APPENDIX A
Water Quality Assessment
Cripple Creek
Cripple Creek WWTF

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I. Water Quality Assessment Summary

Table A-1 includes summary information related to this WQA. This summary table includes key regulatory starting points used in development of the WQA such as: receiving stream information; threatened and endangered species; 303(d) and 305(b) listings; low flow and facility flow summaries; and a list of parameters evaluated.

Table A-1
WQA Summary

Facility Information

Facility Name	Permit Number	Design Flow (max 30-day ave, MGD)	Design Flow (max 30-day ave, CFS)
F1. Cripple Creek WWTF	CO0039900	1.0	1.5

Receiving Stream Information

Receiving Stream Name	Segment ID	Designation	Classification(s)
S1. Cripple Creek	COARUA 21a	Undesignated	Aquatic Life Cold 2, Recreation Class E, Agriculture,

Low Flows (cfs)

1E3 (1-day)	7E3 (7-day)	30E3 (30-day)	Ratio of 30E3 to the Design Flow (cfs)
S1. 0.58	0.61	0.67	F1: 0.44:1

Regulatory Information

T&E Species	303(d) (Reg 93)	TMDL Status	305(b) (Reg 94)	Temporary Modification(s)	Control Regulation
No	None	NA	None	None	None

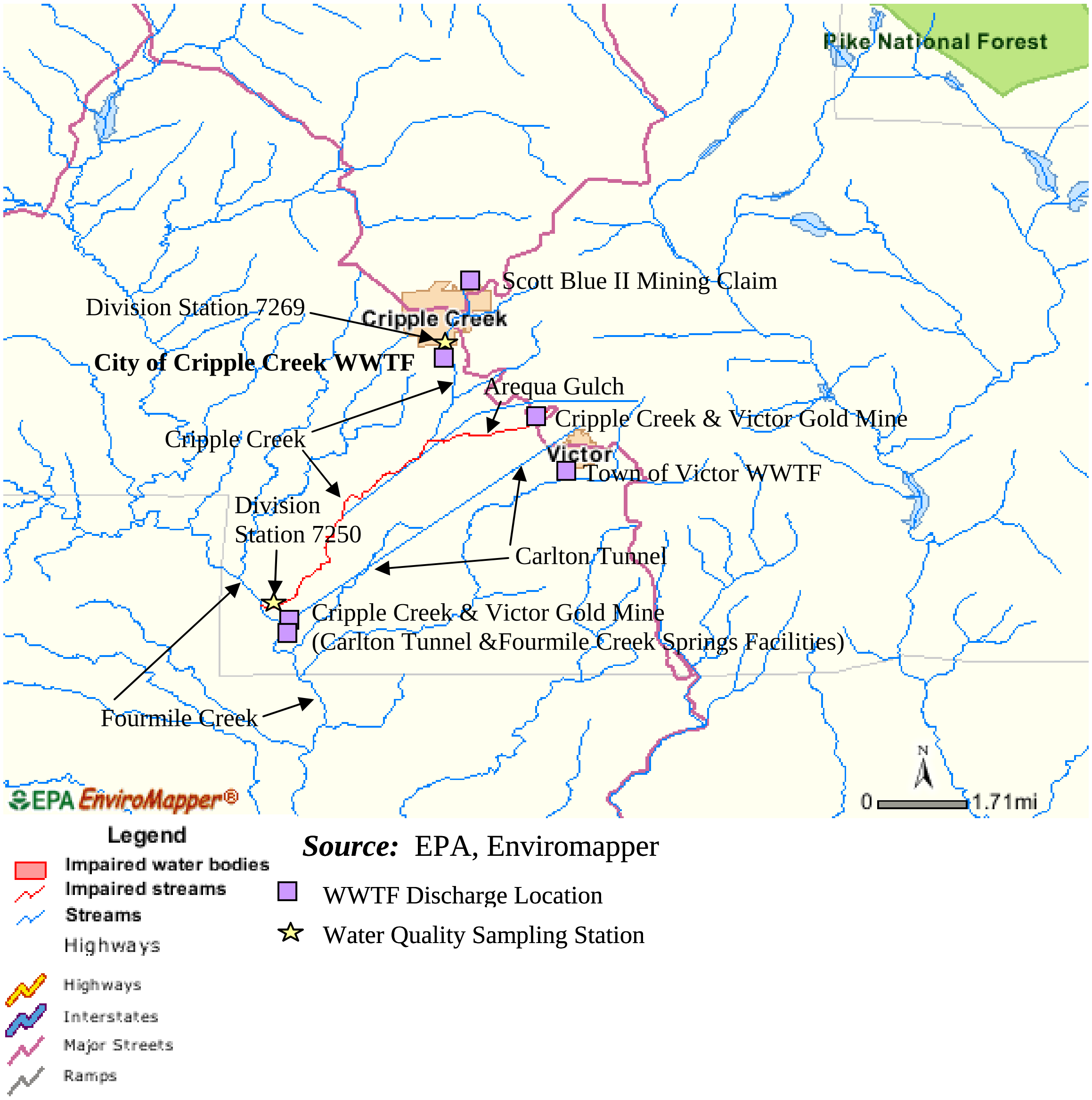
Pollutants Evaluated

F1: Ammonia, E. Coli, Metals

II. Introduction

The water quality assessment (WQA) of Cripple Creek near the Cripple Creek WWTF Wastewater Treatment Facility (WWTF), located in Teller County, is intended to determine the assimilative capacities available for pollutants found to be of concern. This WQA describes how the water quality based effluent limits (WQBELs) are developed. These parameters may or may not appear in the permit with limitations or monitoring requirements, subject to other determinations such as reasonable potential analysis, evaluation of federal effluent limitation guidelines, implementation of state-based technology based limits, mixing zone analyses, 303(d) listings, threatened and endangered species listing, or other requirements as discussed in the permit rationale. Figure A-1 contains a map of the study area evaluated as part of this WQA.

Figure A-1
Study Area



Source: EPA, Enviromapper

The Cripple Creek WWTF WWTF discharges to Cripple Creek, which is in the Water Body Identification (WBID) stream segment COARUA21a. This means the Arkansas River Basin, Upper Arkansas Sub-basin, Stream Segment 21a. This segment is composed of the "Cripple Creek from its source to a point 1.5 miles above the confluence with Fourmile Creek". Stream segment COARUA21a is classified for Cold Water Aquatic Life Class 2, Recreation Class E and Agriculture. The City of Cripple Creek and the surrounding area are located in a historic gold mining district.

