the four action alternatives.

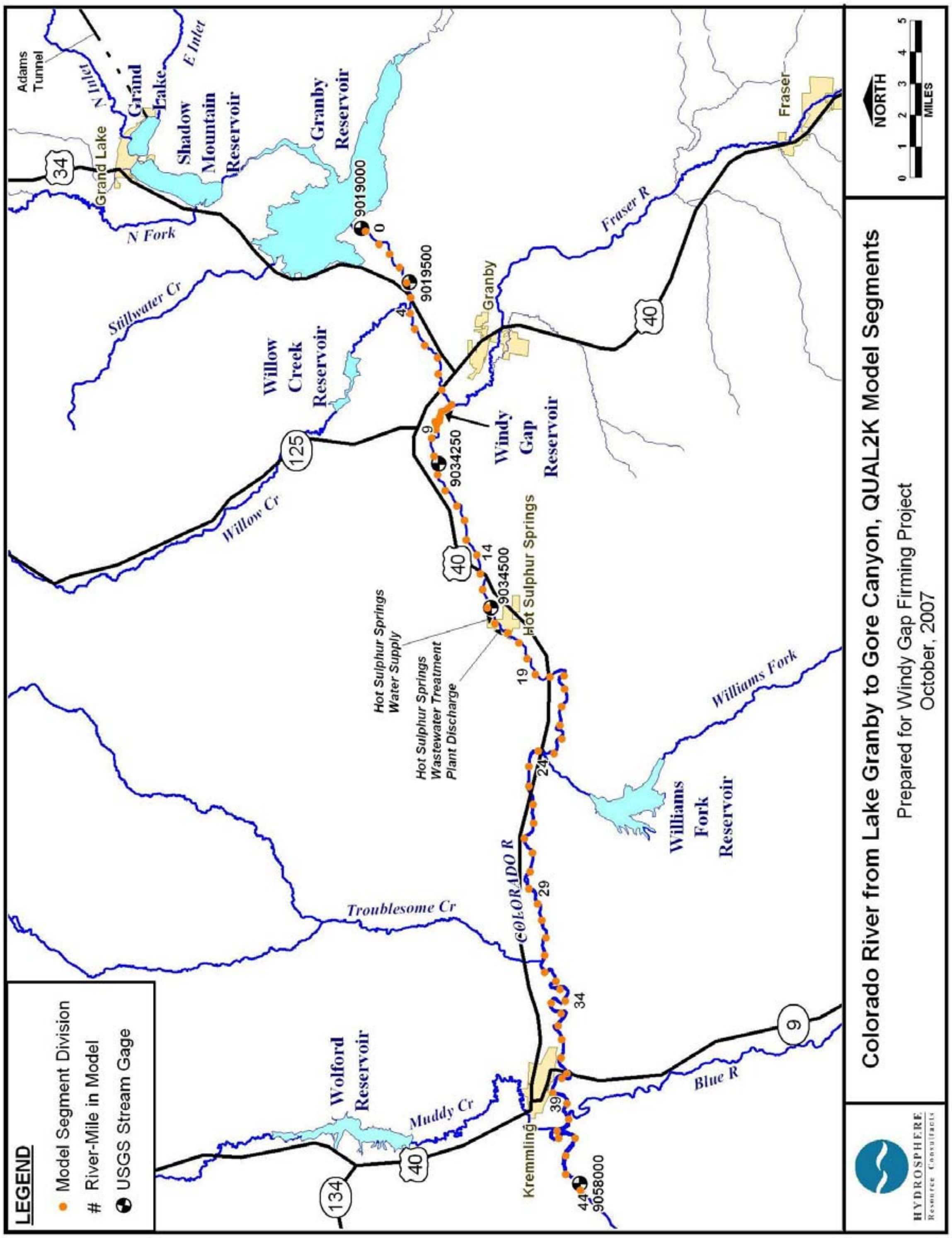
The data requirements for the QUAL2K model for one simulation are large and involve a characterization of inflow to the Colorado River from Granby Reservoir and all inflows and outflows that occur in the reach, meteorological conditions and water quality data for all modeled constituents for all inflows. This data set for flow consists of data for Lake Granby releases, inflow data at the mouths of the six tributaries, withdrawals for drinking water at Hot Sulphur Springs, withdrawal at Windy Gap Reservoir, the Hot Sulphur Springs wastewater treatment plant outfall discharge and other small diffuse gains and losses. Discharge data were provided by Boyle Engineering (2006a) and gains and losses are calculated from Colorado River discharge data at adjacent locations. The water quality of inflows is based on measured data and estimates characterized during the calibration process.

Hourly meteorological conditions are required for the alternative simulations. These data are represented by hourly data for air temperature, dew point temperature, wind speed, and cloud cover were developed from NOAA weather station data at Grand Lake and Kremmling. Relationships between the daily average air and dew point temperatures and the hourly pattern over the day were developed using Kremmling data. The 50th percentile of daily average air and dew point temperatures were used to develop hourly air and dew point temperatures used for the alternative simulations. A constant value for wind speed, representing the average July wind speed at Kremmling was used for the simulations.

The QUAL2K model's sensitivity to meteorological conditions was tested. Hourly temperatures corresponding to the 10th and 90th percentile of air temperatures were developed from measured data. These data were used to drive the QUAL2K model to quantify the magnitude that daily average water temperatures might change for the range of expected air temperatures measured in the area in July.

The impact of cloud cover on the model prediction of daily average water temperature was also investigated using a sensitivity analysis. Simulations were performed describing 10th percentile of air temperature and 100% cloud cover for the day and 90th percentile air temperature and 0% cloud cover for the day. The details of these sensitivity analyses are provided in the Stream Water Quality Modeling and Methods Report (AMEC and ERO 2008).

Figure 7. QUAL2K model segments, Colorado River from Lake Granby to Gore Canyon.



Water quality data characterizing all water inflow points is also required for the simulations. These data consisted of values of conductivity, pH, concentrations of dissolved oxygen, nutrient species, and alkalinity.

For the upstream end of the modeled reach, outflow conditions were characterized based on reservoir modeling of alternatives from the Three Lakes Model (AMEC 2008). The average of July 25th Granby Reservoir outflow model output for average hydrologic years (1975, 1976, 1978, 1979, 1980, 1982, 1985, 1987, and 1988) was used to describe the water quality at the headwater of the model reach for the alternative simulations. The water discharged to the Colorado River is released from the hypolimnion of Lake Granby. The water quality in the hypolimnion is representative of water quality conditions just below the discharge point for all constituents except dissolved oxygen. Data for Lake Granby show that during July, the hypolimnetic dissolved oxygen ranges from 2.6 to 6.2 mg/L (based on USGS grab sample data), simulated hypolimnetic dissolved oxygen concentrations are about 4 mg/L. Dissolved oxygen below the outlet works had a median value of 8.8 mg/L in July (AMEC and ERO 2008). Aeration of the low-DO hypolimnetic water likely occurs as water is released from the reservoir resulting in higher dissolved oxygen water in the Colorado River downstream. This slightly higher DO water is assumed to enter the upstream end of the model. Dissolved oxygen concentration at the upstream end of the reach for all alternatives was set to 8.8 mg/L for each of the simulations.

For other inflows, measured data were used to characterize water quality. The complete set of water quality sampling data for all measurements at all locations was not available for any single day. Therefore, a dataset was developed in order to create a full set of conditions representative of a typical July day. For each location, the median value of all measured water quality data during July for the period of record for a given constituent was calculated. For the Williams Fork, two recent Colorado River water temperature datasets were used with USGS gage data to calculate water temperature for this tributary. This resulting dataset is representative of July water quality measurement and concentration data for tributary inflow water sources to the modeled reach.

The hydrologic conditions and Lake Granby release concentrations were varied between simulations; meteorologic and water quality conditions for the tributaries were kept constant for all alternatives. Water quality conditions as described by temperature, constituent concentration and other water quality measurements (e.g., pH and conductivity) were kept constant; constituent loadings sometimes varied between simulations, with changes in tributary discharge predicted by the hydrologic data.

For cumulative effects, a mass balance model of nutrient load contributions throughout the Fraser River basin was developed for nitrogen and phosphorus concentrations, based on predicted future growth in the basin. For future conditions with lower flow in the Fraser River, a greater population utilizing WWTPs that discharge to the Fraser River, and assumed advanced wastewater treatment implementation, the model predicted higher nitrogen concentrations and lower phosphorus concentrations in the Fraser River inflow to the Colorado River (AMEC and ERO 2008).

Numerous assumptions were made when modeling the water quality of the Colorado River. These assumptions are discussed in the model documentation (Chapra, Pelletier and Tao 2006; AMEC and ERO 2008). It was assumed that water quality changes that could occur to the Colorado River under the WGFP alternatives would be most significant to aquatic life in the river in late July.

7.1.2. Willow Creek

Because the flow of Willow Creek below Willow Creek Reservoir would decrease during May through August under all of the WGFP alternatives, a stream temperature model was used to simulate temperature changes in this segment of Willow Creek. To determine worse case conditions for aquatic life in the stream, July was chosen to simulate Willow Creek during hot, sunny summertime conditions. The maximum average monthly decrease in the flow of the creek would occur under all of the WGFP alternatives during July of an average year. Wet and dry hydrologic conditions for the alternatives were not simulated because decreases in flow would be less in wet years and dry year flows would not change from existing conditions.

The stream temperature model, called SSTEMP, was developed and provided by the U.S. Geological Survey in Fort Collins, Colorado (Bartholow 2002). SSTEMP may be used to evaluate alternative reservoir release proposals, analyze the effects of changing riparian shade or the physical features of a stream, and examine the effects of different stream withdrawals and returns on instream temperature. For the WGFP, the model was used to predict changes in instream temperature due to decreased releases to Willow Creek from Willow Creek Reservoir. The model handles only single stream segments for a single time period, such as a day, week or month. It can be used to perform sensitivity and uncertainty analyses.

SSTEMP requires inputs describing the average stream geometry, stream shading, steady-state hydrology and meteorology. The model estimates the combined topographic and vegetative shade, as well as solar radiation penetrating the water. It handles the case of a dam with steady-state release at the upstream end of the segment. It then predicts the mean daily water temperatures at specified distances downstream. In this case, the top of the model segment is located on Willow Creek at the gaging station just below Willow Creek Reservoir and the bottom of the segment is located in the vicinity of the former USGS/NCWCD gaging station located about ½ mile upstream of the creek's confluence with the Colorado River. The 3-mile segment of Willow Creek below Willow Creek Reservoir was modeled as one segment, meaning that it was assumed that average channel geometry, shading variables and meteorology were the same for the entire segment. Based on model calibration, this assumption appears reasonable.

A mass balance analysis of ammonia, dissolved copper, and dissolved iron concentrations in Willow Creek was completed for the month of July, when the largest percent decreases in the flow of Willow Creek would occur under all of the alternatives. Ammonia, copper and iron were chosen as examples of water quality parameters that are measured in the Three Lakes WWTP effluent discharge that could have more frequent standard exceedances as a result of decreased flows in Willow Creek. For the purpose of comparing calculated ammonia concentrations in Willow Creek below the WWTP discharge to the ammonia standards, it was assumed that the effluent discharge would not significantly change the stream pH or temperature. This may likely be true given that the WWTP discharge point is located 1.6 miles upstream of Willow Creek on Church Creek, a tributary to Willow Creek. Ammonia concentrations change downstream as a result of biogeochemical processes in the stream; the calculated ammonia value is an in-stream value before these changes occur. Thus, the analysis completed is conservative in that it assumes no change in ammonia concentration below the WWTP discharge point.

7.1.3. Intermittent Streams Located at New Reservoir Sites

The predicted water quality of the new reservoirs is provided in the Lake and Reservoir Water Quality Technical Report (AMEC 2008); assumptions made in predicting the water quality of the new reservoirs are discussed in that report. The intermittent streams located downstream of the footprints of the proposed reservoirs would receive water from the reservoirs via releases or seepage. It is assumed that the water quality of these streams would be the same as the water quality of the new upstream reservoirs.

7.1.4. Other East Slope Streams

For other streams whose flow would be increased or decreased under one or more of the WGFP alternatives, several methods were used to evaluate water quality changes due to the project alternatives. For the Big Thompson River below Lake Estes to the Hansen Feeder Canal, there would be 1 to 9% flow increases during high flow months as a result of smaller C-BT skim diversions from the river. The Three Lakes model results for the WGFP, nitrogen and phosphorus concentrations would increase in the water moved through the Adams Tunnel to the East Slope (AMEC 2008). Using the Three Lakes modeled water quality for the Adams Tunnel water and existing water quality data for the Big Thompson River above the Dille Tunnel, mass balance calculations were completed to determine average changes in nitrogen and phosphorus concentrations to the river.

For North St Vrain Creek and St Vrain Creek at Lyons, where both flow increases and decreases would occur, historical water quality data for different flow volumes and months were analyzed to predict water quality changes under the No Action alternative.

For streams receiving increased WWTP return flows under the WGFP, ammonia, iron, copper and manganese were chosen as examples of water quality parameters that are measured in WWTP effluent discharge that could have more frequent standard exceedances as a result of increased WWTP effluent return flows. A mass balance analysis was completed for the month with the largest increase in WWTP return flow under the alternatives. For the purpose of comparing calculated ammonia concentrations in the East Slope streams below the WWTP discharge points to ammonia standards, it was assumed that the effluent discharge would not significantly change the stream pH or temperature. Ammonia concentrations change downstream as a result of biogeochemical processes in the stream; the calculated ammonia value is an in-stream value before these changes occur. It was assumed that water quality would not be further degraded in streams whose flows are already mostly WWTP return flows (Coal Creek and Big Dry Creek).

7.2. Colorado River QUAL2K Model Results

Model simulations for Existing Conditions and the five alternatives were completed; graphical and tabular results are provided in this section. A complete set of the model results for each model segment is provided in Appendix A. The modeled Windy Gap diversion rates for the QUAL2K model date (July 25) are provided in Table 19.

Gradual changes in water quality are primarily due to chemical reaction kinetics and the influences of diffuse water sources and driving atmospheric conditions. Conversely, the influence of tributary inflows can result in large water quality changes over a short physical scale. The magnitude of influence of tributary inflows on Colorado River water quality varies as a result of volume of water inflow and tributary concentration compared to the in-river concentration. The largest changes in water quality seen at tributary inflow points occur where large inflows of water with different water quality from the Colorado River enter, providing a strong dilution or concentrating effect on the river. For the alternative simulations, the volume of flow in the Colorado River was decreased from Existing Conditions as predicted by Boyle's hydrology modeling. The flow decreases enhance the influence of tributary inflows. For the model predictions, the Fraser River increases water temperatures, whereas the Williams Fork, Blue River, and Muddy Creek decrease temperatures. Specific conductivity is increased most by Willow Creek, the Williams Fork, Blue River and Muddy Creek. Troublesome Creek offers some diluting effect on specific conductivity. Dissolved oxygen concentrations are not influenced greatly by tributary inflows. The Fraser River and Hot Sulphur Springs WWTP provide sources of ammonia and inorganic phosphorus, increasing in-river concentrations with their inflows. Based on water quality model sensitivity analysis, the low flow of the natural hot springs near the Town of Hot Sulphur Springs has only a very small influence on the water quality of the Colorado River. Downstream of the Hot Sulphur Springs WWTP, when Colorado River concentrations of ammonia and inorganic phosphorus are highest, the Williams Fork offers a dilution effect. To lesser degrees, the Blue River and Muddy Creek increase ammonia concentrations in the Colorado River and Willow Creek is a source of inorganic phosphorus. Muddy Creek provides elevated dissolved selenium concentrations, raising the concentration in the Colorado River slightly.

Table 19. Windy Gap diversion rates for July 25.

Alternative	Windy Gap Diversion on July 25 (cfs)	Windy Gap Diversion on July 25 assuming diversion to the minimum instream flow below Windy Gap (cfs)
Existing Conditions*	39	---
No Action	91	329
Proposed Action	81	307
Alternative 3	108	313
Alternative 4	108	313
Alternative 5	104	311

*Existing Conditions average July 25 streamflow upstream of Hot Sulphur Springs WWTP = 420 cfs.

7.2.1. Discharge

Predicted average discharge throughout the Colorado River reach for Existing Conditions and the alternatives are presented graphically below, with Lake Granby on the left and the top of Gore Canyon on the right. Computed changes from Existing

Conditions are presented in the tables below. The change in predicted discharge for the Colorado River above the Hot Sulphur Springs wastewater treatment plant outfall was computed, along with the maximum predicted change.

Predicted discharge for Existing Conditions and the alternatives are presented in Figure 8, Table 20, and Table 21. For July 25th, flows were reduced in the Colorado River, with the largest reductions seen below Windy Gap Reservoir. At the Hot Sulphur Springs wastewater treatment plant (HSS WWTP), flows were predicted to be reduced by 80 to 113 cfs on July 25th during average hydrologic conditions. Alternatives 3 and 4 are predicted to produce the largest reductions in river discharge in the reach.

Figure 8. Colorado River average discharge predicted for the alternatives (July 25).

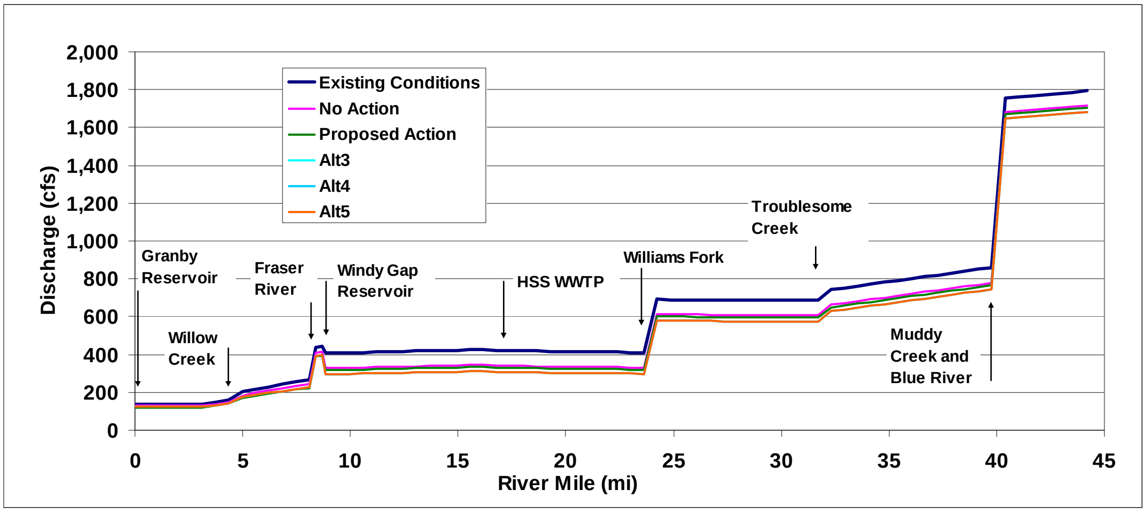


Table 20. Comparisons of predicted Colorado River discharge to Existing Conditions for all alternatives (July 25).

Alternative	Change from Existing Conditions* for Discharge Upstream of HSS WWTP Outfall (cfs)	Greatest Change from Existing* Conditions for Discharge in the Study Reach (cfs)	Greatest Percentage* Change from Existing Conditions in the Study Reach
No Action	-80	-81	-19.6%
Proposed Action	-91	-94	-22.2%
Alternative 3	-113	-116	-27.7%
Alternative 4	-113	-116	-27.7%
Alternative 5	-110	-113	-26.9%

*Existing Conditions average July 25 streamflow upstream of Hot Sulphur Springs WWTP = 420 cfs.

Table 21. Comparisons of predicted Colorado River discharge to No Action for all alternatives (July 25).

Alternative	Change from No Action for Discharge Upstream of HSS WWTP Outfall (cfs)	Greatest Change from No Action for Discharge in the Study Reach (cfs)	Greatest Percentage Change from No Action in the Study Reach
Proposed Action	-11	-21	-8.1%
Alternative 3	-33	-36	-10.0%
Alternative 4	-33	-36	-10.0%
Alternative 5	-30	-33	-9.1%

Minimum instream flow simulations were created for each alternative. The resulting discharges are presented in Figure 9. Calculated differences from Existing Conditions are presented in Table 22. Discharges for the alternatives are very similar and the results appear as coincident lines in Figure 9. Over the entire 47-year period of record (1950–1996), streamflow in July would be less than 100 cfs during 80 out of 1,457 days; Windy Gap pumping under the Proposed Action would occur on 32 of those days. Thus, over the long term, July flows would drop to about 90 cfs less than 1 day per year on average as the result of Windy Gap pumping under the Proposed Action. The longest duration of Windy Gap pumping that would reduce flows to near 90 cfs would be 5 days in a single year under the Proposed Action. Windy Gap diversions that reduce July flow in the Colorado River below 100 cfs (to near the 90 cfs minimum flow) would occur on 25 days over the 47-year period of record under the No Action alternative and 78 days under Alternatives 3, 4, and 5. Windy Gap diversions would reduce August flows to about 90 cfs on 138 out of 1,457 days over the 47-year period of record under the Proposed Action and less for the No Action alternative. In August, the longest duration of Windy Gap pumping that would reduce flows to near 90 cfs would be 24 days and the average would be about 10 days. Colorado River streamflows of 90 cfs or less in July and August already occur when Windy Gap is not diverting as the result of upstream diversions by others and/or low surface runoff or ground water discharge to the river.

Figure 9. Colorado River average daily stream discharge for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

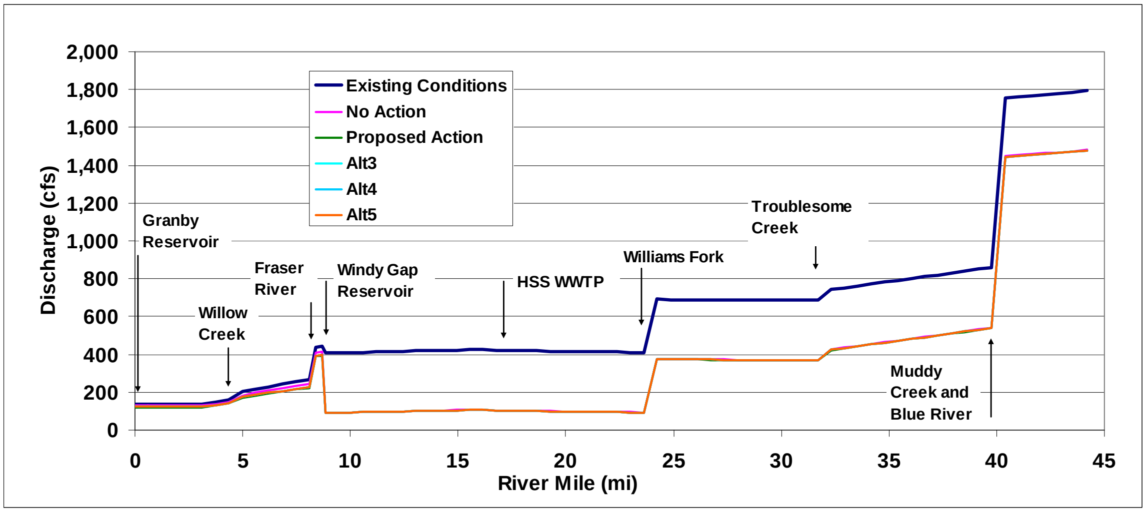


Table 22. Comparisons of Colorado River discharge for Existing Conditions to all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Greatest Change from Existing* Conditions for Discharge in the Study Reach (cfs)	Greatest Percentage* Change from Existing Conditions in the Study Reach
No Action	-318	-77.9%
Proposed Action	-321	-77.9%
Alternative 3	-320	-77.9%
Alternative 4	-320	-77.9%
Alternative 5	-321	-77.9%

*Existing Conditions average July 25 streamflow upstream of Hot Sulphur Springs WWTP = 420 cfs.

7.2.2. Temperature

Model predictions for Existing Conditions and all of the alternatives and calculated differences are presented in Figure 10, Table 23, and Table 24. For Existing Conditions, water temperatures were predicted to increase as water moves downstream, with increases as a result of the Fraser River and Troublesome Creek and temperature decreases downstream of the confluence with the Williams Fork and Blue River. Average daily water temperatures are predicted to increase up to a maximum of 0.8ºC throughout the reach. Meteorological conditions and water temperatures of tributary inflows are consistent across simulations. Granby Reservoir flow, Willow Creek, and Windy Gap Reservoir withdrawals changed for the simulation alternatives, resulting in a reduction in discharge in the Colorado River. The reduction in flow for the alternatives most likely contributes to the slight increase in water temperature predicted in the river throughout the reach. The maximum water temperature occurs just upstream of the confluence with the Williams Fork. The aquatic life maximum weekly average temperature standard (MWAT) for the Colorado River from the Fraser River to Troublesome Creek is 18.2°C and 20°C elsewhere. The model, using median measured USGS temperatures for July and mean climatic conditions, shows that none of the alternatives would increase the river temperature to above 18.2°C on July 25th. It could be assumed that the predicted stream temperatures shown in Figure 10 represent an entire week in late July or early August if the median stream temperature and climatic conditions remain the same throughout the week. The MWAT standard could be exceeded if the Existing Conditions temperature during that week were already near or above the standard. As discussed in Section 6.1.1, Colorado River temperatures exceeded the 7-day standard several times in July and August of 2007.

Figure 10. Colorado River average daily stream temperature predicted for Existing Conditions and all alternatives (July 25).

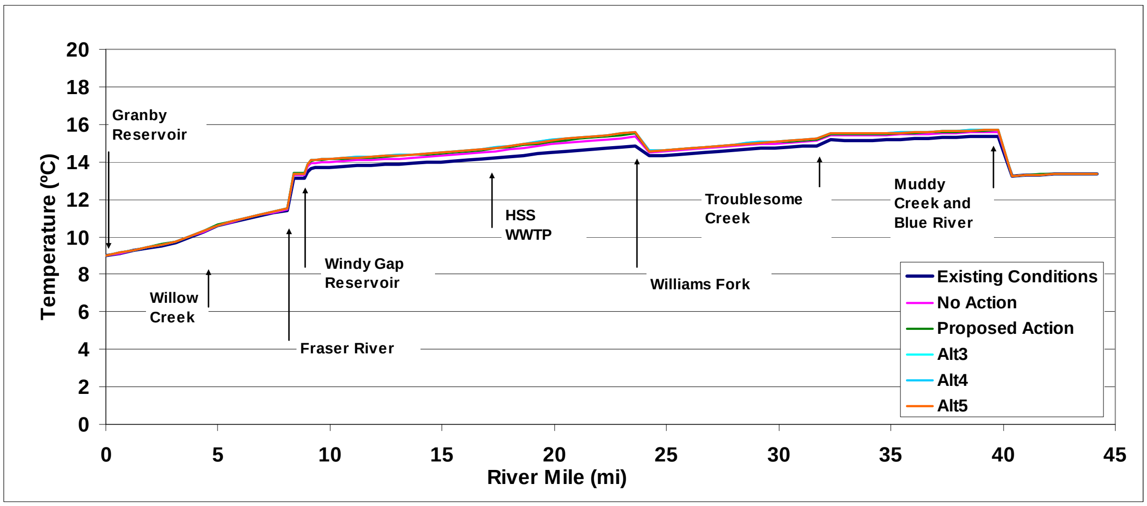


Table 23. Comparisons of predicted Colorado River temperature to Existing Conditions for all alternatives (July 25).

Alternative	Greatest Change from Existing Conditions* for Stream Temperature in the Study Reach (°C)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	0.5	3.3%
Proposed Action	0.6	4.4%
Alternative 3	0.8	5.1%
Alternative 4	0.8	5.1%
Alternative 5	0.7	5.0%

*Existing Conditions average July 25 temperature = 14.3ºC at the location of greatest change under the alternatives.

Table 24. Comparisons of predicted Colorado River temperature to No Action for all alternatives (July 25).

Alternative	Greatest Change from No Action for Stream Temperature in the Study Reach (°C)	Greatest Percentage Change from No Action in the Study Reach
Proposed Action	0.2	1.1%
Alternative 3	0.3	1.8%
Alternative 4	0.3	1.8%
Alternative 5	0.3	1.7%

Water temperature predictions for the minimum instream flow simulation of each alternative are presented in Figure 11. Calculated differences from Existing Conditions are presented in Table 25. Simulation of water temperature for alternatives results in very similar conditions; output appears as coincident lines in Figure 11. Colorado River diversions to produce the minimum instream flow at the end of July results in an increase in water temperatures in the Colorado River downstream of Windy Gap, with the greatest increase of 4°C predicted to occur above Williams Fork. It could be assumed that the predicted stream temperatures shown in Figure 11 represent an entire week in late July or early August if the median stream temperature and climatic conditions remain the same throughout the week. The MWAT standard could be exceeded if the Existing Conditions temperature during that week were already within 4°C of the standard.

Figure 11. Colorado River average daily stream temperature predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

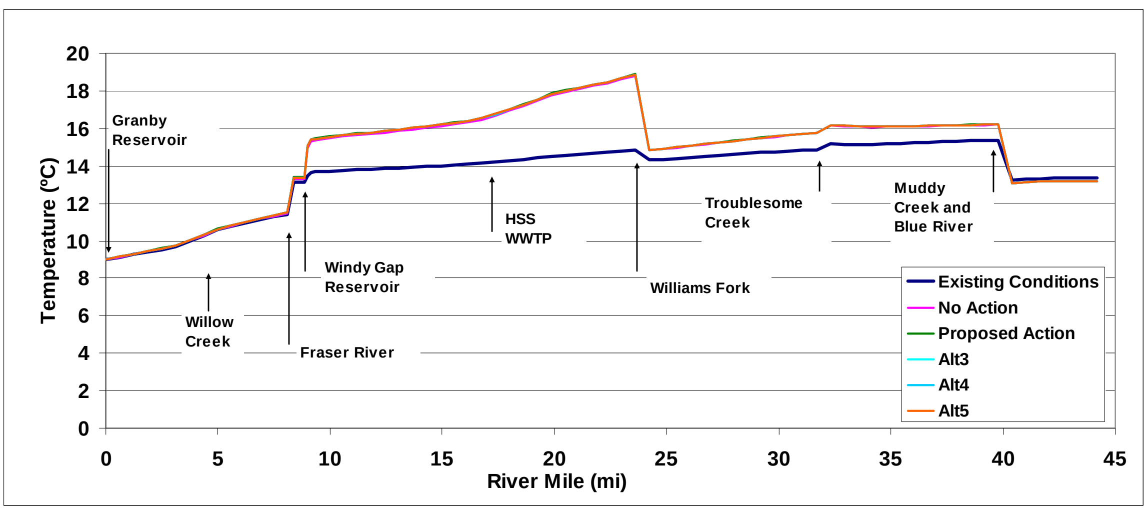


Table 25. Comparisons of predicted Colorado River temperature to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Greatest Change from Existing Conditions* for Stream Temperature in the Study Reach (ºC)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	4.0	26.7%
Proposed Action	4.0	27.2%
Alternative 3	4.0	27.1%
Alternative 4	4.0	27.1%
Alternative 5	4.0	27.1%

*Existing Conditions average July 25 temperature = 14.3ºC at the location of greatest change under the alternatives.

The QUAL2K model output consists of a predicted average daily temperature along with simulated diurnal fluctuations at each location along the river. The predicted diurnal swings in water temperature assuming a 90 cfs low flow condition downstream of the Windy Gap diversion are shown in Table 26. These values represent the location with the highest predicted temperature.

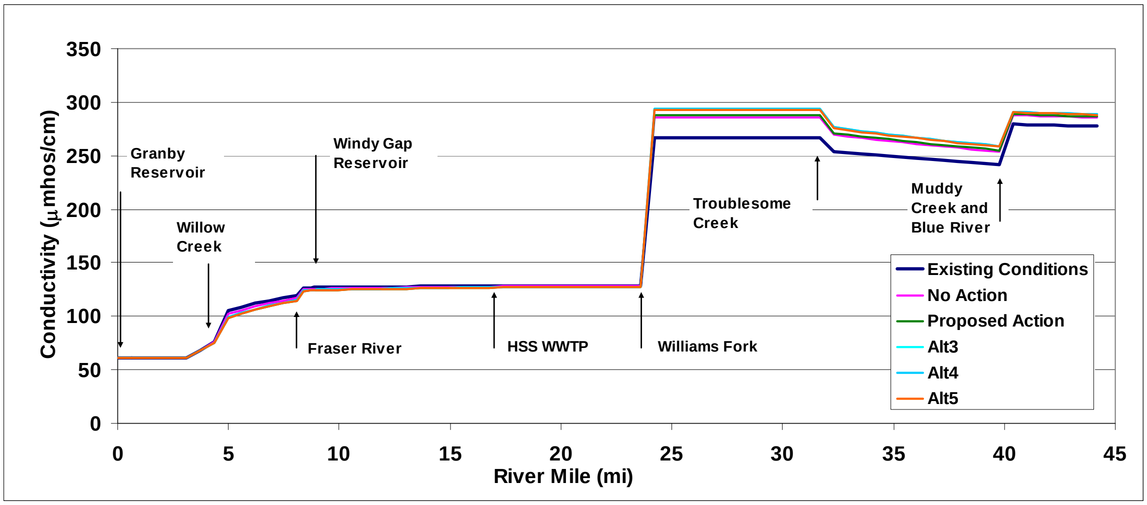
Table 26. Predicted diurnal temperature range for the Colorado River upstream of the Williams Fork for direct effects assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Temperature (°C)		
	Average	Minimum	Maximum
Existing Conditions	14.9	12.9	17.1
No Action	18.8	13.2	25.5
Proposed Action	18.9	13.3	25.5
Alternative 3	18.9	13.2	25.5
Alternative 4	18.9	13.2	25.5
Alternative 5	18.9	13.2	25.5

7.2.3. Specific Conductivity and Total Dissolved Solids

Model results for specific conductivity are presented in Figure 12, Table 27, and Table 28. Changes in specific conductivity are predicted for the alternatives only in the lower section of the reach, below the Williams Fork inflow. Specific conductivity is considered a conservative constituent in the QUAL2K model, where values are only influenced by mixing of source waters of different value. The influence of specific conductivity from the Williams fork is magnified slightly because of reduced flow in the Colorado River.

Figure 12. Colorado River specific conductivity predicted for Existing Conditions and all alternatives (July 25).



The relationship to calculate total dissolved solids concentration from specific conductivity (based on measured data in the Colorado River), is:

Total dissolved solids (mg/L) = 0.6 * conductivity (µmhos/cm)

This relationship is used to calculate total dissolved solids concentrations in the Colorado River (Figure 13).

Figure 13. Colorado River total dissolved solids predicted by the QUAL2K model for Existing Conditions and all alternatives (July 25).

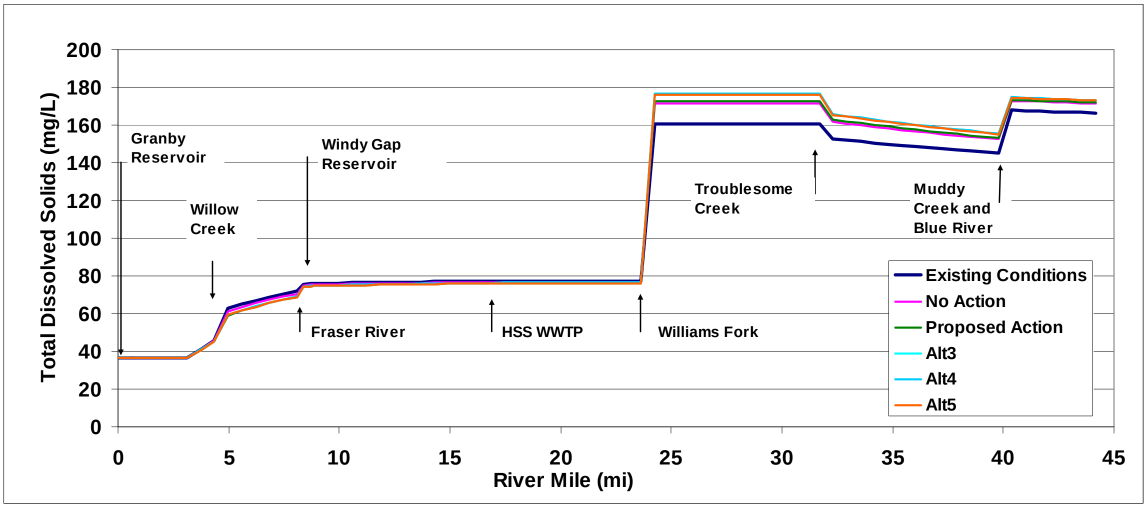


Table 27. Comparisons of predicted Colorado River specific conductivity to Existing Conditions for all alternatives (July 25).

Alternative	Greatest change from Existing Conditions* for Specific Conductivity in the Study Reach (µmhos/cm)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	18.4	6.9%
Proposed Action	20.6	7.7%
Alternative 3	27.0	10.1%
Alternative 4	27.0	10.1%
Alternative 5	25.9	9.7%

*Existing Conditions average July 25 specific conductivity= 267.2 µmhos/cm at the location of greatest change under the alternatives.

Table 28. Comparisons of predicted Colorado River specific conductivity to No Action for all alternatives (July 25).

Alternative	Greatest Change from No Action for Specific Conductivity in the Study Reach (µmhos/cm)	Greatest Percentage Change from No Action in the Study Reach
Proposed Action	2.2	0.8%
Alternative 3	8.6	3.0%
Alternative 4	8.6	3.0%
Alternative 5	7.5	2.6%

Total dissolved solids concentrations are predicted to increase slightly at the most downstream modeled point in the Colorado River at the top of Gore Canyon (Table 29). No Action and all the alternatives are predicted to increase total dissolved solids concentrations slightly. Alternatives 3 and 4 are predicted to produce the greatest increase in total dissolved solids concentrations in the Colorado River at the top of Gore Canyon.

Table 29. Differences between Existing Conditions and the alternatives for total dissolved solids in the Colorado River near Kremmling (July 25).

Alternative	Change from Existing Conditions* for TDS near Kremmling (mg/L)	Percentage Change from Existing Conditions* near Kremmling
No Action	4.9	3.0%
Proposed Action	5.4	3.3%
Alternative 3	6.7	4.0%
Alternative 4	6.7	4.0%
Alternative 5	6.5	3.9%

*Existing Conditions average July 25 TDS concentration near Kremmling = 166 mg/L.

Conductivity and total dissolved solids predictions for the minimum instream flow simulation of each alternative are presented in Figure 14 and Figure 15. Calculated differences from Existing Conditions are presented in Table 30 and Table 31. Model predictions for alternatives result in very similar conditions, output appears as coincident lines in Figure 14 and Figure 15. The withdrawal of the maximum diversion to the minimum instream flow at the end of July would result in decreased flow in the Colorado River. The elevated conductivity of the Williams Fork would, therefore, have a greater impact on the conductivity and TDS concentration of the Colorado River below Windy Gap, with the greatest increase occurring just below Williams Fork.

Figure 14. Colorado River average daily stream conductivity predicted for Existing Conditions and all alternatives assuming diversions to the minimum instream flow below Windy Gap (July 25).

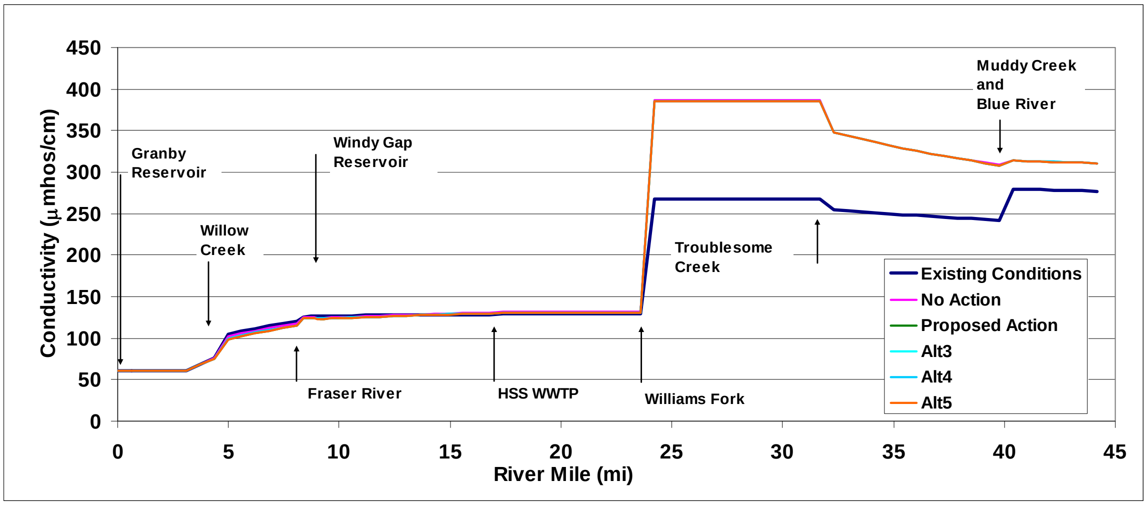


Figure 15. Colorado River average daily stream total dissolved solids predicted for Existing Conditions and all alternatives assuming diversions to the minimum instream flow below Windy Gap (July 25).

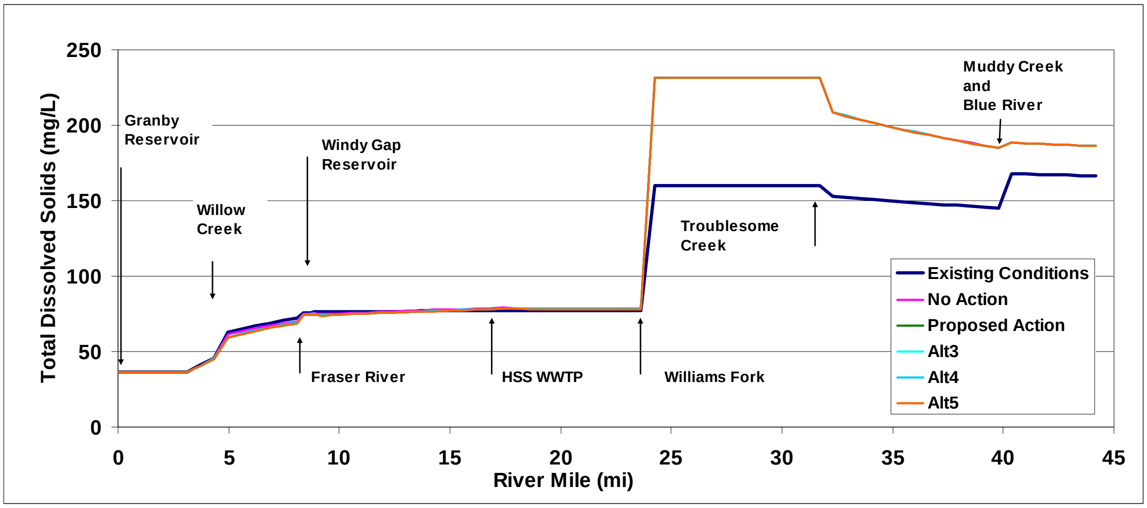


Table 30. Comparisons of predicted Colorado River specific conductivity to Existing Conditions for all alternatives assuming diversions to the minimum instream flow below Windy Gap (July 25).

Alternative	Greatest change from Existing Conditions* for Specific Conductivity in the Study Reach (µmhos/cm)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	118.9	44.5%
Proposed Action	118.8	44.5%
Alternative 3	118.8	44.5%
Alternative 4	118.8	44.5%
Alternative 5	118.7	44.4%

*Existing Conditions average July 25 specific conductivity= 267.2 µmhos/cm at the location of greatest change under the alternatives.

Table 31. Comparisons of predicted Colorado River total dissolved solids to Existing Conditions for all alternatives assuming diversions to the minimum instream flow below Windy Gap (July 25).

Alternative	Greatest change from Existing Conditions* for Specific Conductivity in the Study Reach (µmhos/cm)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	71.3	44.5%
Proposed Action	71.3	44.5%
Alternative 3	71.3	44.5%
Alternative 4	71.3	44.5%
Alternative 5	71.2	44.4%

*Existing Conditions average July 25 TDS concentration near Kremmling = 166 mg/L.

7.2.4. Dissolved Oxygen

Model results for dissolved oxygen for Existing Conditions and the alternatives are presented in Figure 16, Table 32, and Table 33. Dissolved oxygen concentrations would remain relatively constant as water moves downstream from the Lake Granby release. The inflow from the Fraser River and flow of water through Windy Gap reservoir reduces the dissolved oxygen concentration in the river. Concentrations remain stable downstream of the reservoir until reduced by the inflow from the Williams Fork, then are increased by inflows from Troublesome Creek, Muddy Creek and the Blue River. Simulation of the alternatives shows very small reductions in dissolved oxygen concentrations, on the order of 0.1 mg/L at most within the reach. The non-spawning standard of 6 mg/L dissolved oxygen would be met throughout the reach.

Figure 16. Colorado River dissolved oxygen concentrations predicted for Existing Conditions and all alternatives (July 25).

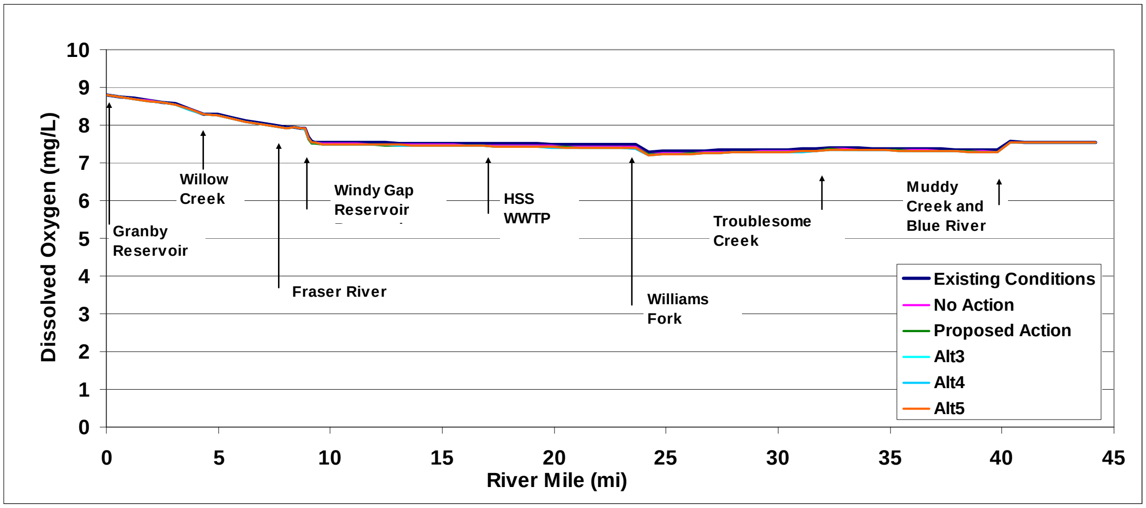


Table 32. Comparisons of predicted Colorado River dissolved oxygen concentrations to Existing Conditions for all alternatives (July 25).

Alternative	Greatest Change from Existing Conditions* for Dissolved Oxygen in the Study Reach (mg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-0.1	-0.8%
Proposed Action	-0.1	-1.2%
Alternative 3	-0.1	-1.3%
Alternative 4	-0.1	-1.3%
Alternative 5	-0.1	-1.3%

*Existing Conditions average July 25 DO concentration = 7.6 mg/L throughout the study reach.

Table 33. Comparisons of predicted Colorado River dissolved oxygen concentrations to No Action for all alternatives (July 25).

Alternative	Greatest Change from No Action for Dissolved Oxygen in the Study Reach (mg/L)	Greatest Percentage Change from No Action in the Study Reach
Proposed Action	0.0	0.0%
Alternative 3	0.0	0.0%
Alternative 4	0.0	0.0%
Alternative 5	0.0	0.0%

Dissolved oxygen predictions for the minimum instream flow simulation of each alternative are presented in Figure 17. Calculated differences from Existing Conditions are presented in Table 34. Simulation of DO for alternatives results in very similar conditions; output appears as coincident lines in Figure 17. Dissolved oxygen concentrations are predicted to be slightly lower below Windy Gap Reservoir for all alternatives at minimum instream flow.

Figure 17. Colorado River average daily stream dissolved oxygen predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

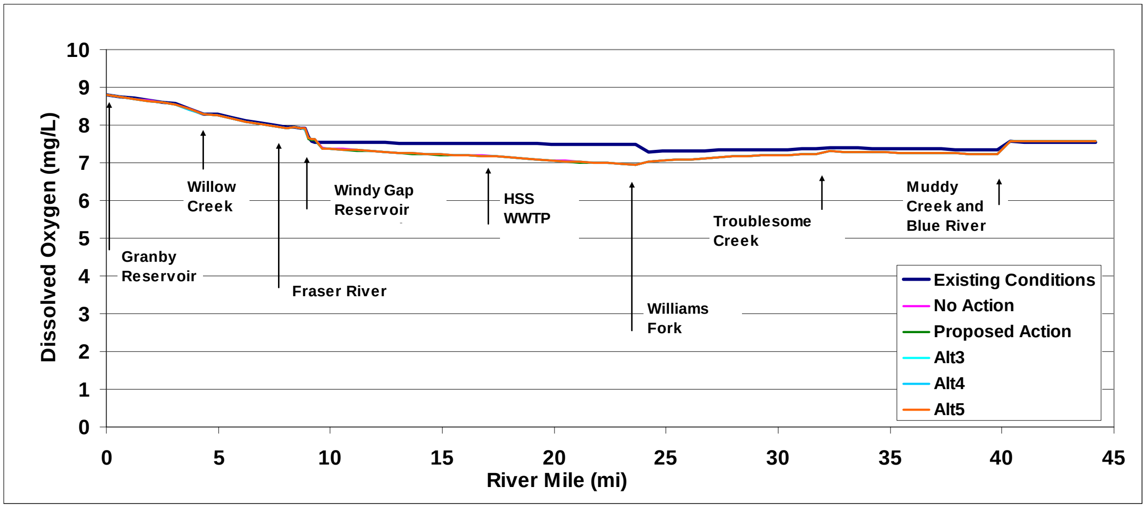


Table 34. Comparisons of predicted Colorado River dissolved oxygen to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Greatest Change from Existing Conditions* for Dissolved Oxygen in the Study Reach (mg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-0.5	7.2%
Proposed Action	-0.6	7.3%
Alternative 3	-0.5	7.3%
Alternative 4	-0.5	7.3%
Alternative 5	-0.5	7.3%

*Existing Conditions average July 25 DO concentration = 7.6 mg/L throughout the study reach.

7.2.5. Ammonia

Ammonia predictions throughout the reach for Existing Conditions and the alternatives are presented in Figure 18, Table 35, and Table 36. Ammonia concentrations under Existing Conditions and the alternatives are below acute and chronic ammonia standards throughout the study reach. Upstream concentrations from Lake Granby outlet vary about 0.001 mg/L between alternatives. Variations in ammonia concentration throughout the reach are primarily driven by inflow sources, where a rapid change over a short length is often seen at a tributary confluence. The Hot Sulphur Springs WWTP source shows a visible increase in the ammonia concentration in the Colorado River. For the alternative simulations, ammonia concentrations are predicted to decrease by up to

0.0009 mg/L upstream of the WWTP outfall. These small decreases in ammonia are attributed to biological uptake as a result of increased plant growth caused by the predicted higher concentrations of phosphorus in the river. Ammonia concentrations are predicted to increase from Existing Conditions as much as 0.0017 mg/L downstream of the WWTP. All of the action alternatives show nearly equivalent increases in ammonia concentrations downstream.

Figure 18. Colorado River ammonia concentrations predicted for Existing Conditions and all alternatives (July 25).

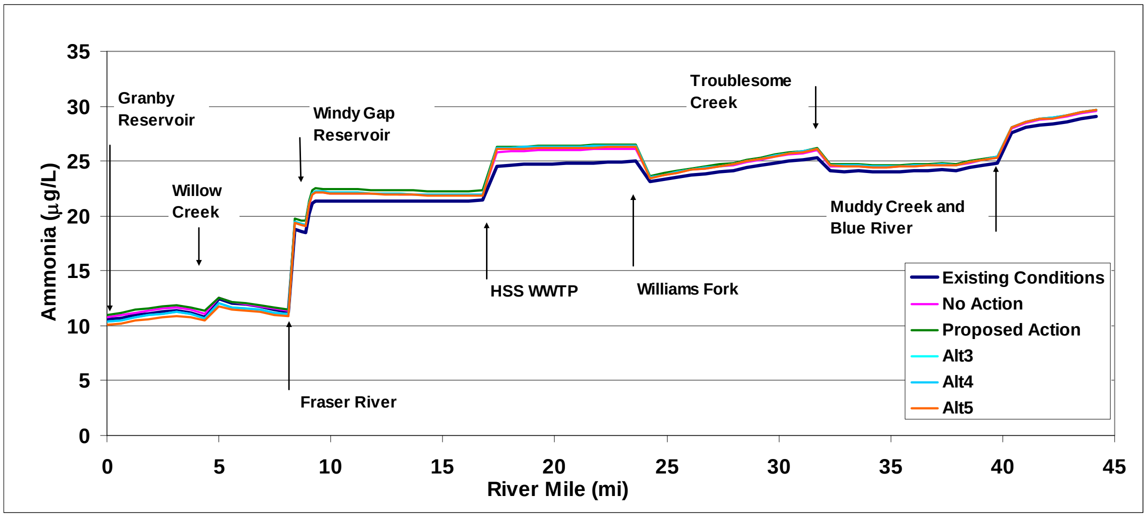


Table 35. Comparisons of predicted Colorado River ammonia concentrations to Existing Conditions for all alternatives (July 25).

Alternative	Change from Existing Conditions* for Ammonia upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Ammonia in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	0.5	1.3	5.1%
Proposed Action	0.9	1.7	6.9%
Alternative 3	0.5	1.6	6.6%
Alternative 4	0.5	1.6	6.6%
Alternative 5	0.4	1.5	6.1%

*Existing Conditions average July 25 ammonia concentration is 21.4 µg/L above the HSS WWTP and 24.9 µg/L at location of greatest change under the alternatives.

Table 36. Comparisons of predicted Colorado River ammonia concentrations to No Action for all alternatives (July 25).

Alternative	Change from No Action for Ammonia upstream of HSS WWTP Outfall (µg/L)	Greatest Change from No Action for Ammonia in the Study Reach (µg/L)	Greatest Percentage Change from No Action in the Study Reach
Proposed Action	0.3	0.5	2.4%
Alternative 3	0.0	0.4	1.4%
Alternative 4	0.0	0.4	1.4%
Alternative 5	-0.1	0.2	0.9%

Ammonia predictions for the minimum instream flow simulation of each alternative are presented in Figure 19. Calculated differences from Existing Conditions are presented in Table 37. Simulation of ammonia for alternatives results in very similar conditions; output appears as nearly coincident lines in Figure 19. Ammonia concentrations are predicted to be higher below Windy Gap Reservoir, HSS WWTP, and downstream of the Williams Fork at minimum instream flow.

Figure 19. Colorado River average daily stream ammonia predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

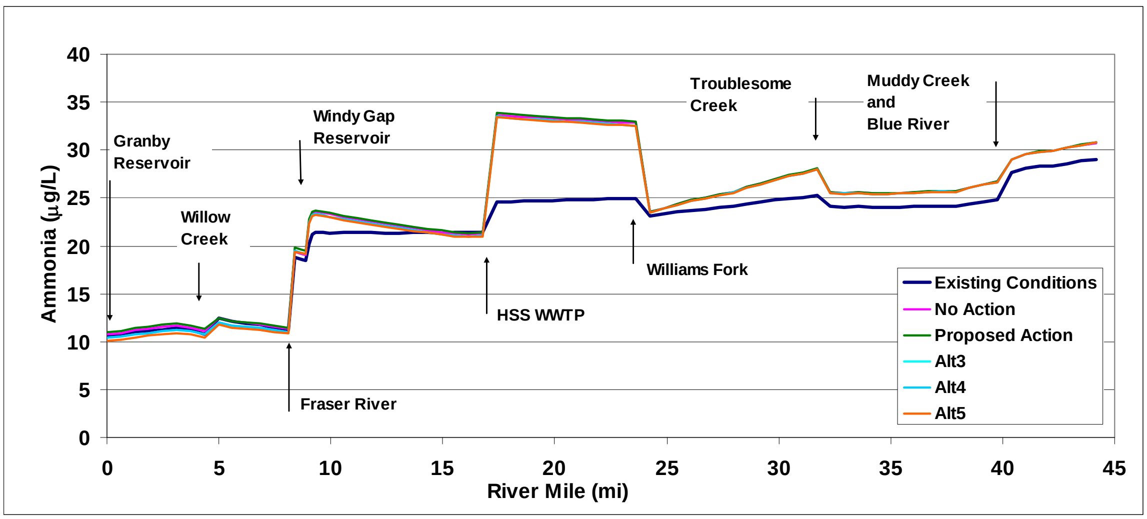


Table 37. Comparisons of predicted Colorado River ammonia to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Change from Existing Conditions* for Ammonia upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Ammonia in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-0.2	9.1	37.2%
Proposed Action	0.0	9.3	37.8%
Alternative 3	-0.4	8.9	36.4%
Alternative 4	-0.4	8.9	36.4%
Alternative 5	-0.4	8.9	36.1%

*Existing Conditions average July 25 ammonia concentration is 21.4 µg/L above the HSS WWTP and 24.9 µg/L at location of greatest change under the alternatives.

7.2.6. Inorganic Phosphorus

Model predictions for inorganic phosphorus are presented in Figure 20, Table 38, and Table 39. As with ammonia, inorganic phosphorus concentrations vary at the upstream end of the study reach at the Lake Granby outlet and throughout the modeled reach, with large changes occurring at the HSS WWTP outfall and tributary inflow points. The Willow Creek, Fraser River, Hot Sulphur Springs WWTP and the Williams Fork clearly change the phosphorus concentration in the Colorado River. Upstream of the HSS WWTP, increases in inorganic phosphorus concentrations of up to 1 µg/L are predicted for alternatives. Increases in concentrations of up to 1.5 µg/L are predicted downstream of the WWTP as a result of decreased river flows under the alternatives.

Figure 20. Colorado River inorganic phosphorus concentrations for Existing Conditions and all alternatives (July 25).

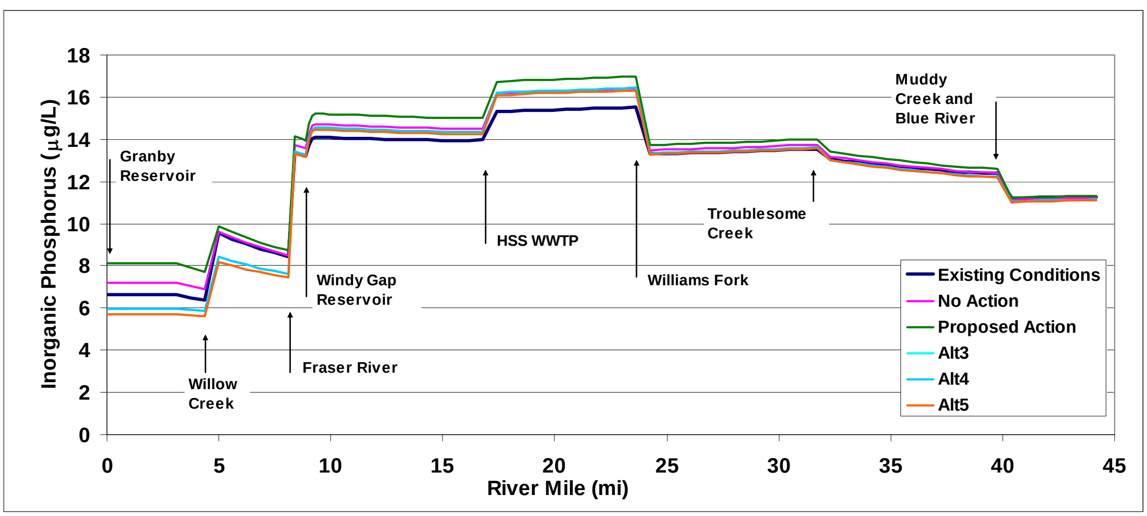


Table 38. Comparisons of predicted Colorado River inorganic phosphorus concentrations to Existing Conditions for all alternatives (July 25).

Alternative	Change from Existing Conditions* for Inorganic Phosphorus Upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Inorganic Phosphorus in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* ins the Study Reach
No Action	0.6	0.9	9.0%
Proposed Action	1.0	1.5	22.8%
Alternative 3	0.4	0.9	5.9%
Alternative 4	0.4	0.9	5.9%
Alternative 5	0.3	0.8	5.2%

*Existing Conditions average July 25 inorganic phosphorus concentration = 13.9 µg/L above HSS WWTP, 15.5 µg/L at location of greatest change under the alternatives.

Table 39. Comparisons of predicted Colorado River inorganic phosphorus concentrations to No Action for all alternatives (July 25).

Alternative	Change from No Action for Inorganic Phosphorus Upstream of HSS WWTP Outfall (µg/L)	Greatest Change from No Action for Inorganic Phosphorus in the Study Reach (µg/L)	Greatest Percentage Change from No Action in the Study Reach
Proposed Action	0.5	0.1	0.7%
Alternative 3	-0.2	-1.2	-17.3%
Alternative 4	-0.2	-1.2	-17.3%
Alternative 5	-0.3	-1.5	-21.0%

Inorganic phosphorus predictions for the minimum instream flow simulation of each alternative are presented in Figure 21. Calculated differences from Existing Conditions are presented in Table 40. Inorganic phosphorus concentrations are predicted to be slightly higher below Windy Gap reservoir and HSS WWTP but are predicted to be lower downstream of the Williams Fork at minimum instream flow.

Figure 21. Colorado River average daily stream inorganic phosphorus predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

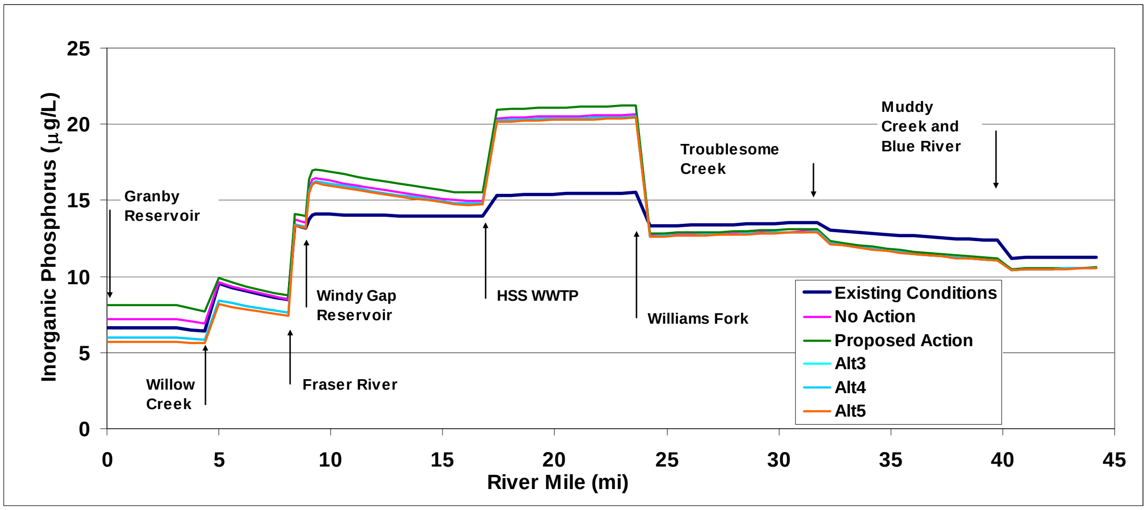


Table 40. Comparisons of predicted Colorado River inorganic phosphorus to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Change from Existing Conditions* for Inorganic Phosphorus Upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Inorganic Phosphorus in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* ins the Study Reach
No Action	1.0	5.1	33.1%
Proposed Action	1.5	5.7	36.9%
Alternative 3	0.8	5.0	32.2%
Alternative 4	0.8	5.0	32.2%
Alternative 5	0.8	4.9	31.6%

*Existing Conditions average July 25 inorganic phosphorus concentration = 13.9 µg/L above HSS WWTP, 15.5 µg/L at location of greatest change under the alternatives.

7.2.7. Selenium

Predicted dissolved selenium concentrations for the alternative simulations are presented in Figure 22, Table 41, and Table 42. Dissolved selenium concentrations from Lake Granby and all tributaries except Muddy Creek are very low (at or near laboratory detection limits). These sources have been represented as having selenium concentrations of 0.5 µg/L in the model. Samples collected in Muddy Creek showed higher dissolved selenium concentrations, with a July median concentration of 2.8 µg/L. For existing conditions, the dissolved selenium concentrations in the Colorado River are predicted to be 0.5 µg/L upstream of Muddy Creek and 0.67 µg/L downstream of the creek. Simulation of the alternatives showed small increases of up to 0.02 µg/L near Kremmling for the alternatives. These increases result from nearly consistent inflow from the Muddy Creek but reductions in Colorado River flow for alternatives as compared to existing conditions.

Figure 22. Colorado River dissolved selenium concentrations predicted for Existing Conditions and all alternatives (July 25).

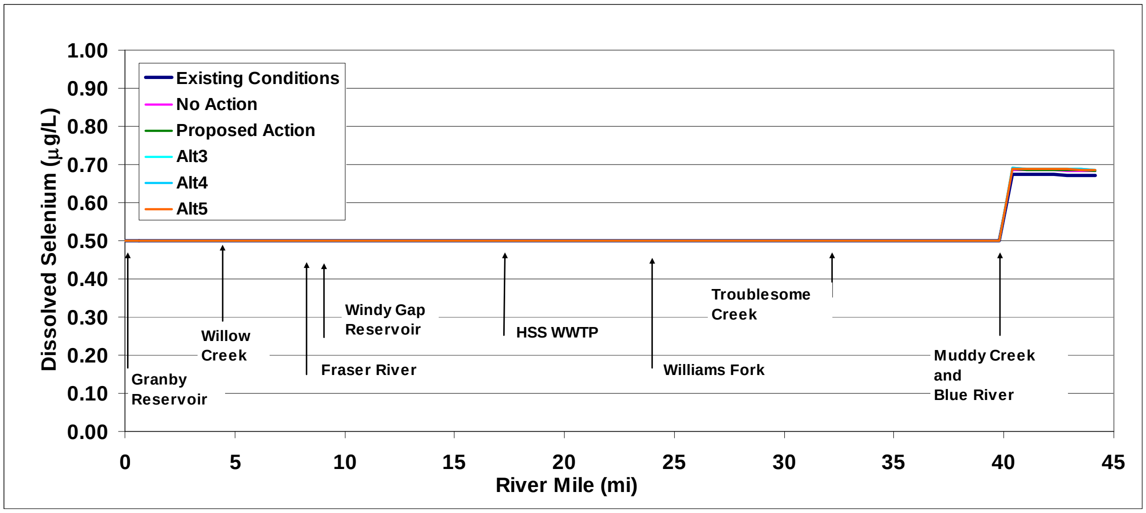


Table 41. Comparisons of predicted Colorado River dissolved selenium concentrations to Existing Conditions for all alternatives (July 25).

Alternative	Greatest Change from Existing Conditions* for Dissolved Selenium in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	0.01	1.7%
Proposed Action	0.01	1.9%
Alternative 3	0.02	2.3%
Alternative 4	0.02	2.3%
Alternative 5	0.01	2.2%

*Existing Conditions average July 25 dissolved selenium concentration at location of greatest change under the alternatives = 0.67 µg/L.

Table 42. Comparisons of predicted Colorado River dissolved selenium concentrations to No Action for all alternatives (July 25).

Alternative	Greatest Change from No Action for Dissolved Selenium in the Study Reach (µg/L)	Greatest Percentage Change from No Action in the Study Reach
Proposed Action	0.001	0.2%
Alternative 3	0.004	0.6%
Alternative 4	0.004	0.6%
Alternative 5	0.004	0.5%

Dissolved selenium predictions for the minimum instream flow simulation of each alternative are presented in Figure 23. Calculated differences from Existing Conditions are presented in Table 43. Simulation of selenium for alternatives results in very similar conditions; output appears as coincident lines in Figure 23. Selenium concentrations are predicted to be slightly higher below Muddy Creek at the minimum instream flow.

Figure 23. Colorado River average daily stream dissolved selenium predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

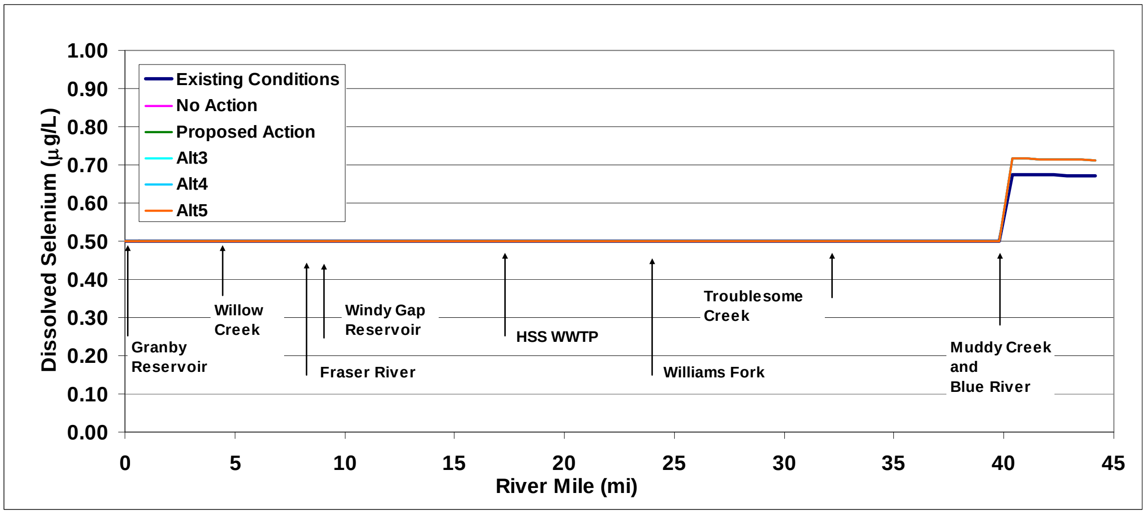


Table 43. Comparisons of predicted Colorado River dissolved selenium to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Greatest Change from Existing Conditions* for Dissolved Selenium in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	0.04	6.2%
Proposed Action	0.04	6.2%
Alternative 3	0.04	6.3%
Alternative 4	0.04	6.3%
Alternative 5	0.04	6.3%

*Existing Conditions average July 25 dissolved selenium concentration at location of greatest change under the alternatives = 0.67 µg/L.

7.3. Willow Creek SSTEMP Model Results

Inflows to Willow Creek from Willow Creek Reservoir for Existing Conditions and the alternatives were provided by Boyle Engineering (2006a). Segment outflow, channel geometry and shading variables were determined from field measurements collected at the Willow Creek site by ERO Resources. Meteorological data were collected by ERO in the field, from the Town of Granby weather station (Weather.com 2006) and NOAA meteorological summary data for Colorado (Western Regional Climate Center 2006). The temperature of ground water entering Willow Creek was derived from USGS ground water temperature recordings from two nearby wells (Earthinfo 2004). Model output files are available upon request.

Field measurements showed that streamflow more than doubled from the top to the bottom of the 3-mile segment. During field measurements, there was only one flowing ditch or tributary, with a measured discharge of 1.5 cfs, within the segment. The remaining inflow to Willow Creek was ground water, some of which, based on an infrared photo of Willow Creek, appears to be subsurface irrigation return flows from meadows located to the east of Willow Creek.

Prior to running the model to determine impacts to stream temperature under the alternatives, the model was calibrated for July and September. The model results show that in July, under the worst case scenario of a 36% decrease in the flow of Willow Creek (a decrease from 32 cfs under Existing Conditions to 20.5 cfs under the Proposed Action), the predicted mean temperature of Willow Creek 3 miles downstream would be 0.2ºC cooler than under Existing Conditions. It appears that ground water inflow greatly influences the temperature of Willow Creek. When less water is available from Willow Creek Reservoir, then the relative contribution of cooler ground water becomes greater.

7.4. Effects to the Colorado River Common to All Alternatives

Streamflow volumes near or below the 90 cfs minimum flow at Windy Gap could occur when no WGFP diversions occur from other upstream water uses or during periods of naturally low runoff. Diversion to the minimum streamflow could occur under Existing Conditions, as well as the No Action and action alternatives. All of the alternatives could potentially result in Colorado River flows below Windy Gap Reservoir that would be as low as the minimum instream flow (90 cfs) about 2 percent of the time; thus, all of the alternatives would have similar water quality effects under these hydrologic conditions. On such occasions, the average July 25th streamflow below Windy Gap Reservoir would be reduced by 78 percent (Table 22). This section summarizes the water quality effects for minimum streamflow conditions on July 25 based on QUAL2K model results described in Section 7.2.

A Colorado River temperature increase of up to 4ºC is predicted to occur above the Williams Fork River at minimum streamflow. Downstream of the Williams Fork River confluence, the temperature of the Colorado River would decrease to about 16ºC or less (Figure 11). A temperature increase of up to 4ºC below the Windy Gap Reservoir could result in a greater frequency when the river exceeds temperature standards.

Conductivity and total dissolved solid concentrations would increase up to about 44 percent from Existing Conditions under minimum streamflow conditions (Table 30 and Table 31). The increased values would occur below the Williams Fork River because there would be less water in the Colorado River to dilute higher total dissolved solids concentrations coming in from the Williams Fork.

Dissolved oxygen concentrations in the Colorado River would decrease by up to 0.6 mg/L below Windy Gap Reservoir from Existing Conditions (Table 34). Dissolved oxygen would remain above the standard of 6.0 mg/L, but could approach the 7.0 mg/L standard for fish spawning at minimum flows.

Ammonia concentrations in the Colorado River could increase by up to 9.3 μg/L at minimum flows from Existing Conditions (Table 35). Inorganic phosphorus concentrations could increase by up to about 5.7 μg/L (Table 38). The largest increase in nutrient concentrations would occur below the Hot Sulphur Springs WWTP from a reduction in Colorado River flow to dilute effluent discharge. Ammonia concentrations would remain below standards for all alternatives at minimum flows and there is currently no water quality standard for phosphorus. For all alternatives, some increase in aquatic plant growth would be expected as a result of the increase in nutrient concentrations.

Selenium concentrations under minimum flows would increase up to about 0.04 μg/L from Existing Conditions (Table 43). The maximum increase would occur below the confluence with Muddy Creek, which has higher selenium concentrations than the Colorado River.

7.5. Alternative 1 (No Action)

Under the No Action alternative, the temperature and water quality of all of the stream segments listed in Table 1 could potentially be affected as a result of increases or decreases in streamflows, with the exception of creeks located below new reservoirs, since no new reservoirs would be constructed under No Action. Windy Gap Participants would maximize their use of Windy Gap water when available, as their demands increase in the future. Windy Gap firm yield deliveries (1,229 AF) would be considerably less than the demand (33,665 AF) because of less storage under the No Action alternative (ERO and Boyle 2007). Only the City of Longmont has an option to develop storage independently if the WGFP is not implemented. Under this alternative, existing operations and agreements would continue between Reclamation and the NCWCD for the conveyance of Windy Gap water through C-BT facilities.

7.5.1. Colorado River

The modeled minimum streamflow scenario, which could occur under the No Action alternative, is discussed in Section 7.4. Under average July 25th flow conditions, the largest predicted decrease in average July 25th Colorado River flow for the model area would be 19.6%, which would occur below Windy Gap Reservoir. The largest change in stream temperature would be a 0.5ºC increase from Existing Conditions in the river just upstream of the confluence with Williams Fork. Specific conductivity would increase at most by 6.9% below the confluence of the Williams Fork River. The maximum decrease in dissolved oxygen concentration would be 0.1 mg/L, which would not decrease the concentration to below the standard. Ammonia concentrations would increase at most by 1.3 μg/L and inorganic phosphorus concentrations would increase at most by 0.9 μg/L within the model reach. Existing selenium concentrations are about 0.5 μg/L in this reach of the Colorado River; the No Action alternative would increase the selenium concentration by a predicted 0.01 μg/L.

The aquatic life 7-day average temperature interim standard is 18.2ºC for gold medal waters between the Fraser River and Troublesome Creek and 20ºC elsewhere. Previous temperature data measured in the study area showed exceedances of the gold medal water standard in 2007. A temperature increase of up to 0.5ºC below the Windy Gap Reservoir to the Blue River could result in more frequent exceedances of temperature standards.

The aquatic life acute and chronic total ammonia standards are temperature and pH dependent. Based on a QUAL2K temperature of 14ºC and a river pH of 7.4 for July 25, the aquatic life acute and chronic ammonia standards would be 15.3 and 4.73 mg/L, respectively. The QUAL2K model shows that the average ammonia concentration under Existing Conditions from Windy Gap Reservoir to the Blue River is about 0.025 mg/L (Appendix A). An increase in the ammonia concentration by 1.3 μg/L (0.0013 mg/L) under No Action would not increase the ammonia concentration to above aquatic ammonia standards. There is no standard for phosphorus; however, a maximum increase in the inorganic phosphorus concentration to about 0.009 mg/L is within the range of natural background concentrations.

None of the projected changes in Colorado River water quality are expected to adversely contribute to the spread of didymo populations that are currently present in the river or its development. This aquatic organism is tolerant of a wide range of stream chemical and physical conditions and none of the water quality parameters that would change under the alternatives would aggravate its dispersal or growth. Studies elsewhere indicate high flows (2,600 to 3,500 cfs) that scour didymo cells from the streambed are one factor that may help reduce biomass levels (Spaulding 2008). Periodic high flows of similar magnitude to existing conditions (1,240 to 6,250 cfs) would continue to occur with slightly less frequency (about 4 to 9 percent less frequent for the Proposed Action) under all of the alternatives (ERO and Boyle 2007, Appendix Table D-19). An aggressive education and outreach program to prevent the spread of didymo is considered an important control technique (Spaulding 2008).

7.5.2. Willow Creek

Because of decreases in releases from Willow Creek Reservoir to Willow Creek that would occur under the alternatives, changes to the water quality of Willow Creek below the reservoir could occur. Water quality changes would be due to increases in the relative contribution of ground water inflows and inflows from Church Creek, which carries effluent discharges from the Three Lakes Water and Sanitation District.

Under No Action, the largest decreases in the flow of Willow Creek would occur from June through August (ERO and Boyle 2007). According to the SSTEMP model, this would not change the temperature of Willow Creek. However, it would reduce the dilution of treated wastewater entering Willow Creek from Church Creek. Using the maximum permitted inflow of treated wastewater from Church Creek of 1.3 cfs, a mass balance was completed for Willow Creek below Church Creek using chemical concentrations in Willow Creek and in the effluent discharge. The ammonia concentration in the WWTP discharge water has sometimes been much higher than the mean ammonia concentration in Willow Creek. The distance from the discharge point to Willow Creek is 1.6 miles; concentrations of ammonia would be expected to decrease in this segment of Church Creek (EPA 2000). Copper concentrations have exceeded standards in Willow Creek and copper and dissolved iron concentrations have occasionally been elevated in the WWTP discharge. A mass balance calculation was completed using mean ammonia, iron, and copper concentrations for Willow Creek at the gage 0.5 mile above the Colorado River and an average of the higher WWTP effluent concentrations measured for these parameters. Results for No Action are provided in Table 44. Under No Action, even under worst-case conditions in August at the maximum allowable WWTP discharge rate, acute and chronic aquatic life ammonia standards would not be exceeded in Willow Creek with the projected increase in ammonia concentration. Given the lack of algae and chlorophyll data for Willow Creek, it is not known whether the predicted increases in ammonia concentrations would result in algal growth problems in the creek. Iron concentrations would not exceed the dissolved (water supply) standard and copper concentrations would not exceed the acute and chronic aquatic standards under No Action.

Table 44. Average monthly increase in ammonia, iron, and copper concentrations in Willow Creek ½ mile above the Colorado River under the No Action alternative.

Parameter	Standard (June/July)	Standard (Aug)	Existing Conditions	WWTP Effluent Concentrations[2]	June		July		August	
			Average	Average	Average	Change	Average	Change	Average	Change
Ammonia (mg/L)	2.87	2.45	0.1	17	0.27	0.17	0.91	0.81	1.9	1.8
Iron, diss (µg/L)	300	300	92.5	260	94.2	1.7	100.5	8	110.36	17.86
Copper, diss (µg/L)[1]	10	10	3.4	21	3.54	0.14	4.24	0.84	5.27	1.87

[1]Copper chronic standard based on mean hardness of 112 mg/L (CDPHE 2008).
[2]Data are from EPA Envirofacts (http://www.epa.gov/enviro/).

7.5.3. Big Thompson River

Under No Action, the flow of the Big Thompson River below Lake Estes to the Hansen Feeder Canal would increase by 1% in June and July in an average year and would not change during any other months in an average year or during dry or wet years (ERO and Boyle 2007). As described in Section 6.2.1, this section of the river has good water quality, particularly during high flows. The average 1% increase in high flows that would occur during June and July are not expected to measurably alter the water quality in this reach of the Big Thompson River.

The Big Thompson River downstream of the Loveland WWTP would also be affected under the No Action alternative. The flow of the river would increase during May through October (up to 9.8 cfs), with the largest percent increase occurring in October (ERO and Boyle 2007). Given that ammonia concentrations occasionally already exceeded the chronic standard in 2000 to 2006 and occasionally the acute standard, most often during low flow from late October through March, a mass balance calculation was completed for ammonia during the month of October, the lowest flow month. In addition, a mass balance calculation was completed for copper concentrations, for which data are available for both the river and the effluent discharge. Results are provided in Table 45. Ammonia concentrations would decrease in the river. Copper concentrations would not exceed the aquatic standards under No Action. The Big Thompson River below Loveland has other occasional water quality exceedances during low flows (nitrate and sulfate); however, WWTP effluent data are not available for these parameters. Flow increases of up to 10 cfs during low flows are well within the historical range of flows which reach 300 cfs during average spring runoff; thus, increased erosion downstream is unlikely.

Table 45. Average changes in ammonia and copper concentrations in October in the Big Thompson River below Loveland under all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	No Action		All Other Alternatives	
		Average	Average	Average	Change	Average	Change
Ammonia (mg/L)	2.86	1.44	1.4	1.06	-0.38	1.21	-0.23
Copper, diss (µg/L)	29	2.94	8.06	4.57	1.63	4.87	1.93

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

7.5.4. North St. Vrain Creek

Under the No Action alternative, the flow of North St. Vrain Creek below Ralph Price Reservoir would change due to exchanges of Windy Gap water to storage in an enlarged Ralph Price Reservoir and Windy Gap releases from Ralph Price Reservoir to meet Longmont's demands (ERO and Boyle 2007). The water quality of North St. Vrain Creek could change due to changes in the quality of water in Ralph Price Reservoir, as well as due to changes in stream flow. As described in Section 6.2.2, North St. Vrain Creek is a pristine mountain stream, with concentrations of inorganic parameters generally lowest during high flow. The existing water quality of Ralph Price Reservoir is expected to be very good because of the lack of contaminant sources; however, no water quality data are available. Water quality is predicted to improve under the No Action alternative due to the increased reservoir volume and depth, (AMEC 2008). Therefore, releases to North St. Vrain Creek from Ralph Price Reservoir would improve the water quality of the creek.

Average monthly streamflow decreases in North St. Vrain Creek ranging from 10 to 27% (a decrease of 15 to 40 cfs) in the high flow months of May and July are projected (ERO and Boyle 2007). Based on a review of the relationship between temperature and flows from historical data collected by the USGS at Longmont Dam (Earthinfo 2006), it is expected that such a flow decrease could increase the stream temperature by as much as 1ºC, remaining well below the standard of 20ºC (the average historical stream temperature in May is 6.6ºC and in July is 11.6ºC). Similarly, based on a review of the relationship between dissolved oxygen and flows from historical USGS data, it is expected that the dissolved oxygen concentration could decrease by less than 0.5 mg/L, remaining above the standard of 6 mg/L (the average historical dissolved oxygen concentration in May is 9.8 mg/L and in July is 8.8 mg/L).

Average monthly flow increases in North St. Vrain Creek ranging from 43 to 90% (a gain of 7 to 18 cfs) in the low flow months of September and October are projected (ERO and Boyle 2007). Based on a review of the relationship between temperature and flows from historical data collected by the USGS at Longmont Dam (Earthinfo 2006), it is expected that such a flow increase could decrease the stream temperature by 4 to 5ºC and raise the dissolved oxygen concentration in the creek by 0.5 to 2 mg/L.

The manganese concentration in North St. Vrain Creek has been at or above the drinking water standard only during low flows (15 cfs or less). The No Action alternative would not decrease the flow of North St. Vrain Creek below 15 cfs during any month (ERO and Boyle 2007). Given that other water quality parameters have historically low concentrations during all flow levels and that predicted changes in flow are well within the historical range, water quality in North St. Vrain Creek is expected to be similar to measured historical values (Table 15).

7.5.5. St. Vrain Creek

St. Vrain Creek at Lyons is a fairly pristine stream, with water quality concentrations generally lowest during high flow. Under the No Action alternative, the flow of the creek would decrease by 13% in July (a 40 cfs decrease) and increase by 18 to 19% (7 to 13 cfs) in September and October (flow changes in other months would be 0 to 5%) (ERO and Boyle 2007). Based on a review of the relationship between temperature and flows from historical data collected by the USGS at Lyons (Earthinfo 2006), it is expected that such a flow decrease during July high flows would not measurably change the stream temperature or dissolved oxygen concentration. The flow increases in September and October would also not measurably change the stream temperature or dissolved oxygen concentration. Given that most other water quality parameters have historically low concentrations during all flow levels, it is not expected that the predicted flow increases or decreases, which are well within historical flows of the St. Vrain at Lyons, would increase to concentrations higher than measured historically (Table 15).

The flow of St. Vrain Creek downstream of Longmont's WWTP and the St. Vrain Sanitation District's WWTP would increase in April through October due to increased effluent discharges (ERO and Boyle 2007). The largest percent increases would occur in October. Ammonia concentrations already occasionally exceed the chronic standard during low flow. At the Longmont WWTP, mass balance calculations were completed for ammonia, for which there are data available for both the river and the WWTP effluent discharge. Results are provided in Table 46. Under the No Action alternative, the increase in ammonia concentrations could increase exceedances of the chronic standard during October. More frequent exceedances of the ammonia standards could also occur during other low flow periods as well, although this would not include the months of November through March, when the WGFP would not result in increased effluent flows from Longmont's WWTP. Predicted increases in ammonia concentrations under No Action would be greater than those predicted for the action alternatives because the No Action Alternative would have higher maximum WWTP return flow increases (Boyle 2006b).

At the St. Vrain Sanitation District WWTP, mass balance calculations were completed for ammonia. Results are provided in Table 47. Ammonia concentrations would not exceed the ammonia standard under No Action. The flow increases (up to 11.5 cfs for both WWTPs during low flows) are not large enough to increase erosion downstream in a channel that supports average spring high flows of 350 cfs or more.

Table 46. Average changes in ammonia concentrations in October in St. Vrain Creek below Longmont WWTP for all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	No Action		All Other Alternatives	
		Average	Average	Average	Change	Average	Change
Ammonia (mg/L)	2.86	1.3	5.2	2.71	1.41	2.5	1.2

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

Table 47. Average changes in ammonia concentrations in October in St. Vrain Creek below St. Vrain Sanitation District WWTP for all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	All Alternatives	
		Average	Average	Average	Change
Ammonia (mg/L)	2.86	0.155	1.05	0.161	0.006

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

7.5.6. Big Dry Creek

Increased discharge from Broomfield's WWTP under No Action during April through October would increase the flow of Big Dry Creek (ERO and Boyle 2007). The largest percent increase would occur during the low flow month of October. Given that ammonia, iron, and manganese concentrations already occasionally exceed standards in Big Dry Creek, mass balance calculations were done for those parameters during the month of October. Results are provided in Table 48. The estimated increase in the ammonia concentration could result in additional exceedances of ammonia standards. Iron and manganese concentrations would decrease in Big Dry Creek below Broomfield's WWTP. The flow increases (up to 3.5 cfs during low flows and 8.5 cfs during high flows) are unlikely to measurably increase erosion downstream.

Table 48. Average changes in ammonia, iron and manganese concentrations in October in Big Dry Creek below Broomfield WWTP for all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	All Alternatives	
		Average	Average	Average	Change
Ammonia (mg/L)	2.86	1.05	2	2.41	1.36
Iron (µg/L)	1,000	1,090	161	461	-629
Manganese (µg/L)	200	80	9.74	31.4	-48.6

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

7.5.7. Coal Creek

Under No Action, increases in the flow of Coal Creek below the four WWTPs (Superior, Louisville, Lafayette, and Erie) would occur in April through October, with the largest percent changes occurring in September, the month with lowest streamflow. The flow increase is predicted to be a maximum of about 5 cfs in September and October (Boyle 2006b). This minor estimated increase in flow is unlikely to increase erosion downstream of the WWTPs. The total average monthly effluent discharge from the four WWTPs is currently 7.9 cfs; this flow constitutes most or all of the flow of Coal Creek, except during high flows in April and May. The average ammonia concentration in Coal Creek is 0.07 mg/L (based on 7 measurements by the USGS); the ammonia concentration in the four WWTP effluent discharges ranges from less than 0.03 mg/L to occasionally greater than 10 mg/L. Increased WWTP return flows from the Superior, Louisville, Lafayette and Erie WWTPs could cause ammonia concentrations in Coal Creek to exceed ammonia standards, particularly during low flow. A mass balance calculation was not completed for ammonia and other parameters due to a lack of data for Coal Creek above and below the four WWTPs.

7.5.8. Cache la Poudre River

Increases in WWTP effluent discharges from Greeley's WWTP would occur in November through March to the Cache la Poudre River below the Greeley WWTP. The estimated WWTP discharge increase during those months ranges from 3.9 to 8.4 cfs (Boyle 2006b) for the No Action alternative. The largest increase would occur in November. Mass balance calculations were completed for ammonia and copper, for which there are data available for both the river and the WWTP effluent discharge. Results are provided in Table 49. It is unlikely that ammonia standards would be exceeded under any of the alternatives. Copper concentrations would increase, but would remain well below acute and chronic standards.

Table 49. Average increases in ammonia and copper concentrations in January or November in the Poudre River near Greeley for all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	No Action (November)		Alternatives 2 to 5 (January)	
		Average	Average	Average	Change	Average	Change
Ammonia (mg/L)	2.86	0.66	4.79	1.4	0.74	1.37	0.71
Copper, diss (µg/L)	29	2	11.1	3.64	1.64	3.56	1.56

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

7.6. Alternative 2 (Chimney Hollow Reservoir with Prepositioning—Proposed Action)

Under the Proposed Action, the temperature and water quality of some West and East Slope streams could potentially be affected as a result of increases or decreases in streamflows. Chimney Hollow Reservoir would be the only new reservoir constructed under the Proposed Action; thus, Chimney Hollow Creek, an intermittent stream, would be affected by this alternative. Chimney Hollow Reservoir would have approximately 90,000 AF of storage and would remain near full at all times.

7.6.1. Colorado River

The modeled minimum streamflow scenario is discussed in Section 7.4. Water quality changes to the Colorado River for July 25th are discussed in Section 7.2. Under average July 25 flow conditions, the largest predicted flow decrease during average flow years for the model area would be -22.2% below Windy Gap Reservoir. A stream temperature increase of up to 0.6ºC would occur just upstream of the confluence with Williams Fork. Specific conductivity would increase up to 7.7% below the confluence of the Williams Fork River. The maximum decrease in dissolved oxygen concentration would be 0.1 mg/L, which would not decrease the concentration to below the standard. Ammonia concentrations would increase at most by 1.7 μg/L and inorganic phosphorus concentrations would increase at most by 1.5 μg/L within the model reach. Existing selenium concentrations are about 0.5 μg/L in this reach of the Colorado River. The Proposed Action alternative would increase the selenium concentration by a predicted 0.01 μg/L.

The aquatic life 7-day average temperature interim standard is 18.2ºC for gold medal waters between the Fraser River and Troublesome Creek and 20ºC elsewhere. Previous temperature data measured in the study area showed exceedances of the gold medal water standard in 2007. A temperature increase of 0.6ºC below the Windy Gap Reservoir to the Blue River could result in more frequent exceedances of the temperature standards.

The aquatic life acute and chronic total ammonia standards are temperature and pH dependent. Based on a QUAL2K temperature of 14ºC and a river pH of 7.4 for July 25, the aquatic life acute and chronic ammonia standards would be 15.3 and 4.73 mg/L, respectively. The QUAL2K model shows that the average ammonia concentration under Existing Conditions from Windy Gap Reservoir to the Blue River is about 0.025 mg/L. An increase in the ammonia concentration by 1.7 μg/L (0.0017 mg/L) under the Proposed Action would not increase the ammonia concentration to above aquatic ammonia standards. There is no standard for phosphorus; however, a maximum increase in the inorganic phosphorus concentration to about 0.015 mg/L is within the range of natural variation.

7.6.2. Willow Creek

A decrease in releases from Willow Creek Reservoir to Willow Creek under the Proposed Action would increase the relative contribution of ground water inflows, as well as inflows from Church Creek, which carries effluent discharges from the Three Lake Water and Sanitation District.

Under the Proposed Action, the largest decreases in the flow of Willow Creek would occur in June through August (ERO and Boyle 2007). According to the SSTEMP model, the temperature of Willow Creek would decrease by 0.2ºC. The lower flow in Willow Creek would reduce the dilution of treated wastewater entering Willow Creek from Church Creek. Using the maximum permitted inflow of treated wastewater from Church Creek of 1.3 cfs, a mass balance can be completed for Willow Creek below Church Creek using chemical concentrations in Willow Creek and in the effluent discharge. The ammonia concentration in the WWTP discharge water has sometimes been much higher than the mean ammonia concentration in Willow Creek, but ammonia concentrations would be expected to decrease in Church Creek between the discharge point and Willow Creek (EPA 2000). Copper and iron concentrations have exceeded standards in Willow Creek and have occasionally been elevated in the WWTP discharge. A mass balance calculation was completed using mean ammonia, iron and copper concentrations for Willow Creek and the average of the highest measured WWTP concentrations for these parameters. Estimated changes in water quality parameters for the Proposed Action are provided in Table 50. Under the Proposed Action, even under worst-case conditions in August at the maximum possible WWTP discharge rate, acute and chronic aquatic life ammonia standards would not be exceeded in Willow Creek with the increase in ammonia concentrations. Given the lack of algae and chlorophyll data for Willow Creek, it is not known whether the predicted increases in ammonia concentrations would result in algal growth problems in the creek. Iron concentrations would not exceed the dissolved (water supply) standard and copper concentrations would not exceed the acute and chronic aquatic standards under the Proposed Action.

Table 50. Average monthly increases in ammonia, iron, and copper concentrations in Willow Creek under the Proposed Action.

Parameter	Standard (June/July)	Standard (Aug)	Existing Conditions	WWTP Effluent Concentrations[2]	June		July		August	
			Average	Average	Average	Change	Average	Change	Average	Change
Ammonia (mg/L)	2.87	2.45	0.1	17	0.29	0.19	1.09	0.99	2.25	2.15
Iron, diss (µg/L)	300	300	92.5	260	94.37	1.87	102.35	9.85	113.83	21.33
Copper, diss (µg/L)[1]	10	10	3.4	21	3. 63	0.23	4.43	1.03	5.64	2.24

[1] Copper chronic standard based on mean hardness of 112 mg/L (CDPHE 2008).
[2] Data are from EPA Envirofacts (http://www.epa.gov/enviro/).

7.6.3. Big Thompson River

Under the Proposed Action, the flow of the Big Thompson River below Lake Estes to the Hansen Feeder Canal would increase by a maximum of 9% in May and July (15 to 18 cfs) in an average year (ERO and Boyle 2007). As described in Section 6.2.1, this section of the river has good water quality, particularly during high flows. Total nitrogen and phosphorus concentrations are low. Based on estimated increases in total nitrogen and phosphorus loading from the Adams Tunnel to the Big Thompson River (AMEC 2008), an 18 cfs increase in flow from the Adams Tunnel would result in small increases in total nitrogen and phosphorus concentrations in the Big Thompson River below Lake Estes. Mass balance calculations show increases in total nitrogen and total phosphorus concentrations in May and July of less than 0.01 mg/L. Minor predicted changes in streamflow would have minimal affect on water temperature.

Potential changes water quality in the Big Thompson River downstream of the Loveland WWTP from additional wastewater discharges under the Proposed Action would be similar to No Action. There would be a slight decrease in ammonia concentrations (Table 45). The increase in copper concentrations would not exceed the aquatic standards under the Proposed Action. The Big Thompson River below Loveland has other occasional water quality exceedances during low flows (nitrate and sulfate); however, WWTP effluent data are not available for these parameters. The flow increases (up to 5 cfs during low flows) are not large enough to increase erosion downstream in a river whose average spring runoff flows are 300 cfs.

7.6.4. North St. Vrain Creek

Under the Proposed Action, North St. Vrain Creek would not be affected by the WGFP.

7.6.5. St. Vrain Creek

Under the Proposed Action, St. Vrain Creek at Lyons would not be affected by the WGFP.

The flow of St. Vrain Creek downstream of Longmont's WWTP and the Little Thompson Water District's WWTP would increase in April through October due to increased effluent discharges (ERO and Boyle 2007). The largest increases would occur in September and October. Ammonia concentrations already occasionally exceed the chronic standard during low flow (of 14 USGS measurements collected during September through November, 21% exceeded the chronic standard (Earthinfo 2006)). Mass balance calculations were completed for ammonia, iron and manganese, for which there are data available for both the river and the WWTP effluent discharge. Results are provided in Table 46. Under the Proposed Action, the increase in ammonia concentrations could increase exceedances of the chronic standard during October. More frequent exceedances of the ammonia standards would likely occur during other low flow periods as well, although this would not include the months of November through March, when the WGFP would not result in increased effluent flows from Longmont's WWTP. The increase in iron concentration in October would not raise the iron concentrations in the river to above the aquatic life standard. Manganese concentrations would decrease in October because manganese concentrations in the creek are higher than those measured in the WWTP effluent. At the St. Vrain Sanitation District WWTP, mass balance calculations were completed for ammonia (Table 47). Ammonia concentrations would not exceed the ammonia standard under the Proposed Action. The flow increases (up to 6.4 cfs during low flows) are not large enough to increase erosion downstream in a channel that supports average spring high flows of 350 cfs or more.

7.6.6. Big Dry Creek

The flow of Big Dry Creek would increase downstream of Broomfield's WWTP during the months of April to October (ERO and Boyle 2007). Given that ammonia, iron and manganese concentrations already occasionally exceed standards in Big Dry Creek, mass balance calculations were for these parameters during the month of October. Results are provided in Table 48. The estimated increase in the ammonia concentration could result in additional exceedances in ammonia standards. Iron and manganese concentrations would decrease in Big Dry Creek below Broomfield's WWTP. The largest relative increases would occur during the low flow months of April and October.

The flow increases (up to 3.5 cfs during low flows and 8.5 cfs during high flows) are not large enough to increase erosion downstream.

7.6.7. Coal Creek

Increases in the flow of Coal Creek below the four WWTPs (Superior, Louisville, Lafayette and Erie) would occur in April through October, with the largest percent change occurring in September, the month with lowest streamflow. Although the flow of Coal Creek might double in September and October, the flow increase is predicted to be a maximum of 5 cfs. It is unlikely that such a flow increase would increase erosion downstream of the WWTPs. The total average monthly effluent discharge from the four WWTPs is currently 7.9 cfs; this flow constitutes most or all of the flow of Coal Creek, except during high flows in April and May. The average ammonia concentration in Coal Creek is 0.07 mg/L (based on 7 measurements by the USGS); the ammonia concentration in the four WWTP effluent discharges ranges from less than 0.03 mg/L to occasionally greater than 10 mg/L. Increased WWTP return flows from the Superior, Louisville, Lafayette and Erie WWTPs could cause ammonia concentrations in Coal Creek to exceed ammonia standards, particularly during low flow. A mass balance calculation was not completed for ammonia and other parameters due to a lack of data for Coal Creek above and below the four WWTPs.

7.6.8. Cache la Poudre River

Increases in WWTP effluent discharges from Greeley's WWTP would occur in November through March to the Cache la Poudre River below the Greeley WWTP. The estimated WWTP discharge increase during those months is 7 cfs (Boyle 2006b) for all of the action alternatives. Based on average monthly flows at the USGS Greeley gage, the percent increase in effluent return flows during those months would range from 5.4 to 6.4%, with the largest increase occurring in January. Mass balance calculations were completed for ammonia and copper, for which there are data available for both the river and the WWTP effluent discharge. Results are provided in Table 49. It is unlikely that ammonia standards would be exceeded for the Proposed Action and other alternatives. Copper concentrations would increase slightly, but would remain well below acute and chronic standards.

7.6.9. Chimney Hollow

Chimney Hollow Creek would receive water from Chimney Hollow Reservoir via discharges and seepage to maintain existing flow volumes. It is expected that the water quality of the creek would be the same as the water quality of the reservoir. Windy Gap water would be delivered to Chimney Hollow Reservoir via the Olympus Tunnel. Under the Proposed Action, the water quality of the reservoir is estimated to be slightly lower than under Alternatives 3 and 4 due to a higher residence time, with less flushing of the lake water (AMEC 2008). The average total nitrogen concentration in the creek is estimated to be 0.18 mg/L and the average total phosphorus concentration is estimated to be 0.01 mg/L. It is estimated that the temperature of the water flowing from Chimney Hollow Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008).

7.7. Alternative 3 (Chimney Hollow Reservoir with Jasper East Reservoir)

Alternative 3 would impact water quality parameters for several stream segments on the East and West Slope. Chimney Hollow and Jasper East Reservoirs would be constructed under Alternative 3; thus, Chimney Hollow and the unnamed tributary to Willow Creek located at the Jasper East site would be affected by this alternative. Chimney Hollow Reservoir would have approximately 70,000 AF of storage and would remain near full. Jasper East Reservoir would have approximately 20,000 AF of storage; the reservoir would be drained during the fall and winter months to less than 5,000 AF (ERO and Boyle 2007).