Information used in this assessment includes data gathered from the Cripple Creek WWTF, the Division, the Colorado Division of Water Resources (DWR), the U.S. Environmental Protection Agency (EPA) and the U.S. Geological Survey (USGS). The data used in the assessment consist of the best information available at the time of preparation of this WQA analysis.

III. Water Quality Standards

Narrative Standards

Narrative Statewide Basic Standards have been developed in Section 31.11(1) of the regulations, and apply to any pollutant of concern, even where there is no numeric standard for that pollutant. Waters of the state shall be free from substances attributable to human-caused point source or nonpoint source discharges in amounts, concentrations or combinations which:

for all surface waters except wetlands;

(i) can settle to form bottom deposits detrimental to the beneficial uses. Depositions are stream bottom buildup of materials which include but are not limited to anaerobic sludge, mine slurry or tailings, silt, or mud; or
(ii) form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or
(iii) produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species or to the water; or
(iv) are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or
(v) produce a predominance of undesirable aquatic life; or
(vi) cause a film on the surface or produce a deposit on shorelines; and

for surface waters in wetlands;

(i) produce color, odor, changes in pH, or other conditions in such a degree as to create a nuisance or harm water quality dependent functions or impart any undesirable taste to significant edible aquatic species of the wetland; or
(ii) are toxic to humans, animals, plants, or aquatic life of the wetland.

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for any parameter of concern could be put in CDPS discharge permits.

Standards for Organic Parameters and Radionuclides

Radionuclides: Statewide Basic Standards have been developed in Section 31.11(2) and (3) of The Basic Standards and Methodologies for Surface Water to protect the waters of the state from radionuclides and organic chemicals.

In no case shall radioactive materials in surface waters be increased by any cause attributable to municipal, industrial, or agricultural practices or discharges to as to exceed the following levels, unless alternative site-specific standards have been adopted. Standards for radionuclides are shown in Table A-2.

Table A-2
Radionuclide Standards

Parameter	Picocuries per Liter
Americium 241*	0.15
Cesium 134	80
Plutonium 239, and 240*	0.15
Radium 226 and 228*	5
Strontium 90*	8
Thorium 230 and 232*	60
Tritium	20,000

*Radionuclide samples for these materials should be analyzed using unfiltered (total) samples. These Human Health based standards are 30-day average values for both plutonium and americium.