7.7.1. Colorado River

The modeled minimum streamflow scenario is discussed in Section 7.4. As discussed in Section 7.1, water quality changes to the Colorado River for July 25th for average flow conditions under Alternative 3 are predicted to be small. The largest predicted flow decrease for the model area is -27.7%, which would occur below Windy Gap Reservoir. The largest change in stream temperature would be 0.8ºC increase, which would occur just upstream of the confluence with Williams Fork. Specific conductivity would increase at most by 10.1% (27.0 µmhos/cm) below the confluence of the Williams Fork River. The maximum decrease in dissolved oxygen concentration would be 0.1 mg/L and would not reduce the concentration below the standard. Ammonia concentrations would increase at most 1.6 µg/L and inorganic phosphorus concentrations would increase at most by 0.9 µg/L within the model reach. Selenium concentrations are currently about 0.5 µg/L in this reach of the Colorado River. The Proposed Action alternative would increase the selenium concentration by a predicted 0.02 µg/L.

The aquatic life 7-day average temperature interim standard is 18.2ºC for gold medal waters between the Fraser River and Troublesome Creek and 20ºC elsewhere. Previous temperature data measured in the study area showed exceedances of the gold medal water standard in 2007. A temperature increase of up to 0.8ºC below the Windy Gap Reservoir to the Blue River could result in more frequent exceedances of temperature standards.

The aquatic life acute and chronic total ammonia standards are temperature and pH dependent, but would be 15.3 and 4.73 mg/L for a temperature of 14ºC and pH of 7.4. The QUAL2K model shows that the average ammonia concentration under Existing Conditions from Windy Gap Reservoir to the Blue River is about 0.025 mg/L. An increase in the ammonia concentration by 0.5 µg/L (0.0005 mg/L) under Alternative 3 would not increase the ammonia concentration to above the standard. There is no standard for phosphorus; however, a maximum increase in the inorganic phosphorus concentration of about 0.009 mg/L is within the range of natural background concentrations.

7.7.2. Willow Creek

A decrease in releases from Willow Creek Reservoir to Willow Creek under Alternative 3 would increase the relative contribution of ground water inflows and Church Creek effluent discharges from the Three Lake Water and Sanitation District. In addition, under Alternative 3, the stream might also receive additional water from the new nearby Jasper East Reservoir, depending on reservoir seepage.

Under Alternative 3, the largest decreases in the flow of Willow Creek would occur in June through August (ERO and Boyle 2007). According to the SSTEMP model, the temperature of Willow Creek would decrease by less than 0.2ºC. The lower flow in Willow Creek would reduce the dilution of treated wastewater entering Willow Creek from Church Creek. Using the maximum permitted inflow of treated wastewater from Church Creek of 1.3 cfs, a mass balance can be completed for Willow Creek below Church Creek using chemical concentrations in Willow Creek and in the effluent discharge. The ammonia concentration in the WWTP discharge water has sometimes been much higher than the mean ammonia concentration in Willow Creek, but ammonia concentrations would be expected to decrease in Church Creek between the discharge point and Willow Creek (EPA 2000). Copper and iron concentrations have exceeded standards in Willow Creek and have occasionally been elevated in the WWTP discharge. A mass balance calculation was completed using mean ammonia, iron and copper concentrations for Willow Creek and the average of the highest measured WWTP concentrations for these parameters. Results of this analysis for Alternative 3 are provided in Table 51. Under Alternative 3, even under worst-case conditions in August at the maximum possible WWTP discharge rate, acute and chronic aquatic life ammonia standards would not be exceeded in Willow Creek. Given the lack of algae and chlorophyll data for Willow Creek, it is not known whether the predicted increases in ammonia concentrations would result in algal growth problems in the creek. Iron concentrations would not exceed the dissolved (water supply) standard and copper concentrations would not exceed the acute and chronic aquatic standards under Alternative 3.

Table 51. Average monthly increases in ammonia, iron, and copper concentrations in Willow Creek under Alternatives 3 and 4.

Parameter	Standard (June/July)	Standard (Aug)	Existing Conditions	WWTP Effluent Concentrations[2]	June		July		August	
			Average	Average	Average	Change	Average	Change	Average	Change
Ammonia (mg/L)	2.87	2.45	0.1	17	0.28	0.18	1.05	0.95	2.06	1.96
Iron, diss (µg/L)	300	300	92.5	260	94.3	1.8	101.93	9.43	119.94	19.44
Copper, diss (µg/L)[1]	10	5	3.4	21	3.62	0.22	4.39	0.99	5.44	2.04

[1] Copper chronic standard based on mean hardness of 112 mg/L (CDPHE 2008).
[2] Data are from EPA Envirofacts (http://www.epa.gov/enviro/).

It is possible that the construction of Jasper East Reservoir might affect the water quality of Willow Creek because the unnamed tributary to Willow Creek that flows through the proposed reservoir site could be affected both in terms of flow volume and water quality as a result of reservoir construction. However, this tributary appears to be a minor source of water supply to Willow Creek.

7.7.3. Big Thompson River

Under Alternative 3, the flow of the Big Thompson River below Lake Estes to the Hansen Feeder Canal would increase by a maximum of 4% in May in an average year (ERO and Boyle 2007). As described in Section 6.2.1, this section of the river has good water quality, particularly during high flows. The average 4% increase in high flows that would occur during May would result in minor changes in water quality similar to Alternative 2.

For the Big Thompson River downstream of the Loveland WWTP, potential impacts to water quality would be the same as for Alternative 2.

7.7.4. North St. Vrain Creek and St. Vrain Creek

North St. Vrain Creek and St. Vrain Creek above Lyons would not be affected by the WGFP under Alternative 3.

For St. Vrain Creek downstream of Longmont's and the LTWD's WWTPs, the estimated water quality effect would be the same as under Alternative 2.

7.7.5. Big Dry Creek, Coal Creek, and the Cache la Poudre River

Water quality effects for Big Dry Creek, Coal Creek, and the Cache la Poudre River under Alternative 3 would be the same as for Alternative 2.

7.7.6. Chimney Hollow Creek

Chimney Hollow Creek would receive water from Chimney Hollow Reservoir via discharges and seepage. It is expected that the water quality of the creek would be the same as the water quality of the reservoir. Windy Gap water would be delivered to Chimney Hollow Reservoir via the Olympus Tunnel. Under Alternative 3, the water quality of the reservoir would be expected to be slightly higher than under the Proposed Action because of a shorter retention time (AMEC 2008). The average total nitrogen concentration in the creek is estimated to be 0.157 mg/L and the average total phosphorus concentration is estimated to be 0.0074 mg/L. It is estimated that the temperature of the water flowing from Chimney Hollow Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008).

7.7.7. Jasper East Reservoir Site

Under Alternative 3, the unnamed tributary to Willow Creek that flows through the footprint of the proposed Jasper East Reservoir would receive water from releases and seepage from Jasper East Reservoir and would no longer receive hay meadow irrigation water. It is expected that the water quality of the tributary would be the same as the water quality of the reservoir. Colorado River water diverted at Windy Gap Reservoir would be the source of water to Jasper East Reservoir. The average total nitrogen concentration in the creek is estimated to be 0.25 mg/L and the average total phosphorus concentration is estimated to be 0.029 mg/L based on the quality of the reservoir water (AMEC 2008). It is estimated that the temperature of the water flowing from Jasper East Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (Hydrosphere, pers. comm. 2007). The only exception might be for manganese, which would be expected to range from 20 to 100 µg/L, sometimes above the water supply standard of 50 µg/L.

7.8. Alternative 4 (Chimney Hollow Reservoir with Rockwell/Mueller Creek Reservoir)

Under Alternative 4, the temperature and water quality of all of the stream segments listed in Table 1 could potentially be affected as a result of increases or decreases in streamflows, with the exception of North St. Vrain Creek, St. Vrain Creek in Lyons, Dry Creek at the Dry Creek Reservoir site, and the unnamed tributary at the Jasper East Reservoir site. Chimney Hollow and Rockwell/Mueller Creek Reservoirs would be constructed under Alternative 4; thus, Chimney Hollow Creek and Rockwell and Mueller Creeks would be affected by this alternative. Chimney Hollow Reservoir would have approximately 70,000 AF of storage and would remain essentially full at all times. Rockwell/Mueller Creek Reservoir would have approximately 20,000 AF of storage; the reservoir would be drained during the fall and winter months to less than 5,000 AF (ERO and Boyle 2007).

7.8.1. Colorado River, Willow Creek, Big Thompson River, North St. Vrain Creek, St. Vrain Creek, Big Dry Creek, Coal Creek, Cache la Poudre River, and Chimney Hollow Creek

Estimated changes to the water quality in these West and East Slope streams for Alternative 4 would be the same as for Alternative 3.

7.8.2. Rockwell and Mueller Creeks

Under Alternative 4, Rockwell and Mueller Creeks would receive water from releases and seepage from Rockwell/Mueller Creek Reservoir. It is expected that the water quality of these creeks would be the same as the water quality of the reservoir. Windy Gap Reservoir water would be the source of water to Rockwell/Mueller Creek Reservoir. The average total nitrogen concentration in the creek is estimated to be 0.23 mg/L and the average total phosphorus concentration is estimated to be 0.028 mg/L (AMEC 2008). It is estimated that the temperature of the water flowing from Rockwell/Mueller Creek Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008). The only exception might be for manganese, which would be expected to range from 20 to 100 µg/L, sometimes above the water supply standard of 50 µg/L.

7.9. Alternative 5 (Dry Creek Reservoir with Rockwell/Mueller Creek Reservoir)

Under Alternative 5, the temperature and water quality of all of the stream segments listed in Table 1 could potentially be affected as a result of increases or decreases in streamflows, with the exception of North St. Vrain Creek, St. Vrain Creek in Lyons, Chimney Hollow Creek, and the unnamed tributary at the Jasper East Reservoir site. Dry Creek and Rockwell/Mueller Creek reservoirs would be constructed under Alternative 5; thus, Dry Creek and Rockwell and Mueller Creeks would be affected by this alternative. Dry Creek Reservoir would have approximately 60,000 AF of storage; the reservoir would be drained during the fall and winter months to less than 45,000 AF in average years. Rockwell/Mueller Creek Reservoir would have approximately 30,000 AF of storage; the reservoir would be drained during the fall and winter months to less than 10,000 AF (ERO and Boyle 2007).

7.9.1. Colorado River

The modeled minimum streamflow scenario is discussed in Section 7.4. As discussed in Section 7.1, water quality changes to the Colorado River for July 25th average flow conditions under Alternative 5 are predicted to be small. The largest predicted flow decrease for the model area is -26.9%, which would occur below Windy Gap Reservoir is slightly less than Alternatives 3 and 4, but the modeled changes in temperature, dissolved oxygen, phosphorus and selenium would be about the same. Changes in temperature, specific conductivity, ammonia and inorganic phosphorus would be slightly less than under Alternatives 3 and 4.

7.9.2. Willow Creek

A decrease in releases from Willow Creek Reservoir to Willow Creek under Alternative 3 would increase the relative contribution of ground water inflows and Church Creek effluent discharges from the Three Lake Water and Sanitation District.

Under Alternative 5, the largest decreases in the flow of Willow Creek would occur in June through August (ERO and Boyle 2007). According to the SSTEMP model, the temperature of Willow Creek would decrease by less than 0.2ºC. The lower flow in Willow Creek would reduce the dilution of treated wastewater entering Willow Creek from Church Creek. Using the maximum permitted inflow of treated wastewater from Church Creek of 1.3 cfs, a mass balance can be completed for Willow Creek below Church Creek using chemical concentrations in Willow Creek and in the effluent discharge. The ammonia concentration in the WWTP discharge water has sometimes been much higher than the mean ammonia concentration in Willow Creek, but ammonia concentrations would be expected to decrease in Church Creek between the discharge point and Willow Creek (EPA 2000). Copper and iron concentrations have exceeded standards in Willow Creek and have occasionally been elevated in the WWTP discharge. A mass balance calculation was completed using mean ammonia, iron, and copper concentrations for Willow Creek and the average of the highest measured WWTP concentrations for these parameters. Results for Alternative 5 are provided in Table 52. Under Alternative 5, even under worst-case conditions in August at the maximum possible WWTP discharge rate, acute and chronic aquatic life ammonia standards would not be exceeded in Willow Creek with an increase in ammonia concentrations. Given the lack of algae and chlorophyll data for Willow Creek, it is not known whether the predicted increases in ammonia concentrations would result in algal growth problems in the creek. Iron concentrations would not exceed the dissolved (water supply) standard and copper concentrations would not exceed the acute and chronic aquatic standards under Alternative 5.

Table 52. Average monthly increase in ammonia, iron, and copper concentrations in Willow Creek under Alternative 5.

Parameter	Standard (June/July)	Standard (Aug)	Existing Conditions	WWTP Effluent Concentrations[2]	June		July		August	
			Average	Average	Average	Change	Average	Change	Average	Change
Ammonia (mg/L)	2.87	2.45	0.1	17	0.286	0.186	1.09	0.99	2.06	1.96
Iron, diss (µg/L)	300	300	92.5	260	94.31	1.81	102.35	9.85	111.94	19.44
Copper, diss, ac/ch (µg/L)[1]	15/10	5	3.4	21	3.54	0.14	4.43	1.03	5.44	2.04

[1] Copper standard based on mean hardness of 112 mg/L (CDPHE 2008). [2] Data are from EPA Envirofacts (http://www.epa.gov/enviro/).

7.9.3. Big Thompson River

Under Alternative 5, the flow of the Big Thompson River below Lake Estes to the Hansen Feeder Canal would increase by a maximum of 5% in May in an average year (ERO and Boyle 2007). As described in Section 6.2.1, this section of the river has good water quality, particularly during high flows. The average 5% increase in high flows that would occur during May would result in minor changes in water quality similar to Alternative 2.

For the Big Thompson River downstream of the Loveland WWTP, impacts to water quality parameters would be the same as for Alternative 2.

7.9.4. North St. Vrain Creek and St. Vrain Creek

North St. Vrain Creek and St. Vrain Creek above Lyons would not be affected by the WGFP under Alternative 5.

For St. Vrain Creek downstream of Longmont’s and the LTWD’s WWTPs, estimated water quality effects would be the same as for Alternative 2.

7.9.5. Big Dry Creek, Coal Creek, and Cache la Poudre River

Estimated changes to the water quality in these East Slope streams for Alternative 5 would be the same as Alternative 3.

7.9.6. Dry Creek

Dry Creek would receive water from Chimney Hollow Reservoir via discharges and seepage. It is expected that the water quality of the creek would be the same as the water quality of the reservoir. Windy Gap water would be delivered to Dry Reservoir via the Olympus Tunnel. The average total nitrogen concentration in the creek is estimated to be 0.2 mg/L and the average total phosphorus concentration is estimated to be 0.0086 mg/L (AMEC 2008). It is estimated that the temperature of the water flowing from Dry Creek Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008).

7.9.7. Rockwell and Mueller Creeks

Alternative 5, Rockwell and Mueller Creeks would receive water from releases and seepage from Rockwell/Mueller Creek Reservoir. It is expected that the water quality of these creeks would be the same as the water quality of the reservoir. Windy Gap Reservoir water would be the source of water to Rockwell/Mueller Creek Reservoir. The average total nitrogen concentration in the creek is estimated to be 0.214 mg/L and the average total phosphorus concentration is estimated to be 0.01 mg/L (AMEC 2008). It is estimated that the temperature of the water flowing from Rockwell/Mueller Creek Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008). The only exception might be for manganese, which would be expected to range from 20 to 100 μg/L, sometimes above the water supply standard of 50 μg/L.

8.0 CUMULATIVE EFFECTS

8.1. Introduction

Cumulative effects result from the incremental effect of an alternative action when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a time period. This section of the report evaluates the potential cumulative effects to stream water quality associated with alternative actions in addition to identified reasonably foreseeable actions that are expected to occur in the future.

8.2. Reasonably Foreseeable Actions

Several reasonably foreseeable actions are anticipated to occur in the future regardless of the implementation of any of the WGFP action alternatives or the No Action alternative. Reasonably foreseeable actions were divided into water-based actions that would affect portions of the Colorado River where Windy Gap diversions would occur, and land-based actions that include ground disturbances or other activities near potential WGFP facilities. Water- and land-based reasonably foreseeable actions are defined below.

8.2.1. Water-Based Reasonably Foreseeable Actions

- **Denver Water Moffat Collection System Project.** The Moffat Collection System Project is currently proposed by Denver Water (DW) to develop 18,000 AF/year of new, annual yield to the Moffat Treatment Plant to meet future raw water demands on the East Slope. This project is anticipated to result in additional diversions, primarily from the upper Fraser River and Williams Fork River basins. DW's proposed additional Fraser River diversions would be located upstream of the Windy Gap Project diversion site on the Colorado River and would directly affect the availability of water for the WGFP. Because a Proposed Action has not been identified for the Moffat Collection System Project, a scenario for hydrologic modeling was considered that maximizes DW's future diversions from the Fraser River basin. DW provided output from its Platte and Colorado Simulations Model (PACSM) run that includes DW's total system demand at approximately 393,000 AF/year, which would be full use of its existing system, plus 18,000 AF of new firm yield generated by the Moffat Collection System Project. DW's current demand is 285,000 AF/year; therefore, an increase in demand of 108,000 AF/year was considered for the cumulative effects analysis.

- **Urban Growth in Grand and Summit Counties.** The population in Grand and Summit Counties is expected to more than double over the next 25 years, from a year-round population of about 39,000 in 2005 to about 79,000 in 2030 (ERO 2005a). Most growth in Grand County is likely to occur in the Fraser River basin upstream of the Windy Gap Project diversion site on the Colorado River. Future increases in water use in Summit County would occur primarily in the Blue River basin, a tributary to the Colorado River downstream of Windy Gap's point of diversion. Increased water use and wastewater discharges are expected to result in changes in streamflow and water quality and contribute to cumulative effects. Urban growth in Grand and Summit Counties was based on build-out municipal and industrial demands of 16,168 AF for Grand County and 17,940 AF for Summit County as identified in the Upper Colorado River Basin Study (Hydrosphere 2003). Year 2000 water demand in Grand County was about 3,100 AF and in Summit County was about 7,700 AF.
- **Reduction of Excel Energy's Shoshone Power Plant Call.** DW and Excel Energy have negotiated an agreement to periodically invoke a relaxation of the junior Shoshone call for hydropower generation on the Colorado River.[1] The agreement to relax the call could result in a one-turbine call of 704 cfs, which would be managed in such a way to avoid a Cameo Call by the Grand Valley Water users[2]. The Shoshone call could be increased above 704 cfs as needed to keep the Cameo water rights satisfied. The Shoshone call relaxation could be invoked if, in March, DW predicts its total system storage to be at or below 80% on July 1 that year, and the March 1 Natural Resources Conservation Service (NRCS) forecast for Colorado River flows at Kremmling or Dotsero are at or below 85% of average. The Shoshone call relaxation could be invoked between March 14 and May 20. DW would make available 15% of the "net water" stored or diverted by DW by virtue of the call relaxation for Excel Energy. Net water is water stored less water subsequently spilled after filling. In addition, DW would make available 10% of the net water stored or diverted by DW by virtue of the call relaxation to West Slope entities. The West Slope beneficiaries and the timing and amount of deliveries are not specified, but would be determined by

[1] The Shoshone Hydro Plant owned by Excel Energy, is a large senior water right on the Colorado River 8 miles east of Glenwood Springs. At flows less than 1,408 cfs, it is the most senior water right on the River and can "call" water downstream from junior water rights upstream, including the Moffat Tunnel, C-BT Project, Windy Gap, and other water rights.

[2] The Cameo Call is a senior water right owned by five entities near Grand Junction. The water is used primarily for irrigation and power.

DW and the Colorado River Water Conservation District (CRWCD). The term of this agreement is from January 1, 2007 through February 28, 2032.

- **Changes in Releases from Williams Fork and Wolford Mountain Reservoirs to Meet U.S. Fish and Wildlife Service (USFWS) Flow Recommendations for Endangered Fish in the 15-Mile Reach.** An agreement that extends through July 1, 2009 between the City and County of Denver, the CWCB and the USFWS exists for the interim provision of water to the 15-Mile Reach of the Colorado River near Grand Junction as part of the Recovery Program to benefit endangered fish. A similar agreement exists between the CRWCD, CWCB, and the USFWS. These agreements provide for the total release of 10,825 AF of water annually from both Williams Fork and Wolford Mountain Reservoirs (5,412.5 AF from each reservoir) to meet USFWS flow recommendations for the 15-Mile Reach. These contracts expire in 2009 and 2010, respectively, and both DW and the CRWCD have said they do not plan to continue making these releases from Williams Fork and Wolford Mountain Reservoirs in the future. The source and location of future water releases of 10,825 AF/year has not been determined. For the purposes of this analysis, it was assumed that the releases would be made from a reservoir located downstream of Kremmling and outside the study area considered for the cumulative effects analysis.
- **Wolford Mountain Reservoir Contract Demand.** The CRWCD projects that the demand for contract water out of Wolford Mountain Reservoir will increase in the future. Currently there is about 8,750 AF/year of available contract water in Wolford Mountain Reservoir (Colorado Springs has a lease for contract water from Wolford Mountain Reservoir which reduces the firm yield of the contract pool from 10,000 AF/yr to 8,750 AF/yr). The CRWCD indicates that the full 8,750 AF/year would likely be contracted for by 2030. In addition, MPWCD has 3,000 AF/yr of water from Wolford Mountain Reservoir, of which 613 AF/yr is owed to DW under the Clinton Reservoir Agreement. The CRWCD indicated that the remaining 2,387 AF/yr would likely be contracted for by 2030. Therefore, the total additional future demand for contract water from Wolford Mountain Reservoir is assumed to be 11,137 AF/yr by 2030.
- **Expiration of DW's Contract with Big Lake Ditch in 2013.** The Big Lake Ditch is a senior irrigation right in the Williams Fork basin that diverts below DW's Williams Fork collection system and above Williams Fork Reservoir. Big Lake Ditch diversions are currently delivered for irrigation above Williams Fork Reservoir and for use in the Reeder Creek drainage, which is a tributary of the Colorado River. Return flows associated with irrigation in the Reeder Creek drainage return to the Colorado River between the confluence with the Williams Fork River and the confluence with the Blue River. In 1963, DW entered into a contract with Bethel Hereford Ranch Inc., which owned and operated the Big Lake Ditch, whereby DW purchased the Ranch's water rights. Bethel Hereford was granted a 40-year lease to continue its operation under the condition that the Big Lake Ditch water rights are not called if needed by DW. The 1963 agreement was superseded by a 1998 agreement, which extended the operation of the Big Lake Ditch through 2013, and provided more detail on the conditions under which DW would need the water. The 1998 agreement expires November 1, 2013 and

DW does not plan to extend the existing contract. After the contract expires in 2013, the Big Lake Ditch can no longer divert water under the enlargement decree for 111 cfs for irrigation in the Reeder Creek drainage. As a result, future Big Lake Ditch water right diversions to the Reeder Creek basin would be abandoned, which would allow DW to capture additional water from the Williams Fork and store the water in Williams Fork Reservoir during all years that its Williams Fork Reservoir water rights are in priority.

8.2.2. Land-Based Reasonably Foreseeable Actions

- **Land Development.** A variety of new land developments are expected to occur in the vicinity of the potential reservoir sites in Larimer, Grand, and Boulder counties. This includes residential and commercial developments on the West Slope; on the East Slope, this includes residential development, a quarry, and a new reservoir.
- **Larimer County Open Space.** Larimer County Parks and Open Lands acquired about 1,850 acres of land adjacent to the proposed Chimney Hollow Reservoir site. The County intends to manage this property for recreation use regardless of whether Chimney Hollow Reservoir is constructed.
- **Urban Growth in the Northern Front Range.** Continued population growth and development is expected to occur in the Northern Front Range, Colorado communities served by many of the Firming Project Participants.

8.3. Water Quality Modeling Method for the Colorado River

The QUAL2K model developed for the simulation of direct effect alternatives was also used to predict the cumulative effects of future changes in tributary watersheds on the water quality of the Upper Colorado River. Cumulative effects hydrologic data for the alternatives were provided by Boyle Engineering (2006a).

To estimate future water quality in the Fraser River, a conceptual model of nutrient load contributions throughout the Fraser River Basin was also developed. The predicted Fraser River nutrient concentrations from this model were used by the QUAL2K river model to predict water quality in the Colorado River. The nutrient loading model incorporates a prediction of load of total nitrogen and total phosphorus from land use, individual sewage disposal systems (ISDSs) and WWTPs to the river. All hydrologic data used by this model were provided by Boyle Engineering (2006a). Details of the Fraser River model are provided in a separate report (AMEC and ERO 2008). Future populations in the Fraser basin are assumed to utilize the three major wastewater treatment plants in the basin. In addition, advanced treatment processes are assumed to be in place to reduce outfall nutrient concentrations. Predicted cumulative effects Fraser River nutrient concentrations for Existing Conditions and the alternatives for July are provided in Table 53.

Table 53. Cumulative effect comparison of Fraser River outflow nutrient concentrations for Existing Conditions and the alternatives simulations (July 25).

Alternative	Organic N (µg/L)	Ammonia (µg/L)	Nitrate and Nitrite (µg/L)	Organic P (µg/L)	Inorganic P (µg/L)
Existing Conditions	106	32	87	34	22
All Alternatives	209	63	172	20	13

For the QUAL2K cumulative effects alternative simulations, headwater hydrologic conditions and concentrations are provided by the Three Lakes reservoir water quality model using forecast inflow conditions. Fraser River nutrient concentrations are provided by the nutrient loading model. Concentrations of other constituents and all constituent concentrations for other tributaries are set to those used by the calibrated QUAL2K model. For each alternative an additional simulation was performed to simulate the minimum instream flow condition below Windy Gap. This analysis demonstrates the potential bounds of River water quality for lowest-allowable flow conditions. The diversion from Windy Gap reservoir was calculated for each alternative such that a flow of 90 cfs occurred below the reservoir. Predicted water quality for cumulative effects for the alternatives is discussed in the following sections.

Because of the similarity in results between Alternatives 3, 4, and 5, only Alternative 5 was used in the model runs to represent the effect of all three alternatives.

8.4. Water Quality Effects

The evaluation of changes in stream water quality for cumulative effects is the same as direct effects for the study area. However, because effects are very similar for Alternatives 3, 4 and 5, results for Alternative 5 are presented and are representative of effects under all three of these alternatives. The predicted Windy Gap diversion rates for the QUAL2K model date (July 25) are provided in Table 54.

Table 54. Windy Gap diversion rates for July 25—cumulative effects.

Alternative	Windy Gap Diversion on July 25 (cfs)	Windy Gap Diversion on July 25 assuming diversion to the minimum instream flow below Windy Gap (cfs)
Existing Conditions*	39	---
No Action	76	289
Proposed Action	55	276
Alternative 5	81	278

*Existing Conditions average July 25 streamflow upstream of Hot Sulphur Springs WWTP = 420 cfs.

8.4.1. Colorado River

8.4.1.1. Discharge

The predicted changes in discharge for No Action and the other alternatives for July 25 are compared with Existing Conditions in Figure 24 and Table 55. Reductions in flow are predicted to occur under all of the alternatives. Compared to Existing Conditions, the flow in the Colorado River is predicted to be reduced throughout the reach. Reduced tributary inflows to the Colorado River are the result of reasonably foreseeable actions.

Figure 24. Colorado River average discharge predicted for the alternatives (July 25)—cumulative effects.

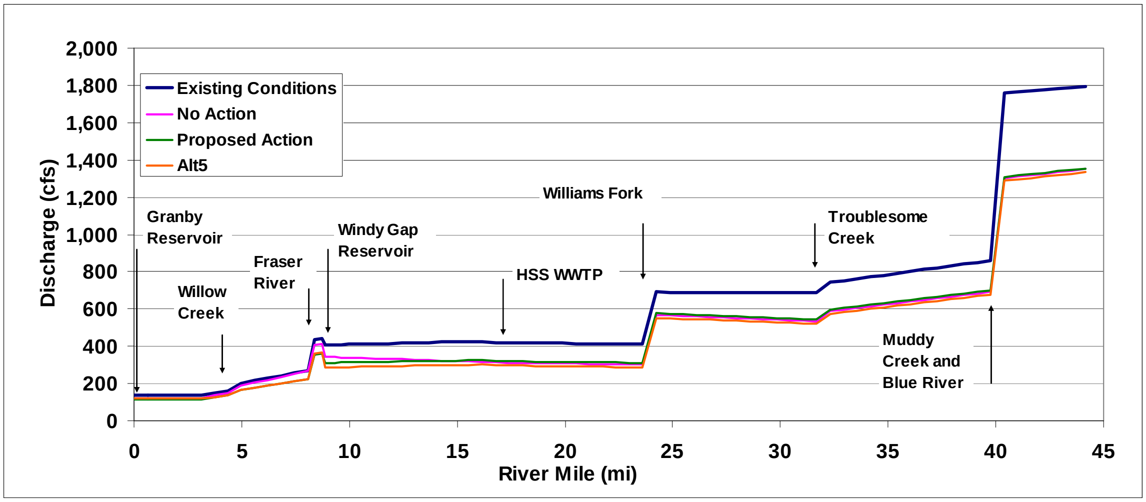


Table 55. Comparison of predicted changes in Colorado River discharge to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Change from Existing Conditions* for Discharge Upstream of HSS WWTP Outfall (cfs)	Greatest Change from Existing Conditions* for Discharge in the Study Reach (cfs)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-108	-454	-26.3%
Proposed Action	-100	-448	-25.5%
Alternative 5	-124	-470	-30.2%

*Existing Conditions average July streamflow upstream of Hot Sulphur Springs WWTP = 420 cfs.

Discharges calculated for the minimum instream flow simulations for cumulative effects is presented in Figure 25. Calculated differences from Existing Conditions are presented in Table 56. Discharges for alternatives are very similar and appear as coincident line on Figure 25. Discharge immediately below Windy Gap Reservoir would be the same as direct effects, but changes in tributary inflows in the future would reduce flows downstream. The greatest change in flow would occur below the Blue River confluence.

Figure 25. Colorado River average daily stream discharge predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

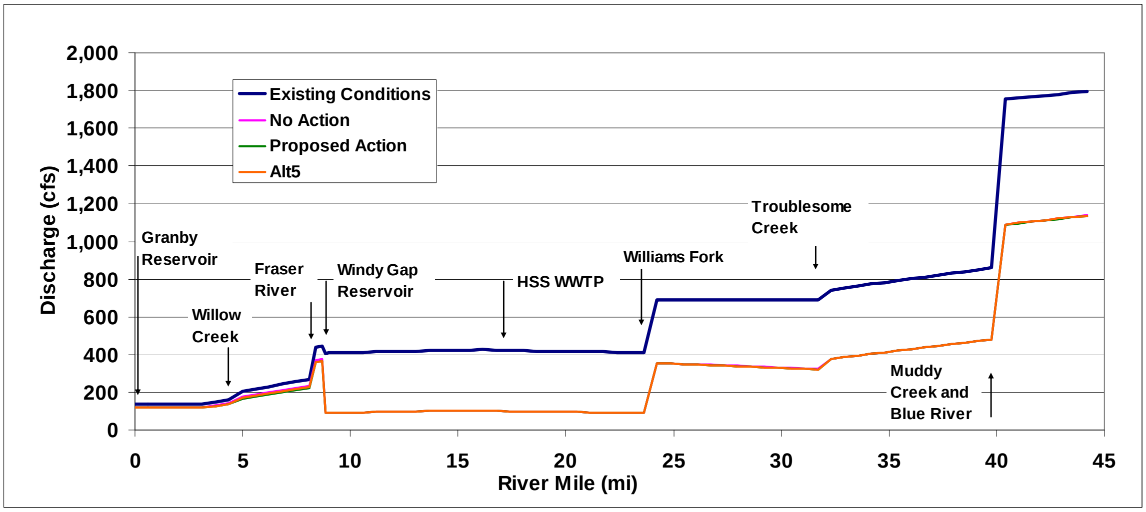


Table 56. Comparisons of predicted Colorado River discharge to Existing Conditions for all alternatives assuming diversions to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Greatest Change from Existing* Conditions for Discharge in the Study Reach (cfs)	Greatest Percentage* Change from Existing Conditions in the Study Reach
No Action	-667	-78.1%
Proposed Action	-669	-78.1%
Alternative 5	-667	-78.1%

*Existing Conditions average July 25 streamflow upstream of Hot Sulphur Springs WWTP = 420 cfs.

8.4.1.2. Temperature

The predicted changes in stream temperature for No Action and the other alternatives are shown in Figure 26 and Table 57. Water temperatures are predicted to increases from 0.4 to 0.7ºC under the alternatives. Alternatives with larger flow reductions in the Colorado River result in higher in-river water temperatures.

The aquatic life 7-day average temperature interim standard is 18.2ºC for gold medal waters between the Fraser River and Troublesome Creek and 20ºC elsewhere. Previous temperature data measured in the study area showed exceedances of the gold medal water standard in 2007. A temperature increase of up to 0.4°C under No Action, 0.6°C for the Proposed Action, and up to 0.7°C for Alternative 5 below the Windy Gap Reservoir to the Blue River could result in a greater frequency when the river temperature exceeds standards.

Figure 26. Colorado River stream temperatures predicted for Existing Conditions and alternatives (July 25)—cumulative effects.

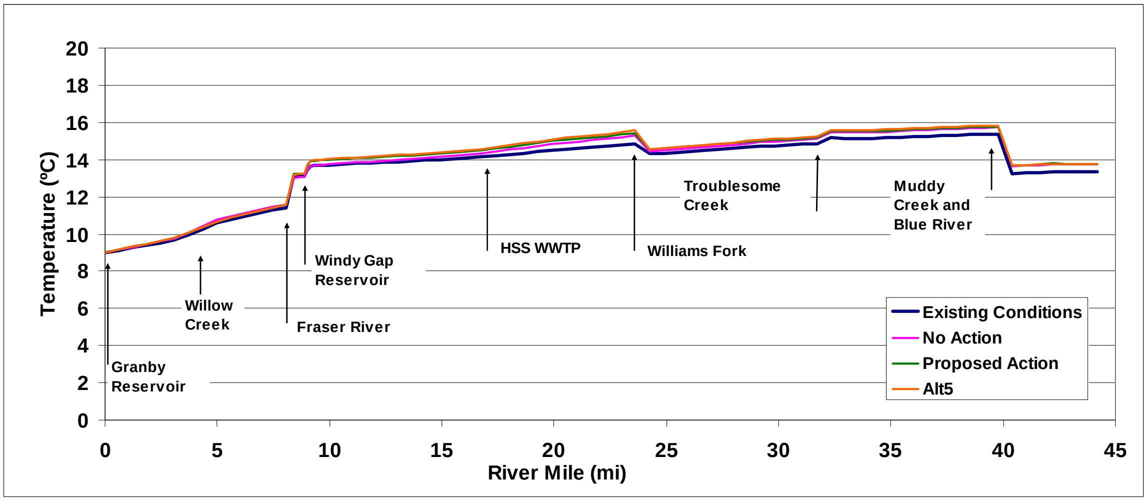


Table 57. Comparison of predicted Colorado River stream temperature to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Stream Temperature in the Study Reach (ºC)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	0.4	3.1%
Proposed Action	0.6	3.8%
Alternative 5	0.7	4.7%

*Existing Conditions average July 25 temperature = 14.3ºC at the location of greatest change under the alternatives.

Predicted water temperature for the minimum instream flow simulations for cumulative effects is presented in Figure 27. Calculated differences from Existing Conditions are presented in Table 58. Results for alternatives are very similar and appear as coincident lines on Figure 27. The withdrawal of the maximum diversion to produce the minimum instream flow at the end of July would result in higher water temperatures in the Colorado River downstream of Windy Gap, with the greatest increase of 4.1ºC predicted to occur above the Williams Fork. Such a temperature increase would result in more frequent exceedances of temperature standards.

Figure 27. Colorado River average daily stream temperature predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

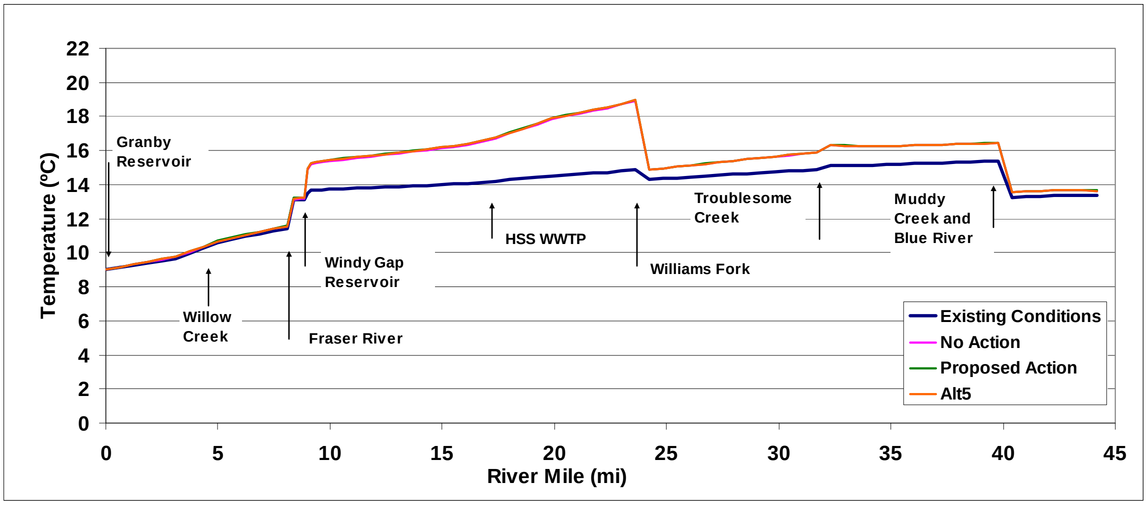


Table 58. Comparisons of predicted Colorado River temperature to Existing Conditions for all alternatives assuming diversions to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Stream Temperature in the Study Reach (ºC)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	4.1	27.3%
Proposed Action	4.1	27.6%
Alternative 5	4.1	27.5%

*Existing Conditions average July 25 temperature = 14.3ºC at the location of greatest change under the alternatives.

The QUAL2K model output consists of a predicted average daily temperature along with simulated diurnal fluctuations at each location along the river. The predicted diurnal swings in water temperature assuming a 90 cfs low flow condition downstream of the Windy Gap diversion are shown in Table 59. These values represent the location with the highest predicted temperature.

Table 59. Predicted diurnal temperature range for the Colorado River upstream of the Williams Fork for direct effects assuming diversion to the minimum instream flow below Windy Gap (July 25).

Alternative	Temperature (°C)		
	Average	Minimum	Maximum
Existing Conditions	14.6	12.9	17.1
No Action	18.9	13.2	25.6
Proposed Action	19.0	13.2	25.7
Alternative 5	19.0	13.2	25.7

8.4.1.3. Specific Conductivity and Total Dissolved Solids

Simulated changes in specific conductivity for No Action and the other alternatives are compared with Existing Conditions in Figure 28 and Table 60. Very small changes in specific conductivity are predicted upstream of the Williams Fork. Specific conductivity increases downstream of Williams Fork because of the higher concentrations in this tributary. An increase in specific conductivity of up to 26 μmhos/cm is predicted for the alternatives below Williams Fork.

Figure 28. Colorado River specific conductivity predicted for Existing Conditions and alternatives (July 25)—cumulative effects.

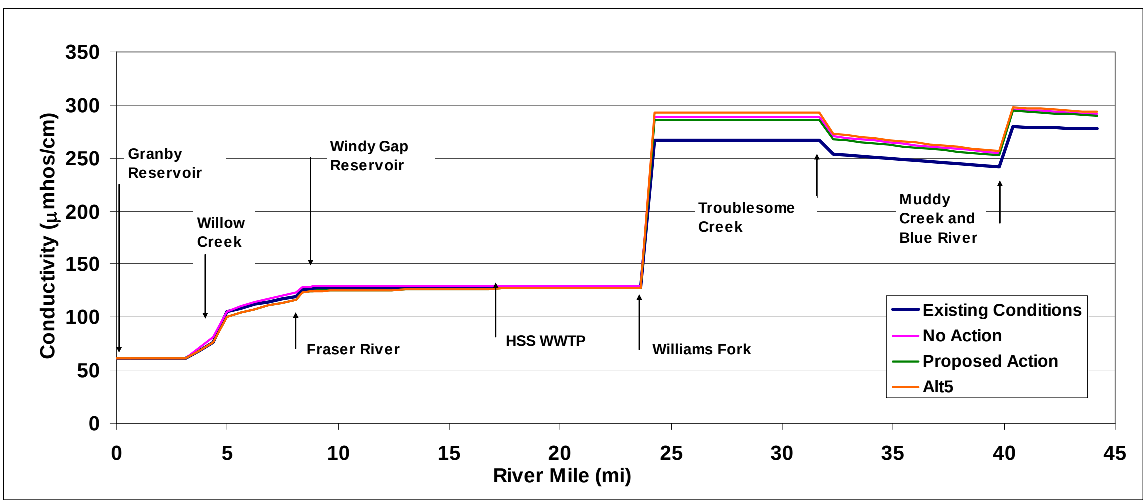


Table 60. Comparison of predicted specific conductivity to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Specific Conductivity in the Study Reach (μmhos/cm)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	22.0	8.2%
Proposed Action	18.6	7.0%
Alternative 5	25.4	9.5%

*Existing Conditions average July 25 specific conductivity = 267.2 μmhos/cm at the location of greatest change under the alternatives.

Changes in total dissolved solids concentrations for the alternatives are compared with Existing Conditions in Figure 29 and Table 61. As expected, these results are very similar to those for specific conductivity, with very small changes in total dissolved solids concentrations predicted upstream of the Williams Fork. Downstream of the Williams Fork, increases in total dissolved solids concentrations of up to 15 mg/L are predicted and correspond to alternatives with higher reductions in flow downstream. Increased total dissolved solids concentrations of up to 10 mg/L are predicted downstream near Kremmling.

Figure 29. Colorado River total dissolved solids concentrations predicted for Existing Conditions and alternatives (July 25)—cumulative effects.

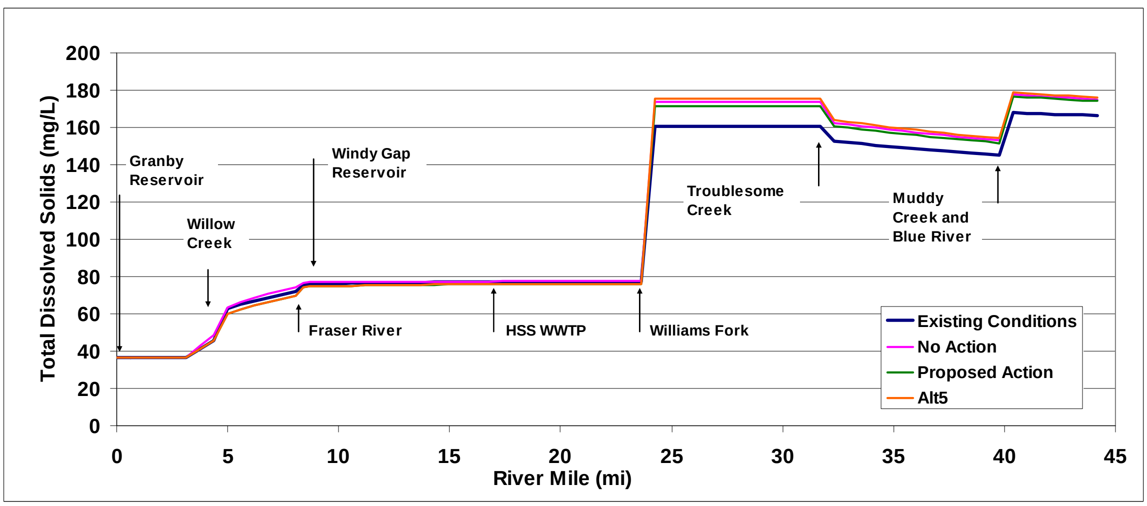


Table 61. Comparison of predicted Colorado River total dissolved solids concentrations to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for TDS in the Study Reach (mg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	13.2	8.28%
Proposed Action	11.1	7.0%
Alternative 5	15.2	9.5%

*Existing Conditions average July 25 TDS concentration above Kremmling = 166 mg/L.

Predicted specific conductivity and total dissolved solids for the minimum instream flow simulations for cumulative effects are presented in Figure 30 and Figure 31. Calculated differences from Existing Conditions are presented in Table 62 and Table 63. Results for alternatives are very similar and appear as coincident lines in Figure 30 and Figure 31. The withdrawal of the maximum diversion to produce the minimum instream flow at the end of July results in higher conductivity and total dissolved solids in the Colorado River downstream of the Williams Fork.

Figure 30. Colorado River average daily stream specific conductivity predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

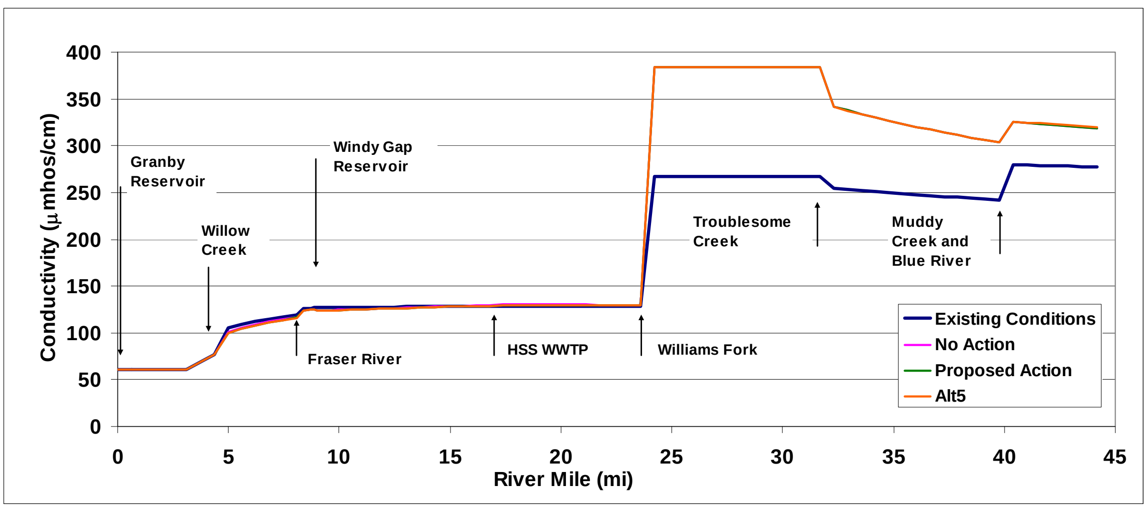


Figure 31. Colorado River average daily stream total dissolved solids predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

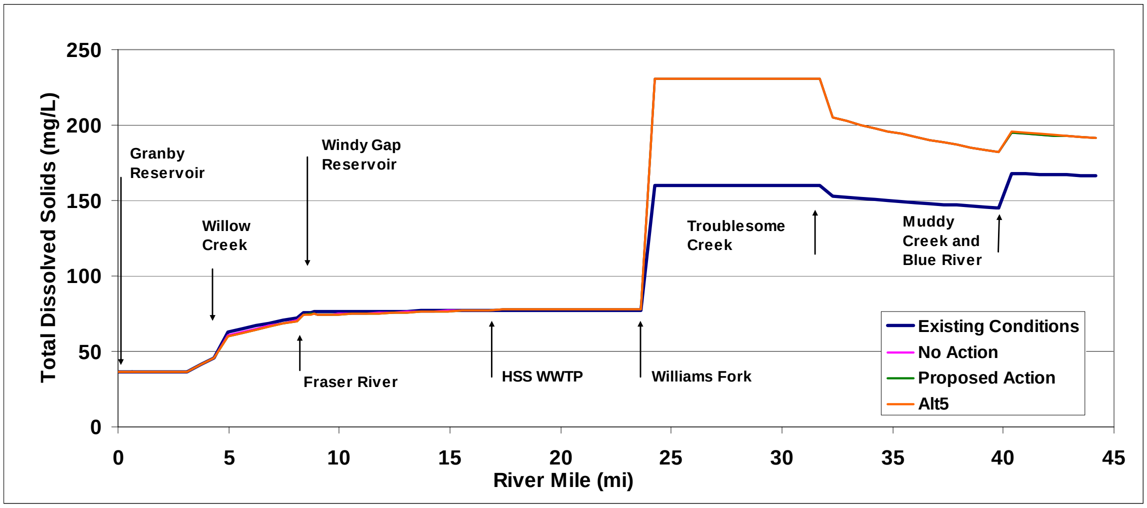


Table 62. Comparisons of predicted Colorado River specific conductivity to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Specific Conductivity in the Study Reach (µmhos/cm)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	117.3	43.9%
Proposed Action	117.3	43.9%
Alternative 5	117.3	43.9%

*Existing Conditions average July 25 specific conductivity = 267.2 µmhos/cm at the location of greatest change under the alternatives.

Table 63. Comparisons of predicted Colorado River total dissolved solids to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for TDS in the Study Reach (mg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	70.4	43.9%
Proposed Action	70.4	43.9%
Alternative 5	70.4	43.9%

*Existing Conditions average July 25 TDS concentration above Kremmling = 166 mg/L.

8.4.1.4. Dissolved Oxygen

The predicted changes in dissolved oxygen for No Action and the other alternatives are compared with Existing Conditions in Figure 32 and Table 64. Very slight (if any) changes in dissolved oxygen are predicted for the alternatives throughout this section of the Colorado River. The decrease in dissolved oxygen concentrations in the Colorado River would not lower the concentration below the standard.

Figure 32. Colorado River dissolved oxygen concentrations predicted for Existing Conditions and alternatives (July 25)—cumulative effects.

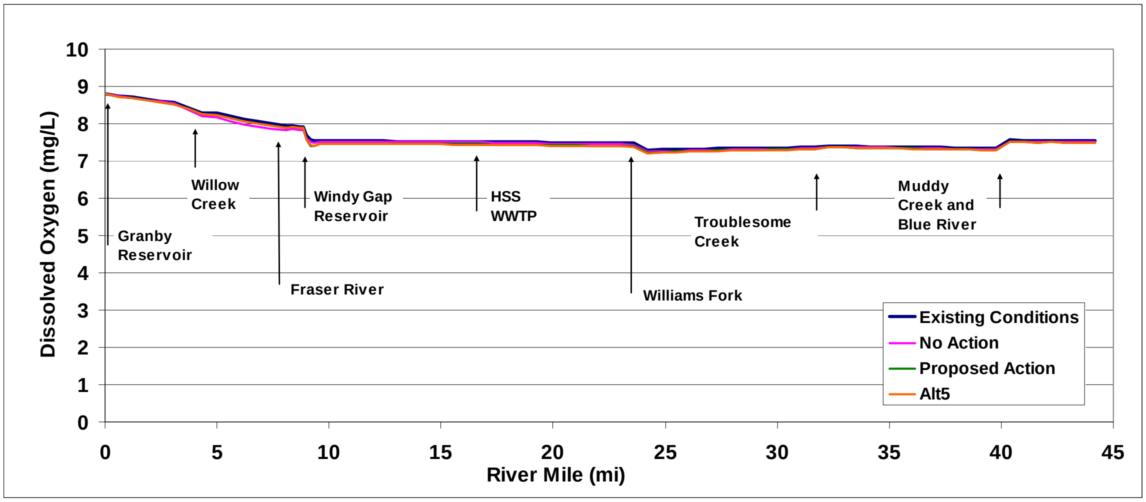


Table 64. Comparison of predicted Colorado River dissolved oxygen concentrations to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Dissolved Oxygen in the Study Reach (mg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-0.1	-1.6%
Proposed Action	-0.1	-1.9%
Alternative 5	-0.1	-1.8%

*Existing Conditions average July 25 DO concentration = 7.6 mg/L throughout the study reach

Predicted dissolved oxygen for the minimum instream flow simulations for cumulative effects is presented in Figure 33. Calculated differences from Existing Conditions are presented in Table 65. Results for alternatives are very similar and appear as coincident lines in Figure 33. Dissolved oxygen is predicted to decrease slightly in the Colorado River below Windy Gap at minimum instream flows.

Figure 33. Colorado River average daily stream dissolved oxygen predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

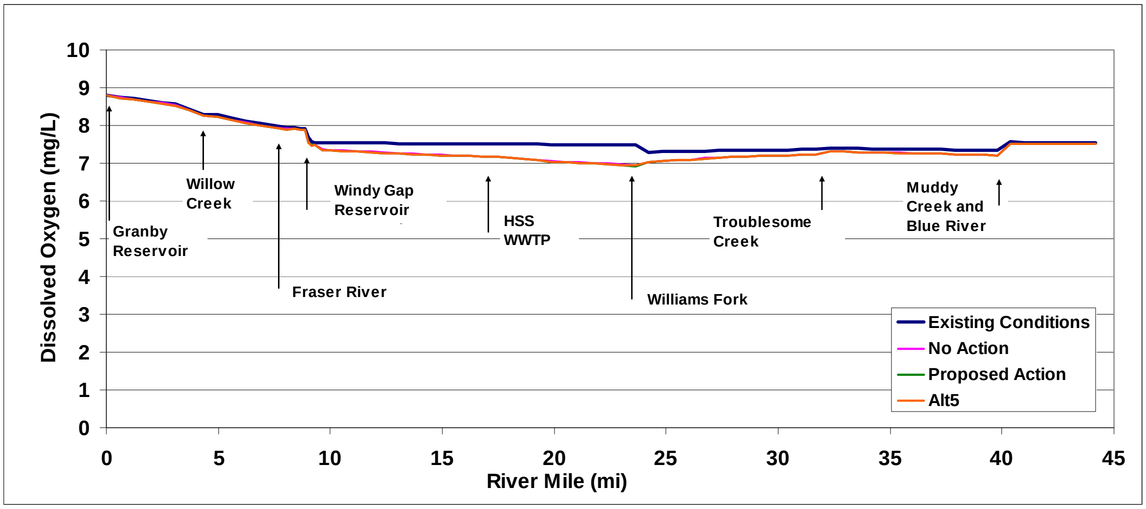


Table 65. Comparisons of predicted Colorado River dissolved oxygen to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Dissolved Oxygen in the Study Reach (mg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-0.5	-7.3%
Proposed Action	-0.6	-7.4%
Alternative 5	-0.6	-7.4%

*Existing Conditions average July 25 DO concentration = 7.6 mg/L throughout the study reach

8.4.1.5. Ammonia

Comparison of ammonia predictions for the alternatives are presented in Figure 34. Predicted future increase in ammonia concentrations in the Fraser River from additional WWTP discharge would increase ammonia concentrations in the Colorado River below the Fraser River confluence. Ammonia concentrations of 8.5 µg/L under the No Action alternative would occur just above the HSS WWTP compared to 9.5 µg/L for the Proposed Action and 9.4 µg/L for Alternative 5 (Table 66). Maximum concentrations in the study reach up to 11.1 µg/L would occur under the Proposed Action, but reaction kinetics and tributary inflow dilution would reduce these concentration increases to about 0.002 mg/L at the downstream end of the study reach.

Based on a QUAL2K temperature of 14ºC and a river pH of 7.4 for July 25, the aquatic life acute and chronic ammonia standards would be 15.3 and 4.73 mg/L, respectively. The QUAL2K model shows that the average ammonia concentration under Existing Conditions from Windy Gap Reservoir to the Blue River is about 0.025 mg/L. An increase in the ammonia concentration by up to 11.1 µg/L (0.011 mg/L) under the

Proposed Action, and less for other alternatives would not increase the ammonia concentration to above aquatic ammonia standards.

Figure 34. Colorado River ammonia concentrations predicted for Existing Conditions and alternatives (July 25)—cumulative effects.

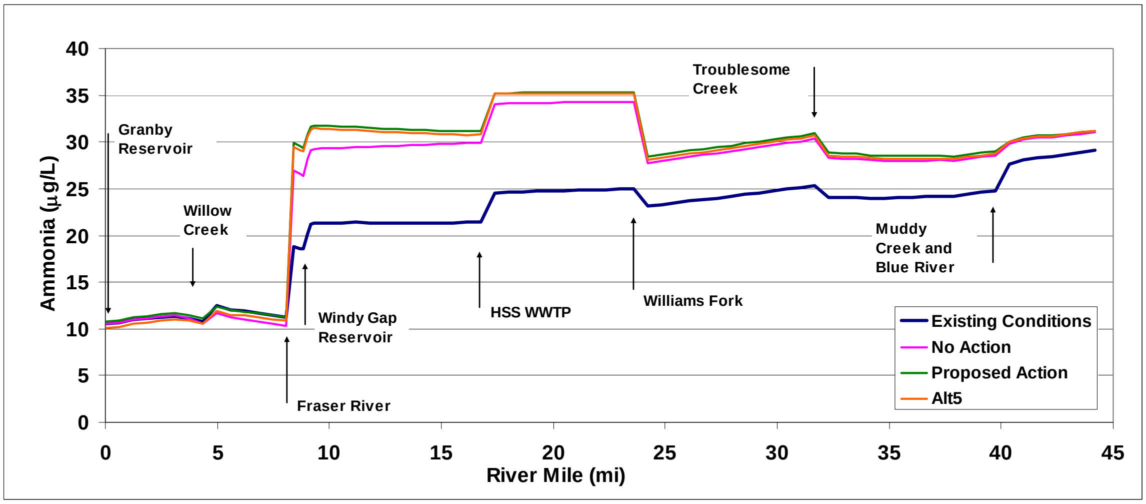


Table 66. Comparison of predicted Colorado River ammonia concentrations to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Change from Existing Conditions* for Ammonia Upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Ammonia in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	8.5	9.5	43.4%
Proposed Action	9.7	11.1	59.0%
Alternative 5	9.4	10.7	56.9%

*Existing Conditions average July 25 ammonia concentration is 21.4 µg/L above the HSS WWTP and 24.9 µg/L at the location of greatest change under the alternatives.

Predicted ammonia for the minimum instream flow simulations for cumulative effects is presented in Figure 35. Calculated differences from Existing Conditions are presented in Table 67. Results for alternatives are very similar and appear as coincident lines on Figure 35. The withdrawal of the maximum diversion to produce the minimum instream flow at the end of July is predicted to result in higher ammonia concentrations in the Colorado River downstream of Windy Gap. The largest increase is predicted to occur just downstream of the HSS WWTP, but the increase would not result in exceedances of total ammonia standards. The elevated ammonia concentrations are reduced downstream by tributary inflows.

Figure 35. Colorado River average daily stream ammonia predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

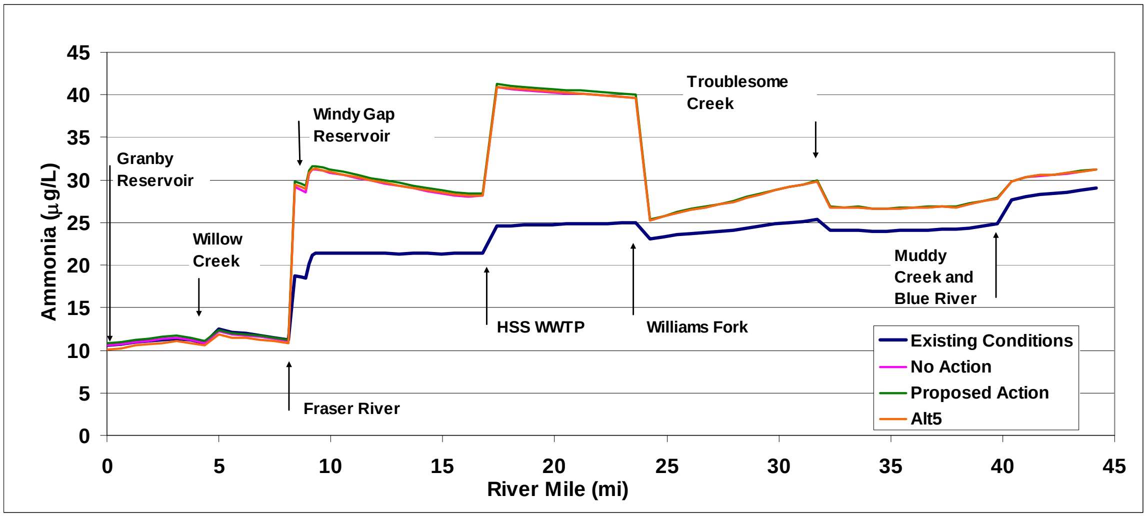


Table 67. Comparisons of predicted Colorado River ammonia to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Change from Existing Conditions* for Ammonia Upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Ammonia in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	6.7	16.3	66.4%
Proposed Action	7.0	16.7	67.9%
Alternative 5	6.8	16.4	66.7%

*Existing Conditions average July 25 ammonia concentration is 21.4 µg/L above the HSS WWTP and 24.9 µg/L at the location of greatest change under the alternatives.

8.4.1.6. Inorganic Phosphorus

Predictions of inorganic phosphorus for No Action and the other alternatives are compared with Existing Conditions in Figure 36 and Table 68. Phosphorus concentrations for all of the alternatives are predicted to be lower than Existing Conditions in the Colorado River below Willow Creek, and particularly below the Fraser River. The phosphorus concentration in Willow Creek was assumed to remain the same as under Existing Conditions, but the inflow volume of Willow Creek is predicted to be lower for the alternatives, decreasing the load of inorganic phosphorus to the Colorado River. The flow of the Fraser River is expected to be lower under future conditions. The concentration of inorganic phosphorus in the Fraser River is predicted to be lower in the future as a result of advanced wastewater treatment practices that are likely to be required in the Fraser basin. Therefore, the Fraser River is likely to introduce less of an inorganic phosphorus load in the future. The reduced inflow load results in predicted concentration reductions of about 4 µg/L in the Colorado River. As a result of biological uptake and tributary inflow sources, concentration differences are predicted to be only 1 µg/L lower than Existing Conditions near Kremmling.

Figure 36. Colorado River inorganic phosphorus concentrations predicted for Existing Conditions and alternatives (July 25)—cumulative effects.

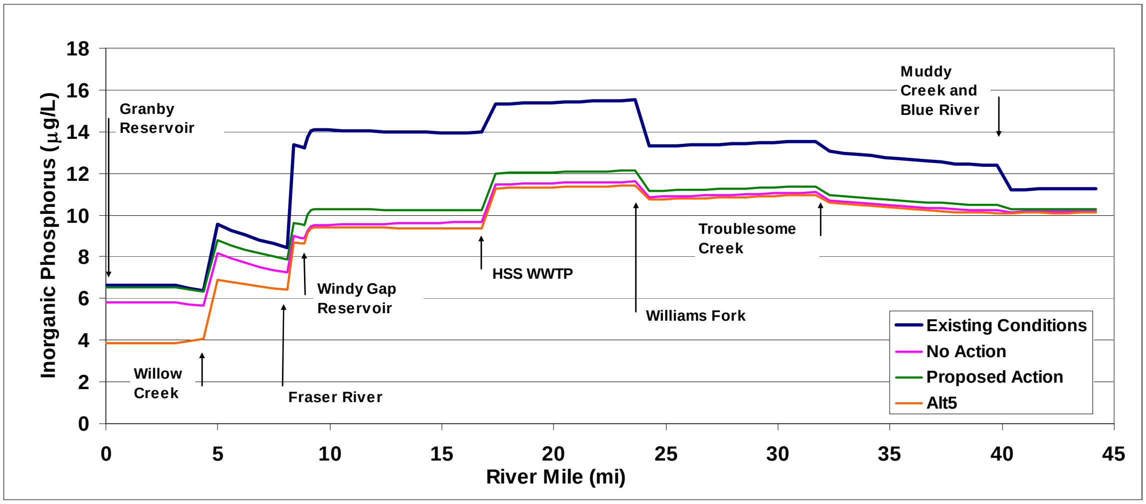


Table 68. Comparison of predicted Colorado River inorganic phosphorus concentrations to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Change from Existing Conditions* for Inorganic Phosphorus Upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Inorganic Phosphorus in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-4.3	-4.6	-32.8%
Proposed Action	-3.7	-3.8	-27.9%
Alternative 5	-4.6	-4.7	-41.7%

*Existing Conditions average July 25 inorganic phosphorus concentration = 13.9 µg/L above HSS WWTP, 15.5 µg/L at location of greatest change under the alternatives.

Predicted water inorganic phosphorus for the minimum instream flow simulations for cumulative effects is presented in Figure 37. Calculated differences from Existing Conditions are presented in Table 69. Results for alternatives are very similar and appear as coincident lines in Figure 37. The withdrawal of the maximum diversion to produce the minimum instream flow at the end of July results in lower flows in the Colorado River. Assumed improvements in WWTP phosphorus removal in the Fraser River basin in the future account for lower concentrations under the alternatives than Existing Conditions. The HSS WWTP effluent load of inorganic phosphorus has a larger impact on increasing river concentrations directly downstream of the plant under low flows. Similarly, the diluting impact of the Williams Fork, Troublesome Creek and Blue River and Muddy Creek have a greater impact on concentration reduction directly below their confluence with the Colorado River.

Figure 37. Colorado River average daily stream inorganic phosphorus for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

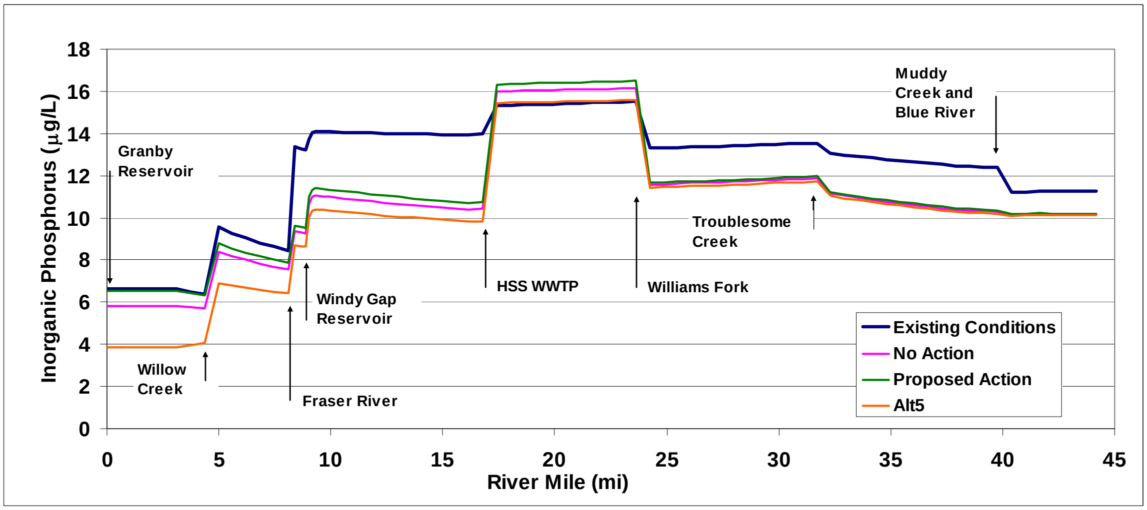


Table 69. Comparisons of predicted Colorado River inorganic phosphorus to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Change from Existing Conditions* for Inorganic Phosphorus Upstream of HSS WWTP Outfall (µg/L)	Greatest Change from Existing Conditions* for Inorganic Phosphorus in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	-3.6	-4.0	-29.9%
Proposed Action	-3.2	-3.7	-27.9%
Alternative 5	-4.1	-4.7	-41.7%

*Existing Conditions average July 25 inorganic phosphorus concentration = 13.9 µg/L above HSS WWTP, 15.5 µg/L at location of greatest change under the alternatives.

8.4.1.7. Selenium

The predicted changes in dissolved selenium for No Action and the other alternatives are compared with Existing Conditions in Figure 38 and Table 70. Very small increases in selenium concentration (no greater than 0.02 µg/L) are predicted to occur and would result in river concentrations well below aquatic standards. These increases result from reductions in Colorado River flow with relatively constant sources from the Muddy Creek for alternatives as compared to existing conditions.

Figure 38. Colorado River dissolved selenium concentrations predicted for Existing Conditions and alternatives (July 25)—cumulative effects.

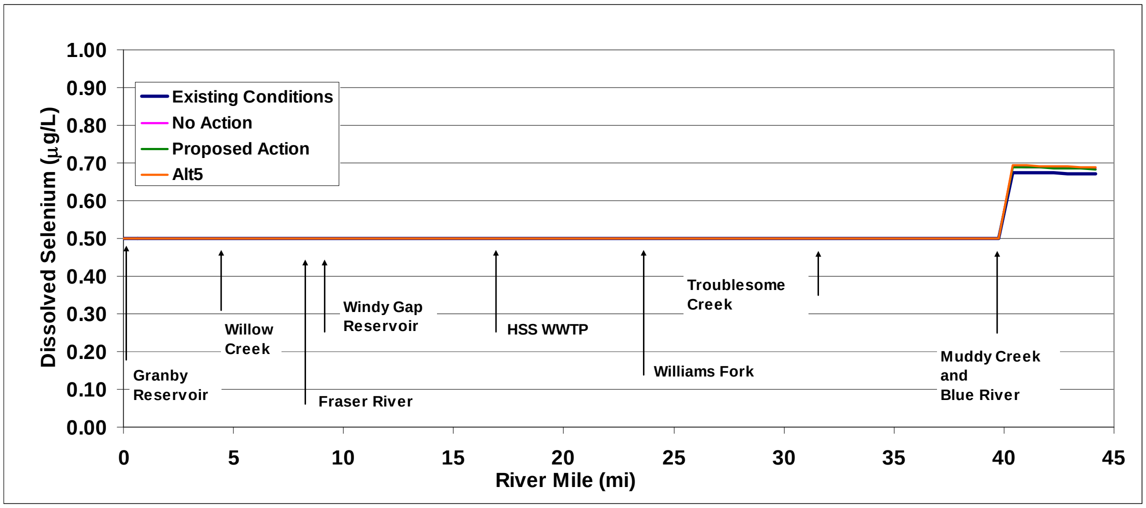


Table 70. Comparison of predicted Colorado River selenium concentrations to Existing Conditions for all alternatives (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Dissolved Selenium in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	0.02	2.4%
Proposed Action	0.01	2.2%
Alternative 5	0.02	3.0%

*Existing Conditions average July 25 dissolved selenium concentration at location of greatest change under the alternatives = 0.67 µg/L.

Predicted dissolved selenium concentration for the minimum instream flow simulations for cumulative effects is presented in Figure 39. Calculated differences from Existing Conditions are presented in Table 71. Results for alternatives are very similar and appear as coincident lines in Figure 39. The minimum instream flow alternatives reduce the Colorado River flow below Windy Gap. The elevated selenium levels in the Muddy Creek provide a stronger influence to increase downstream concentrations.

Figure 39. Colorado River average daily stream dissolved selenium predicted for Existing Conditions and all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

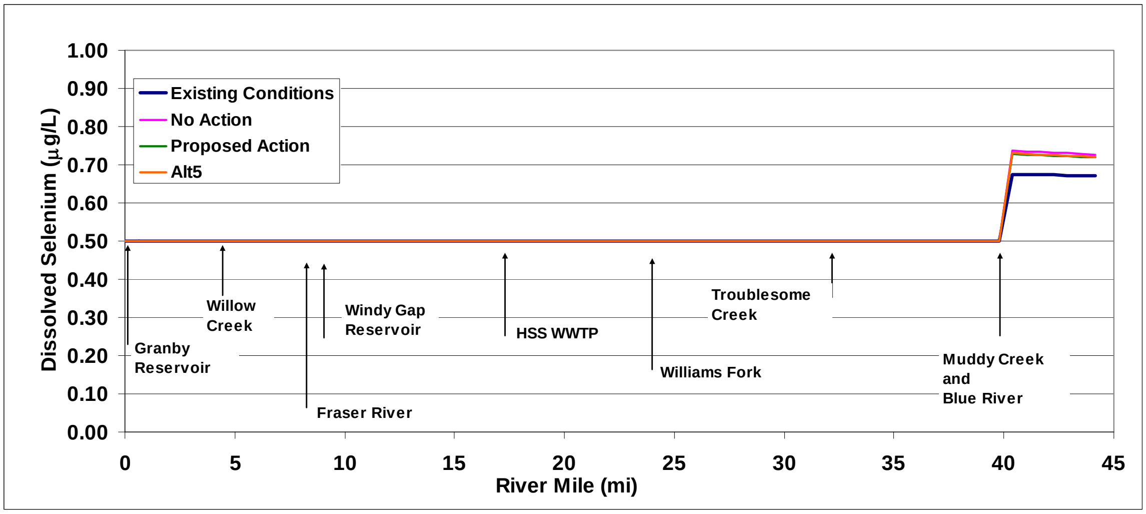


Table 71. Comparisons of predicted Colorado River dissolved selenium to Existing Conditions for all alternatives assuming diversion to the minimum instream flow below Windy Gap (July 25)—cumulative effects.

Alternative	Greatest Change from Existing Conditions* for Dissolved Selenium in the Study Reach (µg/L)	Greatest Percentage Change from Existing Conditions* in the Study Reach
No Action	0.1	9.2%
Proposed Action	0.1	7.9%
Alternative 5	0.1	8.2%

*Existing Conditions average July 25 dissolved selenium concentration at location of greatest change under the alternatives = 0.67 µg/L.

8.4.1.8. Algae

None of the projected changes in Colorado River water quality are expected to adversely contribute to the spread of didymo populations that are currently present in the river or its development. This aquatic organism is tolerant of a wide range of stream chemical and physical conditions and none of the water quality parameters that would change under the alternatives would aggravate its dispersal or growth. Periodic high flows of similar magnitude to existing conditions would continue to occur, but with less frequency (about 6 to 11 percent less for the action alternatives) under all of the alternatives (ERO and Boyle 2007, Appendix Table I-19). An aggressive education and outreach program to prevent the spread of didymo is considered an important control technique (Spaulding 2008).

8.4.2. Willow Creek

Under all the alternatives, the largest decreases in the flow of Willow Creek would occur in June through August (ERO and Boyle 2007). According to the SSTEMP model, this would decrease the temperature of Willow Creek by less than 0.2ºC. The lower flow would reduce the dilution of treated wastewater entering Willow Creek from Church Creek.

The Three Lakes WWTP was recently expanded and has a treatment capacity of 2 million gallons per day. It is assumed that the expansion was designed considering future foreseeable growth in the service area. Using the average permitted discharge of treated wastewater to Church Creek of 1.3 cfs (assuming that WWTP effluent discharges would not increase in the future), a mass balance was completed for Willow Creek below Church Creek using chemical concentrations in Willow Creek and in the effluent discharge. The ammonia concentration in the WWTP discharge water has sometimes been much higher than the mean ammonia concentration in Willow Creek, but ammonia concentrations would be expected to decrease in Church Creek between the discharge point and Willow Creek due to biological uptake (EPA 2000). Copper and iron concentrations have exceeded standards in Willow Creek and have occasionally been elevated in the WWTP discharge. A mass balance calculation was completed using mean ammonia, iron and copper concentrations for Willow Creek and the average of the highest measured WWTP concentrations for these parameters. Results for No Action are provided in Table 72, the Proposed Action in Table 73, and Alternative 5 in Table 74. Under all the alternatives, even under worst-case conditions in August at the maximum possible WWTP discharge rate, aquatic life acute and chronic ammonia standards would not be exceeded in Willow Creek. Given the lack of algae and chlorophyll data for Willow Creek, it is not known whether the predicted increases in ammonia concentrations would result in algal growth problems in the creek. Iron concentrations would not exceed the dissolved (water supply) standard and copper concentrations would not exceed the acute and chronic aquatic standards under all alternatives.

Table 72. Cumulative effects average monthly changes in ammonia, iron, and copper concentrations in Willow Creek under the No Action alternative.

Parameter	Standard (June/July)	Standard (Aug)	Existing Conditions	WWTP Effluent Concentrations[2]	June		July		August	
			Average	Average	Average	Change	Average	Change	Average	Change
Ammonia (mg/L)	2.87	2.45	0.1	17	0.27	0.17	1.01	0.91	2.06	1.96
Iron, diss (µg/L)	300	300	92.5	260	94.2	1.7	101.54	9.04	120	27.5
Copper, diss, ac/ch (µg/L) [1]	15/10	5	3.4	21	3.54	0.14	4.35	0.95	5.73	2.33

[1] Copper standard based on mean hardness of 112 mg/L (CDPHE 2008).
[2] Data are from EPA Envirofacts (http://www.epa.gov/enviro/).

Table 73. Cumulative effects average monthly changes in ammonia, iron, and copper concentrations in Willow Creek under the Proposed Action alternative.

Parameter	Standard (June/July)	Standard (Aug)	Existing Conditions	WWTP Effluent Concentrations[2]	June		July		August	
			Average	Average	Average	Change	Average	Change	Average	Change
Ammonia (mg/L)	2.87	2.45	0.1	17	0.29	0.19	01.09	0.99	2.25	2.15
Iron, diss (μg/L)	300	300	92.5	260	94.37	1.87	102.35	9.85	113.72	21.33
Copper, diss, ac/ch (μg/L) [1]	15/10	5	3.4	21	3.63	0.23	4.43	1.03	5.64	2.24

[1] Copper standard based on mean hardness of 112 mg/L (CDPHE 2008).
[2] Data are from EPA Envirofacts (http://www.epa.gov/enviro/).

Table 74. Cumulative effects average monthly changes in ammonia, iron, and copper concentrations in Willow Creek under Alternative 5.

Parameter	Standard (June/July)	Standard (Aug)	Existing Conditions	WWTP Effluent Concentrations[2]	June		July		August	
			Average	Average	Average	Change	Average	Change	Average	Change
Ammonia (mg/L)	2.87	2.45	0.1	17	0. 28	0.18	1.09	0.99	2.25	2.15
Iron, diss (μg/L)	300	300	92.5	260	94.31	1.81	102.35	9.85	122.67	30.17
Copper, diss, ac/ch (μg/L) [1]	15/10	5	3.4	21	3.54	0.14	4.43	1.03	5.95	2.55

[1] Copper standard based on mean hardness of 112 mg/L (CDPHE 2008).
[2] Data are from EPA Envirofacts (http://www.epa.gov/enviro/).

8.4.3. Big Thompson River

Under No Action (Alternative 1), the flow of the Big Thompson River below Lake Estes to the Hansen Feeder Canal would increase by 1% during 3 months in an average year and would not change during any other months in an average year or during dry or wet years (ERO and Boyle 2007). As described in Section 6.2.1, this section of the river has good water quality, particularly during high flows. A 1% change in flows is not expected to measurably alter the water quality of the Big Thompson River.

Under the Proposed Action (Alternative 2), the flow of the Big Thompson River below Lake Estes to the Hansen Feeder Canal would increase by a maximum of 8 to 9% in May and July in an average year (ERO and Boyle 2007). Total nitrogen and phosphorus concentrations are low in this segment of the Big Thompson River. Based on estimated increases in total nitrogen and phosphorus loading from the Adams Tunnel to the Big Thompson River (AMEC 2008), a 17 cfs increase in flow from the Adams Tunnel would result in small increases in total nitrogen and phosphorus concentrations in the Big Thompson River below Lake Estes. Mass balance calculations show increases in total nitrogen and total phosphorus concentrations in May and July of less than 0.02

mg/L. With a maximum predicted change in river flow of 9.8 cfs (Boyle 2006a), water temperature would not be expected to measurably change.

Under Alternative 5, the flow of the Big Thompson River below Lake Estes to the Hansen Feeder Canal would increase by a maximum of 4% in May in an average year (ERO and Boyle 2007). The average 4% increase in high flows that would occur during May would result in minor changes in water quality similar to Alternative 2.

The Big Thompson River downstream of the Loveland WWTP also would be affected under all of the alternatives. The flow of the river would increase during May through October, with the largest percent increase occurring in October (ERO and Boyle 2007). Given that ammonia concentrations occasionally already exceeded the acute and chronic standards during low flow in 2000 to 2006, a mass balance calculation was completed for ammonia during the month of October, the lowest flow month. In addition a mass balance calculation was completed for copper concentrations, for which data available for both the river and the effluent discharge. Results are provided in Table 75. The ammonia calculation used an average ammonia concentration of 1.4 mg/L for the effluent and average ammonia concentration of 1.44 mg/L for the Big Thompson River below Loveland (EPA 2006). This analysis indicates that the ammonia concentration in the Big Thompson River would decrease slightly for all the alternatives. The increase in copper concentrations would not exceed the aquatic standards under No Action. The Big Thompson River below Loveland has other occasional water quality exceedances during low flows (nitrate and sulfate); however, WWTP effluent data are not available for these parameters. The flow increases (up to 10 cfs during low flows) are not large enough to increase erosion downstream in a river whose average spring runoff flows are 300 cfs.

Table 75. Cumulative effects average changes in ammonia and copper concentrations in October in the Big Thompson River below Loveland under all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	No Action		All Other Alternatives	
		Average	Average	Average	Change	Average	Change
Ammonia (mg/L)	2.86	1.44	1.4	1.06	-0.38	1.22	-0.22
Copper, diss (µg/L)	29	2.94	8.06	4.57	1.63	4.87	1.93

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

8.4.4. North St. Vrain Creek

Under the No Action alternative, the flow of North St. Vrain Creek below Ralph Price Reservoir would change due to exchanges of Windy Gap water to storage in an enlarged Ralph Price Reservoir and Windy Gap releases from Ralph Price Reservoir to meet Longmont's demands (ERO and Boyle 2007). The water quality of North St. Vrain Creek could change due to changes in the quality of water in Ralph Price Reservoir, as well as due to changes in streamflow. As described in Section 6.2.2, North St. Vrain Creek is a pristine mountain stream, with constituent concentrations generally lowest during high flow. The existing water quality of Ralph Price Reservoir is expected to be very good because of the lack of contaminant sources; however, no water quality data are available. Water quality is predicted to improve under the No Action alternative due to the increased reservoir volume and depth (AMEC 2008). Therefore, releases to North St. Vrain Creek from Ralph Price Reservoir would improve the water quality of the creek.

Average monthly streamflow decreases in North St. Vrain Creek are predicted to range from 9 to 25% (a loss of 14 to 42 cfs) in the high flow months of May and July (ERO and Boyle 2007). Based on the relationship between temperature and flows from historical data collected by the USGS at Longmont Dam (Earthinfo 2006), it is expected that such a flow decrease could increase the stream temperature by as much as 1ºC, remaining well below the standard of 20°C (the average historical stream temperature in May is 6.6ºC and in July is 11.6ºC). Similarly, based on historical USGS data, it is expected that the dissolved oxygen concentration could decrease by less than 0.5 mg/L, remaining above the standard of 6 mg/L (the average historical dissolved oxygen concentration in May is 9.8 mg/L and in July is 8.8 mg/L).

Average monthly flow increases in the creek ranging from 43 to 81% (a gain of 6 to 18 cfs) are predicted in the low flow months of September and October (ERO and Boyle 2007). Based on historical flow and temperature data collected by the USGS at Longmont Dam (Earthinfo 2006), it is expected that such a flow increase could decrease the stream temperature by 4 to 5ºC and raise the dissolved oxygen concentration in the creek by 0.5 to 2 mg/L.

Given that other water quality parameters have historically low concentrations during all flow levels and that predicted changes in flow are well within the historical range, water quality in North St. Vrain Creek is expected to be similar to measured historical values (Table 15). The manganese concentration in North St. Vrain Creek has been above the drinking water standard only during low flows (15 cfs or less). The No Action alternative would not decrease the flow of North St. Vrain Creek to such a low flow during any month (ERO and Boyle 2007).

There would be no impact to water quality in North St. Vrain Creek under the Proposed Action or other action alternatives.

8.4.5. St. Vrain Creek

St. Vrain Creek at Lyons is a fairly pristine stream, with water quality concentrations generally lowest during high flow. Stream temperatures increase in late July through mid-September. Under the No Action alternative, the flow of the creek would decrease by 13% in July (a 37 cfs decrease) and increase by 16 to 19% (6 to 12 cfs) in September and October (flow changes in other months would be 0 to 5%) (ERO and Boyle 2007). Based on the relationship between flow and temperature in historical data collected by the USGS at Lyons (Earthinfo 2006), it is expected that such a flow decrease during July high flows would not measurably change the stream temperature or dissolved oxygen concentration. The flow increases in September and October also would not measurably change the stream temperature or dissolved oxygen concentration. Given that most other water quality parameters have historically low concentrations during all flow levels, it is not expected that the predicted flow increases or decreases, which are well within historical flows of the St. Vrain at Lyons, would increase to concentrations higher than measured historically (Table 15). The No Action alternative would not decrease flows during low flow periods; thus, ammonia and phosphorus concentrations would not be expected to increase as a result of implementation of this alternative. There would be no water quality effects in St. Vrain Creek at Lyons under the Proposed Action or other alternatives.

Under all of the alternatives, the flow of St. Vrain Creek downstream of Longmont's WWTP and the St. Vrain Sanitation District's WWTPs would increase in April through October due to increased effluent discharges (ERO and Boyle 2007). The largest increases would occur in October. Ammonia concentrations already occasionally exceed the chronic standard during low flow. Mass balance calculations were completed for the St. Vrain below Longmont for ammonia, for which there are data available for both the river and the WWTP effluent discharge. Results are provided in Table 76. Under all the alternatives, the increase in ammonia concentrations could increase exceedances of the chronic standard during October. More frequent exceedances of the ammonia standards would likely occur during other low flow periods as well, although this would not include the months of November through March, when the WGFP would not result in increased effluent flows from Longmont's WWTP. The flow increases (up to 11 cfs during low flows for No Action and less for other alternatives) are not large enough to increase erosion downstream in a channel that supports average spring high flows of 350 cfs or more. At the St. Vrain Sanitation District WWTP, mass balance calculations were completed for ammonia. Results are provided in Table 77. Ammonia concentrations would not exceed the ammonia standard under No Action. The flow increases (up to 11.5 cfs for both WWTPs during low flows) are not large enough to increase erosion downstream in a channel that supports average spring high flows of 350 cfs or more.

Table 76. Cumulative effects average changes in ammonia concentrations in October in St. Vrain Creek below Longmont WWTP for all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	No Action		All Other Alternatives	
		Average	Average	Average	Change	Average	Change
Ammonia (mg/L)	2.86	1.3	5.2	2.71	1.41	2.48	1.18

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

Table 77. Average changes in ammonia concentrations in October in St. Vrain Creek below St. Vrain Sanitation District WWTP for all WGFP alternatives.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	All Alternatives	
		Average	Average	Average	Change
Ammonia (mg/L)	2.86	0.155	1.05	0.161	0.006

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

There would be no effect to St. Vrain Creek water quality under the Proposed Action or other action alternatives above Lyons.

8.4.6. Big Dry Creek

Due to increases in the discharge from Broomfield's WWTP during April through October, the flow of Big Dry Creek would increase downstream of the WWTP during the months of April to October under all of the alternatives (ERO and Boyle 2007). The largest relative increase would occur during the low flow month of October. Given that ammonia, iron and manganese concentrations already occasionally exceed standards in Big Dry Creek, mass balance calculations were for these parameters during the month of October. Results are provided in Table 78. The estimated increase in the ammonia concentration for all alternatives could result in additional exceedances in ammonia standards. Iron and manganese concentrations would decrease in Big Dry Creek below Broomfield's WWTP for all alternatives. The flow increases under No Action (up to 3.5 cfs during low flows and 8.5 cfs during high flows) and less under other alternatives are not large enough to increase erosion downstream.

Table 78. Average changes in ammonia, iron and manganese concentrations in October in Big Dry Creek below Broomfield WWTP for all WGFP alternatives—cumulative effects.

Parameter	Standard	Existing Conditions	WWTP Effluent Concentrations[1]	No Action		Alternatives 2 and 5	
		Average	Average	Average	Change	Average	Change
Ammonia (mg/L)	2.86	1.05	2	2.41	1.36	2.6	1.55
Iron (µg/L)	1,000	1,090	161	461.32	-628.68	489.7	-600.3
Manganese (µg/L)	200	80	9.74	31.38	-48.62	35	-45

[1] Data are from EPA Envirofacts (http://www.epa.gov/enviro).

8.4.7. Coal Creek

Increases in the flow of Coal Creek below the four WWTPs (Superior, Louisville, Lafayette and Erie) would occur in April through October under all of the alternatives, with the largest percent changes occurring in September, the month with lowest streamflow (Boyle 2006b). The flow of Coal Creek could more than double in September and October; however, the flow increase is predicted to be a maximum of 5 cfs. The total average monthly effluent discharge from the four WWTPs is currently 7.9 cfs; this flow constitutes most or all of the flow of Coal Creek, except during high flows in April and May. The total average monthly effluent discharge from the four WWTPs is currently 7.9 cfs; this flow constitutes most or all of the flow of Coal Creek, except during high flows in April and May. The average ammonia concentration in Coal Creek is 0.07 mg/L (based on 7 measurements by the USGS); the ammonia concentration in the four WWTP effluent discharges ranges from less than 0.03 mg/L to occasionally greater than 10 mg/L. Increased WWTP return flows from the Superior, Louisville, Lafayette and Erie WWTPs could cause ammonia concentrations in Coal Creek to exceed ammonia standards, particularly during low flow. A mass balance calculation was not completed for ammonia and other parameters due to a lack of data for Coal Creek above and below the four WWTPs.

8.4.8. Cache la Poudre River

Increases in WWTP effluent discharges from Greeley's WWTP would occur under all of the alternatives in November through March to the Cache la Poudre River below the Greeley WWTP. The estimated WWTP discharge increase during those months ranges from 3 to 8.15 cfs (Boyle 2006b) for the No Action alternative. The largest increase would occur in November. A mass balance calculation for the No Action alternative was completed for ammonia during the month of November using an average ammonia concentration of 4.79 mg/L for the effluent and average ammonia concentration of 0.66 mg/L for the Poudre River near Greeley (EPA 2006, Earthinfo 2006). Mass balance calculations were also completed for copper, for which there are data available for both the river and the WWTP effluent discharge. Results are similar to direct effects, as shown in Table 49. It is likely that the chronic ammonia standard would not be exceeded during November through March under any of the alternatives. Copper concentrations would increase slightly, but would remain well below acute and chronic standards. Return flows from Greeley's WWTP to the Poudre River for Alternatives 2 to 5 would be the same under cumulative effects as under direct effects.

8.4.9. Chimney Hollow Creek

Chimney Hollow Creek in Alternatives 2, 3, and 4 would receive water from Chimney Hollow Reservoir via discharges and seepage. It is expected that the water quality of the creek would be the same as the water quality of the reservoir. Windy Gap water would be delivered to Chimney Hollow Reservoir via the Olympus Tunnel. The average total nitrogen concentration in the creek is estimated to be 0.19 mg/L and the average total phosphorus concentration is estimated to be 0.008 mg/L (AMEC 2008). It is estimated that the temperature of the water flowing from Chimney Hollow Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008).

8.4.10. Dry Creek

Under Alternative 5, Dry Creek would receive water from Chimney Hollow Reservoir via discharges and seepage. It is expected that the water quality of the creek would be the same as the water quality of the reservoir. Windy Gap water would be delivered to Dry Reservoir via the Olympus Tunnel. The average total nitrogen concentration in the creek is estimated to be 0.224 mg/L and the average total phosphorus concentration is estimated to be 0.01 mg/L (AMEC 2008). It is estimated that the temperature of the water flowing from Dry Creek Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008).

8.4.11. Rockwell/Mueller Creeks

Under Alternatives 4 and 5, Rockwell and Mueller Creeks would receive water from releases and seepage from Rockwell/Mueller Creek Reservoir. It is expected that the water quality of these creeks would be the same as the water quality of the reservoir. Windy Gap Reservoir water would be the source of water to Rockwell/Mueller Creek Reservoir. The average total nitrogen concentration in the creek is estimated to be 0.287 mg/L and the average total phosphorus concentration is estimated to be 0.015 mg/L (AMEC 2008). It is estimated that the temperature of the water flowing from Rockwell/Mueller Creek Reservoir to the creek would range from 14 to 17ºC during late summer. Dissolved oxygen concentrations should meet the standard, as should concentrations of other water quality parameters (AMEC 2008). The only exception might be for manganese, which would be expected to range from 20 to 100 µg/L, sometimes above the water supply standard of 50 µg/L.

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APPENDIX A QUAL2K MODEL RESULTS FOR COLORADO RIVER, DIRECT AND CUMULATIVE EFFECTS

Direct Effects — Average Flow (July 25)

NOTE: Negative values are increases under alternatives

		River Discharge						Change in discharge				
		Existing Conditions	No Action	Proposed Action	Alt 3	Alt 4	Alt 5	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
	River Mile	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)					
Lake Granby outlet	0.0	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	0.6	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	1.2	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	1.9	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	2.5	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	3.1	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
Willow Creek	3.7	149	138	131	133	133	133	10.3	17.7	15.9	15.9	15.4
	4.3	162	150	142	144	144	144	11.8	20.2	18.1	18.1	17.8
	5.0	203	185	170	174	174	174	18.5	32.7	29.2	29.2	29.6
	5.6	216	196	181	185	185	184	19.9	35.2	31.4	31.4	32.0
	6.2	230	208	192	196	196	195	21.3	37.7	33.6	33.6	34.3
	6.8	243	220	203	207	207	206	22.7	40.2	35.8	35.8	36.7
	7.5	256	232	214	218	218	217	24.1	42.8	38.0	38.0	39.1
Fraser River	8.1	270	244	224	229	229	228	25.5	45.3	40.2	40.2	41.5
	8.4	436	410	389	395	395	393	26.2	46.8	41.6	41.6	42.9
Windy Gap Reservoir	8.7	443	416	395	400	400	399	26.9	48.0	42.7	42.7	44.1
	8.9	407	327	317	295	295	298	79.8	90.6	112.6	112.6	109.6
	9.0	408	328	317	295	295	298	79.8	90.6	112.7	112.7	109.7
	9.2	408	328	318	295	295	298	79.9	90.6	112.7	112.7	109.7
	9.3	409	329	318	296	296	299	79.9	90.6	112.7	112.7	109.7
	9.6	409	329	319	297	297	300	79.9	90.7	112.7	112.7	109.7
	9.9	410	330	319	297	297	300	79.9	90.7	112.8	112.8	109.8
	10.6	412	332	321	299	299	302	79.9	90.8	112.8	112.8	109.8
	11.2	413	333	322	300	300	303	80.0	90.8	112.9	112.9	109.9
	11.8	415	335	324	302	302	305	80.0	90.9	112.9	112.9	110.0
	12.4	416	336	326	303	303	306	80.1	91.0	113.0	113.0	110.0
	13.0	418	338	327	305	305	308	80.1	91.1	113.1	113.1	110.1
	13.7	420	340	329	307	307	310	80.2	91.1	113.1	113.1	110.2
	14.3	421	341	330	308	308	311	80.2	91.2	113.2	113.2	110.2

	14.9	423	343	332	310	310	313	80.2	91.3	113.3	113.3	110.3
	15.5	424	344	333	311	311	314	80.3	91.3	113.3	113.3	110.3
	16.2	425	345	334	312	312	315	80.3	91.4	113.4	113.4	110.4
HSS WWTP	16.8	421	340	329	307	307	310	80.3	91.4	113.4	113.4	110.4
	17.4	420	340	329	307	307	310	80.3	91.4	113.4	113.4	110.4
	18.0	419	339	328	306	306	309	80.3	91.4	113.4	113.4	110.4
	18.6	418	338	327	305	305	308	80.3	91.4	113.4	113.4	110.4
	19.3	417	337	326	304	304	307	80.3	91.4	113.4	113.4	110.4
	19.9	416	336	325	303	303	306	80.3	91.4	113.4	113.4	110.4
	20.5	415	335	324	302	302	305	80.3	91.4	113.4	113.4	110.4
	21.1	415	334	323	301	301	304	80.3	91.4	113.4	113.4	110.4
	21.7	414	333	322	300	300	303	80.3	91.4	113.4	113.4	110.4
	22.4	413	332	321	299	299	302	80.3	91.4	113.4	113.4	110.4
	23.0	412	331	320	298	298	301	80.3	91.4	113.4	113.4	110.4
Williams Fork	23.6	411	331	319	297	297	300	80.3	91.4	113.4	113.4	110.4
	24.2	691	612	601	579	579	582	78.3	89.7	111.7	111.7	108.7
	24.9	690	612	600	578	578	581	78.5	90.0	111.9	111.9	108.9
	25.5	690	611	600	578	578	581	78.7	90.3	112.2	112.2	109.2
	26.1	690	611	599	577	577	580	78.8	90.5	112.4	112.4	109.5
	26.7	690	611	599	577	577	580	79.0	90.8	112.7	112.7	109.7
	27.3	689	610	598	576	576	579	79.2	91.1	112.9	112.9	110.0
	28.0	689	610	598	576	576	579	79.3	91.4	113.2	113.2	110.2
	28.6	689	609	597	575	575	578	79.5	91.6	113.4	113.4	110.5
	29.2	688	609	597	575	575	578	79.7	91.9	113.7	113.7	110.7
	29.8	688	608	596	574	574	577	79.8	92.2	113.9	113.9	111.0
	30.4	688	608	595	574	574	577	80.0	92.5	114.2	114.2	111.3
	31.1	688	607	595	573	573	576	80.2	92.8	114.4	114.4	111.5
Troublesome Creek	31.7	687	607	594	573	573	576	80.3	93.0	114.7	114.7	111.8
	32.3	743	663	650	628	628	631	80.4	93.2	114.8	114.8	111.9
	32.9	753	672	659	638	638	641	80.4	93.3	114.9	114.9	112.0
	33.6	762	682	669	648	648	650	80.5	93.4	115.0	115.0	112.1
	34.2	772	692	679	657	657	660	80.5	93.5	115.0	115.0	112.2
	34.8	782	701	688	667	667	670	80.5	93.6	115.1	115.1	112.3
	35.4	792	711	698	676	676	679	80.5	93.7	115.2	115.2	112.3
	36.0	801	721	708	686	686	689	80.5	93.8	115.3	115.3	112.4

	36.7	811	731	717	696	696	699	80.5	93.9	115.3	115.3	112.5
	37.3	821	740	727	705	705	708	80.5	94.0	115.4	115.4	112.6
	37.9	830	750	736	715	715	718	80.6	94.1	115.5	115.5	112.6
	38.5	840	760	746	725	725	727	80.6	94.2	115.5	115.5	112.7
	39.1	850	769	756	734	734	737	80.6	94.3	115.6	115.6	112.8
Muddy Ck/Blue River	39.8	860	779	765	744	744	747	80.6	94.4	115.7	115.7	112.9
	40.4	1,757	1,684	1,671	1,649	1,649	1,652	73.2	86.7	108.5	108.5	105.6
	41.0	1,763	1,690	1,676	1,654	1,654	1,657	73.5	87.1	108.9	108.9	106.0
	41.6	1,769	1,695	1,681	1,660	1,660	1,662	73.8	87.6	109.3	109.3	106.4
	42.3	1,775	1,701	1,687	1,665	1,665	1,668	74.0	88.1	109.8	109.8	106.9
	42.9	1,781	1,706	1,692	1,670	1,670	1,673	74.3	88.6	110.2	110.2	107.3
	43.5	1,786	1,712	1,697	1,676	1,676	1,679	74.6	89.1	110.6	110.6	107.8
top of Gore Canyon	44.2	1,793	1,718	1,703	1,682	1,682	1,684	74.9	89.6	111.1	111.1	108.3

		River Temperature						**Change in temperature**				
		Existing Conditions	No Action	Proposed Action	Alt 3	Alt 4	Alt 5	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
	River Mile	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)					
Lake Granby outlet	0.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0
	0.6	9.1	9.1	9.1	9.1	9.1	9.1	0.0	0.0	0.0	0.0	0.0
	1.2	9.3	9.3	9.3	9.3	9.3	9.3	0.0	0.0	0.0	0.0	0.0
	1.9	9.4	9.4	9.5	9.5	9.5	9.4	0.0	0.0	0.0	0.0	0.0
	2.5	9.5	9.6	9.6	9.6	9.6	9.6	0.0	-0.1	-0.1	-0.1	-0.1
	3.1	9.7	9.7	9.8	9.7	9.7	9.7	0.0	-0.1	-0.1	-0.1	-0.1
Willow Creek	3.7	10.0	10.0	10.0	10.0	10.0	10.0	0.0	-0.1	-0.1	-0.1	-0.1
	4.3	10.2	10.3	10.3	10.3	10.3	10.3	0.0	-0.1	-0.1	-0.1	-0.1
	5.0	10.6	10.6	10.6	10.6	10.6	10.6	0.0	0.0	0.0	0.0	0.0
	5.6	10.8	10.8	10.8	10.8	10.8	10.8	0.0	-0.1	0.0	0.0	0.0
	6.2	10.9	11.0	11.0	11.0	11.0	11.0	0.0	-0.1	-0.1	-0.1	-0.1
	6.8	11.1	11.1	11.2	11.2	11.2	11.2	0.0	-0.1	-0.1	-0.1	-0.1
	7.5	11.3	11.3	11.4	11.3	11.3	11.3	-0.1	-0.1	-0.1	-0.1	-0.1
Fraser River	8.1	11.4	11.5	11.5	11.5	11.5	11.5	-0.1	-0.1	-0.1	-0.1	-0.1
	8.4	13.1	13.3	13.4	13.4	13.4	13.4	-0.1	-0.3	-0.2	-0.2	-0.2
Windy Gap Reservoir	8.7	13.1	13.3	13.4	13.4	13.4	13.4	-0.1	-0.3	-0.2	-0.2	-0.2
	8.9	13.1	13.3	13.4	13.4	13.4	13.4	-0.1	-0.3	-0.2	-0.2	-0.2