Organics: The organic pollutant standards contained in the Basic Standards for Organic Chemicals Table are applicable to all surface waters of the state for the corresponding use classifications, unless alternative site-specific standards have been adopted. These standards have been adopted as "interim standards" and will remain in effect until alternative permanent standards are adopted by the Commission. These interim standards shall not be considered final or permanent standards subject to antibacksliding or downgrading restrictions. Although not reproduced in this WQA, the specific standards for organic chemicals can be found in Regulation 31.11(3).

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for radionuclides, organics, or any other parameter of concern could be put in CDPS discharge permits.

The aquatic life standards apply to all stream segments that are classified for aquatic life. The water supply standards apply only to those segments that are classified for water supply. The water + fish standards apply to those segments that have a Class 1 aquatic life and a water supply classification. The fish ingestion standards apply to Class 1 aquatic life segments that do not have a water supply designation. The water + fish and the fish ingestion standards may also apply to Class 2 aquatic life segments, where fish of a catchable size and which are normally consumed are present, and where fishing occurs on a regular basis.

Because the Cripple Creek is classified for Class 2 aquatic life, without a water supply designation, the aquatic life standards apply to this discharge.

Salinity and Phosphorus

Phosphorus: Regulations 71, 72, 73 and 74, for Dillon Reservoir Watershed, Cherry Creek Reservoir Watershed, Chatfield Reservoir Watershed and the Bear Creek Watershed, contain requirements for phosphorus concentrations and phosphorus annual loadings for point source dischargers. If a facility discharges to one of these watersheds, a phosphorus allocation may be necessary, and limitations and annual loadings may be added to a permit.

Salinity: Regulation 61.8(2)(l) contains requirements regarding salinity for any discharges to the Colorado River Watershed. For industrial dischargers this is a no-salt discharge requirement. However, the regulation states that this requirement may be waived where the salt load reaching the mainstem of the Colorado River is less than 1 ton per day, or less than 366 tons per year. The Division may permit the discharge of salt upon a satisfactory demonstration that it is not practicable to prevent the discharge of all salt. See Regulation 61.8(2)(l)(i)(A)(1) for more information regarding this demonstration.

For municipal dischargers, an incremental increase of 400 mg/l above the flow weighted averaged salinity of the intake water supply is allowed. This may be waived where the salt load reaching the mainstem of the Colorado River is less than 1 ton per day, or less than 366 tons per year. The Division may permit the discharge of salt in excess of the 400 mg/l incremental increase, upon a satisfactory demonstration that it is not practicable to attain this limit. See Regulation 61.8(2)(l)(vi)(A)(1) for more information regarding this demonstration.

Regulation 75 contains requirements for the release of water from Cheraw Lake. Any entity releasing water from Cheraw Lake must ensure that either: 1) the water has a TDS concentration less than or equal to 4300 mg/l, or 2) that an adequate quantity of water of less saline nature can be supplied for dilution purposes such that a salinity level of 4300 ppm, measured as TDS, can be maintained in Horse Creek immediately above the first diversion below the confluence with the Cheraw Lake outlet channel.

In addition, the Division's policy, Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, may be applied to discharges where an agricultural water intake exists downstream of a discharge point. Limitations for electrical conductivity, sodium absorption ratio, or sodium, may be applied in accordance with this policy.

Temperature

Temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life. This standard shall not be interpreted or applied in a manner inconsistent with section 25-8-104, C.R.S. Effective until December 31, 2012: Segments or portions of segments that are first, second or third order streams above 7000 feet elevation and classified Aquatic Life cold 1 or 2 shall have a chronic temperature standard of 17 ºC (MWAT) with no acute standard.

Other cold class 1 or 2 segments or portions of segments shall have a chronic temperature standard of 20 ºC (MWAT) with no acute standard. Segments that are classified Aquatic Life warm 1 or 2 shall have a chronic temperature standard of 30 ºC (MWAT) with no acute standard.

Segment Specific Numeric Standards

Numeric standards are developed on a basin-specific basis and are adopted for particular stream segments by the Water Quality Control Commission. To simplify the listing of the segment-specific standards, many of the aquatic life standards are contained in a table at the beginning of each chapter of the regulations. The standards in Table A-3 have been assigned to stream segment COARUA21a in accordance with the *Classifications and Numeric Standards for Arkansas River Basin*.