	9.0	13.5	13.7	13.9	13.9	13.9	13.9	-0.2	-0.4	-0.4	-0.4	-0.4
	9.2	13.7	13.9	14.1	14.1	14.1	14.1	-0.3	-0.4	-0.4	-0.4	-0.4
	9.3	13.7	14.0	14.1	14.1	14.1	14.1	-0.3	-0.4	-0.4	-0.4	-0.4
	9.6	13.7	14.0	14.1	14.1	14.1	14.1	-0.3	-0.4	-0.4	-0.4	-0.4
	9.9	13.7	14.0	14.1	14.2	14.2	14.1	-0.3	-0.4	-0.4	-0.4	-0.4
	10.6	13.8	14.0	14.2	14.2	14.2	14.2	-0.3	-0.4	-0.4	-0.4	-0.4
	11.2	13.8	14.1	14.2	14.2	14.2	14.2	-0.3	-0.4	-0.5	-0.5	-0.4
	11.8	13.8	14.1	14.2	14.3	14.3	14.3	-0.3	-0.4	-0.5	-0.5	-0.5
	12.4	13.8	14.1	14.3	14.3	14.3	14.3	-0.3	-0.4	-0.5	-0.5	-0.5
	13.0	13.9	14.2	14.3	14.4	14.4	14.3	-0.3	-0.4	-0.5	-0.5	-0.5
	13.7	13.9	14.2	14.4	14.4	14.4	14.4	-0.3	-0.4	-0.5	-0.5	-0.5
	14.3	14.0	14.3	14.4	14.4	14.4	14.4	-0.3	-0.5	-0.5	-0.5	-0.5
	14.9	14.0	14.3	14.5	14.5	14.5	14.5	-0.3	-0.5	-0.5	-0.5	-0.5
	15.5	14.0	14.4	14.5	14.6	14.6	14.5	-0.3	-0.5	-0.5	-0.5	-0.5
	16.2	14.1	14.4	14.6	14.6	14.6	14.6	-0.3	-0.5	-0.5	-0.5	-0.5
HSS WWTP	16.8	14.1	14.5	14.6	14.7	14.7	14.7	-0.3	-0.5	-0.5	-0.5	-0.5
	17.4	14.2	14.6	14.7	14.8	14.8	14.7	-0.4	-0.5	-0.6	-0.6	-0.5
	18.0	14.3	14.6	14.8	14.9	14.9	14.8	-0.4	-0.5	-0.6	-0.6	-0.6
	18.6	14.4	14.7	14.9	15.0	15.0	14.9	-0.4	-0.5	-0.6	-0.6	-0.6
	19.3	14.4	14.8	15.0	15.1	15.1	15.0	-0.4	-0.6	-0.6	-0.6	-0.6
	19.9	14.5	14.9	15.1	15.2	15.2	15.2	-0.4	-0.6	-0.7	-0.7	-0.6
	20.5	14.6	15.0	15.2	15.2	15.2	15.2	-0.4	-0.6	-0.7	-0.7	-0.7
	21.1	14.6	15.1	15.2	15.3	15.3	15.3	-0.4	-0.6	-0.7	-0.7	-0.7
	21.7	14.7	15.1	15.3	15.4	15.4	15.4	-0.4	-0.6	-0.7	-0.7	-0.7
	22.4	14.7	15.2	15.3	15.4	15.4	15.4	-0.5	-0.6	-0.7	-0.7	-0.7
	23.0	14.8	15.3	15.4	15.5	15.5	15.5	-0.5	-0.6	-0.7	-0.7	-0.7
Williams Fork	23.6	14.9	15.3	15.5	15.6	15.6	15.6	-0.5	-0.6	-0.8	-0.8	-0.7
	24.2	14.3	14.5	14.6	14.6	14.6	14.6	-0.2	-0.3	-0.3	-0.3	-0.3
	24.9	14.4	14.5	14.6	14.6	14.6	14.6	-0.2	-0.3	-0.3	-0.3	-0.3
	25.5	14.4	14.6	14.7	14.7	14.7	14.7	-0.2	-0.3	-0.3	-0.3	-0.3
	26.1	14.5	14.7	14.7	14.8	14.8	14.8	-0.2	-0.3	-0.3	-0.3	-0.3
	26.7	14.5	14.7	14.8	14.8	14.8	14.8	-0.2	-0.3	-0.3	-0.3	-0.3
	27.3	14.6	14.8	14.8	14.9	14.9	14.9	-0.2	-0.3	-0.3	-0.3	-0.3
	28.0	14.6	14.8	14.9	14.9	14.9	14.9	-0.2	-0.3	-0.3	-0.3	-0.3
	28.6	14.7	14.9	15.0	15.0	15.0	15.0	-0.2	-0.3	-0.3	-0.3	-0.3

	29.2	14.7	14.9	15.0	15.0	15.0	15.0	-0.2	-0.3	-0.3	-0.3	-0.3
	29.8	14.7	15.0	15.1	15.1	15.1	15.1	-0.2	-0.3	-0.3	-0.3	-0.3
	30.4	14.8	15.0	15.1	15.1	15.1	15.1	-0.2	-0.3	-0.4	-0.4	-0.3
	31.1	14.8	15.1	15.1	15.2	15.2	15.2	-0.2	-0.3	-0.4	-0.4	-0.4
Troublesome Creek	31.7	14.9	15.1	15.2	15.2	15.2	15.2	-0.2	-0.3	-0.4	-0.4	-0.4
	32.3	15.2	15.4	15.5	15.5	15.5	15.5	-0.3	-0.3	-0.4	-0.4	-0.4
	32.9	15.2	15.4	15.5	15.5	15.5	15.5	-0.3	-0.3	-0.4	-0.4	-0.4
	33.6	15.2	15.4	15.5	15.5	15.5	15.5	-0.3	-0.3	-0.4	-0.4	-0.4
	34.2	15.2	15.4	15.5	15.5	15.5	15.5	-0.2	-0.3	-0.4	-0.4	-0.4
	34.8	15.2	15.4	15.5	15.5	15.5	15.5	-0.2	-0.3	-0.4	-0.4	-0.4
	35.4	15.2	15.4	15.5	15.6	15.6	15.6	-0.2	-0.3	-0.4	-0.4	-0.4
	36.0	15.2	15.5	15.5	15.6	15.6	15.6	-0.2	-0.3	-0.4	-0.4	-0.4
	36.7	15.3	15.5	15.6	15.6	15.6	15.6	-0.2	-0.3	-0.4	-0.4	-0.3
	37.3	15.3	15.5	15.6	15.6	15.6	15.6	-0.2	-0.3	-0.4	-0.4	-0.3
	37.9	15.3	15.5	15.6	15.7	15.7	15.6	-0.2	-0.3	-0.3	-0.3	-0.3
	38.5	15.3	15.6	15.6	15.7	15.7	15.7	-0.2	-0.3	-0.3	-0.3	-0.3
	39.1	15.4	15.6	15.7	15.7	15.7	15.7	-0.2	-0.3	-0.3	-0.3	-0.3
Muddy Ck/Blue River	39.8	15.4	15.6	15.7	15.7	15.7	15.7	-0.2	-0.3	-0.3	-0.3	-0.3
	40.4	13.3	13.3	13.3	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0
	41.0	13.3	13.3	13.3	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0
	41.6	13.3	13.3	13.3	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0
	42.3	13.3	13.3	13.4	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0
	42.9	13.3	13.3	13.4	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0
	43.5	13.3	13.3	13.4	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0
top of Gore Canyon	44.2	13.3	13.3	13.4	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0

		River Specific Conductivity						**Change in conductivity**				
	River Mile	Existing Conditions Conducti-vity (umhos)	No Action Conducti-vity (umhos)	Proposed Action Conducti-vity (umhos)	Alt 3 Conducti-vity (umhos)	Alt 4 Conductiv-ity (umhos)	Alt 5 Conducti-vity (umhos)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	0.6	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	1.2	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	1.9	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0

	2.5	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	3.1	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
Willow Creek	3.7	68.6	68.3	68.0	68.1	68.1	68.0	0.3	0.6	0.5	0.5	0.6
	4.3	76.6	76.0	75.4	75.6	75.6	75.4	0.6	1.1	0.9	0.9	1.2
	5.0	104.9	101.8	98.5	99.3	99.3	98.6	3.0	6.4	5.6	5.6	6.3
	5.6	108.6	105.7	102.4	103.2	103.2	102.5	2.9	6.2	5.3	5.3	6.0
	6.2	111.8	109.1	105.9	106.7	106.7	106.0	2.8	5.9	5.1	5.1	5.8
	6.8	114.8	112.1	109.1	109.9	109.9	109.2	2.7	5.7	4.9	4.9	5.6
	7.5	117.4	114.8	111.9	112.7	112.7	112.0	2.6	5.5	4.7	4.7	5.4
Fraser River	8.1	119.7	117.2	114.5	115.2	115.2	114.5	2.5	5.3	4.5	4.5	5.2
	8.4	126.0	124.9	123.6	123.9	123.9	123.5	1.1	2.4	2.1	2.1	2.5
Windy Gap Reservoir	8.7	126.6	125.4	124.1	124.5	124.5	124.1	1.2	2.4	2.1	2.1	2.5
	8.9	126.9	125.7	124.4	124.8	124.8	124.4	1.2	2.5	2.1	2.1	2.5
	9.0	127.0	125.8	124.5	124.9	124.9	124.5	1.1	2.4	2.1	2.1	2.5
	9.2	127.0	125.9	124.6	124.9	124.9	124.5	1.1	2.4	2.1	2.1	2.5
	9.3	127.0	125.9	124.6	124.9	124.9	124.5	1.1	2.4	2.1	2.1	2.5
	9.6	127.1	125.9	124.7	125.0	125.0	124.6	1.1	2.4	2.0	2.0	2.4
	9.9	127.1	126.0	124.8	125.1	125.1	124.7	1.1	2.4	2.0	2.0	2.4
	10.6	127.3	126.2	125.0	125.3	125.3	124.9	1.1	2.3	2.0	2.0	2.3
	11.2	127.4	126.4	125.1	125.5	125.5	125.1	1.0	2.3	1.9	1.9	2.3
	11.8	127.6	126.6	125.3	125.7	125.7	125.3	1.0	2.2	1.8	1.8	2.2
	12.4	127.7	126.8	125.5	125.9	125.9	125.5	1.0	2.2	1.8	1.8	2.2
	13.0	127.9	126.9	125.7	126.1	126.1	125.7	0.9	2.2	1.7	1.7	2.1
	13.7	128.0	127.1	125.9	126.3	126.3	125.9	0.9	2.1	1.7	1.7	2.1
	14.3	128.1	127.3	126.1	126.5	126.5	126.1	0.9	2.1	1.6	1.6	2.0
	14.9	128.3	127.5	126.2	126.7	126.7	126.3	0.8	2.0	1.6	1.6	2.0
	15.5	128.4	127.6	126.4	126.9	126.9	126.5	0.8	2.0	1.5	1.5	1.9
	16.2	128.5	127.7	126.5	127.0	127.0	126.6	0.8	2.0	1.5	1.5	1.9
HSS WWTP	16.8	128.5	127.7	126.5	127.0	127.0	126.6	0.8	2.0	1.5	1.5	1.9
	17.4	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	18.0	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	18.6	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	19.3	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	19.9	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	20.5	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8

	21.1	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	21.7	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	22.4	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	23.0	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
Williams Fork	23.6	128.8	128.1	126.9	127.4	127.4	127.0	0.7	1.9	1.4	1.4	1.8
	24.2	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	24.9	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	25.5	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	26.1	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	26.7	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	27.3	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	28.0	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	28.6	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	29.2	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	29.8	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	30.4	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	31.1	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
Troublesome Creek	31.7	267.2	285.6	287.8	294.2	294.2	293.1	-18.4	-20.6	-27.0	-27.0	-25.9
	32.3	254.2	269.5	271.2	276.4	276.4	275.5	-15.3	-17.0	-22.2	-22.2	-21.3
	32.9	253.0	268.0	269.6	274.7	274.7	273.9	-14.9	-16.6	-21.7	-21.7	-20.8
	33.6	251.9	266.5	268.1	273.1	273.1	272.3	-14.6	-16.2	-21.2	-21.2	-20.3
	34.2	250.8	265.1	266.7	271.5	271.5	270.7	-14.3	-15.9	-20.7	-20.7	-19.9
	34.8	249.8	263.7	265.3	270.0	270.0	269.2	-14.0	-15.5	-20.2	-20.2	-19.4
	35.4	248.7	262.4	263.9	268.5	268.5	267.7	-13.6	-15.2	-19.8	-19.8	-19.0
	36.0	247.7	261.1	262.5	267.0	267.0	266.3	-13.4	-14.8	-19.3	-19.3	-18.6
	36.7	246.7	259.8	261.2	265.6	265.6	264.9	-13.1	-14.5	-18.9	-18.9	-18.2
	37.3	245.8	258.5	260.0	264.2	264.2	263.5	-12.8	-14.2	-18.5	-18.5	-17.8
	37.9	244.8	257.3	258.7	262.9	262.9	262.2	-12.5	-13.9	-18.1	-18.1	-17.4
	38.5	243.9	256.2	257.5	261.6	261.6	260.9	-12.3	-13.6	-17.7	-17.7	-17.0
	39.1	243.0	255.0	256.3	260.3	260.3	259.6	-12.0	-13.3	-17.3	-17.3	-16.7
Muddy Ck/Blue River	39.8	242.1	253.9	255.2	259.1	259.1	258.4	-11.8	-13.1	-17.0	-17.0	-16.3
	40.4	279.6	288.0	288.7	291.0	291.0	290.7	-8.3	-9.1	-11.4	-11.4	-11.0
	41.0	279.2	287.6	288.3	290.6	290.6	290.3	-8.3	-9.1	-11.4	-11.4	-11.0
	41.6	278.9	287.2	287.9	290.2	290.2	289.8	-8.3	-9.1	-11.3	-11.3	-11.0
	42.3	278.5	286.8	287.6	289.8	289.8	289.4	-8.3	-9.1	-11.3	-11.3	-11.0

	42.9	278.1	286.4	287.2	289.4	289.4	289.0	-8.2	-9.0	-11.3	-11.3	-10.9
	43.5	277.8	286.0	286.8	289.0	289.0	288.7	-8.2	-9.0	-11.2	-11.2	-10.9
top of Gore Canyon	44.2	277.4	285.5	286.4	288.6	288.6	288.2	-8.2	-9.0	-11.2	-11.2	-10.9

		River TDS						**Change in TDS concentration**				
	River Mile	Existing Conditions TDS (mg/L)	No Action TDS (mg/L)	Proposed Action TDS (mg/L)	Alt 3 TDS (mg/L)	Alt 4 TDS (mg/L)	Alt 5 TDS (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	0.6	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	1.2	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	1.9	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	2.5	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	3.1	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
Willow Creek	3.7	41.2	41.0	40.8	40.9	40.9	40.8	0.2	0.4	0.3	0.3	0.4
	4.3	45.9	45.6	45.3	45.4	45.4	45.2	0.3	0.7	0.6	0.6	0.7
	5.0	62.9	61.1	59.1	59.6	59.6	59.2	1.8	3.9	3.4	3.4	3.8
	5.6	65.1	63.4	61.5	61.9	61.9	61.5	1.7	3.7	3.2	3.2	3.6
	6.2	67.1	65.4	63.6	64.0	64.0	63.6	1.7	3.5	3.1	3.1	3.5
	6.8	68.9	67.3	65.5	65.9	65.9	65.5	1.6	3.4	2.9	2.9	3.4
	7.5	70.4	68.9	67.1	67.6	67.6	67.2	1.5	3.3	2.8	2.8	3.2
Fraser River	8.1	71.8	70.3	68.7	69.1	69.1	68.7	1.5	3.2	2.7	2.7	3.1
	8.4	75.6	74.9	74.1	74.3	74.3	74.1	0.7	1.5	1.3	1.3	1.5
Windy Gap Reservoir	8.7	76.0	75.3	74.5	74.7	74.7	74.5	0.7	1.5	1.3	1.3	1.5
	8.9	76.1	75.4	74.7	74.9	74.9	74.6	0.7	1.5	1.3	1.3	1.5
	9.0	76.2	75.5	74.7	74.9	74.9	74.7	0.7	1.5	1.2	1.2	1.5
	9.2	76.2	75.5	74.7	74.9	74.9	74.7	0.7	1.5	1.2	1.2	1.5
	9.3	76.2	75.5	74.7	74.9	74.9	74.7	0.7	1.5	1.2	1.2	1.5
	9.6	76.2	75.6	74.8	75.0	75.0	74.8	0.7	1.4	1.2	1.2	1.5
	9.9	76.3	75.6	74.9	75.1	75.1	74.8	0.7	1.4	1.2	1.2	1.4
	10.6	76.4	75.7	75.0	75.2	75.2	75.0	0.6	1.4	1.2	1.2	1.4
	11.2	76.5	75.8	75.1	75.3	75.3	75.1	0.6	1.4	1.1	1.1	1.4
	11.8	76.5	75.9	75.2	75.4	75.4	75.2	0.6	1.3	1.1	1.1	1.3
	12.4	76.6	76.1	75.3	75.6	75.6	75.3	0.6	1.3	1.1	1.1	1.3
	13.0	76.7	76.2	75.4	75.7	75.7	75.4	0.6	1.3	1.0	1.0	1.3

	13.7	76.8	76.3	75.5	75.8	75.8	75.6	0.5	1.3	1.0	1.0	1.2
	14.3	76.9	76.4	75.6	75.9	75.9	75.7	0.5	1.2	1.0	1.0	1.2
	14.9	77.0	76.5	75.7	76.0	76.0	75.8	0.5	1.2	0.9	0.9	1.2
	15.5	77.1	76.6	75.8	76.1	76.1	75.9	0.5	1.2	0.9	0.9	1.2
	16.2	77.1	76.6	75.9	76.2	76.2	76.0	0.5	1.2	0.9	0.9	1.1
HSS WWTP	16.8	77.1	76.6	75.9	76.2	76.2	76.0	0.5	1.2	0.9	0.9	1.1
	17.4	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	18.0	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	18.6	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	19.3	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	19.9	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	20.5	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	21.1	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	21.7	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	22.4	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	23.0	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
Williams Fork	23.6	77.3	76.8	76.1	76.4	76.4	76.2	0.4	1.1	0.8	0.8	1.1
	24.2	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	24.9	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	25.5	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	26.1	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	26.7	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	27.3	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	28.0	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	28.6	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	29.2	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	29.8	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	30.4	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	31.1	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
Troublesome Creek	31.7	160.3	171.4	172.7	176.5	176.5	175.9	-11.1	-12.4	-16.2	-16.2	-15.6
	32.3	152.5	161.7	162.7	165.9	165.9	165.3	-9.2	-10.2	-13.3	-13.3	-12.8
	32.9	151.8	160.8	161.8	164.8	164.8	164.3	-9.0	-10.0	-13.0	-13.0	-12.5
	33.6	151.2	159.9	160.9	163.9	163.9	163.4	-8.8	-9.7	-12.7	-12.7	-12.2
	34.2	150.5	159.1	160.0	162.9	162.9	162.4	-8.6	-9.5	-12.4	-12.4	-11.9
	34.8	149.9	158.2	159.2	162.0	162.0	161.5	-8.4	-9.3	-12.1	-12.1	-11.7

	35.4	149.2	157.4	158.3	161.1	161.1	160.6	-8.2	-9.1	-11.9	-11.9	-11.4
	36.0	148.6	156.6	157.5	160.2	160.2	159.8	-8.0	-8.9	-11.6	-11.6	-11.1
	36.7	148.0	155.9	156.7	159.4	159.4	158.9	-7.8	-8.7	-11.3	-11.3	-10.9
	37.3	147.5	155.1	156.0	158.5	158.5	158.1	-7.7	-8.5	-11.1	-11.1	-10.7
	37.9	146.9	154.4	155.2	157.7	157.7	157.3	-7.5	-8.3	-10.9	-10.9	-10.4
	38.5	146.3	153.7	154.5	157.0	157.0	156.5	-7.4	-8.2	-10.6	-10.6	-10.2
	39.1	145.8	153.0	153.8	156.2	156.2	155.8	-7.2	-8.0	-10.4	-10.4	-10.0
Muddy Ck/Blue River	39.8	145.3	152.3	153.1	155.5	155.5	155.1	-7.1	-7.8	-10.2	-10.2	-9.8
	40.4	167.8	172.8	173.2	174.6	174.6	174.4	-5.0	-5.5	-6.8	-6.8	-6.6
	41.0	167.5	172.5	173.0	174.4	174.4	174.2	-5.0	-5.5	-6.8	-6.8	-6.6
	41.6	167.3	172.3	172.8	174.1	174.1	173.9	-5.0	-5.4	-6.8	-6.8	-6.6
	42.3	167.1	172.1	172.5	173.9	173.9	173.7	-5.0	-5.4	-6.8	-6.8	-6.6
	42.9	166.9	171.8	172.3	173.6	173.6	173.4	-4.9	-5.4	-6.8	-6.8	-6.6
	43.5	166.7	171.6	172.1	173.4	173.4	173.2	-4.9	-5.4	-6.7	-6.7	-6.5
top of Gore Canyon	44.2	166.4	171.3	171.8	173.1	173.1	172.9	-4.9	-5.4	-6.7	-6.7	-6.5

		River Dissolved Oxygen						**Change in DO concentration**				
		Existing Conditions	No Action	Proposed Action	Alt 3	Alt 4	Alt 5	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
	River Mile	DO (mg/L)	DO (mg/L)	DO (mg/L)	DO (mg/L)	DO (mg/L)	DO (mg/L)					
Lake Granby outlet	0.0	8.8	8.8	8.8	8.8	8.8	8.8	0.0	0.0	0.0	0.0	0.0
	0.6	8.7	8.7	8.7	8.7	8.7	8.7	0.0	0.0	0.0	0.0	0.0
	1.2	8.7	8.7	8.7	8.7	8.7	8.7	0.0	0.0	0.0	0.0	0.0
	1.9	8.7	8.6	8.6	8.6	8.6	8.6	0.0	0.0	0.0	0.0	0.0
	2.5	8.6	8.6	8.6	8.6	8.6	8.6	0.0	0.0	0.0	0.0	0.0
	3.1	8.6	8.5	8.5	8.5	8.5	8.5	0.0	0.0	0.0	0.0	0.0
Willow Creek	3.7	8.4	8.4	8.4	8.4	8.4	8.4	0.0	0.0	0.0	0.0	0.0
	4.3	8.3	8.3	8.3	8.3	8.3	8.3	0.0	0.0	0.0	0.0	0.0
	5.0	8.3	8.3	8.3	8.3	8.3	8.3	0.0	0.0	0.0	0.0	0.0
	5.6	8.2	8.2	8.2	8.2	8.2	8.2	0.0	0.0	0.0	0.0	0.0
	6.2	8.1	8.1	8.1	8.1	8.1	8.1	0.0	0.0	0.0	0.0	0.0
	6.8	8.0	8.0	8.0	8.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0
	7.5	8.0	8.0	8.0	8.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0
Fraser River	8.1	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0
	8.4	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0

Windy Gap Reservoir	8.7	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0
	8.9	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0
	9.0	7.7	7.7	7.6	7.7	7.7	7.7	0.0	0.0	0.0	0.0	0.0
	9.2	7.6	7.5	7.5	7.5	7.5	7.5	0.0	0.0	0.0	0.0	0.0
	9.3	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.0	0.0	0.0	0.0
	9.6	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.0
	9.9	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.0
	10.6	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.0
	11.2	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	11.8	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	12.4	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	13.0	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	13.7	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	14.3	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	14.9	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	15.5	7.5	7.5	7.5	7.5	7.5	7.5	0.0	0.1	0.1	0.1	0.1
	16.2	7.5	7.5	7.4	7.4	7.4	7.4	0.0	0.1	0.1	0.1	0.1
HSS WWTP	16.8	7.5	7.5	7.4	7.4	7.4	7.4	0.0	0.1	0.1	0.1	0.1
	17.4	7.5	7.5	7.4	7.4	7.4	7.4	0.0	0.1	0.1	0.1	0.1
	18.0	7.5	7.5	7.4	7.4	7.4	7.4	0.0	0.1	0.1	0.1	0.1
	18.6	7.5	7.5	7.4	7.4	7.4	7.4	0.0	0.1	0.1	0.1	0.1
	19.3	7.5	7.5	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
	19.9	7.5	7.4	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
	20.5	7.5	7.4	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
	21.1	7.5	7.4	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
	21.7	7.5	7.4	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
	22.4	7.5	7.4	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
	23.0	7.5	7.4	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
Williams Fork	23.6	7.5	7.4	7.4	7.4	7.4	7.4	0.1	0.1	0.1	0.1	0.1
	24.2	7.3	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	24.9	7.3	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	25.5	7.3	7.3	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	26.1	7.3	7.3	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	26.7	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
	27.3	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1

	28.0	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
	28.6	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
	29.2	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
	29.8	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
	30.4	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
	31.1	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
Troublesome Creek	31.7	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.1	0.1	0.1	0.1
	32.3	7.4	7.4	7.4	7.4	7.4	7.4	0.0	0.0	0.0	0.0	0.0
	32.9	7.4	7.4	7.4	7.3	7.3	7.3	0.0	0.0	0.0	0.0	0.0
	33.6	7.4	7.4	7.3	7.3	7.3	7.3	0.0	0.0	0.0	0.0	0.0
	34.2	7.4	7.4	7.3	7.3	7.3	7.3	0.0	0.0	0.0	0.0	0.0
	34.8	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.0	0.0	0.0
	35.4	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.0	0.0	0.0
	36.0	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.1	0.1	0.0
	36.7	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.1	0.1	0.0
	37.3	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.1	0.1	0.0
	37.9	7.4	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.1	0.1	0.0
	38.5	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.1	0.1	0.0
	39.1	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.1	0.1	0.0
Muddy Ck/Blue River	39.8	7.3	7.3	7.3	7.3	7.3	7.3	0.0	0.0	0.1	0.1	0.0
	40.4	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
	41.0	7.6	7.6	7.5	7.5	7.5	7.5	0.0	0.0	0.0	0.0	0.0
	41.6	7.6	7.5	7.5	7.5	7.5	7.5	0.0	0.0	0.0	0.0	0.0
	42.3	7.6	7.6	7.5	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
	42.9	7.6	7.5	7.5	7.5	7.5	7.5	0.0	0.0	0.0	0.0	0.0
	43.5	7.6	7.5	7.5	7.5	7.5	7.5	0.0	0.0	0.0	0.0	0.0
top of Gore Canyon	44.2	7.6	7.5	7.5	7.5	7.5	7.5	0.0	0.0	0.0	0.0	0.0

		River Ammonia						**Change in ammonia concentration**				
	River Mile	Existing Conditions Ammon-ium (µg/L)	No Action Ammon-ium (µg/L)	Proposed Action Ammon-ium (µg/L)	Alt 3 Ammon-ium (µg/L)	Alt 4 Ammon-ium (µg/L)	Alt 5 Ammon-ium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	10.5	10.8	11.0	10.4	10.4	10.0	-0.3	-0.5	0.2	0.2	0.5
	0.6	10.7	10.9	11.2	10.5	10.5	10.2	-0.3	-0.5	0.2	0.2	0.5
	1.2	10.9	11.2	11.4	10.8	10.8	10.4	-0.3	-0.5	0.2	0.2	0.5

	1.9	11.1	11.4	11.6	10.9	10.9	10.6	-0.3	-0.5	0.2	0.2	0.5
	2.5	11.3	11.5	11.8	11.1	11.1	10.8	-0.3	-0.5	0.2	0.2	0.5
	3.1	11.4	11.7	11.9	11.2	11.2	10.9	-0.3	-0.5	0.2	0.2	0.5
Willow Creek	3.7	11.2	11.5	11.7	11.1	11.1	10.8	-0.3	-0.5	0.1	0.1	0.4
	4.3	10.8	11.1	11.3	10.7	10.7	10.5	-0.3	-0.5	0.1	0.1	0.3
	5.0	12.5	12.5	12.5	12.0	12.0	11.8	0.0	0.0	0.4	0.4	0.7
	5.6	12.1	12.1	12.1	11.7	11.7	11.5	0.0	-0.1	0.4	0.4	0.6
	6.2	11.9	12.0	12.0	11.6	11.6	11.4	-0.1	-0.1	0.3	0.3	0.6
	6.8	11.7	11.8	11.9	11.4	11.4	11.2	-0.1	-0.1	0.3	0.3	0.5
	7.5	11.5	11.6	11.6	11.2	11.2	11.0	-0.1	-0.1	0.3	0.3	0.4
Fraser River	8.1	11.3	11.4	11.4	11.0	11.0	10.9	-0.1	-0.2	0.2	0.2	0.4
	8.4	18.8	19.3	19.8	19.4	19.4	19.4	-0.5	-1.0	-0.7	-0.7	-0.6
Windy Gap Reservoir	8.7	18.6	19.2	19.6	19.3	19.3	19.2	-0.5	-1.0	-0.7	-0.7	-0.6
	8.9	18.5	19.1	19.5	19.2	19.2	19.1	-0.5	-1.0	-0.7	-0.7	-0.6
	9.0	20.2	21.0	21.4	21.1	21.1	21.0	-0.8	-1.2	-0.9	-0.9	-0.8
	9.2	21.2	21.9	22.3	22.0	22.0	21.9	-0.8	-1.2	-0.9	-0.9	-0.8
	9.3	21.4	22.1	22.5	22.2	22.2	22.1	-0.8	-1.1	-0.9	-0.9	-0.8
	9.6	21.4	22.1	22.5	22.2	22.2	22.1	-0.8	-1.1	-0.8	-0.8	-0.8
	9.9	21.4	22.1	22.5	22.2	22.2	22.1	-0.7	-1.1	-0.8	-0.8	-0.7
	10.6	21.4	22.1	22.4	22.2	22.2	22.1	-0.7	-1.1	-0.8	-0.8	-0.7
	11.2	21.4	22.1	22.4	22.1	22.1	22.0	-0.7	-1.1	-0.8	-0.8	-0.7
	11.8	21.4	22.0	22.4	22.1	22.1	22.0	-0.7	-1.0	-0.7	-0.7	-0.6
	12.4	21.4	22.0	22.4	22.0	22.0	22.0	-0.7	-1.0	-0.7	-0.7	-0.6
	13.0	21.3	22.0	22.3	22.0	22.0	21.9	-0.6	-1.0	-0.7	-0.7	-0.6
	13.7	21.4	22.0	22.3	22.0	22.0	21.9	-0.6	-1.0	-0.6	-0.6	-0.5
	14.3	21.4	22.0	22.3	22.0	22.0	21.9	-0.6	-0.9	-0.6	-0.6	-0.5
	14.9	21.4	21.9	22.3	21.9	21.9	21.8	-0.6	-0.9	-0.6	-0.6	-0.5
	15.5	21.4	21.9	22.2	21.9	21.9	21.8	-0.6	-0.9	-0.5	-0.5	-0.5
	16.2	21.4	21.9	22.3	21.9	21.9	21.8	-0.6	-0.9	-0.5	-0.5	-0.4
HSS WWTP	16.8	21.4	22.0	22.3	22.0	22.0	21.9	-0.5	-0.9	-0.5	-0.5	-0.4
	17.4	24.6	25.8	26.3	26.2	26.2	26.1	-1.3	-1.7	-1.6	-1.6	-1.5
	18.0	24.6	25.9	26.3	26.2	26.2	26.1	-1.2	-1.7	-1.6	-1.6	-1.5
	18.6	24.7	25.9	26.3	26.3	26.3	26.1	-1.2	-1.7	-1.6	-1.6	-1.5
	19.3	24.7	26.0	26.4	26.3	26.3	26.2	-1.2	-1.6	-1.6	-1.6	-1.4
	19.9	24.8	26.0	26.4	26.3	26.3	26.2	-1.2	-1.6	-1.6	-1.6	-1.4

	20.5	24.8	26.0	26.4	26.3	26.3	26.2	-1.2	-1.6	-1.5	-1.5	-1.4
	21.1	24.8	26.0	26.4	26.3	26.3	26.2	-1.2	-1.6	-1.5	-1.5	-1.4
	21.7	24.9	26.1	26.5	26.4	26.4	26.2	-1.2	-1.6	-1.5	-1.5	-1.4
	22.4	24.9	26.1	26.5	26.4	26.4	26.3	-1.2	-1.6	-1.5	-1.5	-1.4
	23.0	24.9	26.1	26.5	26.4	26.4	26.3	-1.2	-1.6	-1.5	-1.5	-1.4
Williams Fork	23.6	25.0	26.1	26.5	26.4	26.4	26.3	-1.2	-1.6	-1.5	-1.5	-1.3
	24.2	23.1	23.5	23.7	23.5	23.5	23.4	-0.4	-0.5	-0.4	-0.4	-0.3
	24.9	23.3	23.7	23.9	23.7	23.7	23.7	-0.4	-0.6	-0.4	-0.4	-0.4
	25.5	23.5	24.0	24.1	24.0	24.0	23.9	-0.4	-0.6	-0.5	-0.5	-0.4
	26.1	23.7	24.2	24.4	24.2	24.2	24.2	-0.5	-0.6	-0.5	-0.5	-0.5
	26.7	23.8	24.3	24.5	24.4	24.4	24.3	-0.5	-0.7	-0.5	-0.5	-0.5
	27.3	24.0	24.5	24.7	24.6	24.6	24.5	-0.5	-0.7	-0.6	-0.6	-0.5
	28.0	24.1	24.7	24.8	24.7	24.7	24.7	-0.5	-0.7	-0.6	-0.6	-0.5
	28.6	24.4	25.0	25.1	25.0	25.0	25.0	-0.6	-0.7	-0.6	-0.6	-0.6
	29.2	24.6	25.1	25.3	25.2	25.2	25.2	-0.6	-0.8	-0.7	-0.7	-0.6
	29.8	24.8	25.4	25.6	25.5	25.5	25.5	-0.6	-0.8	-0.7	-0.7	-0.7
	30.4	25.0	25.6	25.8	25.7	25.7	25.7	-0.6	-0.8	-0.8	-0.8	-0.7
	31.1	25.1	25.7	25.9	25.9	25.9	25.8	-0.7	-0.9	-0.8	-0.8	-0.7
Troublesome Creek	31.7	25.3	26.0	26.2	26.1	26.1	26.1	-0.7	-0.9	-0.8	-0.8	-0.8
	32.3	24.1	24.6	24.7	24.6	24.6	24.6	-0.5	-0.6	-0.5	-0.5	-0.5
	32.9	24.0	24.5	24.7	24.6	24.6	24.5	-0.5	-0.6	-0.5	-0.5	-0.5
	33.6	24.1	24.5	24.7	24.6	24.6	24.5	-0.5	-0.6	-0.5	-0.5	-0.5
	34.2	24.0	24.5	24.6	24.5	24.5	24.5	-0.5	-0.6	-0.5	-0.5	-0.5
	34.8	24.0	24.4	24.6	24.5	24.5	24.4	-0.4	-0.6	-0.5	-0.5	-0.4
	35.4	24.0	24.5	24.6	24.5	24.5	24.5	-0.4	-0.6	-0.5	-0.5	-0.4
	36.0	24.1	24.5	24.7	24.6	24.6	24.5	-0.4	-0.6	-0.5	-0.5	-0.5
	36.7	24.1	24.6	24.7	24.6	24.6	24.6	-0.4	-0.6	-0.5	-0.5	-0.5
	37.3	24.2	24.6	24.8	24.7	24.7	24.6	-0.4	-0.6	-0.5	-0.5	-0.5
	37.9	24.2	24.6	24.8	24.7	24.7	24.6	-0.4	-0.6	-0.5	-0.5	-0.4
	38.5	24.4	24.8	25.0	24.9	24.9	24.9	-0.5	-0.6	-0.5	-0.5	-0.5
	39.1	24.6	25.1	25.2	25.2	25.2	25.1	-0.5	-0.6	-0.5	-0.5	-0.5
Muddy Ck/Blue River	39.8	24.8	25.3	25.4	25.4	25.4	25.3	-0.5	-0.6	-0.6	-0.6	-0.5
	40.4	27.6	28.0	28.1	28.1	28.1	28.1	-0.4	-0.5	-0.5	-0.5	-0.5
	41.0	28.1	28.5	28.6	28.6	28.6	28.6	-0.4	-0.5	-0.5	-0.5	-0.5
	41.6	28.3	28.8	28.9	28.9	28.9	28.8	-0.4	-0.5	-0.6	-0.6	-0.5

	42.3	28.4	28.8	28.9	28.9	28.9	28.9	-0.4	-0.6	-0.6	-0.6	-0.5
	42.9	28.6	29.1	29.2	29.2	29.2	29.2	-0.5	-0.6	-0.6	-0.6	-0.6
	43.5	28.9	29.3	29.4	29.5	29.5	29.4	-0.5	-0.6	-0.6	-0.6	-0.6
top of Gore Canyon	44.2	29.1	29.5	29.7	29.7	29.7	29.7	-0.5	-0.6	-0.6	-0.6	-0.6

		River Inorganic Phosphorus						**Change in inorganic P concentration**				
	River Mile	Existing Conditions Inorganic P (µg/L)	No Action Inorganic P (µg/L)	Proposed Action Inorganic P (µg/L)	Alt 3 Inorganic P (µg/L)	Alt 4 Inorganic P (µg/L)	Alt 5 Inorganic P (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.7	0.7	0.9
	0.6	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.7	0.7	0.9
	1.2	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.7	0.7	0.9
	1.9	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.6	0.6	0.9
	2.5	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.6	0.6	0.9
	3.1	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.6	0.6	0.9
Willow Creek	3.7	6.5	7.1	7.9	5.9	5.9	5.7	-0.6	-1.4	0.6	0.6	0.8
	4.3	6.4	6.9	7.7	5.8	5.8	5.6	-0.5	-1.3	0.5	0.5	0.8
	5.0	9.5	9.6	9.9	8.4	8.4	8.2	-0.1	-0.3	1.1	1.1	1.4
	5.6	9.3	9.3	9.6	8.2	8.2	8.0	-0.1	-0.3	1.0	1.0	1.3
	6.2	9.0	9.1	9.4	8.1	8.1	7.8	-0.1	-0.3	1.0	1.0	1.2
	6.8	8.8	8.9	9.1	7.9	7.9	7.7	-0.1	-0.3	0.9	0.9	1.1
	7.5	8.6	8.7	8.9	7.7	7.7	7.6	-0.1	-0.3	0.9	0.9	1.1
Fraser River	8.1	8.4	8.5	8.7	7.6	7.6	7.4	-0.1	-0.3	0.8	0.8	1.0
	8.4	13.4	13.7	14.1	13.4	13.4	13.3	-0.4	-0.8	0.0	0.0	0.0
Windy Gap Reservoir	8.7	13.3	13.6	14.0	13.3	13.3	13.2	-0.4	-0.8	-0.1	-0.1	0.0
	8.9	13.2	13.6	14.0	13.3	13.3	13.2	-0.4	-0.8	-0.1	-0.1	0.0
	9.0	13.7	14.3	14.7	14.1	14.1	14.0	-0.6	-1.0	-0.4	-0.4	-0.3
	9.2	14.0	14.6	15.1	14.5	14.5	14.4	-0.6	-1.1	-0.5	-0.5	-0.4
	9.3	14.1	14.7	15.2	14.6	14.6	14.5	-0.6	-1.1	-0.5	-0.5	-0.4
	9.6	14.1	14.7	15.2	14.5	14.5	14.4	-0.6	-1.1	-0.5	-0.5	-0.4
	9.9	14.1	14.7	15.2	14.5	14.5	14.4	-0.6	-1.1	-0.5	-0.5	-0.4
	10.6	14.1	14.7	15.2	14.5	14.5	14.4	-0.6	-1.1	-0.5	-0.5	-0.4
	11.2	14.1	14.7	15.2	14.5	14.5	14.4	-0.6	-1.1	-0.4	-0.4	-0.4
	11.8	14.0	14.6	15.1	14.5	14.5	14.4	-0.6	-1.1	-0.4	-0.4	-0.3
	12.4	14.0	14.6	15.1	14.4	14.4	14.3	-0.6	-1.1	-0.4	-0.4	-0.3

	13.0	14.0	14.6	15.1	14.4	14.4	14.3	-0.6	-1.1	-0.4	-0.4	-0.3
	13.7	14.0	14.6	15.1	14.4	14.4	14.3	-0.6	-1.1	-0.4	-0.4	-0.3
	14.3	14.0	14.5	15.0	14.4	14.4	14.3	-0.6	-1.1	-0.4	-0.4	-0.3
	14.9	14.0	14.5	15.0	14.4	14.4	14.3	-0.6	-1.1	-0.4	-0.4	-0.3
	15.5	13.9	14.5	15.0	14.3	14.3	14.2	-0.6	-1.0	-0.4	-0.4	-0.3
	16.2	13.9	14.5	15.0	14.3	14.3	14.2	-0.6	-1.0	-0.4	-0.4	-0.3
HSS WWTP	16.8	14.0	14.5	15.0	14.4	14.4	14.3	-0.6	-1.0	-0.4	-0.4	-0.3
	17.4	15.3	16.2	16.7	16.2	16.2	16.1	-0.9	-1.4	-0.9	-0.9	-0.8
	18.0	15.3	16.2	16.8	16.2	16.2	16.1	-0.9	-1.4	-0.9	-0.9	-0.8
	18.6	15.4	16.2	16.8	16.3	16.3	16.2	-0.9	-1.4	-0.9	-0.9	-0.8
	19.3	15.4	16.3	16.8	16.3	16.3	16.2	-0.9	-1.4	-0.9	-0.9	-0.8
	19.9	15.4	16.3	16.8	16.3	16.3	16.2	-0.9	-1.4	-0.9	-0.9	-0.8
	20.5	15.4	16.3	16.9	16.3	16.3	16.2	-0.9	-1.4	-0.9	-0.9	-0.8
	21.1	15.4	16.3	16.9	16.3	16.3	16.2	-0.9	-1.4	-0.9	-0.9	-0.8
	21.7	15.5	16.3	16.9	16.4	16.4	16.3	-0.9	-1.5	-0.9	-0.9	-0.8
	22.4	15.5	16.4	16.9	16.4	16.4	16.3	-0.9	-1.5	-0.9	-0.9	-0.8
	23.0	15.5	16.4	17.0	16.4	16.4	16.3	-0.9	-1.5	-0.9	-0.9	-0.8
Williams Fork	23.6	15.5	16.4	17.0	16.4	16.4	16.3	-0.9	-1.5	-0.9	-0.9	-0.8
	24.2	13.3	13.5	13.7	13.3	13.3	13.3	-0.2	-0.4	0.0	0.0	0.0
	24.9	13.3	13.5	13.8	13.3	13.3	13.3	-0.2	-0.4	0.0	0.0	0.0
	25.5	13.3	13.5	13.8	13.4	13.4	13.3	-0.2	-0.4	0.0	0.0	0.0
	26.1	13.4	13.5	13.8	13.4	13.4	13.4	-0.2	-0.4	0.0	0.0	0.0
	26.7	13.4	13.6	13.8	13.4	13.4	13.4	-0.2	-0.4	0.0	0.0	0.0
	27.3	13.4	13.6	13.8	13.4	13.4	13.4	-0.2	-0.4	0.0	0.0	0.0
	28.0	13.4	13.6	13.9	13.5	13.5	13.4	-0.2	-0.4	0.0	0.0	0.0
	28.6	13.4	13.6	13.9	13.5	13.5	13.4	-0.2	-0.4	0.0	0.0	0.0
	29.2	13.5	13.7	13.9	13.5	13.5	13.5	-0.2	-0.5	0.0	0.0	0.0
	29.8	13.5	13.7	13.9	13.5	13.5	13.5	-0.2	-0.5	-0.1	-0.1	0.0
	30.4	13.5	13.7	14.0	13.6	13.6	13.5	-0.2	-0.5	-0.1	-0.1	0.0
	31.1	13.5	13.7	14.0	13.6	13.6	13.5	-0.2	-0.5	-0.1	-0.1	0.0
Troublesome Creek	31.7	13.5	13.7	14.0	13.6	13.6	13.6	-0.2	-0.5	-0.1	-0.1	0.0
	32.3	13.1	13.2	13.4	13.0	13.0	13.0	-0.1	-0.4	0.0	0.0	0.1
	32.9	13.0	13.1	13.3	12.9	12.9	12.9	-0.1	-0.3	0.0	0.0	0.1
	33.6	12.9	13.0	13.2	12.9	12.9	12.8	-0.1	-0.3	0.1	0.1	0.1
	34.2	12.8	12.9	13.1	12.8	12.8	12.7	-0.1	-0.3	0.1	0.1	0.1

	34.8	12.8	12.8	13.1	12.7	12.7	12.6	-0.1	-0.3	0.1	0.1	0.1
	35.4	12.7	12.8	13.0	12.6	12.6	12.6	-0.1	-0.3	0.1	0.1	0.1
	36.0	12.6	12.7	12.9	12.5	12.5	12.5	-0.1	-0.3	0.1	0.1	0.1
	36.7	12.6	12.6	12.8	12.5	12.5	12.4	-0.1	-0.3	0.1	0.1	0.1
	37.3	12.5	12.6	12.8	12.4	12.4	12.4	0.0	-0.3	0.1	0.1	0.2
	37.9	12.5	12.5	12.7	12.3	12.3	12.3	0.0	-0.2	0.1	0.1	0.2
	38.5	12.4	12.5	12.7	12.3	12.3	12.3	0.0	-0.2	0.1	0.1	0.2
	39.1	12.4	12.4	12.6	12.3	12.3	12.2	0.0	-0.2	0.1	0.1	0.2
Muddy Ck/Blue River	39.8	12.4	12.4	12.6	12.2	12.2	12.2	0.0	-0.2	0.2	0.2	0.2
	40.4	11.2	11.1	11.2	11.0	11.0	11.0	0.1	0.0	0.2	0.2	0.2
	41.0	11.2	11.2	11.3	11.1	11.1	11.1	0.1	0.0	0.2	0.2	0.2
	41.6	11.2	11.2	11.3	11.1	11.1	11.1	0.0	0.0	0.2	0.2	0.2
	42.3	11.2	11.2	11.3	11.1	11.1	11.1	0.0	0.0	0.2	0.2	0.2
	42.9	11.3	11.2	11.3	11.1	11.1	11.1	0.0	0.0	0.1	0.1	0.2
	43.5	11.3	11.2	11.3	11.1	11.1	11.1	0.0	0.0	0.1	0.1	0.2
top of Gore Canyon	44.2	11.3	11.2	11.3	11.1	11.1	11.1	0.0	0.0	0.1	0.1	0.2

		River Selenium						**Change in selenium concentration**				
	River Mile	Existing Conditions Selenium (µg/L)	No Action Selenium (µg/L)	Proposed Action Selenium (µg/L)	Alt 3 Selenium (µg/L)	Alt 4 Selenium (µg/L)	Alt 5 Selenium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	0.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	1.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	1.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	2.5	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	3.1	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Willow Creek	3.7	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	4.3	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	5.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	5.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	6.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	6.8	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	7.5	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Fraser River	8.1	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00

	8.4	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Windy Gap Reservoir	8.7	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	8.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	9.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	9.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	9.3	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	9.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	9.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	10.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	11.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	11.8	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	12.4	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	13.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	13.7	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	14.3	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	14.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	15.5	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	16.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
HSS WWTP	16.8	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	17.4	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	18.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	18.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	19.3	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	19.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	20.5	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	21.1	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	21.7	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	22.4	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	23.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Williams Fork	23.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	24.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	24.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	25.5	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	26.1	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	26.7	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00

	27.3	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	28.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	28.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	29.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	29.8	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	30.4	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	31.1	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Troublesome Creek	31.7	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	32.3	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	32.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	33.6	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	34.2	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	34.8	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	35.4	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	36.0	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	36.7	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	37.3	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	37.9	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	38.5	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	39.1	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Muddy Ck/Blue River	39.8	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
	40.4	0.67	0.69	0.69	0.69	0.69	0.69	-0.01	-0.01	-0.02	-0.02	-0.01
	41.0	0.67	0.69	0.69	0.69	0.69	0.69	-0.01	-0.01	-0.02	-0.02	-0.01
	41.6	0.67	0.69	0.69	0.69	0.69	0.69	-0.01	-0.01	-0.02	-0.02	-0.01
	42.3	0.67	0.68	0.69	0.69	0.69	0.69	-0.01	-0.01	-0.02	-0.02	-0.01
	42.9	0.67	0.68	0.69	0.69	0.69	0.69	-0.01	-0.01	-0.02	-0.02	-0.01
	43.5	0.67	0.68	0.68	0.69	0.69	0.69	-0.01	-0.01	-0.02	-0.02	-0.01
top of Gore Canyon	44.2	0.67	0.68	0.68	0.69	0.69	0.69	-0.01	-0.01	-0.02	-0.02	-0.01

Direct Effects – Minimum Instream Flow Run (July 25)

NOTE: Negative values are increases under alternatives

		River Discharge						**Change in discharge**				
	River Mile	Existing Conditions Q (cfs)	No Action Q (cfs)	Proposed Action Q (cfs)	Alt 3 Q (cfs)	Alt 4 Q (cfs)	Alt 5 Q (cfs)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	0.6	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	1.2	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	1.9	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	2.5	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
	3.1	138	128	122	124	124	124	9.2	15.6	14.1	14.1	13.4
Willow Creek	3.7	149	138	131	133	133	133	10.3	17.7	15.9	15.9	15.4
	4.3	162	150	142	144	144	144	11.8	20.2	18.1	18.1	17.8
	5.0	203	185	170	174	174	174	18.5	32.7	29.2	29.2	29.6
	5.6	216	196	181	185	185	184	19.9	35.2	31.4	31.4	32.0
	6.2	230	208	192	196	196	195	21.3	37.7	33.6	33.6	34.3
	6.8	243	220	203	207	207	206	22.7	40.2	35.8	35.8	36.7
	7.5	256	232	214	218	218	217	24.1	42.8	38.0	38.0	39.1
Fraser River	8.1	270	244	224	229	229	228	25.5	45.3	40.2	40.2	41.5
	8.4	436	410	389	395	395	393	26.2	46.8	41.6	41.6	42.9
Windy Gap Reservoir	8.7	443	416	395	400	400	399	26.9	48.0	42.7	42.7	44.1
	8.9	407	90	90	90	90	90	317.3	317.3	317.3	317.3	317.3
	9.0	408	90	90	90	90	90	317.3	317.3	317.3	317.3	317.3
	9.2	408	91	91	91	91	91	317.3	317.4	317.4	317.4	317.4
	9.3	409	91	91	91	91	91	317.4	317.4	317.4	317.4	317.4
	9.6	409	92	92	92	92	92	317.4	317.4	317.4	317.4	317.4
	9.9	410	93	93	93	93	93	317.4	317.5	317.4	317.4	317.4
	10.6	412	94	94	94	94	94	317.4	317.5	317.5	317.5	317.5
	11.2	413	96	96	96	96	96	317.5	317.6	317.6	317.6	317.6
	11.8	415	97	97	97	97	97	317.5	317.7	317.6	317.6	317.6
	12.4	416	99	99	99	99	99	317.6	317.7	317.7	317.7	317.7
	13.0	418	100	100	100	100	100	317.6	317.8	317.8	317.8	317.8
	13.7	420	102	102	102	102	102	317.6	317.9	317.8	317.8	317.8
	14.3	421	104	103	103	103	103	317.7	317.9	317.9	317.9	317.9

	14.9	423	105	105	105	105	105	317.7	318.0	317.9	317.9	318.0
	15.5	424	107	106	106	106	106	317.8	318.1	318.0	318.0	318.0
	16.2	425	107	107	107	107	107	317.8	318.1	318.0	318.0	318.1
HSS WWTP	16.8	421	103	103	103	103	103	317.8	318.1	318.0	318.0	318.1
	17.4	420	102	102	102	102	102	317.8	318.1	318.0	318.0	318.1
	18.0	419	101	101	101	101	101	317.8	318.1	318.0	318.0	318.1
	18.6	418	100	100	100	100	100	317.8	318.1	318.0	318.0	318.1
	19.3	417	99	99	99	99	99	317.8	318.1	318.0	318.0	318.1
	19.9	416	99	98	98	98	98	317.8	318.1	318.0	318.0	318.1
	20.5	415	98	97	97	97	97	317.8	318.1	318.0	318.0	318.1
	21.1	415	97	96	96	96	96	317.8	318.1	318.0	318.0	318.1
	21.7	414	96	95	96	96	96	317.8	318.1	318.0	318.0	318.1
	22.4	413	95	95	95	95	95	317.8	318.1	318.0	318.0	318.1
	23.0	412	94	94	94	94	94	317.8	318.1	318.0	318.0	318.1
Williams Fork	23.6	411	93	93	93	93	93	317.8	318.1	318.0	318.0	318.1
	24.2	691	375	374	374	374	374	315.8	316.4	316.3	316.3	316.4
	24.9	690	374	374	374	374	374	316.0	316.7	316.6	316.6	316.6
	25.5	690	374	373	373	373	373	316.2	317.0	316.8	316.8	316.9
	26.1	690	373	373	373	373	373	316.3	317.3	317.1	317.1	317.1
	26.7	690	373	372	372	372	372	316.5	317.6	317.3	317.3	317.4
	27.3	689	373	371	372	372	372	316.7	317.8	317.6	317.6	317.7
	28.0	689	372	371	371	371	371	316.8	318.1	317.8	317.8	317.9
	28.6	689	372	370	371	371	371	317.0	318.4	318.1	318.1	318.2
	29.2	688	371	370	370	370	370	317.2	318.7	318.3	318.3	318.4
	29.8	688	371	369	370	370	369	317.3	319.0	318.6	318.6	318.7
	30.4	688	370	369	369	369	369	317.5	319.2	318.8	318.8	318.9
	31.1	688	370	368	369	369	368	317.7	319.5	319.1	319.1	319.2
Troublesome Creek	31.7	687	370	368	368	368	368	317.8	319.8	319.3	319.3	319.5
	32.3	743	425	423	424	424	423	317.9	320.0	319.5	319.5	319.6
	32.9	753	435	433	433	433	433	317.9	320.1	319.6	319.6	319.7
	33.6	762	445	442	443	443	443	318.0	320.2	319.6	319.6	319.8
	34.2	772	454	452	452	452	452	318.0	320.3	319.7	319.7	319.9
	34.8	782	464	462	462	462	462	318.0	320.3	319.8	319.8	319.9
	35.4	792	474	471	472	472	472	318.0	320.4	319.9	319.9	320.0
	36.0	801	483	481	481	481	481	318.0	320.5	319.9	319.9	320.1

	36.7	811	493	490	491	491	491	318.0	320.6	320.0	320.0	320.2
	37.3	821	503	500	501	501	501	318.0	320.7	320.1	320.1	320.2
	37.9	830	512	510	510	510	510	318.1	320.8	320.2	320.2	320.3
	38.5	840	522	519	520	520	520	318.1	320.9	320.2	320.2	320.4
	39.1	850	532	529	530	530	529	318.1	321.0	320.3	320.3	320.5
Muddy Ck/Blue River	39.8	860	542	539	539	539	539	318.1	321.1	320.4	320.4	320.6
	40.4	1757	1447	1444	1444	1444	1444	310.7	313.4	313.2	313.2	313.3
	41.0	1763	1452	1449	1450	1450	1449	311.0	313.9	313.6	313.6	313.7
	41.6	1769	1458	1455	1455	1455	1455	311.3	314.4	314.0	314.0	314.1
	42.3	1775	1463	1460	1460	1460	1460	311.5	314.9	314.4	314.4	314.6
	42.9	1781	1469	1465	1466	1466	1466	311.8	315.4	314.9	314.9	315.0
	43.5	1786	1474	1471	1471	1471	1471	312.1	315.8	315.3	315.3	315.5
top of Gore Canyon	44.2	1793	1480	1476	1477	1477	1477	312.4	316.4	315.8	315.8	315.9

		River Temperature						**Change in temperature**				
		Existing Conditions	No Action	Proposed Action	Alt 3	Alt 4	Alt 5	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
	River Mile	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)					
Lake Granby outlet	0.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0
	0.6	9.1	9.1	9.1	9.1	9.1	9.1	0.0	0.0	0.0	0.0	0.0
	1.2	9.3	9.3	9.3	9.3	9.3	9.3	0.0	0.0	0.0	0.0	0.0
	1.9	9.4	9.4	9.5	9.5	9.5	9.4	0.0	0.0	0.0	0.0	0.0
	2.5	9.5	9.6	9.6	9.6	9.6	9.6	0.0	-0.1	-0.1	-0.1	-0.1
	3.1	9.7	9.7	9.8	9.7	9.7	9.7	0.0	-0.1	-0.1	-0.1	-0.1
Willow Creek	3.7	10.0	10.0	10.0	10.0	10.0	10.0	0.0	-0.1	-0.1	-0.1	-0.1
	4.3	10.2	10.3	10.3	10.3	10.3	10.3	0.0	-0.1	-0.1	-0.1	-0.1
	5.0	10.6	10.6	10.6	10.6	10.6	10.6	0.0	0.0	0.0	0.0	0.0
	5.6	10.8	10.8	10.8	10.8	10.8	10.8	0.0	-0.1	0.0	0.0	0.0
	6.2	10.9	11.0	11.0	11.0	11.0	11.0	0.0	-0.1	-0.1	-0.1	-0.1
	6.8	11.1	11.1	11.2	11.2	11.2	11.2	0.0	-0.1	-0.1	-0.1	-0.1
	7.5	11.3	11.3	11.4	11.3	11.3	11.3	-0.1	-0.1	-0.1	-0.1	-0.1
Fraser River	8.1	11.4	11.5	11.5	11.5	11.5	11.5	-0.1	-0.1	-0.1	-0.1	-0.1
	8.4	13.1	13.3	13.4	13.4	13.4	13.4	-0.1	-0.3	-0.2	-0.2	-0.2
Windy Gap Reservoir	8.7	13.1	13.3	13.4	13.4	13.4	13.4	-0.1	-0.3	-0.2	-0.2	-0.2
	8.9	13.1	13.3	13.4	13.4	13.4	13.4	-0.1	-0.3	-0.2	-0.2	-0.2

	9.0	13.5	15.0	15.1	15.1	15.1	15.1	-1.5	-1.6	-1.6	-1.6	-1.6
	9.2	13.7	15.3	15.4	15.4	15.4	15.4	-1.7	-1.8	-1.7	-1.7	-1.7
	9.3	13.7	15.4	15.5	15.4	15.4	15.4	-1.7	-1.8	-1.8	-1.8	-1.8
	9.6	13.7	15.4	15.5	15.5	15.5	15.5	-1.7	-1.8	-1.8	-1.8	-1.8
	9.9	13.7	15.5	15.6	15.5	15.5	15.5	-1.7	-1.8	-1.8	-1.8	-1.8
	10.6	13.8	15.6	15.7	15.6	15.6	15.6	-1.8	-1.9	-1.9	-1.9	-1.9
	11.2	13.8	15.7	15.8	15.7	15.7	15.7	-1.9	-2.0	-1.9	-1.9	-1.9
	11.8	13.8	15.7	15.8	15.8	15.8	15.8	-1.9	-2.0	-2.0	-2.0	-2.0
	12.4	13.8	15.8	15.9	15.8	15.8	15.9	-1.9	-2.0	-2.0	-2.0	-2.0
	13.0	13.9	15.9	16.0	15.9	15.9	15.9	-2.0	-2.1	-2.1	-2.1	-2.1
	13.7	13.9	15.9	16.0	16.0	16.0	16.0	-2.0	-2.1	-2.1	-2.1	-2.1
	14.3	14.0	16.0	16.1	16.1	16.1	16.1	-2.1	-2.2	-2.1	-2.1	-2.1
	14.9	14.0	16.1	16.2	16.2	16.2	16.2	-2.1	-2.2	-2.2	-2.2	-2.2
	15.5	14.0	16.2	16.3	16.3	16.3	16.3	-2.2	-2.3	-2.2	-2.2	-2.2
	16.2	14.1	16.3	16.4	16.4	16.4	16.4	-2.2	-2.3	-2.3	-2.3	-2.3
HSS WWTP	16.8	14.1	16.5	16.6	16.5	16.5	16.5	-2.3	-2.4	-2.4	-2.4	-2.4
	17.4	14.2	16.7	16.8	16.8	16.8	16.8	-2.5	-2.6	-2.6	-2.6	-2.6
	18.0	14.3	17.0	17.0	17.0	17.0	17.0	-2.7	-2.8	-2.7	-2.7	-2.7
	18.6	14.4	17.2	17.3	17.3	17.3	17.3	-2.9	-2.9	-2.9	-2.9	-2.9
	19.3	14.4	17.5	17.5	17.5	17.5	17.5	-3.0	-3.1	-3.1	-3.1	-3.1
	19.9	14.5	17.8	17.9	17.8	17.8	17.8	-3.3	-3.3	-3.3	-3.3	-3.3
	20.5	14.6	17.9	18.0	18.0	18.0	18.0	-3.4	-3.5	-3.4	-3.4	-3.4
	21.1	14.6	18.1	18.2	18.2	18.2	18.2	-3.5	-3.6	-3.6	-3.6	-3.6
	21.7	14.7	18.3	18.4	18.3	18.3	18.3	-3.6	-3.7	-3.7	-3.7	-3.7
	22.4	14.7	18.4	18.5	18.5	18.5	18.5	-3.7	-3.8	-3.7	-3.7	-3.7
	23.0	14.8	18.6	18.7	18.7	18.7	18.7	-3.8	-3.9	-3.9	-3.9	-3.9
Williams Fork	23.6	14.9	18.8	18.9	18.9	18.9	18.9	-4.0	-4.0	-4.0	-4.0	-4.0
	24.2	14.3	14.8	14.8	14.8	14.8	14.8	-0.5	-0.5	-0.5	-0.5	-0.5
	24.9	14.4	14.9	14.9	14.9	14.9	14.9	-0.5	-0.6	-0.6	-0.6	-0.6
	25.5	14.4	15.0	15.0	15.0	15.0	15.0	-0.6	-0.6	-0.6	-0.6	-0.6
	26.1	14.5	15.1	15.1	15.1	15.1	15.1	-0.6	-0.6	-0.6	-0.6	-0.6
	26.7	14.5	15.1	15.2	15.2	15.2	15.2	-0.6	-0.7	-0.7	-0.7	-0.7
	27.3	14.6	15.2	15.2	15.2	15.2	15.2	-0.7	-0.7	-0.7	-0.7	-0.7
	28.0	14.6	15.3	15.3	15.3	15.3	15.3	-0.7	-0.7	-0.7	-0.7	-0.7
	28.6	14.7	15.4	15.4	15.4	15.4	15.4	-0.7	-0.8	-0.8	-0.8	-0.8

	29.2	14.7	15.5	15.5	15.5	15.5	15.5	-0.8	-0.8	-0.8	-0.8	-0.8
	29.8	14.7	15.6	15.6	15.6	15.6	15.6	-0.8	-0.8	-0.8	-0.8	-0.8
	30.4	14.8	15.6	15.6	15.6	15.6	15.6	-0.8	-0.9	-0.9	-0.9	-0.9
	31.1	14.8	15.7	15.7	15.7	15.7	15.7	-0.9	-0.9	-0.9	-0.9	-0.9
Troublesome Creek	31.7	14.9	15.8	15.8	15.8	15.8	15.8	-0.9	-0.9	-0.9	-0.9	-0.9
	32.3	15.2	16.2	16.2	16.2	16.2	16.2	-1.0	-1.0	-1.0	-1.0	-1.0
	32.9	15.2	16.1	16.1	16.1	16.1	16.1	-1.0	-1.0	-1.0	-1.0	-1.0
	33.6	15.2	16.1	16.1	16.1	16.1	16.1	-0.9	-1.0	-1.0	-1.0	-1.0
	34.2	15.2	16.1	16.1	16.1	16.1	16.1	-0.9	-0.9	-0.9	-0.9	-0.9
	34.8	15.2	16.1	16.1	16.1	16.1	16.1	-0.9	-0.9	-0.9	-0.9	-0.9
	35.4	15.2	16.1	16.1	16.1	16.1	16.1	-0.9	-0.9	-0.9	-0.9	-0.9
	36.0	15.2	16.1	16.1	16.1	16.1	16.1	-0.9	-0.9	-0.9	-0.9	-0.9
	36.7	15.3	16.1	16.1	16.1	16.1	16.1	-0.9	-0.9	-0.9	-0.9	-0.9
	37.3	15.3	16.1	16.2	16.2	16.2	16.2	-0.9	-0.9	-0.9	-0.9	-0.9
	37.9	15.3	16.2	16.2	16.2	16.2	16.2	-0.8	-0.9	-0.9	-0.9	-0.9
	38.5	15.3	16.2	16.2	16.2	16.2	16.2	-0.8	-0.9	-0.9	-0.9	-0.9
	39.1	15.4	16.2	16.2	16.2	16.2	16.2	-0.8	-0.9	-0.8	-0.8	-0.8
Muddy Ck/Blue River	39.8	15.4	16.2	16.2	16.2	16.2	16.2	-0.8	-0.8	-0.8	-0.8	-0.8
	40.4	13.3	13.1	13.1	13.1	13.1	13.1	0.2	0.2	0.2	0.2	0.2
	41.0	13.3	13.1	13.1	13.1	13.1	13.1	0.2	0.2	0.2	0.2	0.2
	41.6	13.3	13.2	13.2	13.2	13.2	13.2	0.2	0.2	0.2	0.2	0.2
	42.3	13.3	13.2	13.2	13.2	13.2	13.2	0.1	0.1	0.1	0.1	0.1
	42.9	13.3	13.2	13.2	13.2	13.2	13.2	0.1	0.1	0.1	0.1	0.1
	43.5	13.3	13.2	13.2	13.2	13.2	13.2	0.1	0.1	0.1	0.1	0.1
top of Gore Canyon	44.2	13.3	13.2	13.2	13.2	13.2	13.2	0.1	0.1	0.1	0.1	0.1

		River Specific Conductivity						**Change in conductivity**				
	River Mile	Existing Conditions Conducti-vity (umhos)	No Action Conducti-vity (umhos)	Proposed Action Conducti-vity (umhos)	Alt 3 Conducti-vity (umhos)	Alt 4 Conductiv-ity (umhos)	Alt 5 Conducti-vity (umhos)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	0.6	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	1.2	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	1.9	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0

	2.5	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
	3.1	61.0	61.0	61.0	61.0	61.0	61.0	0.0	0.0	0.0	0.0	0.0
Willow Creek	3.7	68.6	68.3	68.0	68.1	68.1	68.0	0.3	0.6	0.5	0.5	0.6
	4.3	76.6	76.0	75.4	75.6	75.6	75.4	0.6	1.1	0.9	0.9	1.2
	5.0	104.9	101.8	98.5	99.3	99.3	98.6	3.0	6.4	5.6	5.6	6.3
	5.6	108.6	105.7	102.4	103.2	103.2	102.5	2.9	6.2	5.3	5.3	6.0
	6.2	111.8	109.1	105.9	106.7	106.7	106.0	2.8	5.9	5.1	5.1	5.8
	6.8	114.8	112.1	109.1	109.9	109.9	109.2	2.7	5.7	4.9	4.9	5.6
	7.5	117.4	114.8	111.9	112.7	112.7	112.0	2.6	5.5	4.7	4.7	5.4
Fraser River	8.1	119.7	117.2	114.5	115.2	115.2	114.5	2.5	5.3	4.5	4.5	5.2
	8.4	126.0	124.9	123.6	123.9	123.9	123.5	1.1	2.4	2.1	2.1	2.5
Windy Gap Reservoir	8.7	126.6	125.4	124.1	124.5	124.5	124.1	1.2	2.4	2.1	2.1	2.5
	8.9	126.9	125.7	124.4	124.8	124.8	124.4	1.2	2.5	2.1	2.1	2.5
	9.0	127.0	124.8	123.5	123.8	123.8	123.5	2.2	3.5	3.1	3.1	3.5
	9.2	127.0	124.5	123.3	123.6	123.6	123.2	2.5	3.7	3.4	3.4	3.8
	9.3	127.0	124.5	123.2	123.5	123.5	123.2	2.5	3.8	3.5	3.5	3.8
	9.6	127.1	124.8	123.5	123.9	123.9	123.5	2.3	3.5	3.2	3.2	3.6
	9.9	127.1	125.1	123.9	124.2	124.2	123.8	2.0	3.3	2.9	2.9	3.3
	10.6	127.3	125.8	124.5	124.8	124.8	124.5	1.5	2.8	2.4	2.4	2.8
	11.2	127.4	126.4	125.1	125.5	125.5	125.1	1.1	2.3	2.0	2.0	2.3
	11.8	127.6	127.0	125.7	126.1	126.1	125.7	0.6	1.8	1.5	1.5	1.9
	12.4	127.7	127.6	126.3	126.7	126.7	126.3	0.2	1.4	1.1	1.1	1.4
	13.0	127.9	128.1	126.9	127.2	127.2	126.9	-0.3	0.9	0.6	0.6	1.0
	13.7	128.0	128.7	127.5	127.8	127.8	127.4	-0.7	0.5	0.2	0.2	0.6
	14.3	128.1	129.2	128.0	128.3	128.3	128.0	-1.0	0.1	-0.2	-0.2	0.2
	14.9	128.3	129.7	128.5	128.8	128.8	128.5	-1.4	-0.2	-0.5	-0.5	-0.2
	15.5	128.4	130.2	129.0	129.3	129.3	129.0	-1.8	-0.6	-0.9	-0.9	-0.6
	16.2	128.5	130.5	129.3	129.6	129.6	129.3	-2.0	-0.8	-1.1	-1.1	-0.8
HSS WWTP	16.8	128.5	130.5	129.3	129.6	129.6	129.3	-2.0	-0.8	-1.1	-1.1	-0.8
	17.4	128.8	131.6	130.4	130.7	130.7	130.4	-2.8	-1.6	-1.9	-1.9	-1.6
	18.0	128.8	131.5	130.4	130.7	130.7	130.4	-2.8	-1.6	-1.9	-1.9	-1.6
	18.6	128.8	131.5	130.4	130.7	130.7	130.3	-2.7	-1.6	-1.9	-1.9	-1.6
	19.3	128.8	131.5	130.3	130.6	130.6	130.3	-2.7	-1.6	-1.9	-1.9	-1.6
	19.9	128.8	131.5	130.3	130.6	130.6	130.3	-2.7	-1.6	-1.9	-1.9	-1.5
	20.5	128.8	131.5	130.3	130.6	130.6	130.3	-2.7	-1.5	-1.8	-1.8	-1.5

	21.1	128.8	131.5	130.3	130.6	130.6	130.3	-2.7	-1.5	-1.8	-1.8	-1.5
	21.7	128.8	131.4	130.3	130.6	130.6	130.3	-2.7	-1.5	-1.8	-1.8	-1.5
	22.4	128.8	131.4	130.3	130.6	130.6	130.3	-2.7	-1.5	-1.8	-1.8	-1.5
	23.0	128.8	131.4	130.3	130.6	130.6	130.2	-2.6	-1.5	-1.8	-1.8	-1.5
Williams Fork	23.6	128.8	131.4	130.2	130.5	130.5	130.2	-2.6	-1.5	-1.8	-1.8	-1.4
	24.2	267.2	386.1	386.0	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	24.9	267.2	386.1	386.0	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	25.5	267.2	386.1	386.0	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	26.1	267.2	386.1	386.0	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	26.7	267.2	386.1	385.9	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	27.3	267.2	386.1	385.9	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	28.0	267.2	386.0	385.9	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	28.6	267.2	386.0	385.9	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	29.2	267.2	386.0	385.9	386.0	386.0	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	29.8	267.2	386.0	385.9	385.9	385.9	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	30.4	267.2	386.0	385.9	385.9	385.9	385.9	-118.9	-118.8	-118.8	-118.8	-118.7
	31.1	267.2	386.0	385.9	385.9	385.9	385.9	-118.9	-118.7	-118.8	-118.8	-118.7
Troublesome Creek	31.7	267.2	386.0	385.9	385.9	385.9	385.9	-118.9	-118.7	-118.8	-118.8	-118.7
	32.3	254.2	347.8	347.5	347.6	347.6	347.5	-93.6	-93.3	-93.4	-93.4	-93.3
	32.9	253.0	343.7	343.4	343.5	343.5	343.4	-90.6	-90.4	-90.4	-90.4	-90.4
	33.6	251.9	339.8	339.6	339.6	339.6	339.5	-87.8	-87.6	-87.7	-87.7	-87.6
	34.2	250.8	336.0	335.8	335.9	335.9	335.8	-85.2	-85.0	-85.0	-85.0	-85.0
	34.8	249.8	332.5	332.3	332.3	332.3	332.3	-82.7	-82.5	-82.5	-82.5	-82.5
	35.4	248.7	329.0	328.9	328.9	328.9	328.8	-80.3	-80.1	-80.2	-80.2	-80.1
	36.0	247.7	325.7	325.6	325.6	325.6	325.5	-78.0	-77.9	-77.9	-77.9	-77.8
	36.7	246.7	322.6	322.4	322.4	322.4	322.4	-75.8	-75.7	-75.7	-75.7	-75.7
	37.3	245.8	319.5	319.4	319.4	319.4	319.4	-73.8	-73.6	-73.7	-73.7	-73.6
	37.9	244.8	316.6	316.5	316.5	316.5	316.4	-71.8	-71.7	-71.7	-71.7	-71.6
	38.5	243.9	313.8	313.7	313.7	313.7	313.6	-69.9	-69.8	-69.8	-69.8	-69.7
	39.1	243.0	311.0	310.9	311.0	311.0	310.9	-68.1	-68.0	-68.0	-68.0	-67.9
Muddy Ck/Blue River	39.8	242.1	308.4	308.3	308.3	308.3	308.3	-66.3	-66.2	-66.2	-66.2	-66.2
	40.4	279.6	314.0	313.8	313.9	313.9	313.9	-34.4	-34.2	-34.3	-34.3	-34.3
	41.0	279.2	313.4	313.3	313.4	313.4	313.4	-34.2	-34.0	-34.1	-34.1	-34.1
	41.6	278.9	312.8	312.7	312.8	312.8	312.8	-34.0	-33.9	-34.0	-34.0	-33.9
	42.3	278.5	312.3	312.2	312.3	312.3	312.3	-33.8	-33.7	-33.8	-33.8	-33.8

	42.9	278.1	311.7	311.6	311.7	311.7	311.7	-33.6	-33.5	-33.6	-33.6	-33.6
	43.5	277.8	311.2	311.1	311.2	311.2	311.2	-33.4	-33.4	-33.5	-33.5	-33.4
top of Gore Canyon	44.2	277.4	310.6	310.5	310.6	310.6	310.6	-33.2	-33.2	-33.3	-33.3	-33.3

		River TDS						**Change in TDS concentration**				
	River Mile	Existing Conditions TDS (mg/L)	No Action TDS (mg/L)	Proposed Action TDS (mg/L)	Alt 3 TDS (mg/L)	Alt 4 TDS (mg/L)	Alt 5 TDS (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	0.6	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	1.2	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	1.9	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	2.5	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
	3.1	36.6	36.6	36.6	36.6	36.6	36.6	0.0	0.0	0.0	0.0	0.0
Willow Creek	3.7	41.2	41.0	40.8	40.9	40.9	40.8	0.2	0.4	0.3	0.3	0.4
	4.3	45.9	45.6	45.3	45.4	45.4	45.2	0.3	0.7	0.6	0.6	0.7
	5.0	62.9	61.1	59.1	59.6	59.6	59.2	1.8	3.9	3.4	3.4	3.8
	5.6	65.1	63.4	61.5	61.9	61.9	61.5	1.7	3.7	3.2	3.2	3.6
	6.2	67.1	65.4	63.6	64.0	64.0	63.6	1.7	3.5	3.1	3.1	3.5
	6.8	68.9	67.3	65.5	65.9	65.9	65.5	1.6	3.4	2.9	2.9	3.4
	7.5	70.4	68.9	67.1	67.6	67.6	67.2	1.5	3.3	2.8	2.8	3.2
Fraser River	8.1	71.8	70.3	68.7	69.1	69.1	68.7	1.5	3.2	2.7	2.7	3.1
	8.4	75.6	74.9	74.1	74.3	74.3	74.1	0.7	1.5	1.3	1.3	1.5
Windy Gap Reservoir	8.7	76.0	75.3	74.5	74.7	74.7	74.5	0.7	1.5	1.3	1.3	1.5
	8.9	76.1	75.4	74.7	74.9	74.9	74.6	0.7	1.5	1.3	1.3	1.5
	9.0	76.2	74.9	74.1	74.3	74.3	74.1	1.3	2.1	1.9	1.9	2.1
	9.2	76.2	74.7	74.0	74.1	74.1	73.9	1.5	2.2	2.0	2.0	2.3
	9.3	76.2	74.7	73.9	74.1	74.1	73.9	1.5	2.3	2.1	2.1	2.3
	9.6	76.2	74.9	74.1	74.3	74.3	74.1	1.4	2.1	1.9	1.9	2.1
	9.9	76.3	75.1	74.3	74.5	74.5	74.3	1.2	2.0	1.8	1.8	2.0
	10.6	76.4	75.5	74.7	74.9	74.9	74.7	0.9	1.7	1.5	1.5	1.7
	11.2	76.5	75.8	75.1	75.3	75.3	75.1	0.6	1.4	1.2	1.2	1.4
	11.8	76.5	76.2	75.4	75.6	75.6	75.4	0.4	1.1	0.9	0.9	1.1
	12.4	76.6	76.5	75.8	76.0	76.0	75.8	0.1	0.8	0.6	0.6	0.8
	13.0	76.7	76.9	76.1	76.3	76.3	76.1	-0.2	0.6	0.4	0.4	0.6

	13.7	76.8	77.2	76.5	76.7	76.7	76.5	-0.4	0.3	0.1	0.1	0.3
	14.3	76.9	77.5	76.8	77.0	77.0	76.8	-0.6	0.1	-0.1	-0.1	0.1
	14.9	77.0	77.8	77.1	77.3	77.3	77.1	-0.9	-0.1	-0.3	-0.3	-0.1
	15.5	77.1	78.1	77.4	77.6	77.6	77.4	-1.1	-0.4	-0.5	-0.5	-0.4
	16.2	77.1	78.3	77.6	77.8	77.8	77.6	-1.2	-0.5	-0.7	-0.7	-0.5
HSS WWTP	16.8	77.1	78.3	77.6	77.8	77.8	77.6	-1.2	-0.5	-0.7	-0.7	-0.5
	17.4	77.3	78.9	78.2	78.4	78.4	78.2	-1.7	-1.0	-1.2	-1.2	-1.0
	18.0	77.3	78.9	78.2	78.4	78.4	78.2	-1.7	-1.0	-1.1	-1.1	-1.0
	18.6	77.3	78.9	78.2	78.4	78.4	78.2	-1.6	-1.0	-1.1	-1.1	-0.9
	19.3	77.3	78.9	78.2	78.4	78.4	78.2	-1.6	-0.9	-1.1	-1.1	-0.9
	19.9	77.3	78.9	78.2	78.4	78.4	78.2	-1.6	-0.9	-1.1	-1.1	-0.9
	20.5	77.3	78.9	78.2	78.4	78.4	78.2	-1.6	-0.9	-1.1	-1.1	-0.9
	21.1	77.3	78.9	78.2	78.4	78.4	78.2	-1.6	-0.9	-1.1	-1.1	-0.9
	21.7	77.3	78.9	78.2	78.4	78.4	78.2	-1.6	-0.9	-1.1	-1.1	-0.9
	22.4	77.3	78.9	78.2	78.3	78.3	78.2	-1.6	-0.9	-1.1	-1.1	-0.9
	23.0	77.3	78.8	78.2	78.3	78.3	78.1	-1.6	-0.9	-1.1	-1.1	-0.9
Williams Fork	23.6	77.3	78.8	78.1	78.3	78.3	78.1	-1.6	-0.9	-1.1	-1.1	-0.9
	24.2	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	24.9	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	25.5	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	26.1	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	26.7	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	27.3	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	28.0	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	28.6	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	29.2	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	29.8	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	30.4	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.3	-71.3	-71.3	-71.2
	31.1	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.2	-71.3	-71.3	-71.2
Troublesome Creek	31.7	160.3	231.6	231.6	231.6	231.6	231.5	-71.3	-71.2	-71.3	-71.3	-71.2
	32.3	152.5	208.7	208.5	208.5	208.5	208.5	-56.1	-56.0	-56.0	-56.0	-56.0
	32.9	151.8	206.2	206.1	206.1	206.1	206.1	-54.4	-54.2	-54.3	-54.3	-54.2
	33.6	151.2	203.9	203.7	203.8	203.8	203.7	-52.7	-52.6	-52.6	-52.6	-52.6
	34.2	150.5	201.6	201.5	201.5	201.5	201.5	-51.1	-51.0	-51.0	-51.0	-51.0
	34.8	149.9	199.5	199.4	199.4	199.4	199.4	-49.6	-49.5	-49.5	-49.5	-49.5

	35.4	149.2	197.4	197.3	197.3	197.3	197.3	-48.2	-48.1	-48.1	-48.1	-48.1
	36.0	148.6	195.4	195.3	195.4	195.4	195.3	-46.8	-46.7	-46.7	-46.7	-46.7
	36.7	148.0	193.5	193.5	193.5	193.5	193.4	-45.5	-45.4	-45.4	-45.4	-45.4
	37.3	147.5	191.7	191.6	191.6	191.6	191.6	-44.3	-44.2	-44.2	-44.2	-44.2
	37.9	146.9	190.0	189.9	189.9	189.9	189.9	-43.1	-43.0	-43.0	-43.0	-43.0
	38.5	146.3	188.3	188.2	188.2	188.2	188.2	-41.9	-41.9	-41.9	-41.9	-41.8
	39.1	145.8	186.6	186.6	186.6	186.6	186.5	-40.8	-40.8	-40.8	-40.8	-40.8
Muddy Ck/Blue River	39.8	145.3	185.1	185.0	185.0	185.0	185.0	-39.8	-39.7	-39.7	-39.7	-39.7
	40.4	167.8	188.4	188.3	188.4	188.4	188.3	-20.6	-20.5	-20.6	-20.6	-20.6
	41.0	167.5	188.0	188.0	188.0	188.0	188.0	-20.5	-20.4	-20.5	-20.5	-20.5
	41.6	167.3	187.7	187.6	187.7	187.7	187.7	-20.4	-20.3	-20.4	-20.4	-20.4
	42.3	167.1	187.4	187.3	187.4	187.4	187.4	-20.3	-20.2	-20.3	-20.3	-20.3
	42.9	166.9	187.0	187.0	187.0	187.0	187.0	-20.2	-20.1	-20.2	-20.2	-20.2
	43.5	166.7	186.7	186.7	186.7	186.7	186.7	-20.0	-20.0	-20.1	-20.1	-20.1
top of Gore Canyon	44.2	166.4	186.3	186.3	186.4	186.4	186.4	-19.9	-19.9	-20.0	-20.0	-20.0

		River Dissolved Oxygen						**Change in DO concentration**				
	River Mile	Existing Conditions DO (mg/L)	No Action DO (mg/L)	Proposed Action DO (mg/L)	Alt 3 DO (mg/L)	Alt 4 DO (mg/L)	Alt 5 DO (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	8.8	8.8	8.8	8.8	8.8	8.8	0.0	0.0	0.0	0.0	0.0
	0.6	8.7	8.7	8.7	8.7	8.7	8.7	0.0	0.0	0.0	0.0	0.0
	1.2	8.7	8.7	8.7	8.7	8.7	8.7	0.0	0.0	0.0	0.0	0.0
	1.9	8.7	8.6	8.6	8.6	8.6	8.6	0.0	0.0	0.0	0.0	0.0
	2.5	8.6	8.6	8.6	8.6	8.6	8.6	0.0	0.0	0.0	0.0	0.0
	3.1	8.6	8.5	8.5	8.5	8.5	8.5	0.0	0.0	0.0	0.0	0.0
Willow Creek	3.7	8.4	8.4	8.4	8.4	8.4	8.4	0.0	0.0	0.0	0.0	0.0
	4.3	8.3	8.3	8.3	8.3	8.3	8.3	0.0	0.0	0.0	0.0	0.0
	5.0	8.3	8.3	8.3	8.3	8.3	8.3	0.0	0.0	0.0	0.0	0.0
	5.6	8.2	8.2	8.2	8.2	8.2	8.2	0.0	0.0	0.0	0.0	0.0
	6.2	8.1	8.1	8.1	8.1	8.1	8.1	0.0	0.0	0.0	0.0	0.0
	6.8	8.0	8.0	8.0	8.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0
	7.5	8.0	8.0	8.0	8.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0
Fraser River	8.1	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0
	8.4	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0

Windy Gap Reservoir	8.7	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0
	8.9	7.9	7.9	7.9	7.9	7.9	7.9	0.0	0.0	0.0	0.0	0.0
	9.0	7.7	7.7	7.6	7.6	7.6	7.7	0.0	0.0	0.0	0.0	0.0
	9.2	7.6	7.6	7.6	7.6	7.6	7.6	-0.1	0.0	-0.1	-0.1	-0.1
	9.3	7.5	7.6	7.6	7.6	7.6	7.6	-0.1	-0.1	-0.1	-0.1	-0.1
	9.6	7.5	7.4	7.4	7.4	7.4	7.4	0.2	0.2	0.2	0.2	0.2
	9.9	7.5	7.4	7.4	7.4	7.4	7.4	0.2	0.2	0.2	0.2	0.2
	10.6	7.5	7.4	7.3	7.3	7.3	7.4	0.2	0.2	0.2	0.2	0.2
	11.2	7.5	7.3	7.3	7.3	7.3	7.3	0.2	0.2	0.2	0.2	0.2
	11.8	7.5	7.3	7.3	7.3	7.3	7.3	0.2	0.2	0.2	0.2	0.2
	12.4	7.5	7.3	7.3	7.3	7.3	7.3	0.2	0.3	0.2	0.2	0.2
	13.0	7.5	7.3	7.3	7.3	7.3	7.3	0.3	0.3	0.3	0.3	0.3
	13.7	7.5	7.3	7.2	7.2	7.2	7.2	0.3	0.3	0.3	0.3	0.3
	14.3	7.5	7.2	7.2	7.2	7.2	7.2	0.3	0.3	0.3	0.3	0.3
	14.9	7.5	7.2	7.2	7.2	7.2	7.2	0.3	0.3	0.3	0.3	0.3
	15.5	7.5	7.2	7.2	7.2	7.2	7.2	0.3	0.3	0.3	0.3	0.3
	16.2	7.5	7.2	7.2	7.2	7.2	7.2	0.3	0.3	0.3	0.3	0.3
HSS WWTP	16.8	7.5	7.2	7.2	7.2	7.2	7.2	0.3	0.3	0.3	0.3	0.3
	17.4	7.5	7.2	7.2	7.2	7.2	7.2	0.3	0.4	0.3	0.3	0.3
	18.0	7.5	7.2	7.1	7.1	7.1	7.1	0.4	0.4	0.4	0.4	0.4
	18.6	7.5	7.1	7.1	7.1	7.1	7.1	0.4	0.4	0.4	0.4	0.4
	19.3	7.5	7.1	7.1	7.1	7.1	7.1	0.4	0.4	0.4	0.4	0.4
	19.9	7.5	7.1	7.0	7.0	7.0	7.0	0.4	0.5	0.5	0.5	0.5
	20.5	7.5	7.0	7.0	7.0	7.0	7.0	0.5	0.5	0.5	0.5	0.5
	21.1	7.5	7.0	7.0	7.0	7.0	7.0	0.5	0.5	0.5	0.5	0.5
	21.7	7.5	7.0	7.0	7.0	7.0	7.0	0.5	0.5	0.5	0.5	0.5
	22.4	7.5	7.0	7.0	7.0	7.0	7.0	0.5	0.5	0.5	0.5	0.5
	23.0	7.5	7.0	7.0	7.0	7.0	7.0	0.5	0.5	0.5	0.5	0.5
Williams Fork	23.6	7.5	6.9	6.9	6.9	6.9	6.9	0.5	0.5	0.5	0.5	0.5
	24.2	7.3	7.0	7.0	7.0	7.0	7.0	0.3	0.3	0.3	0.3	0.3
	24.9	7.3	7.1	7.0	7.0	7.0	7.0	0.3	0.3	0.3	0.3	0.3
	25.5	7.3	7.1	7.1	7.1	7.1	7.1	0.2	0.2	0.2	0.2	0.2
	26.1	7.3	7.1	7.1	7.1	7.1	7.1	0.2	0.2	0.2	0.2	0.2
	26.7	7.3	7.1	7.1	7.1	7.1	7.1	0.2	0.2	0.2	0.2	0.2
	27.3	7.3	7.1	7.1	7.1	7.1	7.1	0.2	0.2	0.2	0.2	0.2

	28.0	7.3	7.2	7.2	7.2	7.2	7.2	0.2	0.2	0.2	0.2	0.2
	28.6	7.3	7.2	7.2	7.2	7.2	7.2	0.2	0.2	0.2	0.2	0.2
	29.2	7.3	7.2	7.2	7.2	7.2	7.2	0.2	0.2	0.2	0.2	0.2
	29.8	7.4	7.2	7.2	7.2	7.2	7.2	0.2	0.2	0.2	0.2	0.2
	30.4	7.4	7.2	7.2	7.2	7.2	7.2	0.1	0.2	0.2	0.2	0.2
	31.1	7.4	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
Troublesome Creek	31.7	7.4	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	32.3	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	32.9	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	33.6	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	34.2	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	34.8	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	35.4	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	36.0	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	36.7	7.4	7.3	7.3	7.3	7.3	7.3	0.1	0.1	0.1	0.1	0.1
	37.3	7.4	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	37.9	7.4	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	38.5	7.3	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	39.1	7.3	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
Muddy Ck/Blue River	39.8	7.3	7.2	7.2	7.2	7.2	7.2	0.1	0.1	0.1	0.1	0.1
	40.4	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
	41.0	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
	41.6	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
	42.3	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
	42.9	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
	43.5	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0
top of Gore Canyon	44.2	7.6	7.6	7.6	7.6	7.6	7.6	0.0	0.0	0.0	0.0	0.0

		River Ammonia						**Change in ammonia concentration**				
	River Mile	Existing Conditions Ammon-ium (µg/L)	No Action Ammon-ium (µg/L)	Proposed Action Ammon-ium (µg/L)	Alt 3 Ammon-ium (µg/L)	Alt 4 Ammon-ium (µg/L)	Alt 5 Ammon-ium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	10.5	10.8	11.0	10.4	10.4	10.0	-0.3	-0.5	0.2	0.2	0.5
	0.6	10.7	10.9	11.2	10.5	10.5	10.2	-0.3	-0.5	0.2	0.2	0.5
	1.2	10.9	11.2	11.4	10.8	10.8	10.4	-0.3	-0.5	0.2	0.2	0.5

	1.9	11.1	11.4	11.6	10.9	10.9	10.6	-0.3	-0.5	0.2	0.2	0.5
	2.5	11.3	11.5	11.8	11.1	11.1	10.8	-0.3	-0.5	0.2	0.2	0.5
	3.1	11.4	11.7	11.9	11.2	11.2	10.9	-0.3	-0.5	0.2	0.2	0.5
Willow Creek	3.7	11.2	11.5	11.7	11.1	11.1	10.8	-0.3	-0.5	0.1	0.1	0.4
	4.3	10.8	11.1	11.3	10.7	10.7	10.5	-0.3	-0.5	0.1	0.1	0.3
	5.0	12.5	12.5	12.5	12.0	12.0	11.8	0.0	0.0	0.4	0.4	0.7
	5.6	12.1	12.1	12.1	11.7	11.7	11.5	0.0	-0.1	0.4	0.4	0.6
	6.2	11.9	12.0	12.0	11.6	11.6	11.4	-0.1	-0.1	0.3	0.3	0.6
	6.8	11.7	11.8	11.9	11.4	11.4	11.2	-0.1	-0.1	0.3	0.3	0.5
	7.5	11.5	11.6	11.6	11.2	11.2	11.0	-0.1	-0.1	0.3	0.3	0.4
Fraser River	8.1	11.3	11.4	11.4	11.0	11.0	10.9	-0.1	-0.2	0.2	0.2	0.4
	8.4	18.8	19.3	19.8	19.4	19.4	19.4	-0.5	-1.0	-0.7	-0.7	-0.6
Windy Gap Reservoir	8.7	18.6	19.2	19.6	19.3	19.3	19.2	-0.5	-1.0	-0.7	-0.7	-0.6
	8.9	18.5	19.1	19.5	19.2	19.2	19.1	-0.5	-1.0	-0.7	-0.7	-0.6
	9.0	20.2	22.6	22.8	22.4	22.4	22.3	-2.4	-2.6	-2.2	-2.2	-2.2
	9.2	21.2	23.4	23.6	23.2	23.2	23.1	-2.3	-2.4	-2.0	-2.0	-2.0
	9.3	21.4	23.6	23.7	23.3	23.3	23.3	-2.2	-2.4	-2.0	-2.0	-1.9
	9.6	21.4	23.5	23.6	23.2	23.2	23.1	-2.1	-2.2	-1.8	-1.8	-1.8
	9.9	21.4	23.3	23.4	23.1	23.1	23.0	-2.0	-2.1	-1.7	-1.7	-1.6
	10.6	21.4	23.0	23.2	22.8	22.8	22.7	-1.7	-1.8	-1.4	-1.4	-1.3
	11.2	21.4	22.8	22.9	22.5	22.5	22.5	-1.4	-1.5	-1.2	-1.2	-1.1
	11.8	21.4	22.5	22.7	22.3	22.3	22.2	-1.2	-1.3	-0.9	-0.9	-0.8
	12.4	21.4	22.3	22.4	22.0	22.0	22.0	-0.9	-1.1	-0.7	-0.7	-0.6
	13.0	21.3	22.1	22.2	21.8	21.8	21.7	-0.7	-0.8	-0.5	-0.5	-0.4
	13.7	21.4	21.9	22.0	21.6	21.6	21.6	-0.5	-0.6	-0.3	-0.3	-0.2
	14.3	21.4	21.7	21.8	21.4	21.4	21.4	-0.3	-0.4	-0.1	-0.1	0.0
	14.9	21.4	21.5	21.6	21.2	21.2	21.2	-0.1	-0.2	0.1	0.1	0.2
	15.5	21.4	21.3	21.4	21.1	21.1	21.0	0.1	-0.1	0.3	0.3	0.4
	16.2	21.4	21.2	21.4	21.0	21.0	20.9	0.2	0.0	0.4	0.4	0.5
HSS WWTP	16.8	21.4	21.3	21.4	21.1	21.1	21.0	0.2	0.0	0.4	0.4	0.4
	17.4	24.6	33.7	33.9	33.5	33.5	33.4	-9.1	-9.3	-8.9	-8.9	-8.9
	18.0	24.6	33.6	33.7	33.4	33.4	33.3	-8.9	-9.1	-8.7	-8.7	-8.7
	18.6	24.7	33.5	33.6	33.3	33.3	33.2	-8.8	-8.9	-8.6	-8.6	-8.5
	19.3	24.7	33.4	33.5	33.2	33.2	33.1	-8.7	-8.8	-8.4	-8.4	-8.4
	19.9	24.8	33.3	33.5	33.1	33.1	33.0	-8.6	-8.7	-8.3	-8.3	-8.3

	20.5	24.8	33.2	33.4	33.0	33.0	32.9	-8.4	-8.6	-8.2	-8.2	-8.1
	21.1	24.8	33.2	33.3	32.9	32.9	32.9	-8.3	-8.5	-8.1	-8.1	-8.0
	21.7	24.9	33.1	33.2	32.9	32.9	32.8	-8.2	-8.4	-8.0	-8.0	-7.9
	22.4	24.9	33.0	33.1	32.8	32.8	32.7	-8.1	-8.2	-7.9	-7.9	-7.8
	23.0	24.9	32.9	33.0	32.7	32.7	32.6	-8.0	-8.1	-7.7	-7.7	-7.7
Williams Fork	23.6	25.0	32.8	32.9	32.6	32.6	32.5	-7.8	-8.0	-7.6	-7.6	-7.5
	24.2	23.1	23.5	23.5	23.5	23.5	23.4	-0.4	-0.4	-0.3	-0.3	-0.3
	24.9	23.3	23.9	24.0	23.9	23.9	23.9	-0.6	-0.6	-0.6	-0.6	-0.5
	25.5	23.5	24.4	24.4	24.3	24.3	24.3	-0.8	-0.9	-0.8	-0.8	-0.7
	26.1	23.7	24.8	24.8	24.7	24.7	24.7	-1.0	-1.1	-1.0	-1.0	-1.0
	26.7	23.8	25.0	25.0	25.0	25.0	24.9	-1.2	-1.2	-1.1	-1.1	-1.1
	27.3	24.0	25.3	25.4	25.3	25.3	25.2	-1.3	-1.4	-1.3	-1.3	-1.2
	28.0	24.1	25.6	25.7	25.6	25.6	25.5	-1.5	-1.5	-1.4	-1.4	-1.4
	28.6	24.4	26.1	26.2	26.1	26.1	26.1	-1.8	-1.8	-1.7	-1.7	-1.7
	29.2	24.6	26.5	26.5	26.4	26.4	26.4	-1.9	-2.0	-1.9	-1.9	-1.8
	29.8	24.8	27.0	27.0	26.9	26.9	26.9	-2.2	-2.2	-2.1	-2.1	-2.1
	30.4	25.0	27.3	27.4	27.3	27.3	27.3	-2.4	-2.4	-2.3	-2.3	-2.3
	31.1	25.1	27.6	27.6	27.5	27.5	27.5	-2.5	-2.5	-2.4	-2.4	-2.4
Troublesome Creek	31.7	25.3	28.0	28.1	28.0	28.0	28.0	-2.7	-2.8	-2.7	-2.7	-2.6
	32.3	24.1	25.6	25.6	25.5	25.5	25.5	-1.5	-1.5	-1.4	-1.4	-1.4
	32.9	24.0	25.5	25.5	25.5	25.5	25.4	-1.5	-1.5	-1.4	-1.4	-1.4
	33.6	24.1	25.6	25.6	25.5	25.5	25.5	-1.5	-1.5	-1.4	-1.4	-1.4
	34.2	24.0	25.4	25.5	25.4	25.4	25.4	-1.4	-1.5	-1.4	-1.4	-1.4
	34.8	24.0	25.4	25.5	25.4	25.4	25.4	-1.4	-1.5	-1.4	-1.4	-1.4
	35.4	24.0	25.5	25.5	25.5	25.5	25.4	-1.5	-1.5	-1.4	-1.4	-1.4
	36.0	24.1	25.6	25.6	25.5	25.5	25.5	-1.5	-1.5	-1.5	-1.5	-1.4
	36.7	24.1	25.7	25.7	25.6	25.6	25.6	-1.5	-1.6	-1.5	-1.5	-1.5
	37.3	24.2	25.7	25.8	25.7	25.7	25.7	-1.5	-1.6	-1.5	-1.5	-1.5
	37.9	24.2	25.7	25.7	25.7	25.7	25.6	-1.5	-1.6	-1.5	-1.5	-1.5
	38.5	24.4	26.1	26.1	26.0	26.0	26.0	-1.7	-1.7	-1.6	-1.6	-1.6
	39.1	24.6	26.4	26.4	26.4	26.4	26.4	-1.8	-1.8	-1.8	-1.8	-1.7
Muddy Ck/Blue River	39.8	24.8	26.7	26.7	26.7	26.7	26.7	-1.9	-1.9	-1.9	-1.9	-1.9
	40.4	27.6	29.0	29.0	29.0	29.0	29.0	-1.4	-1.4	-1.4	-1.4	-1.4
	41.0	28.1	29.6	29.6	29.6	29.6	29.6	-1.5	-1.5	-1.5	-1.5	-1.5
	41.6	28.3	29.9	29.9	29.9	29.9	29.8	-1.5	-1.6	-1.5	-1.5	-1.5

	42.3	28.4	29.9	30.0	29.9	29.9	29.9	-1.6	-1.6	-1.6	-1.6	-1.6
	42.9	28.6	30.2	30.3	30.2	30.2	30.2	-1.6	-1.6	-1.6	-1.6	-1.6
	43.5	28.9	30.5	30.6	30.5	30.5	30.5	-1.7	-1.7	-1.7	-1.7	-1.7
top of Gore Canyon	44.2	29.1	30.8	30.8	30.8	30.8	30.8	-1.7	-1.7	-1.7	-1.7	-1.7

		River Inorganic Phosphorus						**Change in inorganic P concentration**				
	River Mile	Existing Conditions Inorganic P (µg/L)	No Action Inorganic P (µg/L)	Proposed Action Inorganic P (µg/L)	Alt 3 Inorganic P (µg/L)	Alt 4 Inorganic P (µg/L)	Alt 5 Inorganic P (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.7	0.7	0.9
	0.6	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.7	0.7	0.9
	1.2	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.7	0.7	0.9
	1.9	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.6	0.6	0.9
	2.5	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.6	0.6	0.9
	3.1	6.6	7.2	8.1	6.0	6.0	5.7	-0.6	-1.5	0.6	0.6	0.9
Willow Creek	3.7	6.5	7.1	7.9	5.9	5.9	5.7	-0.6	-1.4	0.6	0.6	0.8
	4.3	6.4	6.9	7.7	5.8	5.8	5.6	-0.5	-1.3	0.5	0.5	0.8
	5.0	9.5	9.6	9.9	8.4	8.4	8.2	-0.1	-0.3	1.1	1.1	1.4
	5.6	9.3	9.3	9.6	8.2	8.2	8.0	-0.1	-0.3	1.0	1.0	1.3
	6.2	9.0	9.1	9.4	8.1	8.1	7.8	-0.1	-0.3	1.0	1.0	1.2
	6.8	8.8	8.9	9.1	7.9	7.9	7.7	-0.1	-0.3	0.9	0.9	1.1
	7.5	8.6	8.7	8.9	7.7	7.7	7.6	-0.1	-0.3	0.9	0.9	1.1
Fraser River	8.1	8.4	8.5	8.7	7.6	7.6	7.4	-0.1	-0.3	0.8	0.8	1.0
	8.4	13.4	13.7	14.1	13.4	13.4	13.3	-0.4	-0.8	0.0	0.0	0.0
Windy Gap Reservoir	8.7	13.3	13.6	14.0	13.3	13.3	13.2	-0.4	-0.8	-0.1	-0.1	0.0
	8.9	13.2	13.6	14.0	13.2	13.2	13.2	-0.4	-0.8	-0.1	-0.1	0.0
	9.0	13.7	15.8	16.4	15.6	15.6	15.5	-2.1	-2.6	-1.9	-1.9	-1.8
	9.2	14.0	16.3	16.9	16.1	16.1	16.0	-2.3	-2.9	-2.1	-2.1	-2.0
	9.3	14.1	16.5	17.0	16.2	16.2	16.1	-2.4	-3.0	-2.2	-2.2	-2.1
	9.6	14.1	16.4	17.0	16.2	16.2	16.1	-2.3	-2.9	-2.1	-2.1	-2.0
	9.9	14.1	16.3	16.9	16.1	16.1	16.0	-2.2	-2.8	-2.0	-2.0	-1.9
	10.6	14.1	16.1	16.7	15.9	15.9	15.8	-2.1	-2.7	-1.9	-1.9	-1.8
	11.2	14.1	16.0	16.6	15.8	15.8	15.7	-1.9	-2.5	-1.7	-1.7	-1.6
	11.8	14.0	15.8	16.4	15.6	15.6	15.5	-1.8	-2.4	-1.6	-1.6	-1.5
	12.4	14.0	15.7	16.2	15.5	15.5	15.4	-1.7	-2.2	-1.5	-1.5	-1.4

	13.0	14.0	15.5	16.1	15.3	15.3	15.3	-1.5	-2.1	-1.3	-1.3	-1.3
	13.7	14.0	15.4	16.0	15.2	15.2	15.1	-1.4	-2.0	-1.2	-1.2	-1.1
	14.3	14.0	15.3	15.8	15.1	15.1	15.0	-1.3	-1.8	-1.1	-1.1	-1.0
	14.9	14.0	15.1	15.7	15.0	15.0	14.9	-1.2	-1.7	-1.0	-1.0	-0.9
	15.5	13.9	15.0	15.6	14.8	14.8	14.8	-1.1	-1.6	-0.9	-0.9	-0.8
	16.2	13.9	14.9	15.5	14.8	14.8	14.7	-1.0	-1.5	-0.8	-0.8	-0.7
HSS WWTP	16.8	14.0	15.0	15.5	14.8	14.8	14.7	-1.0	-1.5	-0.8	-0.8	-0.8
	17.4	15.3	20.4	21.0	20.2	20.2	20.2	-5.1	-5.6	-4.9	-4.9	-4.8
	18.0	15.3	20.4	21.0	20.3	20.3	20.2	-5.1	-5.6	-4.9	-4.9	-4.8
	18.6	15.4	20.5	21.0	20.3	20.3	20.2	-5.1	-5.7	-4.9	-4.9	-4.9
	19.3	15.4	20.5	21.1	20.3	20.3	20.3	-5.1	-5.7	-5.0	-5.0	-4.9
	19.9	15.4	20.5	21.1	20.4	20.4	20.3	-5.1	-5.7	-5.0	-5.0	-4.9
	20.5	15.4	20.5	21.1	20.4	20.4	20.3	-5.1	-5.7	-5.0	-5.0	-4.9
	21.1	15.4	20.5	21.1	20.4	20.4	20.3	-5.1	-5.7	-5.0	-5.0	-4.9
	21.7	15.5	20.6	21.1	20.4	20.4	20.3	-5.1	-5.7	-5.0	-5.0	-4.9
	22.4	15.5	20.6	21.2	20.4	20.4	20.4	-5.1	-5.7	-5.0	-5.0	-4.9
	23.0	15.5	20.6	21.2	20.5	20.5	20.4	-5.1	-5.7	-5.0	-5.0	-4.9
Williams Fork	23.6	15.5	20.6	21.2	20.5	20.5	20.4	-5.1	-5.7	-5.0	-5.0	-4.9
	24.2	13.3	12.7	12.8	12.6	12.6	12.6	0.6	0.5	0.7	0.7	0.7
	24.9	13.3	12.7	12.8	12.7	12.7	12.6	0.6	0.5	0.7	0.7	0.7
	25.5	13.3	12.7	12.9	12.7	12.7	12.7	0.6	0.5	0.7	0.7	0.7
	26.1	13.4	12.7	12.9	12.7	12.7	12.7	0.6	0.5	0.7	0.7	0.7
	26.7	13.4	12.8	12.9	12.7	12.7	12.7	0.6	0.5	0.7	0.7	0.7
	27.3	13.4	12.8	12.9	12.7	12.7	12.7	0.6	0.5	0.6	0.6	0.7
	28.0	13.4	12.8	12.9	12.8	12.8	12.7	0.6	0.5	0.6	0.6	0.7
	28.6	13.4	12.8	13.0	12.8	12.8	12.8	0.6	0.5	0.6	0.6	0.7
	29.2	13.5	12.9	13.0	12.8	12.8	12.8	0.6	0.4	0.6	0.6	0.7
	29.8	13.5	12.9	13.0	12.9	12.9	12.8	0.6	0.4	0.6	0.6	0.6
	30.4	13.5	12.9	13.1	12.9	12.9	12.9	0.6	0.4	0.6	0.6	0.6
	31.1	13.5	12.9	13.1	12.9	12.9	12.9	0.6	0.4	0.6	0.6	0.6
Troublesome Creek	31.7	13.5	13.0	13.1	12.9	12.9	12.9	0.6	0.4	0.6	0.6	0.6
	32.3	13.1	12.2	12.3	12.2	12.2	12.1	0.9	0.7	0.9	0.9	0.9
	32.9	13.0	12.1	12.2	12.0	12.0	12.0	0.9	0.8	1.0	1.0	1.0
	33.6	12.9	11.9	12.1	11.9	11.9	11.9	1.0	0.8	1.0	1.0	1.0
	34.2	12.8	11.8	11.9	11.8	11.8	11.8	1.0	0.9	1.0	1.0	1.1

	River Mile											
	34.8	12.8	11.7	11.8	11.7	11.7	11.7	1.0	0.9	1.1	1.1	1.1
	35.4	12.7	11.6	11.7	11.6	11.6	11.6	1.1	1.0	1.1	1.1	1.1
	36.0	12.6	11.5	11.6	11.5	11.5	11.5	1.1	1.0	1.1	1.1	1.2
	36.7	12.6	11.4	11.5	11.4	11.4	11.4	1.2	1.0	1.2	1.2	1.2
	37.3	12.5	11.3	11.5	11.3	11.3	11.3	1.2	1.1	1.2	1.2	1.2
	37.9	12.5	11.3	11.4	11.2	11.2	11.2	1.2	1.1	1.2	1.2	1.3
	38.5	12.4	11.2	11.3	11.2	11.2	11.2	1.2	1.1	1.3	1.3	1.3
	39.1	12.4	11.1	11.3	11.1	11.1	11.1	1.3	1.2	1.3	1.3	1.3
Muddy Ck/Blue River	39.8	12.4	11.1	11.2	11.1	11.1	11.1	1.3	1.2	1.3	1.3	1.3
	40.4	11.2	10.4	10.5	10.4	10.4	10.4	0.8	0.7	0.8	0.8	0.8
	41.0	11.2	10.5	10.5	10.5	10.5	10.5	0.7	0.7	0.8	0.8	0.8
	41.6	11.2	10.5	10.5	10.5	10.5	10.5	0.7	0.7	0.8	0.8	0.8
	42.3	11.2	10.5	10.5	10.5	10.5	10.5	0.7	0.7	0.8	0.8	0.8
	42.9	11.3	10.5	10.6	10.5	10.5	10.5	0.7	0.7	0.7	0.7	0.8
	43.5	11.3	10.5	10.6	10.5	10.5	10.5	0.7	0.7	0.7	0.7	0.8
top of Gore Canyon	44.2	11.3	10.5	10.6	10.5	10.5	10.5	0.7	0.7	0.7	0.7	0.7

		River Selenium						**Change in selenium concentration**				
	River Mile	Existing Conditions Selenium (µg/L)	No Action Selenium (µg/L)	Proposed Action Selenium (µg/L)	Alt 3 Selenium (µg/L)	Alt 4 Selenium (µg/L)	Alt 5 Selenium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	0.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	1.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	1.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	2.5	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	3.1	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Willow Creek	3.7	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	4.3	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	5.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	5.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	6.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	6.8	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	7.5	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Fraser River	8.1	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000

	8.4	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Windy Gap Reservoir	8.7	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	8.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	9.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	9.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	9.3	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	9.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	9.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	10.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	11.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	11.8	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	12.4	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	13.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	13.7	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	14.3	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	14.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	15.5	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	16.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
HSS WWTP	16.8	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	17.4	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	18.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	18.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	19.3	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	19.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	20.5	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	21.1	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	21.7	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	22.4	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	23.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Williams Fork	23.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	24.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	24.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	25.5	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	26.1	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	26.7	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000

	27.3	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	28.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	28.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	29.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	29.8	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	30.4	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	31.1	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Troublesome Creek	31.7	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	32.3	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	32.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	33.6	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	34.2	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	34.8	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	35.4	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	36.0	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	36.7	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	37.3	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	37.9	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	38.5	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	39.1	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Muddy Ck/Blue River	39.8	0.500	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000
	40.4	0.675	0.717	0.717	0.717	0.717	0.717	-0.042	-0.042	-0.042	-0.042	-0.042
	41.0	0.674	0.716	0.716	0.716	0.716	0.716	-0.042	-0.042	-0.042	-0.042	-0.042
	41.6	0.674	0.715	0.716	0.716	0.716	0.716	-0.041	-0.042	-0.042	-0.042	-0.042
	42.3	0.673	0.715	0.715	0.715	0.715	0.715	-0.041	-0.041	-0.042	-0.042	-0.042
	42.9	0.673	0.714	0.714	0.714	0.714	0.714	-0.041	-0.041	-0.041	-0.041	-0.041
	43.5	0.672	0.713	0.713	0.713	0.713	0.713	-0.041	-0.041	-0.041	-0.041	-0.041
top of Gore Canyon	44.2	0.672	0.712	0.712	0.712	0.712	0.712	-0.040	-0.041	-0.041	-0.041	-0.041

Cumulative Effects — Average Flow (July 25)

NOTE: Negative values are increases under alternatives

	River Discharge							Change in discharge				
	River Mile	EC Q (cfs)	No Action Q (cfs)	Proposed Action Q (cfs)	Alt 3 Q (cfs)	Alt 4 Q (cfs)	Alt 5 Q (cfs)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	138	122	117			119	15.6	20.4			19.0
	0.6	138	122	117			119	15.6	20.4			19.0
	1.2	138	122	117			119	15.6	20.4			19.0
	1.9	138	122	117			119	15.6	20.4			19.0
	2.5	138	122	117			119	15.6	20.4			19.0
	3.1	138	122	117			119	15.6	20.4			19.0
Willow Creek	3.7	149	135	126			128	13.1	22.1			20.6
	4.3	162	152	138			139	10.1	24.2			22.6
	5.0	203	188	167			169	15.2	36.3			34.5
	5.6	216	204	178			180	12.2	38.4			36.4
	6.2	230	221	189			191	9.2	40.5			38.4
	6.8	243	237	200			203	6.2	42.7			40.3
	7.5	256	253	212			214	3.2	44.8			42.3
Fraser River	8.1	270	270	223			225	0.2	46.9			44.3
	8.4	436	407	357			360	29.6	78.9			76.3
Windy Gap Reservoir	8.7	443	415	363			365	28.1	80.0			77.2
	8.9	407	343	311			287	64.4	96.6			120.2
	9.0	408	342	311			287	65.3	96.6			120.3
	9.2	408	342	311			288	66.3	96.7			120.3
	9.3	409	341	312			288	67.3	96.8			120.4
	9.6	409	340	312			289	69.2	97.0			120.6
	9.9	410	339	313			289	71.1	97.1			120.7
	10.6	412	337	314			291	74.9	97.5			121.1
	11.2	413	335	316			292	78.8	97.8			121.4
	11.8	415	332	317			293	82.6	98.1			121.7
	12.4	416	330	318			294	86.5	98.4			122.0
	13.0	418	328	319			296	90.3	98.7			122.3
	13.7	420	326	321			297	94.1	99.1			122.7
	14.3	421	323	322			298	98.0	99.4			123.0

	14.9	423	321	323			300	101.8	99.7			123.3
	15.5	424	319	324			301	105.7	100.0			123.6
	16.2	425	317	325			301	107.9	100.2			123.8
HSS WWTP	16.8	421	313	320			297	107.9	100.2			123.8
	17.4	420	312	320			296	107.9	100.2			123.8
	18.0	419	311	319			295	107.9	100.3			123.8
	18.6	418	310	318			294	107.9	100.3			123.8
	19.3	417	309	317			293	107.9	100.3			123.8
	19.9	416	308	316			293	107.9	100.3			123.8
	20.5	415	307	315			292	108.0	100.3			123.8
	21.1	415	307	314			291	108.0	100.3			123.9
	21.7	414	306	313			290	108.0	100.3			123.9
	22.4	413	305	312			289	108.0	100.3			123.9
	23.0	412	304	311			288	108.0	100.3			123.9
Williams Fork	23.6	411	303	311			287	108.0	100.3			123.9
	24.2	691	569	576			553	121.9	114.2			137.8
	24.9	690	566	574			550	124.4	116.8			140.3
	25.5	690	563	571			547	126.9	119.3			142.9
	26.1	690	560	568			544	129.4	121.9			145.4
	26.7	690	558	565			542	131.9	124.4			147.9
	27.3	689	555	562			539	134.4	127.0			150.5
	28.0	689	552	559			536	136.9	129.6			153.0
	28.6	689	549	557			533	139.4	132.1			155.6
	29.2	688	547	554			530	141.9	134.7			158.1
	29.8	688	544	551			527	144.4	137.3			160.7
	30.4	688	541	548			525	146.8	139.8			163.2
	31.1	688	538	545			522	149.3	142.4			165.8
Troublesome Creek	31.7	687	536	542			519	151.8	144.9			168.3
	32.3	743	590	597			574	153.0	146.2			169.5
	32.9	753	599	605			582	154.1	147.3			170.7
	33.6	762	607	614			591	155.2	148.5			171.8
	34.2	772	616	623			599	156.3	149.7			172.9
	34.8	782	625	631			608	157.4	150.8			174.0
	35.4	792	633	640			617	158.5	152.0			175.1
	36.0	801	642	648			625	159.6	153.1			176.2

	36.7	811	650	657			634	160.7	154.3			177.3
	37.3	821	659	665			642	161.8	155.4			178.4
	37.9	830	668	674			651	162.9	156.6			179.5
	38.5	840	676	682			660	164.0	157.7			180.7
	39.1	850	685	691			668	165.1	158.9			181.8
Muddy Ck/Blue River	39.8	860	693	700			677	166.2	160.0			182.9
	40.4	1,757	1,303	1,309			1,288	453.9	448.0			469.7
	41.0	1,763	1,311	1,317			1,295	452.1	446.3			467.9
	41.6	1,769	1,319	1,324			1,303	450.2	444.6			466.1
	42.3	1,775	1,326	1,332			1,310	448.4	442.9			464.4
	42.9	1,781	1,334	1,339			1,318	446.5	441.1			462.6
	43.5	1,786	1,342	1,347			1,325	444.7	439.4			460.8
top of Gore Canyon	44.2	1,793	1,350	1,355			1,334	442.6	437.5			458.9

		River Temperature						Change in temperature				
	River Mile	EC T (deg. C)	No Action T (deg. C)	Proposed Action T (deg. C)	Alt 3 T (deg. C)	Alt 4 T (deg. C)	Alt 5 T (deg. C)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	9.0	9.0	9.0			9.0	0.0	0.0			0.0
	0.6	9.1	9.1	9.2			9.2	0.0	0.0			0.0
	1.2	9.3	9.3	9.3			9.3	0.0	0.0			0.0
	1.9	9.4	9.5	9.5			9.5	0.0	-0.1			-0.1
	2.5	9.5	9.6	9.6			9.6	-0.1	-0.1			-0.1
	3.1	9.7	9.8	9.8			9.8	-0.1	-0.1			-0.1
Willow Creek	3.7	10.0	10.1	10.1			10.1	-0.1	-0.1			-0.1
	4.3	10.2	10.4	10.4			10.4	-0.2	-0.1			-0.1
	5.0	10.6	10.8	10.7			10.7	-0.2	-0.1			-0.1
	5.6	10.8	10.9	10.9			10.9	-0.2	-0.1			-0.1
	6.2	10.9	11.1	11.1			11.1	-0.2	-0.1			-0.1
	6.8	11.1	11.3	11.2			11.2	-0.2	-0.1			-0.1
	7.5	11.3	11.5	11.4			11.4	-0.2	-0.2			-0.1
Fraser River	8.1	11.4	11.6	11.6			11.6	-0.2	-0.2			-0.2
	8.4	13.1	13.0	13.2			13.2	0.1	-0.1			-0.1
Windy Gap Reservoir	8.7	13.1	13.0	13.2			13.2	0.1	-0.1			-0.1
	8.9	13.1	13.0	13.2			13.2	0.1	-0.1			-0.1
	9.0	13.5	13.5	13.7			13.7	0.0	-0.2			-0.2

	9.2	13.7	13.7	13.9			13.9	0.0	-0.2			-0.3
	9.3	13.7	13.7	13.9			14.0	0.0	-0.3			-0.3
	9.6	13.7	13.7	14.0			14.0	0.0	-0.3			-0.3
	9.9	13.7	13.7	14.0			14.0	0.0	-0.3			-0.3
	10.6	13.8	13.8	14.0			14.1	0.0	-0.3			-0.3
	11.2	13.8	13.8	14.1			14.1	-0.1	-0.3			-0.3
	11.8	13.8	13.9	14.1			14.1	-0.1	-0.3			-0.3
	12.4	13.8	13.9	14.1			14.2	-0.1	-0.3			-0.3
	13.0	13.9	14.0	14.2			14.2	-0.1	-0.3			-0.4
	13.7	13.9	14.0	14.2			14.3	-0.1	-0.3			-0.4
	14.3	14.0	14.1	14.3			14.3	-0.1	-0.3			-0.4
	14.9	14.0	14.2	14.3			14.4	-0.2	-0.3			-0.4
	15.5	14.0	14.2	14.4			14.5	-0.2	-0.3			-0.4
	16.2	14.1	14.3	14.4			14.5	-0.2	-0.4			-0.4
HSS WWTP	16.8	14.1	14.3	14.5			14.6	-0.2	-0.4			-0.4
	17.4	14.2	14.4	14.6			14.7	-0.2	-0.4			-0.5
	18.0	14.3	14.5	14.7			14.8	-0.3	-0.4			-0.5
	18.6	14.4	14.6	14.8			14.9	-0.3	-0.4			-0.5
	19.3	14.4	14.7	14.9			15.0	-0.3	-0.5			-0.6
	19.9	14.5	14.8	15.0			15.1	-0.3	-0.5			-0.6
	20.5	14.6	14.9	15.1			15.2	-0.3	-0.5			-0.6
	21.1	14.6	15.0	15.1			15.2	-0.4	-0.5			-0.6
	21.7	14.7	15.1	15.2			15.3	-0.4	-0.5			-0.6
	22.4	14.7	15.1	15.2			15.4	-0.4	-0.5			-0.7
	23.0	14.8	15.2	15.3			15.5	-0.4	-0.5			-0.7
Williams Fork	23.6	14.9	15.3	15.4			15.6	-0.4	-0.6			-0.7
	24.2	14.3	14.5	14.5			14.6	-0.1	-0.2			-0.3
	24.9	14.4	14.5	14.6			14.6	-0.2	-0.2			-0.3
	25.5	14.4	14.6	14.6			14.7	-0.2	-0.2			-0.3
	26.1	14.5	14.6	14.7			14.7	-0.2	-0.3			-0.3
	26.7	14.5	14.7	14.8			14.8	-0.2	-0.3			-0.3
	27.3	14.6	14.7	14.8			14.9	-0.2	-0.3			-0.3
	28.0	14.6	14.8	14.9			14.9	-0.2	-0.3			-0.3
	28.6	14.7	14.9	14.9			15.0	-0.2	-0.3			-0.3
	29.2	14.7	14.9	15.0			15.1	-0.2	-0.3			-0.3

	29.8	14.7	15.0	15.1			15.1	-0.2	-0.3			-0.4
	30.4	14.8	15.0	15.1			15.2	-0.2	-0.3			-0.4
	31.1	14.8	15.1	15.1			15.2	-0.3	-0.3			-0.4
Troublesome Creek	31.7	14.9	15.1	15.2			15.3	-0.3	-0.3			-0.4
	32.3	15.2	15.5	15.5			15.6	-0.3	-0.4			-0.4
	32.9	15.2	15.5	15.5			15.6	-0.3	-0.4			-0.4
	33.6	15.2	15.5	15.5			15.6	-0.3	-0.4			-0.4
	34.2	15.2	15.5	15.5			15.6	-0.3	-0.4			-0.4
	34.8	15.2	15.5	15.6			15.6	-0.3	-0.4			-0.4
	35.4	15.2	15.5	15.6			15.6	-0.3	-0.4			-0.4
	36.0	15.2	15.6	15.6			15.7	-0.3	-0.4			-0.4
	36.7	15.3	15.6	15.6			15.7	-0.3	-0.4			-0.4
	37.3	15.3	15.6	15.7			15.7	-0.3	-0.4			-0.5
	37.9	15.3	15.7	15.7			15.8	-0.3	-0.4			-0.5
	38.5	15.3	15.7	15.7			15.8	-0.3	-0.4			-0.5
	39.1	15.4	15.7	15.8			15.8	-0.4	-0.4			-0.5
Muddy Ck/Blue River	39.8	15.4	15.7	15.8			15.8	-0.4	-0.4			-0.5
	40.4	13.3	13.7	13.7			13.7	-0.4	-0.4			-0.4
	41.0	13.3	13.7	13.7			13.7	-0.4	-0.4			-0.4
	41.6	13.3	13.7	13.8			13.7	-0.4	-0.4			-0.4
	42.3	13.3	13.8	13.8			13.8	-0.4	-0.4			-0.4
	42.9	13.3	13.7	13.8			13.8	-0.4	-0.4			-0.4
	43.5	13.3	13.7	13.8			13.8	-0.4	-0.4			-0.4
top of Gore Canyon	44.2	13.3	13.7	13.8			13.8	-0.4	-0.4			-0.4

		River Specific Conductivity						**Change in conductivity**				
	River Mile	EC Conduct-ivity (umhos)	No Action Conduct-ivity (umhos)	Proposed Action Conduct-ivity (umhos)	Alt 3 Conduct-ivity (umhos)	Alt 4 Conduct-ivity (umhos)	Alt 5 Conduct-ivity (umhos)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	0.6	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	1.2	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	1.9	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	2.5	61.0	61.0	61.0			61.0	0.0	0.0			0.0

	3.1	61.0	61.0	61.0			61.0	0.0	0.0			0.0
Willow Creek	3.7	68.6	71.3	68.6			68.6	-2.6	0.1			0.1
	4.3	76.6	81.4	76.4			76.4	-4.8	0.2			0.1
	5.0	104.9	105.4	100.0			99.9	-0.5	4.8			5.0
	5.6	108.6	110.2	104.1			104.0	-1.6	4.5			4.6
	6.2	111.8	114.2	107.7			107.6	-2.4	4.1			4.2
	6.8	114.8	117.7	110.9			110.8	-3.0	3.8			3.9
	7.5	117.4	120.8	113.8			113.7	-3.4	3.6			3.7
Fraser River	8.1	119.7	123.5	116.4			116.3	-3.7	3.4			3.4
	8.4	126.0	127.9	123.8			123.8	-1.9	2.2			2.3
Windy Gap Reservoir	8.7	126.6	128.7	124.5			124.4	-2.1	2.1			2.2
	8.9	126.9	129.0	124.8			124.7	-2.2	2.1			2.2
	9.0	127.0	129.0	124.9			124.8	-2.1	2.1			2.1
	9.2	127.0	129.0	124.9			124.8	-2.0	2.1			2.1
	9.3	127.0	129.0	124.9			124.8	-2.0	2.1			2.1
	9.6	127.1	129.0	125.0			124.9	-2.0	2.1			2.1
	9.9	127.1	129.0	125.1			125.0	-1.9	2.1			2.1
	10.6	127.3	129.0	125.2			125.2	-1.7	2.1			2.1
	11.2	127.4	129.0	125.4			125.4	-1.6	2.0			2.1
	11.8	127.6	129.0	125.6			125.5	-1.5	2.0			2.0
	12.4	127.7	129.0	125.7			125.7	-1.3	2.0			2.0
	13.0	127.9	129.0	125.9			125.9	-1.2	2.0			2.0
	13.7	128.0	129.0	126.0			126.0	-1.0	2.0			2.0
	14.3	128.1	129.0	126.2			126.2	-0.9	2.0			1.9
	14.9	128.3	129.0	126.3			126.4	-0.8	2.0			1.9
	15.5	128.4	129.0	126.5			126.5	-0.6	1.9			1.9
	16.2	128.5	129.0	126.6			126.6	-0.5	1.9			1.9
HSS WWTP	16.8	128.5	129.0	126.6			126.6	-0.5	1.9			1.9
	17.4	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	18.0	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	18.6	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	19.3	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	19.9	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	20.5	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	21.1	128.8	129.4	126.9			127.0	-0.6	1.8			1.7

	21.7	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	22.4	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	23.0	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
Williams Fork	23.6	128.8	129.4	126.9			127.0	-0.6	1.8			1.7
	24.2	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	24.9	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	25.5	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	26.1	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	26.7	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	27.3	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	28.0	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	28.6	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	29.2	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	29.8	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	30.4	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	31.1	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
Troublesome Creek	31.7	267.2	289.2	285.8			292.6	-22.0	-18.6			-25.4
	32.3	254.2	270.7	267.8			273.2	-16.5	-13.6			-19.0
	32.9	253.0	269.2	266.4			271.6	-16.1	-13.3			-18.6
	33.6	251.9	267.7	265.0			270.1	-15.8	-13.0			-18.2
	34.2	250.8	266.3	263.6			268.6	-15.4	-12.8			-17.8
	34.8	249.8	264.9	262.3			267.1	-15.1	-12.5			-17.4
	35.4	248.7	263.5	261.0			265.7	-14.8	-12.2			-17.0
	36.0	247.7	262.2	259.7			264.3	-14.5	-12.0			-16.6
	36.7	246.7	260.9	258.5			263.0	-14.2	-11.7			-16.2
	37.3	245.8	259.7	257.2			261.6	-13.9	-11.5			-15.9
	37.9	244.8	258.4	256.1			260.4	-13.6	-11.3			-15.6
	38.5	243.9	257.2	254.9			259.1	-13.4	-11.1			-15.2
	39.1	243.0	256.1	253.8			257.9	-13.1	-10.8			-14.9
Muddy Ck/Blue River	39.8	242.1	255.0	252.7			256.7	-12.9	-10.6			-14.6
	40.4	279.6	295.9	294.4			298.0	-16.3	-14.8			-18.4
	41.0	279.2	295.2	293.7			297.2	-15.9	-14.4			-18.0
	41.6	278.9	294.4	293.0			296.5	-15.6	-14.1			-17.6
	42.3	278.5	293.7	292.2			295.7	-15.2	-13.7			-17.2
	42.9	278.1	292.9	291.5			295.0	-14.8	-13.4			-16.8

	43.5	277.8	292.2	290.8			294.2	-14.5	-13.1			-16.5
top of Gore Canyon	44.2	277.4	291.4	290.0			293.4	-14.1	-12.7			-16.1

		River TDS						Change in TDS				
	River Mile	EC TDS (mg/L)	No Action TDS (mg/L)	Proposed Action TDS (mg/L)	Alt 3 TDS (mg/L)	Alt 4 TDS (mg/L)	Alt 5 TDS (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	0.6	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	1.2	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	1.9	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	2.5	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	3.1	36.6	36.6	36.6			36.6	0.0	0.0			0.0
Willow Creek	3.7	41.2	42.8	41.1			41.1	-1.6	0.1			0.0
	4.3	45.9	48.8	45.8			45.9	-2.9	0.1			0.1
	5.0	62.9	63.3	60.0			59.9	-0.3	2.9			3.0
	5.6	65.1	66.1	62.5			62.4	-1.0	2.7			2.7
	6.2	67.1	68.5	64.6			64.6	-1.4	2.5			2.5
	6.8	68.9	70.6	66.6			66.5	-1.8	2.3			2.4
	7.5	70.4	72.5	68.3			68.2	-2.0	2.1			2.2
Fraser River	8.1	71.8	74.1	69.8			69.8	-2.2	2.0			2.1
	8.4	75.6	76.8	74.3			74.3	-1.2	1.3			1.4
Windy Gap Reservoir	8.7	76.0	77.2	74.7			74.6	-1.3	1.3			1.3
	8.9	76.1	77.4	74.9			74.8	-1.3	1.3			1.3
	9.0	76.2	77.4	74.9			74.9	-1.2	1.2			1.3
	9.2	76.2	77.4	74.9			74.9	-1.2	1.2			1.3
	9.3	76.2	77.4	74.9			74.9	-1.2	1.2			1.3
	9.6	76.2	77.4	75.0			75.0	-1.2	1.2			1.3
	9.9	76.3	77.4	75.0			75.0	-1.1	1.2			1.3
	10.6	76.4	77.4	75.1			75.1	-1.0	1.2			1.3
	11.2	76.5	77.4	75.2			75.2	-1.0	1.2			1.2
	11.8	76.5	77.4	75.3			75.3	-0.9	1.2			1.2
	12.4	76.6	77.4	75.4			75.4	-0.8	1.2			1.2
	13.0	76.7	77.4	75.5			75.5	-0.7	1.2			1.2
	13.7	76.8	77.4	75.6			75.6	-0.6	1.2			1.2

	14.3	76.9	77.4	75.7			75.7	-0.5	1.2			1.2
	14.9	77.0	77.4	75.8			75.8	-0.5	1.2			1.1
	15.5	77.1	77.4	75.9			75.9	-0.4	1.2			1.1
	16.2	77.1	77.4	75.9			76.0	-0.3	1.2			1.1
HSS WWTP	16.8	77.1	77.4	75.9			76.0	-0.3	1.2			1.1
	17.4	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	18.0	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	18.6	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	19.3	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	19.9	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	20.5	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	21.1	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	21.7	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	22.4	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	23.0	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
Williams Fork	23.6	77.3	77.6	76.2			76.2	-0.4	1.1			1.0
	24.2	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	24.9	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	25.5	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	26.1	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	26.7	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	27.3	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	28.0	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	28.6	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	29.2	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	29.8	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	30.4	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	31.1	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
Troublesome Creek	31.7	160.3	173.5	171.5			175.5	-13.2	-11.1			-15.2
	32.3	152.5	162.4	160.7			163.9	-9.9	-8.2			-11.4
	32.9	151.8	161.5	159.8			163.0	-9.7	-8.0			-11.2
	33.6	151.2	160.6	159.0			162.1	-9.5	-7.8			-10.9
	34.2	150.5	159.8	158.2			161.1	-9.3	-7.7			-10.7
	34.8	149.9	158.9	157.4			160.3	-9.1	-7.5			-10.4
	35.4	149.2	158.1	156.6			159.4	-8.9	-7.3			-10.2

	36.0	148.6	157.3	155.8			158.6	-8.7	-7.2			-10.0
	36.7	148.0	156.5	155.1			157.8	-8.5	-7.0			-9.7
	37.3	147.5	155.8	154.3			157.0	-8.3	-6.9			-9.5
	37.9	146.9	155.1	153.6			156.2	-8.2	-6.8			-9.3
	38.5	146.3	154.3	153.0			155.5	-8.0	-6.6			-9.1
	39.1	145.8	153.7	152.3			154.7	-7.9	-6.5			-9.0
Muddy Ck/Blue River	39.8	145.3	153.0	151.6			154.0	-7.7	-6.4			-8.8
	40.4	167.8	177.6	176.7			178.8	-9.8	-8.9			-11.0
	41.0	167.5	177.1	176.2			178.3	-9.6	-8.7			-10.8
	41.6	167.3	176.7	175.8			177.9	-9.3	-8.5			-10.6
	42.3	167.1	176.2	175.3			177.4	-9.1	-8.2			-10.3
	42.9	166.9	175.8	174.9			177.0	-8.9	-8.0			-10.1
	43.5	166.7	175.3	174.5			176.5	-8.7	-7.8			-9.9
top of Gore Canyon	44.2	166.4	174.8	174.0			176.0	-8.4	-7.6			-9.6

		River Dissolved Oxygen						**Change in DO**				
	River Mile	EC DO (mg/L)	No Action DO (mg/L)	Proposed Action DO (mg/L)	Alt 3 DO (mg/L)	Alt 4 DO (mg/L)	Alt 5 DO (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	8.8	8.8	8.8			8.8	0.0	0.0			0.0
	0.6	8.7	8.7	8.7			8.7	0.0	0.0			0.0
	1.2	8.7	8.7	8.7			8.7	0.0	0.0			0.0
	1.9	8.7	8.6	8.6			8.6	0.0	0.0			0.0
	2.5	8.6	8.6	8.6			8.6	0.0	0.0			0.0
	3.1	8.6	8.5	8.5			8.5	0.0	0.0			0.0
Willow Creek	3.7	8.4	8.4	8.4			8.4	0.1	0.0			0.0
	4.3	8.3	8.2	8.3			8.3	0.1	0.0			0.0
	5.0	8.3	8.2	8.2			8.2	0.1	0.0			0.0
	5.6	8.2	8.1	8.1			8.1	0.1	0.0			0.0
	6.2	8.1	8.0	8.1			8.1	0.1	0.0			0.0
	6.8	8.0	7.9	8.0			8.0	0.1	0.0			0.0
	7.5	8.0	7.9	7.9			7.9	0.1	0.0			0.0
Fraser River	8.1	7.9	7.8	7.9			7.9	0.1	0.0			0.0
	8.4	7.9	7.9	7.9			7.9	0.1	0.0			0.0
Windy Gap Reservoir	8.7	7.9	7.8	7.9			7.9	0.1	0.0			0.0
	8.9	7.9	7.8	7.9			7.9	0.1	0.0			0.0

	9.0	7.7	7.6	7.6			7.6	0.1	0.1			0.1
	9.2	7.6	7.5	7.4			7.4	0.1	0.1			0.1
	9.3	7.5	7.5	7.4			7.4	0.1	0.1			0.1
	9.6	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	9.9	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	10.6	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	11.2	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	11.8	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	12.4	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	13.0	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	13.7	7.5	7.5	7.5			7.4	0.0	0.1			0.1
	14.3	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	14.9	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	15.5	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	16.2	7.5	7.5	7.4			7.4	0.0	0.1			0.1
HSS WWTP	16.8	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	17.4	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	18.0	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	18.6	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	19.3	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	19.9	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	20.5	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	21.1	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	21.7	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	22.4	7.5	7.5	7.4			7.4	0.0	0.1			0.1
	23.0	7.5	7.4	7.4			7.4	0.0	0.1			0.1
Williams Fork	23.6	7.5	7.4	7.4			7.4	0.0	0.1			0.1
	24.2	7.3	7.2	7.2			7.2	0.1	0.1			0.1
	24.9	7.3	7.3	7.2			7.2	0.0	0.1			0.1
	25.5	7.3	7.3	7.2			7.2	0.0	0.1			0.1
	26.1	7.3	7.3	7.3			7.2	0.0	0.1			0.1
	26.7	7.3	7.3	7.3			7.3	0.0	0.1			0.1
	27.3	7.3	7.3	7.3			7.3	0.0	0.1			0.1
	28.0	7.3	7.3	7.3			7.3	0.0	0.1			0.1
	28.6	7.3	7.3	7.3			7.3	0.0	0.1			0.1

	29.2	7.3	7.3	7.3			7.3	0.0	0.1			0.1
	29.8	7.4	7.3	7.3			7.3	0.0	0.0			0.1
	30.4	7.4	7.3	7.3			7.3	0.0	0.0			0.1
	31.1	7.4	7.3	7.3			7.3	0.0	0.0			0.1
Troublesome Creek	31.7	7.4	7.3	7.3			7.3	0.0	0.0			0.1
	32.3	7.4	7.4	7.4			7.4	0.0	0.0			0.0
	32.9	7.4	7.4	7.4			7.4	0.0	0.0			0.0
	33.6	7.4	7.4	7.4			7.3	0.0	0.0			0.0
	34.2	7.4	7.4	7.3			7.3	0.0	0.0			0.0
	34.8	7.4	7.4	7.3			7.3	0.0	0.0			0.0
	35.4	7.4	7.4	7.3			7.3	0.0	0.0			0.0
	36.0	7.4	7.3	7.3			7.3	0.0	0.0			0.0
	36.7	7.4	7.3	7.3			7.3	0.0	0.0			0.0
	37.3	7.4	7.3	7.3			7.3	0.0	0.0			0.0
	37.9	7.4	7.3	7.3			7.3	0.0	0.0			0.0
	38.5	7.3	7.3	7.3			7.3	0.0	0.0			0.0
	39.1	7.3	7.3	7.3			7.3	0.0	0.0			0.0
Muddy Ck/Blue River	39.8	7.3	7.3	7.3			7.3	0.0	0.0			0.0
	40.4	7.6	7.5	7.5			7.5	0.0	0.1			0.1
	41.0	7.6	7.5	7.5			7.5	0.0	0.1			0.1
	41.6	7.6	7.5	7.5			7.5	0.0	0.1			0.1
	42.3	7.6	7.5	7.5			7.5	0.0	0.1			0.1
	42.9	7.6	7.5	7.5			7.5	0.0	0.1			0.1
	43.5	7.6	7.5	7.5			7.5	0.1	0.1			0.1
top of Gore Canyon	44.2	7.6	7.5	7.5			7.5	0.1	0.1			0.1

		River Ammonia						**Change in ammonia**				
	River Mile	EC Ammon-ium (µg/L)	No Action Ammon-ium (µg/L)	Proposed Action Ammon-ium (µg/L)	Alt 3 Ammon-ium (µg/L)	Alt 4 Ammon-ium (µg/L)	Alt 5 Ammon-ium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	10.5	10.5	10.8			10.1	0.0	-0.2			0.5
	0.6	10.7	10.7	10.9			10.2	0.0	-0.2			0.5
	1.2	10.9	11.0	11.2			10.5	0.0	-0.3			0.4
	1.9	11.1	11.2	11.4			10.7	-0.1	-0.3			0.4
	2.5	11.3	11.3	11.6			10.9	-0.1	-0.3			0.4

	3.1	11.4	11.5	11.7			11.0	-0.1	-0.3			0.4
Willow Creek	3.7	11.2	11.1	11.5			10.9	0.1	-0.3			0.3
	4.3	10.8	10.5	11.1			10.6	0.2	-0.3			0.2
	5.0	12.5	11.7	12.4			11.9	0.8	0.1			0.6
	5.6	12.1	11.2	12.0			11.5	0.9	0.1			0.6
	6.2	11.9	11.0	11.9			11.4	0.9	0.1			0.5
	6.8	11.7	10.8	11.7			11.3	0.9	0.0			0.5
	7.5	11.5	10.5	11.4			11.0	1.0	0.0			0.4
Fraser River	8.1	11.3	10.3	11.3			10.9	1.0	0.0			0.4
	8.4	18.8	27.0	29.9			29.5	-8.2	-11.1			-10.7
Windy Gap Reservoir	8.7	18.6	26.5	29.5			29.1	-7.9	-10.9			-10.5
	8.9	18.5	26.3	29.3			28.9	-7.8	-10.8			-10.4
	9.0	20.2	28.1	30.9			30.6	-8.0	-10.7			-10.4
	9.2	21.2	29.1	31.6			31.3	-7.9	-10.5			-10.2
	9.3	21.4	29.3	31.8			31.5	-7.9	-10.4			-10.1
	9.6	21.4	29.3	31.7			31.4	-7.9	-10.4			-10.1
	9.9	21.4	29.3	31.7			31.4	-8.0	-10.4			-10.1
	10.6	21.4	29.4	31.7			31.3	-8.0	-10.3			-10.0
	11.2	21.4	29.5	31.6			31.3	-8.1	-10.2			-9.9
	11.8	21.4	29.5	31.5			31.2	-8.1	-10.2			-9.8
	12.4	21.4	29.6	31.5			31.1	-8.2	-10.1			-9.8
	13.0	21.3	29.6	31.4			31.0	-8.3	-10.0			-9.7
	13.7	21.4	29.7	31.3			31.0	-8.3	-10.0			-9.6
	14.3	21.4	29.7	31.3			30.9	-8.4	-9.9			-9.6
	14.9	21.4	29.8	31.2			30.8	-8.4	-9.9			-9.5
	15.5	21.4	29.9	31.2			30.8	-8.5	-9.8			-9.4
	16.2	21.4	29.9	31.1			30.8	-8.5	-9.7			-9.4
HSS WWTP	16.8	21.4	30.0	31.2			30.8	-8.5	-9.7			-9.4
	17.4	24.6	34.1	35.2			35.2	-9.5	-10.6			-10.6
	18.0	24.6	34.1	35.2			35.2	-9.5	-10.6			-10.5
	18.6	24.7	34.2	35.3			35.2	-9.5	-10.6			-10.5
	19.3	24.7	34.2	35.3			35.2	-9.5	-10.5			-10.5
	19.9	24.8	34.2	35.3			35.2	-9.4	-10.5			-10.4
	20.5	24.8	34.2	35.3			35.2	-9.4	-10.5			-10.4
	21.1	24.8	34.2	35.3			35.2	-9.4	-10.5			-10.4

	21.7	24.9	34.2	35.3			35.2	-9.4	-10.5			-10.4
	22.4	24.9	34.3	35.3			35.2	-9.4	-10.4			-10.3
	23.0	24.9	34.3	35.3			35.2	-9.3	-10.4			-10.3
Williams Fork	23.6	25.0	34.3	35.3			35.2	-9.3	-10.4			-10.3
	24.2	23.1	27.8	28.4			28.1	-4.7	-5.3			-5.0
	24.9	23.3	28.0	28.7			28.3	-4.7	-5.3			-5.0
	25.5	23.5	28.2	28.9			28.6	-4.7	-5.4			-5.0
	26.1	23.7	28.5	29.1			28.8	-4.8	-5.4			-5.1
	26.7	23.8	28.6	29.2			28.9	-4.8	-5.4			-5.1
	27.3	24.0	28.8	29.4			29.1	-4.8	-5.4			-5.1
	28.0	24.1	29.0	29.6			29.3	-4.8	-5.4			-5.1
	28.6	24.4	29.3	29.9			29.6	-4.9	-5.5			-5.2
	29.2	24.6	29.5	30.1			29.8	-4.9	-5.5			-5.2
	29.8	24.8	29.7	30.3			30.1	-4.9	-5.5			-5.3
	30.4	25.0	29.9	30.5			30.3	-5.0	-5.5			-5.3
	31.1	25.1	30.1	30.6			30.4	-5.0	-5.6			-5.3
Troublesome Creek	31.7	25.3	30.3	30.9			30.7	-5.0	-5.6			-5.4
	32.3	24.1	28.3	28.8			28.6	-4.2	-4.8			-4.5
	32.9	24.0	28.2	28.7			28.5	-4.2	-4.7			-4.4
	33.6	24.1	28.2	28.7			28.4	-4.1	-4.6			-4.4
	34.2	24.0	28.1	28.6			28.3	-4.0	-4.6			-4.3
	34.8	24.0	28.0	28.5			28.2	-4.0	-4.5			-4.2
	35.4	24.0	28.0	28.5			28.2	-4.0	-4.5			-4.2
	36.0	24.1	28.0	28.5			28.2	-3.9	-4.4			-4.1
	36.7	24.1	28.0	28.5			28.2	-3.9	-4.4			-4.1
	37.3	24.2	28.0	28.5			28.2	-3.8	-4.3			-4.1
	37.9	24.2	28.0	28.4			28.2	-3.8	-4.3			-4.0
	38.5	24.4	28.2	28.6			28.4	-3.8	-4.3			-4.0
	39.1	24.6	28.4	28.8			28.6	-3.8	-4.2			-4.0
Muddy Ck/Blue River	39.8	24.8	28.6	29.0			28.8	-3.8	-4.2			-4.0
	40.4	27.6	29.8	30.1			30.0	-2.2	-2.4			-2.4
	41.0	28.1	30.3	30.5			30.4	-2.2	-2.4			-2.3
	41.6	28.3	30.5	30.7			30.6	-2.2	-2.4			-2.3
	42.3	28.4	30.5	30.7			30.6	-2.1	-2.3			-2.3
	42.9	28.6	30.7	30.9			30.8	-2.1	-2.3			-2.2

	43.5	28.9	30.9	31.1			31.0	-2.0	-2.2			-2.2
top of Gore Canyon	44.2	29.1	31.0	31.2			31.2	-2.0	-2.2			-2.1

		River Inorganic Phosphorus						**Change in inorganic P**				
	River Mile	EC Inorganic P (µg/L)	No Action Inorganic P (µg/L)	Proposed Action Inorganic P (µg/L)	Alt 3 Inorganic P (µg/L)	Alt 4 Inorganic P (µg/L)	Alt 5 Inorganic P (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	0.6	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	1.2	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	1.9	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	2.5	6.6	5.8	6.6			3.9	0.8	0.1			2.8
	3.1	6.6	5.8	6.6			3.9	0.8	0.1			2.8
Willow Creek	3.7	6.5	5.7	6.4			4.0	0.8	0.1			2.6
	4.3	6.4	5.7	6.3			4.0	0.7	0.1			2.3
	5.0	9.5	8.2	8.8			6.9	1.4	0.8			2.7
	5.6	9.3	7.9	8.6			6.8	1.3	0.7			2.5
	6.2	9.0	7.7	8.4			6.7	1.3	0.7			2.4
	6.8	8.8	7.5	8.2			6.6	1.3	0.6			2.2
	7.5	8.6	7.4	8.0			6.5	1.2	0.6			2.1
Fraser River	8.1	8.4	7.2	7.9			6.4	1.2	0.6			2.0
	8.4	13.4	9.0	9.6			8.7	4.4	3.7			4.7
Windy Gap Reservoir	8.7	13.3	8.9	9.6			8.7	4.3	3.7			4.6
	8.9	13.2	8.9	9.5			8.6	4.3	3.7			4.6
	9.0	13.7	9.3	10.0			9.1	4.4	3.7			4.6
	9.2	14.0	9.5	10.2			9.4	4.5	3.8			4.6
	9.3	14.1	9.5	10.3			9.4	4.6	3.8			4.7
	9.6	14.1	9.5	10.3			9.4	4.6	3.8			4.7
	9.9	14.1	9.5	10.3			9.4	4.5	3.8			4.7
	10.6	14.1	9.5	10.3			9.4	4.5	3.8			4.7
	11.2	14.1	9.6	10.3			9.4	4.5	3.8			4.6
	11.8	14.0	9.6	10.3			9.4	4.5	3.8			4.6
	12.4	14.0	9.6	10.3			9.4	4.4	3.8			4.6
	13.0	14.0	9.6	10.2			9.4	4.4	3.8			4.6
	13.7	14.0	9.6	10.2			9.4	4.4	3.7			4.6

	14.3	14.0	9.6	10.2			9.4	4.4	3.7			4.6
	14.9	14.0	9.6	10.2			9.4	4.3	3.7			4.6
	15.5	13.9	9.7	10.2			9.4	4.3	3.7			4.6
	16.2	13.9	9.7	10.2			9.4	4.3	3.7			4.6
HSS WWTP	16.8	14.0	9.7	10.2			9.4	4.3	3.7			4.6
	17.4	15.3	11.5	12.0			11.3	3.8	3.3			4.0
	18.0	15.3	11.5	12.0			11.3	3.9	3.3			4.0
	18.6	15.4	11.5	12.0			11.3	3.9	3.3			4.1
	19.3	15.4	11.5	12.0			11.3	3.9	3.3			4.1
	19.9	15.4	11.5	12.1			11.3	3.9	3.3			4.1
	20.5	15.4	11.5	12.1			11.3	3.9	3.4			4.1
	21.1	15.4	11.6	12.1			11.4	3.9	3.4			4.1
	21.7	15.5	11.6	12.1			11.4	3.9	3.4			4.1
	22.4	15.5	11.6	12.1			11.4	3.9	3.4			4.1
	23.0	15.5	11.6	12.1			11.4	3.9	3.4			4.1
Williams Fork	23.6	15.5	11.6	12.1			11.4	3.9	3.4			4.1
	24.2	13.3	10.9	11.2			10.7	2.4	2.1			2.5
	24.9	13.3	10.9	11.2			10.8	2.4	2.1			2.6
	25.5	13.3	10.9	11.2			10.8	2.4	2.1			2.6
	26.1	13.4	10.9	11.2			10.8	2.4	2.1			2.6
	26.7	13.4	10.9	11.2			10.8	2.4	2.1			2.6
	27.3	13.4	11.0	11.2			10.8	2.4	2.1			2.6
	28.0	13.4	11.0	11.3			10.8	2.4	2.1			2.6
	28.6	13.4	11.0	11.3			10.9	2.4	2.2			2.6
	29.2	13.5	11.0	11.3			10.9	2.4	2.2			2.6
	29.8	13.5	11.0	11.3			10.9	2.5	2.2			2.6
	30.4	13.5	11.1	11.3			10.9	2.5	2.2			2.6
	31.1	13.5	11.1	11.4			10.9	2.5	2.2			2.6
Troublesome Creek	31.7	13.5	11.1	11.4			11.0	2.5	2.2			2.6
	32.3	13.1	10.7	11.0			10.6	2.4	2.1			2.5
	32.9	13.0	10.6	10.9			10.5	2.3	2.1			2.5
	33.6	12.9	10.6	10.9			10.5	2.3	2.1			2.4
	34.2	12.8	10.5	10.8			10.4	2.3	2.0			2.4
	34.8	12.8	10.5	10.7			10.4	2.3	2.0			2.4
	35.4	12.7	10.4	10.7			10.3	2.3	2.0			2.4

	36.0	12.6	10.4	10.7			10.3	2.2	2.0			2.4
	36.7	12.6	10.4	10.6			10.2	2.2	2.0			2.3
	37.3	12.5	10.3	10.6			10.2	2.2	2.0			2.3
	37.9	12.5	10.3	10.5			10.2	2.2	1.9			2.3
	38.5	12.4	10.3	10.5			10.1	2.2	1.9			2.3
	39.1	12.4	10.2	10.5			10.1	2.2	1.9			2.3
Muddy Ck/Blue River	39.8	12.4	10.2	10.5			10.1	2.2	1.9			2.3
	40.4	11.2	10.1	10.3			10.1	1.1	0.9			1.1
	41.0	11.2	10.2	10.3			10.1	1.1	0.9			1.1
	41.6	11.2	10.2	10.3			10.1	1.1	0.9			1.1
	42.3	11.2	10.2	10.3			10.1	1.1	0.9			1.1
	42.9	11.3	10.2	10.3			10.1	1.1	1.0			1.1
	43.5	11.3	10.2	10.3			10.1	1.1	1.0			1.2
top of Gore Canyon	44.2	11.3	10.2	10.3			10.1	1.1	1.0			1.2

		River Selenium						**Change in selenium**				
	River Mile	EC Selenium (µg/L)	No Action Selenium (µg/L)	Proposed Action Selenium (µg/L)	Alt 3 Selenium (µg/L)	Alt 4 Selenium (µg/L)	Alt 5 Selenium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	0.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	1.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	1.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	2.5	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	3.1	0.50	0.50	0.50			0.50	0.00	0.00			0.00
Willow Creek	3.7	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	4.3	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	5.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	5.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	6.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	6.8	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	7.5	0.50	0.50	0.50			0.50	0.00	0.00			0.00
Fraser River	8.1	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	8.4	0.50	0.50	0.50			0.50	0.00	0.00			0.00
Windy Gap Reservoir	8.7	0.50	0.50	0.50			0.50	0.00	0.00			0.00

	8.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	9.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	9.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	9.3	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	9.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	9.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	10.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	11.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	11.8	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	12.4	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	13.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	13.7	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	14.3	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	14.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	15.5	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	16.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
HSS WWTP	16.8	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	17.4	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	18.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	18.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	19.3	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	19.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	20.5	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	21.1	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	21.7	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	22.4	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	23.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00
Williams Fork	23.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	24.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	24.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	25.5	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	26.1	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	26.7	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	27.3	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	28.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00

	28.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	29.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	29.8	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	30.4	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	31.1	0.50	0.50	0.50			0.50	0.00	0.00			0.00
Troublesome Creek	31.7	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	32.3	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	32.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	33.6	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	34.2	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	34.8	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	35.4	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	36.0	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	36.7	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	37.3	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	37.9	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	38.5	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	39.1	0.50	0.50	0.50			0.50	0.00	0.00			0.00
Muddy Ck/Blue River	39.8	0.50	0.50	0.50			0.50	0.00	0.00			0.00
	40.4	0.67	0.69	0.69			0.69	-0.02	-0.01			-0.02
	41.0	0.67	0.69	0.69			0.69	-0.02	-0.01			-0.02
	41.6	0.67	0.69	0.69			0.69	-0.01	-0.01			-0.02
	42.3	0.67	0.69	0.69			0.69	-0.01	-0.01			-0.02
	42.9	0.67	0.69	0.69			0.69	-0.01	-0.01			-0.02
	43.5	0.67	0.69	0.68			0.69	-0.01	-0.01			-0.02
top of Gore Canyon	44.2	0.67	0.68	0.68			0.69	-0.01	-0.01			-0.02

Cumulative Effects – Minimum Instream Flow Run (July 25)

NOTE: Negative values are increases under alternatives

	River Discharge							Change in discharge				
	River Mile	EC Q (cfs)	No Action Q (cfs)	Proposed Action Q (cfs)	Alt 3 Q (cfs)	Alt 4 Q (cfs)	Alt 5 Q (cfs)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	137.6	122.0	117.2			118.6	15.6	20.4			19.0
	0.6	137.6	122.0	117.2			118.6	15.6	20.4			19.0
	1.2	137.6	122.0	117.2			118.6	15.6	20.4			19.0
	1.9	137.6	122.0	117.2			118.6	15.6	20.4			19.0
	2.5	137.6	122.0	117.2			118.6	15.6	20.4			19.0
	3.1	137.6	122.0	117.2			118.6	15.6	20.4			19.0
Willow Creek	3.7	148.5	131.8	126.4			127.9	16.8	22.1			20.6
	4.3	161.8	143.7	137.6			139.2	18.2	24.2			22.6
	5.0	203.1	175.5	166.8			168.6	27.7	36.3			34.5
	5.6	216.4	187.4	178.0			180.0	29.1	38.4			36.4
	6.2	229.7	199.3	189.2			191.3	30.5	40.5			38.4
	6.8	243.0	211.2	200.4			202.7	31.9	42.7			40.3
	7.5	256.4	223.1	211.6			214.1	33.3	44.8			42.3
Fraser River	8.1	269.7	235.0	222.8			225.4	34.7	46.9			44.3
	8.4	436.1	369.8	357.1			359.8	66.3	78.9			76.3
Windy Gap Reservoir	8.7	442.7	375.7	362.7			365.5	67.0	80.0			77.2
	8.9	407.3	90.0	90.0			90.0	317.3	317.3			317.3
	9.0	407.7	90.3	90.3			90.3	317.4	317.4			317.4
	9.2	408.1	90.6	90.6			90.6	317.5	317.5			317.5
	9.3	408.5	91.0	91.0			91.0	317.6	317.6			317.6
	9.6	409.3	91.6	91.6			91.6	317.7	317.7			317.7
	9.9	410.1	92.3	92.2			92.2	317.9	317.9			317.9
	10.6	411.7	93.5	93.5			93.5	318.2	318.2			318.2
	11.2	413.3	94.8	94.8			94.8	318.5	318.5			318.5
	11.8	414.9	96.1	96.0			96.0	318.8	318.9			318.8
	12.4	416.5	97.4	97.3			97.3	319.1	319.2			319.2
	13.0	418.1	98.7	98.6			98.6	319.4	319.5			319.5
	13.7	419.7	100.0	99.8			99.9	319.7	319.8			319.8
	14.3	421.3	101.3	101.1			101.1	320.0	320.2			320.1

	14.9	422.9	102.6	102.4			102.4	320.3	320.5			320.4
	15.5	424.5	103.9	103.7			103.7	320.6	320.8			320.8
	16.2	425.0	104.2	104.0			104.0	320.8	321.0			321.0
HSS WWTP	16.8	420.7	99.9	99.7			99.8	320.8	321.0			321.0
	17.4	420.0	99.3	99.0			99.1	320.8	321.0			321.0
	18.0	419.1	98.3	98.1			98.2	320.8	321.0			321.0
	18.6	418.2	97.4	97.2			97.2	320.8	321.0			321.0
	19.3	417.3	96.5	96.3			96.3	320.8	321.0			321.0
	19.9	416.4	95.5	95.3			95.4	320.8	321.0			321.0
	20.5	415.4	94.6	94.4			94.4	320.8	321.0			321.0
	21.1	414.5	93.7	93.5			93.5	320.8	321.1			321.0
	21.7	413.6	92.8	92.6			92.6	320.8	321.1			321.0
	22.4	412.7	91.8	91.6			91.7	320.8	321.1			321.0
	23.0	411.8	90.9	90.7			90.7	320.9	321.1			321.0
Williams Fork	23.6	410.9	90.0	89.8			89.8	320.9	321.1			321.0
	24.2	690.6	355.8	355.6			355.7	334.8	335.0			334.9
	24.9	690.3	353.0	352.8			352.9	337.3	337.5			337.5
	25.5	690.1	350.3	350.0			350.1	339.8	340.1			340.0
	26.1	689.8	347.5	347.1			347.2	342.3	342.6			342.6
	26.7	689.5	344.7	344.3			344.4	344.8	345.2			345.1
	27.3	689.3	342.0	341.5			341.6	347.3	347.8			347.6
	28.0	689.0	339.2	338.7			338.8	349.8	350.3			350.2
	28.6	688.7	336.5	335.8			336.0	352.2	352.9			352.7
	29.2	688.5	333.7	333.0			333.2	354.7	355.5			355.3
	29.8	688.2	331.0	330.2			330.3	357.2	358.0			357.8
	30.4	687.9	328.2	327.3			327.5	359.7	360.6			360.4
	31.1	687.6	325.4	324.5			324.7	362.2	363.1			362.9
Troublesome Creek	31.7	687.4	322.7	321.7			321.9	364.7	365.7			365.5
	32.3	743.1	377.2	376.1			376.4	365.9	367.0			366.7
	32.9	752.8	385.8	384.7			385.0	367.0	368.1			367.8
	33.6	762.5	394.4	393.2			393.6	368.1	369.3			368.9
	34.2	772.2	403.0	401.8			402.2	369.2	370.4			370.0
	34.8	781.9	411.6	410.4			410.8	370.3	371.6			371.1
	35.4	791.6	420.2	418.9			419.4	371.4	372.7			372.3
	36.0	801.3	428.9	427.5			428.0	372.5	373.9			373.4

	36.7	811.1	437.5	436.0			436.6	373.6	375.0			374.5
	37.3	820.8	446.1	444.6			445.2	374.7	376.2			375.6
	37.9	830.5	454.7	453.2			453.8	375.8	377.3			376.7
	38.5	840.2	463.3	461.7			462.4	376.9	378.5			377.8
	39.1	849.9	471.9	470.3			471.0	378.0	379.6			378.9
Muddy Ck/Blue River	39.8	859.6	480.5	478.8			479.6	379.1	380.8			380.0
	40.4	1757.3	1090.5	1088.5			1090.5	666.8	668.8			666.8
	41.0	1763.1	1098.2	1096.0			1098.1	665.0	667.1			665.1
	41.6	1768.9	1105.8	1103.6			1105.6	663.1	665.3			663.3
	42.3	1774.7	1113.5	1111.1			1113.2	661.2	663.6			661.5
	42.9	1780.5	1121.1	1118.6			1120.8	659.4	661.9			659.8
	43.5	1786.3	1128.8	1126.2			1128.3	657.5	660.2			658.0
top of Gore Canyon	44.2	1792.7	1137.2	1134.5			1136.7	655.5	658.3			656.0

		River Temperature						**Change in temperature**				
		EC	No Action	Proposed Action	Alt 3	Alt 4	Alt 5	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
	River Mile	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)	T (deg. C)					
Lake Granby outlet	0.0	9.0	9.0	9.0			9.0	0.0	0.0			0.0
	0.6	9.1	9.1	9.2			9.2	0.0	0.0			0.0
	1.2	9.3	9.3	9.3			9.3	0.0	0.0			0.0
	1.9	9.4	9.5	9.5			9.5	0.0	-0.1			-0.1
	2.5	9.5	9.6	9.6			9.6	-0.1	-0.1			-0.1
	3.1	9.7	9.8	9.8			9.8	-0.1	-0.1			-0.1
Willow Creek	3.7	10.0	10.0	10.1			10.1	-0.1	-0.1			-0.1
	4.3	10.2	10.3	10.4			10.4	-0.1	-0.1			-0.1
	5.0	10.6	10.7	10.7			10.7	-0.1	-0.1			-0.1
	5.6	10.8	10.9	10.9			10.9	-0.1	-0.1			-0.1
	6.2	10.9	11.0	11.1			11.1	-0.1	-0.1			-0.1
	6.8	11.1	11.2	11.2			11.2	-0.1	-0.1			-0.1
	7.5	11.3	11.4	11.4			11.4	-0.1	-0.2			-0.1
Fraser River	8.1	11.4	11.5	11.6			11.6	-0.1	-0.2			-0.2
	8.4	13.1	13.1	13.2			13.2	0.0	-0.1			-0.1
Windy Gap Reservoir	8.7	13.1	13.1	13.2			13.2	0.0	-0.1			-0.1
	8.9	13.1	13.2	13.2			13.2	0.0	-0.1			-0.1
	9.0	13.5	14.9	14.9			14.9	-1.4	-1.4			-1.4

	9.2	13.7	15.2	15.3			15.3	-1.5	-1.6			-1.6
	9.3	13.7	15.3	15.3			15.3	-1.6	-1.6			-1.6
	9.6	13.7	15.3	15.4			15.4	-1.6	-1.7			-1.7
	9.9	13.7	15.4	15.4			15.4	-1.6	-1.7			-1.7
	10.6	13.8	15.5	15.5			15.5	-1.7	-1.8			-1.8
	11.2	13.8	15.6	15.6			15.6	-1.8	-1.9			-1.8
	11.8	13.8	15.6	15.7			15.7	-1.8	-1.9			-1.9
	12.4	13.8	15.7	15.8			15.8	-1.9	-2.0			-1.9
	13.0	13.9	15.8	15.9			15.9	-1.9	-2.0			-2.0
	13.7	13.9	15.9	16.0			16.0	-2.0	-2.1			-2.1
	14.3	14.0	16.0	16.1			16.1	-2.1	-2.1			-2.1
	14.9	14.0	16.1	16.2			16.2	-2.1	-2.2			-2.2
	15.5	14.0	16.2	16.3			16.3	-2.2	-2.3			-2.2
	16.2	14.1	16.4	16.4			16.4	-2.3	-2.3			-2.3
HSS WWTP	16.8	14.1	16.5	16.6			16.5	-2.4	-2.4			-2.4
	17.4	14.2	16.7	16.8			16.8	-2.5	-2.6			-2.6
	18.0	14.3	17.0	17.1			17.0	-2.7	-2.8			-2.8
	18.6	14.4	17.3	17.3			17.3	-2.9	-3.0			-2.9
	19.3	14.4	17.5	17.6			17.6	-3.1	-3.1			-3.1
	19.9	14.5	17.8	17.9			17.9	-3.3	-3.4			-3.4
	20.5	14.6	18.0	18.1			18.1	-3.4	-3.5			-3.5
	21.1	14.6	18.2	18.2			18.2	-3.6	-3.6			-3.6
	21.7	14.7	18.4	18.4			18.4	-3.7	-3.7			-3.7
	22.4	14.7	18.5	18.5			18.5	-3.8	-3.8			-3.8
	23.0	14.8	18.7	18.7			18.7	-3.9	-4.0			-3.9
Williams Fork	23.6	14.9	18.9	19.0			18.9	-4.1	-4.1			-4.1
	24.2	14.3	14.9	14.9			14.9	-0.6	-0.6			-0.6
	24.9	14.4	14.9	15.0			15.0	-0.6	-0.6			-0.6
	25.5	14.4	15.0	15.0			15.0	-0.6	-0.6			-0.6
	26.1	14.5	15.1	15.1			15.1	-0.7	-0.7			-0.7
	26.7	14.5	15.2	15.2			15.2	-0.7	-0.7			-0.7
	27.3	14.6	15.3	15.3			15.3	-0.8	-0.8			-0.8
	28.0	14.6	15.4	15.4			15.4	-0.8	-0.8			-0.8
	28.6	14.7	15.5	15.5			15.5	-0.8	-0.8			-0.8
	29.2	14.7	15.6	15.6			15.6	-0.9	-0.9			-0.9

	29.8	14.7	15.7	15.7			15.7	-0.9	-0.9			-0.9
	30.4	14.8	15.7	15.7			15.7	-0.9	-1.0			-1.0
	31.1	14.8	15.8	15.8			15.8	-1.0	-1.0			-1.0
Troublesome Creek	31.7	14.9	15.9	15.9			15.9	-1.0	-1.0			-1.0
	32.3	15.2	16.3	16.3			16.3	-1.2	-1.2			-1.2
	32.9	15.2	16.3	16.3			16.3	-1.1	-1.1			-1.1
	33.6	15.2	16.3	16.3			16.3	-1.1	-1.1			-1.1
	34.2	15.2	16.2	16.2			16.2	-1.1	-1.1			-1.1
	34.8	15.2	16.3	16.3			16.3	-1.1	-1.1			-1.1
	35.4	15.2	16.3	16.3			16.3	-1.1	-1.1			-1.1
	36.0	15.2	16.3	16.3			16.3	-1.1	-1.1			-1.1
	36.7	15.3	16.3	16.3			16.3	-1.1	-1.1			-1.1
	37.3	15.3	16.3	16.4			16.3	-1.1	-1.1			-1.1
	37.9	15.3	16.4	16.4			16.4	-1.1	-1.1			-1.1
	38.5	15.3	16.4	16.4			16.4	-1.1	-1.1			-1.1
	39.1	15.4	16.4	16.4			16.4	-1.1	-1.1			-1.1
Muddy Ck/Blue River	39.8	15.4	16.4	16.4			16.4	-1.1	-1.1			-1.1
	40.4	13.3	13.6	13.6			13.6	-0.3	-0.3			-0.3
	41.0	13.3	13.6	13.6			13.6	-0.3	-0.3			-0.3
	41.6	13.3	13.6	13.6			13.6	-0.3	-0.3			-0.3
	42.3	13.3	13.7	13.7			13.7	-0.3	-0.3			-0.3
	42.9	13.3	13.7	13.7			13.7	-0.3	-0.3			-0.3
	43.5	13.3	13.7	13.7			13.7	-0.3	-0.3			-0.3
top of Gore Canyon	44.2	13.3	13.6	13.6			13.6	-0.3	-0.3			-0.3

		River Specific Conductivity						Change in conductivity				
	River Mile	EC Conduct-ivity (umhos)	No Action Conduct-ivity (umhos)	Proposed Action Conduct-ivity (umhos)	Alt 3 Conduct-ivity (umhos)	Alt 4 Conduct-ivity (umhos)	Alt 5 Conduct-ivity (umhos)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	0.6	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	1.2	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	1.9	61.0	61.0	61.0			61.0	0.0	0.0			0.0
	2.5	61.0	61.0	61.0			61.0	0.0	0.0			0.0

	3.1	61.0	61.0	61.0			61.0	0.0	0.0			0.0
Willow Creek	3.7	68.6	68.7	68.6			68.6	-0.1	0.1			0.1
	4.3	76.6	76.7	76.4			76.4	-0.1	0.2			0.1
	5.0	104.9	101.2	100.0			99.9	3.7	4.8			5.0
	5.6	108.6	105.2	104.1			104.0	3.3	4.5			4.6
	6.2	111.8	108.8	107.7			107.6	3.0	4.1			4.2
	6.8	114.8	112.0	110.9			110.8	2.8	3.8			3.9
	7.5	117.4	114.8	113.8			113.7	2.6	3.6			3.7
Fraser River	8.1	119.7	117.3	116.4			116.3	2.4	3.4			3.4
	8.4	126.0	124.3	123.8			123.8	1.7	2.2			2.3
Windy Gap Reservoir	8.7	126.6	124.9	124.5			124.4	1.7	2.1			2.2
	8.9	126.9	125.2	124.8			124.7	1.7	2.1			2.2
	9.0	127.0	124.2	123.8			123.7	2.8	3.2			3.3
	9.2	127.0	123.9	123.5			123.4	3.0	3.5			3.6
	9.3	127.0	123.9	123.5			123.4	3.1	3.5			3.6
	9.6	127.1	124.2	123.7			123.7	2.9	3.3			3.4
	9.9	127.1	124.4	124.0			123.9	2.7	3.1			3.2
	10.6	127.3	125.0	124.5			124.5	2.3	2.7			2.8
	11.2	127.4	125.5	125.1			125.0	1.9	2.4			2.4
	11.8	127.6	126.0	125.6			125.5	1.6	2.0			2.1
	12.4	127.7	126.5	126.1			126.0	1.2	1.6			1.7
	13.0	127.9	127.0	126.6			126.5	0.9	1.3			1.3
	13.7	128.0	127.5	127.0			127.0	0.5	1.0			1.0
	14.3	128.1	127.9	127.5			127.4	0.2	0.6			0.7
	14.9	128.3	128.4	127.9			127.9	-0.1	0.3			0.4
	15.5	128.4	128.8	128.4			128.3	-0.4	0.0			0.1
	16.2	128.5	129.1	128.6			128.6	-0.6	-0.1			-0.1
HSS WWTP	16.8	128.5	129.0	128.6			128.6	-0.6	-0.1			-0.1
	17.4	128.8	130.2	129.8			129.7	-1.4	-1.0			-0.9
	18.0	128.8	130.2	129.7			129.7	-1.4	-1.0			-0.9
	18.6	128.8	130.1	129.7			129.7	-1.4	-0.9			-0.9
	19.3	128.8	130.1	129.7			129.6	-1.4	-0.9			-0.9
	19.9	128.8	130.1	129.7			129.6	-1.3	-0.9			-0.9
	20.5	128.8	130.1	129.7			129.6	-1.3	-0.9			-0.8
	21.1	128.8	130.1	129.7			129.6	-1.3	-0.9			-0.8

	21.7	128.8	130.1	129.6			129.6	-1.3	-0.9			-0.8
	22.4	128.8	130.1	129.6			129.6	-1.3	-0.8			-0.8
	23.0	128.8	130.0	129.6			129.5	-1.3	-0.8			-0.8
Williams Fork	23.6	128.8	130.0	129.6			129.5	-1.2	-0.8			-0.8
	24.2	267.2	384.4	384.5			384.5	-117.3	-117.3			-117.3
	24.9	267.2	384.4	384.5			384.5	-117.3	-117.3			-117.3
	25.5	267.2	384.4	384.5			384.5	-117.2	-117.3			-117.3
	26.1	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.3
	26.7	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.3
	27.3	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.3
	28.0	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.3
	28.6	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.3
	29.2	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.3
	29.8	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.3
	30.4	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.2
	31.1	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.2
Troublesome Creek	31.7	267.2	384.4	384.5			384.4	-117.2	-117.3			-117.2
	32.3	254.2	341.5	341.5			341.5	-87.3	-87.3			-87.3
	32.9	253.0	337.6	337.5			337.5	-84.5	-84.5			-84.5
	33.6	251.9	333.8	333.8			333.7	-81.9	-81.9			-81.8
	34.2	250.8	330.2	330.2			330.1	-79.4	-79.4			-79.3
	34.8	249.8	326.7	326.7			326.7	-77.0	-77.0			-76.9
	35.4	248.7	323.4	323.4			323.3	-74.7	-74.7			-74.6
	36.0	247.7	320.2	320.2			320.1	-72.5	-72.5			-72.4
	36.7	246.7	317.2	317.2			317.1	-70.4	-70.5			-70.4
	37.3	245.8	314.2	314.3			314.1	-68.5	-68.5			-68.4
	37.9	244.8	311.4	311.4			311.3	-66.6	-66.6			-66.5
	38.5	243.9	308.7	308.7			308.6	-64.8	-64.8			-64.7
	39.1	243.0	306.0	306.1			306.0	-63.0	-63.1			-63.0
Muddy Ck/Blue River	39.8	242.1	303.5	303.6			303.4	-61.4	-61.5			-61.3
	40.4	279.6	325.3	325.2			326.0	-45.7	-45.6			-46.4
	41.0	279.2	324.2	324.1			324.9	-45.0	-44.9			-45.7
	41.6	278.9	323.1	323.0			323.8	-44.2	-44.2			-44.9
	42.3	278.5	322.0	322.0			322.7	-43.5	-43.5			-44.2
	42.9	278.1	320.9	320.9			321.6	-42.8	-42.8			-43.5

	River Mile	EC TDS (mg/L)	No Action TDS (mg/L)	Proposed Action TDS (mg/L)	Alt 3 TDS (mg/L)	Alt 4 TDS (mg/L)	Alt 5 TDS (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
	43.5	277.8	319.9	319.9			320.6	-42.1	-42.1			-42.8
top of Gore Canyon	44.2	277.4	318.7	318.7			319.5	-41.4	-41.4			-42.1

	River TDS						Change in TDS				
River Mile	EC TDS (mg/L)	No Action TDS (mg/L)	Proposed Action TDS (mg/L)	Alt 3 TDS (mg/L)	Alt 4 TDS (mg/L)	Alt 5 TDS (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5

	River Mile	EC TDS (mg/L)	No Action TDS (mg/L)	Proposed Action TDS (mg/L)	Alt 3 TDS (mg/L)	Alt 4 TDS (mg/L)	Alt 5 TDS (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	0.6	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	1.2	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	1.9	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	2.5	36.6	36.6	36.6			36.6	0.0	0.0			0.0
	3.1	36.6	36.6	36.6			36.6	0.0	0.0			0.0
Willow Creek	3.7	41.2	41.2	41.1			41.1	0.0	0.1			0.0
	4.3	45.9	46.0	45.8			45.9	-0.1	0.1			0.1
	5.0	62.9	60.7	60.0			59.9	2.2	2.9			3.0
	5.6	65.1	63.1	62.5			62.4	2.0	2.7			2.7
	6.2	67.1	65.3	64.6			64.6	1.8	2.5			2.5
	6.8	68.9	67.2	66.6			66.5	1.7	2.3			2.4
	7.5	70.4	68.9	68.3			68.2	1.5	2.1			2.2
Fraser River	8.1	71.8	70.4	69.8			69.8	1.4	2.0			2.1
	8.4	75.6	74.6	74.3			74.3	1.0	1.3			1.4
Windy Gap Reservoir	8.7	76.0	74.9	74.7			74.6	1.0	1.3			1.3
	8.9	76.1	75.1	74.9			74.8	1.0	1.3			1.3
	9.0	76.2	74.5	74.3			74.2	1.7	1.9			2.0
	9.2	76.2	74.4	74.1			74.1	1.8	2.1			2.1
	9.3	76.2	74.3	74.1			74.0	1.9	2.1			2.2
	9.6	76.2	74.5	74.2			74.2	1.7	2.0			2.0
	9.9	76.3	74.7	74.4			74.4	1.6	1.9			1.9
	10.6	76.4	75.0	74.7			74.7	1.4	1.6			1.7
	11.2	76.5	75.3	75.0			75.0	1.2	1.4			1.5
	11.8	76.5	75.6	75.3			75.3	0.9	1.2			1.2
	12.4	76.6	75.9	75.6			75.6	0.7	1.0			1.0
	13.0	76.7	76.2	75.9			75.9	0.5	0.8			0.8
	13.7	76.8	76.5	76.2			76.2	0.3	0.6			0.6

	14.3	76.9	76.8	76.5			76.5	0.1	0.4			0.4
	14.9	77.0	77.0	76.8			76.7	-0.1	0.2			0.2
	15.5	77.1	77.3	77.0			77.0	-0.2	0.0			0.1
	16.2	77.1	77.4	77.2			77.1	-0.3	-0.1			0.0
HSS WWTP	16.8	77.1	77.4	77.2			77.1	-0.3	-0.1			0.0
	17.4	77.3	78.1	77.9			77.8	-0.9	-0.6			-0.6
	18.0	77.3	78.1	77.8			77.8	-0.8	-0.6			-0.5
	18.6	77.3	78.1	77.8			77.8	-0.8	-0.6			-0.5
	19.3	77.3	78.1	77.8			77.8	-0.8	-0.5			-0.5
	19.9	77.3	78.1	77.8			77.8	-0.8	-0.5			-0.5
	20.5	77.3	78.1	77.8			77.8	-0.8	-0.5			-0.5
	21.1	77.3	78.1	77.8			77.8	-0.8	-0.5			-0.5
	21.7	77.3	78.0	77.8			77.8	-0.8	-0.5			-0.5
	22.4	77.3	78.0	77.8			77.7	-0.8	-0.5			-0.5
	23.0	77.3	78.0	77.8			77.7	-0.8	-0.5			-0.5
Williams Fork	23.6	77.3	78.0	77.7			77.7	-0.7	-0.5			-0.5
	24.2	160.3	230.7	230.7			230.7	-70.4	-70.4			-70.4
	24.9	160.3	230.7	230.7			230.7	-70.4	-70.4			-70.4
	25.5	160.3	230.7	230.7			230.7	-70.3	-70.4			-70.4
	26.1	160.3	230.7	230.7			230.7	-70.3	-70.4			-70.4
	26.7	160.3	230.7	230.7			230.7	-70.3	-70.4			-70.4
	27.3	160.3	230.6	230.7			230.7	-70.3	-70.4			-70.4
	28.0	160.3	230.6	230.7			230.7	-70.3	-70.4			-70.4
	28.6	160.3	230.6	230.7			230.7	-70.3	-70.4			-70.4
	29.2	160.3	230.6	230.7			230.7	-70.3	-70.4			-70.4
	29.8	160.3	230.6	230.7			230.7	-70.3	-70.4			-70.4
	30.4	160.3	230.6	230.7			230.7	-70.3	-70.4			-70.3
	31.1	160.3	230.6	230.7			230.7	-70.3	-70.4			-70.3
Troublesome Creek	31.7	160.3	230.6	230.7			230.6	-70.3	-70.4			-70.3
	32.3	152.5	204.9	204.9			204.9	-52.4	-52.4			-52.4
	32.9	151.8	202.5	202.5			202.5	-50.7	-50.7			-50.7
	33.6	151.2	200.3	200.3			200.2	-49.1	-49.1			-49.1
	34.2	150.5	198.1	198.1			198.1	-47.6	-47.6			-47.6
	34.8	149.9	196.0	196.0			196.0	-46.2	-46.2			-46.1
	35.4	149.2	194.0	194.1			194.0	-44.8	-44.8			-44.8

	36.0	148.6	192.1	192.1			192.1	-43.5	-43.5			-43.5
	36.7	148.0	190.3	190.3			190.3	-42.3	-42.3			-42.2
	37.3	147.5	188.5	188.6			188.5	-41.1	-41.1			-41.0
	37.9	146.9	186.8	186.9			186.8	-39.9	-40.0			-39.9
	38.5	146.3	185.2	185.2			185.1	-38.9	-38.9			-38.8
	39.1	145.8	183.6	183.7			183.6	-37.8	-37.9			-37.8
Muddy Ck/Blue River	39.8	145.3	182.1	182.1			182.0	-36.8	-36.9			-36.8
	40.4	167.8	195.2	195.1			195.6	-27.4	-27.4			-27.8
	41.0	167.5	194.5	194.5			194.9	-27.0	-26.9			-27.4
	41.6	167.3	193.9	193.8			194.3	-26.5	-26.5			-27.0
	42.3	167.1	193.2	193.2			193.6	-26.1	-26.1			-26.5
	42.9	166.9	192.6	192.5			193.0	-25.7	-25.7			-26.1
	43.5	166.7	191.9	191.9			192.4	-25.3	-25.3			-25.7
top of Gore Canyon	44.2	166.4	191.2	191.2			191.7	-24.8	-24.8			-25.3

		River Dissolved Oxygen						Change in DO				
	River Mile	EC DO (mg/L)	No Action DO (mg/L)	Proposed Action DO (mg/L)	Alt 3 DO (mg/L)	Alt 4 DO (mg/L)	Alt 5 DO (mg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	8.8	8.8	8.8			8.8	0.0	0.0			0.0
	0.6	8.7	8.7	8.7			8.7	0.0	0.0			0.0
	1.2	8.7	8.7	8.7			8.7	0.0	0.0			0.0
	1.9	8.7	8.6	8.6			8.6	0.0	0.0			0.0
	2.5	8.6	8.6	8.6			8.6	0.0	0.0			0.0
	3.1	8.6	8.5	8.5			8.5	0.0	0.0			0.0
Willow Creek	3.7	8.4	8.4	8.4			8.4	0.0	0.0			0.0
	4.3	8.3	8.3	8.3			8.3	0.0	0.0			0.0
	5.0	8.3	8.2	8.2			8.2	0.0	0.0			0.0
	5.6	8.2	8.1	8.1			8.1	0.0	0.0			0.0
	6.2	8.1	8.1	8.1			8.1	0.0	0.0			0.0
	6.8	8.0	8.0	8.0			8.0	0.0	0.0			0.0
	7.5	8.0	7.9	7.9			7.9	0.0	0.0			0.0
Fraser River	8.1	7.9	7.9	7.9			7.9	0.0	0.0			0.0
	8.4	7.9	7.9	7.9			7.9	0.0	0.0			0.0
Windy Gap Reservoir	8.7	7.9	7.9	7.9			7.9	0.0	0.0			0.0
	8.9	7.9	7.9	7.9			7.9	0.0	0.0			0.0

	9.0	7.7	7.6	7.5			7.5	0.1	0.1			0.1
	9.2	7.6	7.5	7.5			7.5	0.1	0.1			0.1
	9.3	7.5	7.5	7.5			7.5	0.0	0.1			0.1
	9.6	7.5	7.4	7.3			7.3	0.2	0.2			0.2
	9.9	7.5	7.4	7.3			7.3	0.2	0.2			0.2
	10.6	7.5	7.3	7.3			7.3	0.2	0.2			0.2
	11.2	7.5	7.3	7.3			7.3	0.2	0.2			0.2
	11.8	7.5	7.3	7.3			7.3	0.2	0.2			0.2
	12.4	7.5	7.3	7.3			7.3	0.2	0.3			0.3
	13.0	7.5	7.3	7.3			7.3	0.3	0.3			0.3
	13.7	7.5	7.3	7.2			7.2	0.3	0.3			0.3
	14.3	7.5	7.2	7.2			7.2	0.3	0.3			0.3
	14.9	7.5	7.2	7.2			7.2	0.3	0.3			0.3
	15.5	7.5	7.2	7.2			7.2	0.3	0.3			0.3
	16.2	7.5	7.2	7.2			7.2	0.3	0.3			0.3
HSS WWTP	16.8	7.5	7.2	7.2			7.2	0.3	0.3			0.3
	17.4	7.5	7.2	7.2			7.2	0.3	0.4			0.3
	18.0	7.5	7.1	7.1			7.1	0.4	0.4			0.4
	18.6	7.5	7.1	7.1			7.1	0.4	0.4			0.4
	19.3	7.5	7.1	7.1			7.1	0.4	0.4			0.4
	19.9	7.5	7.0	7.0			7.0	0.5	0.5			0.5
	20.5	7.5	7.0	7.0			7.0	0.5	0.5			0.5
	21.1	7.5	7.0	7.0			7.0	0.5	0.5			0.5
	21.7	7.5	7.0	7.0			7.0	0.5	0.5			0.5
	22.4	7.5	7.0	7.0			7.0	0.5	0.5			0.5
	23.0	7.5	7.0	7.0			7.0	0.5	0.5			0.5
Williams Fork	23.6	7.5	6.9	6.9			6.9	0.5	0.6			0.6
	24.2	7.3	7.0	7.0			7.0	0.3	0.3			0.3
	24.9	7.3	7.1	7.0			7.0	0.3	0.3			0.3
	25.5	7.3	7.1	7.1			7.1	0.2	0.2			0.2
	26.1	7.3	7.1	7.1			7.1	0.2	0.2			0.2
	26.7	7.3	7.1	7.1			7.1	0.2	0.2			0.2
	27.3	7.3	7.2	7.1			7.2	0.2	0.2			0.2
	28.0	7.3	7.2	7.2			7.2	0.2	0.2			0.2
	28.6	7.3	7.2	7.2			7.2	0.2	0.2			0.2

	29.2	7.3	7.2	7.2			7.2	0.2	0.2			0.2
	29.8	7.4	7.2	7.2			7.2	0.1	0.2			0.2
	30.4	7.4	7.2	7.2			7.2	0.1	0.1			0.1
	31.1	7.4	7.2	7.2			7.2	0.1	0.1			0.1
Troublesome Creek	31.7	7.4	7.2	7.2			7.2	0.1	0.1			0.1
	32.3	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	32.9	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	33.6	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	34.2	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	34.8	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	35.4	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	36.0	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	36.7	7.4	7.3	7.3			7.3	0.1	0.1			0.1
	37.3	7.4	7.2	7.2			7.2	0.1	0.1			0.1
	37.9	7.4	7.2	7.2			7.2	0.1	0.1			0.1
	38.5	7.3	7.2	7.2			7.2	0.1	0.1			0.1
	39.1	7.3	7.2	7.2			7.2	0.1	0.1			0.1
Muddy Ck/Blue River	39.8	7.3	7.2	7.2			7.2	0.1	0.1			0.1
	40.4	7.6	7.5	7.5			7.5	0.0	0.0			0.0
	41.0	7.6	7.5	7.5			7.5	0.0	0.0			0.0
	41.6	7.6	7.5	7.5			7.5	0.0	0.0			0.0
	42.3	7.6	7.5	7.5			7.5	0.0	0.0			0.0
	42.9	7.6	7.5	7.5			7.5	0.0	0.0			0.0
	43.5	7.6	7.5	7.5			7.5	0.0	0.0			0.0
top of Gore Canyon	44.2	7.6	7.5	7.5			7.5	0.0	0.0			0.0

		River Ammonia						Change in ammonia				
	River Mile	EC Ammon-ium (µg/L)	No Action Ammon-ium (µg/L)	Proposed Action Ammon-ium (µg/L)	Alt 3 Ammon-ium (µg/L)	Alt 4 Ammon-ium (µg/L)	Alt 5 Ammon-ium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	10.5	10.5	10.8			10.1	0.0	-0.2			0.5
	0.6	10.7	10.7	10.9			10.2	0.0	-0.2			0.5
	1.2	10.9	11.0	11.2			10.5	0.0	-0.3			0.4
	1.9	11.1	11.2	11.4			10.7	-0.1	-0.3			0.4
	2.5	11.3	11.3	11.6			10.9	-0.1	-0.3			0.4

	3.1	11.4	11.5	11.7			11.0	-0.1	-0.3			0.4
Willow Creek	3.7	11.2	11.3	11.5			10.9	-0.1	-0.3			0.3
	4.3	10.8	10.9	11.1			10.6	-0.1	-0.3			0.2
	5.0	12.5	12.2	12.4			11.9	0.2	0.1			0.6
	5.6	12.1	11.8	12.0			11.5	0.2	0.1			0.6
	6.2	11.9	11.7	11.9			11.4	0.2	0.1			0.5
	6.8	11.7	11.6	11.7			11.3	0.2	0.0			0.5
	7.5	11.5	11.3	11.4			11.0	0.2	0.0			0.4
Fraser River	8.1	11.3	11.1	11.3			10.9	0.2	0.0			0.4
	8.4	18.8	29.2	29.9			29.5	-10.4	-11.1			-10.7
Windy Gap Reservoir	8.7	18.6	28.8	29.5			29.1	-10.2	-10.9			-10.5
	8.9	18.5	28.6	29.3			28.9	-10.1	-10.8			-10.4
	9.0	20.2	30.7	31.1			30.8	-10.5	-10.9			-10.6
	9.2	21.2	31.2	31.6			31.2	-10.0	-10.4			-10.1
	9.3	21.4	31.3	31.7			31.3	-9.9	-10.3			-10.0
	9.6	21.4	31.1	31.5			31.2	-9.7	-10.1			-9.8
	9.9	21.4	30.9	31.3			31.0	-9.6	-9.9			-9.6
	10.6	21.4	30.6	30.9			30.6	-9.2	-9.6			-9.3
	11.2	21.4	30.2	30.6			30.3	-8.8	-9.2			-8.9
	11.8	21.4	29.9	30.3			30.0	-8.5	-8.9			-8.6
	12.4	21.4	29.6	30.0			29.7	-8.2	-8.6			-8.3
	13.0	21.3	29.3	29.7			29.4	-7.9	-8.3			-8.0
	13.7	21.4	29.0	29.4			29.1	-7.6	-8.0			-7.7
	14.3	21.4	28.7	29.1			28.8	-7.4	-7.7			-7.4
	14.9	21.4	28.5	28.8			28.5	-7.1	-7.5			-7.2
	15.5	21.4	28.2	28.6			28.3	-6.9	-7.2			-6.9
	16.2	21.4	28.1	28.5			28.2	-6.7	-7.1			-6.8
HSS WWTP	16.8	21.4	28.1	28.5			28.2	-6.7	-7.0			-6.8
	17.4	24.6	40.9	41.2			41.0	-16.3	-16.7			-16.4
	18.0	24.6	40.7	41.1			40.8	-16.1	-16.4			-16.1
	18.6	24.7	40.5	40.9			40.6	-15.9	-16.2			-15.9
	19.3	24.7	40.4	40.8			40.5	-15.7	-16.1			-15.8
	19.9	24.8	40.3	40.7			40.4	-15.6	-15.9			-15.6
	20.5	24.8	40.2	40.6			40.3	-15.4	-15.8			-15.5
	21.1	24.8	40.1	40.5			40.2	-15.3	-15.7			-15.4

	21.7	24.9	40.0	40.4			40.1	-15.1	-15.5			-15.2
	22.4	24.9	39.9	40.2			40.0	-15.0	-15.4			-15.1
	23.0	24.9	39.8	40.1			39.8	-14.8	-15.2			-14.9
Williams Fork	23.6	25.0	39.6	40.0			39.7	-14.7	-15.0			-14.7
	24.2	23.1	25.3	25.4			25.3	-2.2	-2.2			-2.2
	24.9	23.3	25.7	25.8			25.7	-2.4	-2.5			-2.4
	25.5	23.5	26.1	26.2			26.1	-2.6	-2.7			-2.6
	26.1	23.7	26.5	26.6			26.6	-2.8	-2.9			-2.8
	26.7	23.8	26.8	26.9			26.8	-2.9	-3.0			-3.0
	27.3	24.0	27.1	27.2			27.1	-3.1	-3.2			-3.1
	28.0	24.1	27.4	27.5			27.4	-3.3	-3.3			-3.3
	28.6	24.4	27.9	28.0			27.9	-3.5	-3.6			-3.5
	29.2	24.6	28.3	28.4			28.3	-3.7	-3.8			-3.7
	29.8	24.8	28.8	28.9			28.8	-4.0	-4.1			-4.0
	30.4	25.0	29.2	29.2			29.2	-4.2	-4.3			-4.2
	31.1	25.1	29.4	29.5			29.4	-4.3	-4.4			-4.3
Troublesome Creek	31.7	25.3	29.9	29.9			29.9	-4.6	-4.6			-4.6
	32.3	24.1	26.8	26.9			26.8	-2.7	-2.8			-2.7
	32.9	24.0	26.7	26.8			26.7	-2.7	-2.7			-2.7
	33.6	24.1	26.8	26.8			26.8	-2.7	-2.8			-2.7
	34.2	24.0	26.6	26.7			26.6	-2.6	-2.7			-2.6
	34.8	24.0	26.6	26.7			26.6	-2.6	-2.7			-2.6
	35.4	24.0	26.7	26.7			26.7	-2.6	-2.7			-2.6
	36.0	24.1	26.7	26.8			26.7	-2.6	-2.7			-2.6
	36.7	24.1	26.8	26.9			26.8	-2.7	-2.7			-2.7
	37.3	24.2	26.8	26.9			26.8	-2.7	-2.7			-2.7
	37.9	24.2	26.8	26.9			26.8	-2.6	-2.7			-2.6
	38.5	24.4	27.2	27.2			27.2	-2.8	-2.9			-2.8
	39.1	24.6	27.5	27.6			27.5	-2.9	-3.0			-2.9
Muddy Ck/Blue River	39.8	24.8	27.8	27.9			27.8	-3.0	-3.1			-3.0
	40.4	27.6	29.8	29.8			29.8	-2.2	-2.2			-2.2
	41.0	28.1	30.3	30.3			30.3	-2.2	-2.3			-2.2
	41.6	28.3	30.5	30.6			30.6	-2.2	-2.3			-2.2
	42.3	28.4	30.5	30.6			30.6	-2.2	-2.2			-2.2
	42.9	28.6	30.8	30.8			30.8	-2.2	-2.2			-2.2

	43.5	28.9	31.0	31.0			31.0	-2.2	-2.2			-2.2
top of Gore Canyon	44.2	29.1	31.2	31.2			31.2	-2.1	-2.2			-2.2

		River Inorganic Phosphorus						Change in inorganic P				
	River Mile	EC Inorganic P (µg/L)	No Action Inorganic P (µg/L)	Proposed Action Inorganic P (µg/L)	Alt 3 Inorganic P (µg/L)	Alt 4 Inorganic P (µg/L)	Alt 5 Inorganic P (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	0.6	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	1.2	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	1.9	6.6	5.8	6.5			3.9	0.8	0.1			2.8
	2.5	6.6	5.8	6.6			3.9	0.8	0.1			2.8
	3.1	6.6	5.8	6.6			3.9	0.8	0.1			2.8
Willow Creek	3.7	6.5	5.7	6.4			4.0	0.8	0.1			2.6
	4.3	6.4	5.7	6.3			4.0	0.7	0.1			2.3
	5.0	9.5	8.4	8.8			6.9	1.1	0.8			2.7
	5.6	9.3	8.2	8.6			6.8	1.1	0.7			2.5
	6.2	9.0	8.0	8.4			6.7	1.0	0.7			2.4
	6.8	8.8	7.8	8.2			6.6	1.0	0.6			2.2
	7.5	8.6	7.7	8.0			6.5	0.9	0.6			2.1
Fraser River	8.1	8.4	7.6	7.9			6.4	0.9	0.6			2.0
	8.4	13.4	9.4	9.6			8.7	4.0	3.7			4.7
Windy Gap Reservoir	8.7	13.3	9.3	9.6			8.7	3.9	3.7			4.6
	8.9	13.2	9.3	9.5			8.6	3.9	3.7			4.6
	9.0	13.7	10.7	11.0			10.0	3.0	2.7			3.7
	9.2	14.0	11.0	11.3			10.3	3.0	2.7			3.7
	9.3	14.1	11.1	11.4			10.4	3.0	2.7			3.7
	9.6	14.1	11.0	11.4			10.4	3.1	2.7			3.7
	9.9	14.1	11.0	11.3			10.3	3.1	2.7			3.7
	10.6	14.1	10.9	11.3			10.3	3.1	2.8			3.8
	11.2	14.1	10.9	11.2			10.2	3.2	2.9			3.8
	11.8	14.0	10.8	11.1			10.2	3.2	2.9			3.9
	12.4	14.0	10.7	11.1			10.1	3.3	3.0			3.9
	13.0	14.0	10.7	11.0			10.1	3.3	3.0			3.9
	13.7	14.0	10.6	10.9			10.0	3.4	3.1			4.0

	14.3	14.0	10.5	10.9			10.0	3.4	3.1			4.0
	14.9	14.0	10.5	10.8			9.9	3.5	3.2			4.1
	15.5	13.9	10.4	10.7			9.9	3.5	3.2			4.1
	16.2	13.9	10.4	10.7			9.8	3.5	3.2			4.1
HSS WWTP	16.8	14.0	10.4	10.7			9.8	3.6	3.2			4.1
	17.4	15.3	16.0	16.3			15.4	-0.7	-1.0			-0.1
	18.0	15.3	16.0	16.3			15.5	-0.7	-1.0			-0.1
	18.6	15.4	16.0	16.4			15.5	-0.7	-1.0			-0.1
	19.3	15.4	16.1	16.4			15.5	-0.7	-1.0			-0.1
	19.9	15.4	16.1	16.4			15.5	-0.7	-1.0			-0.1
	20.5	15.4	16.1	16.4			15.5	-0.7	-1.0			-0.1
	21.1	15.4	16.1	16.4			15.5	-0.7	-1.0			-0.1
	21.7	15.5	16.1	16.4			15.5	-0.6	-1.0			-0.1
	22.4	15.5	16.1	16.5			15.6	-0.6	-1.0			-0.1
	23.0	15.5	16.1	16.5			15.6	-0.6	-1.0			-0.1
Williams Fork	23.6	15.5	16.1	16.5			15.6	-0.6	-1.0			-0.1
	24.2	13.3	11.6	11.7			11.4	1.7	1.6			1.9
	24.9	13.3	11.6	11.7			11.5	1.7	1.6			1.9
	25.5	13.3	11.6	11.7			11.5	1.7	1.6			1.9
	26.1	13.4	11.6	11.7			11.5	1.7	1.6			1.9
	26.7	13.4	11.7	11.7			11.5	1.7	1.6			1.9
	27.3	13.4	11.7	11.8			11.5	1.7	1.6			1.9
	28.0	13.4	11.7	11.8			11.6	1.7	1.6			1.8
	28.6	13.4	11.7	11.8			11.6	1.7	1.6			1.8
	29.2	13.5	11.8	11.8			11.6	1.7	1.6			1.8
	29.8	13.5	11.8	11.9			11.7	1.7	1.6			1.8
	30.4	13.5	11.8	11.9			11.7	1.7	1.6			1.8
	31.1	13.5	11.8	11.9			11.7	1.7	1.6			1.8
Troublesome Creek	31.7	13.5	11.9	12.0			11.7	1.7	1.6			1.8
	32.3	13.1	11.2	11.2			11.0	1.9	1.8			2.0
	32.9	13.0	11.0	11.1			10.9	1.9	1.9			2.1
	33.6	12.9	11.0	11.0			10.8	2.0	1.9			2.1
	34.2	12.8	10.9	10.9			10.7	2.0	1.9			2.1
	34.8	12.8	10.8	10.8			10.6	2.0	1.9			2.1
	35.4	12.7	10.7	10.8			10.6	2.0	2.0			2.1

	36.0	12.6	10.6	10.7			10.5	2.0	2.0			2.1
	36.7	12.6	10.5	10.6			10.4	2.1	2.0			2.2
	37.3	12.5	10.5	10.5			10.4	2.1	2.0			2.2
	37.9	12.5	10.4	10.5			10.3	2.1	2.0			2.2
	38.5	12.4	10.4	10.4			10.2	2.1	2.0			2.2
	39.1	12.4	10.3	10.4			10.2	2.1	2.0			2.2
Muddy Ck/Blue River	39.8	12.4	10.3	10.3			10.2	2.1	2.0			2.2
	40.4	11.2	10.1	10.2			10.1	1.0	1.0			1.1
	41.0	11.2	10.2	10.2			10.1	1.1	1.0			1.1
	41.6	11.2	10.2	10.2			10.1	1.1	1.0			1.1
	42.3	11.2	10.2	10.2			10.1	1.1	1.0			1.1
	42.9	11.3	10.2	10.2			10.1	1.1	1.1			1.1
	43.5	11.3	10.2	10.2			10.1	1.1	1.1			1.1
top of Gore Canyon	44.2	11.3	10.2	10.2			10.1	1.1	1.1			1.1

		River Selenium						**Change in selenium**				
	River Mile	EC Selenium (µg/L)	No Action Selenium (µg/L)	Proposed Action Selenium (µg/L)	Alt 3 Selenium (µg/L)	Alt 4 Selenium (µg/L)	Alt 5 Selenium (µg/L)	EC-NA	EC-PA	EC-Alt 3	EC-Alt 4	EC-Alt 5
Lake Granby outlet	0.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	0.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	1.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	1.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	2.5	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	3.1	0.500	0.500	0.500			0.500	0.000	0.000			0.000
Willow Creek	3.7	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	4.3	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	5.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	5.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	6.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	6.8	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	7.5	0.500	0.500	0.500			0.500	0.000	0.000			0.000
Fraser River	8.1	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	8.4	0.500	0.500	0.500			0.500	0.000	0.000			0.000
Windy Gap Reservoir	8.7	0.500	0.500	0.500			0.500	0.000	0.000			0.000

	8.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	9.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	9.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	9.3	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	9.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	9.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	10.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	11.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	11.8	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	12.4	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	13.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	13.7	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	14.3	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	14.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	15.5	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	16.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
HSS WWTP	16.8	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	17.4	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	18.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	18.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	19.3	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	19.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	20.5	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	21.1	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	21.7	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	22.4	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	23.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000
Williams Fork	23.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	24.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	24.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	25.5	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	26.1	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	26.7	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	27.3	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	28.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000

	28.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	29.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	29.8	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	30.4	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	31.1	0.500	0.500	0.500			0.500	0.000	0.000			0.000
Troublesome Creek	31.7	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	32.3	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	32.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	33.6	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	34.2	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	34.8	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	35.4	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	36.0	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	36.7	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	37.3	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	37.9	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	38.5	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	39.1	0.500	0.500	0.500			0.500	0.000	0.000			0.000
Muddy Ck/Blue River	39.8	0.500	0.500	0.500			0.500	0.000	0.000			0.000
	40.4	0.675	0.737	0.728			0.730	-0.062	-0.053			-0.055
	41.0	0.674	0.735	0.727			0.729	-0.061	-0.052			-0.054
	41.6	0.674	0.733	0.725			0.727	-0.060	-0.051			-0.053
	42.3	0.673	0.732	0.723			0.725	-0.059	-0.050			-0.052
	42.9	0.673	0.730	0.722			0.724	-0.057	-0.049			-0.051
	43.5	0.672	0.729	0.720			0.722	-0.056	-0.048			-0.050
top of Gore Canyon	44.2	0.672	0.727	0.719			0.721	-0.055	-0.047			-0.049