Table A-3 In-stream Standards for Stream Segment COARUA21a
Physical and Biological
Dissolved Oxygen (DO) = 6 mg/l, minimum (7 mg/l, minimum during spawning)
pH = 6.5 - 9 su
E. coli chronic = 126 colonies/100 ml
Temperature chronic (MWAT) = 17 ° C
Inorganic
Total Ammonia acute (sa) and chronic (ela) = TVS
Chlorine acute = 0.019 mg/l
Chlorine chronic = 0.011 mg/l
Free Cyanide acute = 0.005 mg/l
Sulfide chronic = 0.002 mg/l
Boron chronic = 0.75 mg/l
Nitrite acute = 0.05 mg/l
Metals
Dissolved Arsenic acute = 340 µg/l
Total Recoverable Arsenic chronic = 100 µg/l
Dissolved Cadmium acute and chronic = TVS
Total Recoverable Trivalent Chromium chronic = 100 µg/l
Dissolved Hexavalent Chromium acute and chronic = TVS
Dissolved Copper acute and chronic = TVS
Total Recoverable Iron chronic = 1000 µg/l
Dissolved Lead acute and chronic = TVS
Dissolved Manganese acute and chronic = TVS
Total Mercury chronic = 0.01 µg/l
Dissolved Nickel acute and chronic = TVS
Dissolved Selenium acute and chronic = TVS
Dissolved Silver acute and chronic = TVS
Dissolved Zinc acute and chronic = TVS

Table Value Standards and Hardness Calculations

Standards for metals are generally shown in the regulations as Table Value Standards (TVS), and these often must be derived from equations that depend on the receiving stream hardness or species of fish present; for ammonia, standards are discussed further in Section IV of this WQA. The Classification and Numeric Standards documents for each basin include a specification for appropriate hardness values to be used. Specifically, the regulations state that:

> The hardness values used in calculating the appropriate metal standard should be based on the lower 95% confidence limit of the mean hardness value at the periodic low flow criteria as determined from a regression analysis of site-specific data. Where insufficient site-specific data exists to define the mean hardness value at the periodic low flow criteria, representative regional data shall be used to perform the regression analysis. Where a regression analysis is not appropriate, a site-specific method should be used.

Hardness data for Cripple Creek near the point of discharge of the Cripple Creek WWTF were insufficient to conduct a regression analysis based on the low flow. Therefore, the Division's alternative approach to calculating hardness was used, which involves computing a mean hardness. The mean hardness was computed to be 221 mg/l based on sampling data from Division Station 7250 (Cripple Creek Above Fourmile Creek) located on Cripple Creek approximately six miles downstream from the Cripple Creek WWTF discharge point. Data from this location were available for a period of record from May 1998 through May 2007. This mean hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals, shown in Table A-4.

Table A-4

TVS-Based Metals Water Quality Standards for CO0039900

Based on the Table Value Standards Contained in the Colorado Department of Public Health and Environment Water Quality Control Commission *Regulation 32*

Parameter	***In-Stream Water Quality Standard***			***TVS Formula: Hardness (mg/l) as CaCO3 =*** **222**
Cadmium, Dissolved	Acute	5.5	µg/l	$[1.136672-0.041838\ln(hardness)]e^{(0.9151(\ln(hardness))-3.1485)}$
	Chronic	0.77	µg/l	$[1.101672-0.041838\ln(hardness)]e^{(0.7998(\ln(hardness))-4.4451)}$
Hexavalent Chromium, Dissolved	Acute	16	µg/l	Numeric standards provided, formula not applicable
	Chronic	11	µg/l	Numeric standards provided, formula not applicable
Copper, Dissolved	Acute	28	µg/l	$e^{(0.9422(\ln(hardness))-1.7408)}$
	Chronic	18	µg/l	$e^{(0.8545(\ln(hardness))-1.7428)}$
Lead, Dissolved	Acute	152	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-1.46)}]$
	Chronic	5.9	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-4.705)}]$
Manganese, Dissolved	Acute	3894	µg/l	$e^{(0.3331(\ln(hardness))+6.4676)}$
	Chronic	2152	µg/l	$e^{(0.3331(\ln(hardness))+5.8743)}$
Nickel, Dissolved	Acute	919	µg/l	$e^{(0.846(\ln(hardness))+2.253)}$
	Chronic	102	µg/l	$e^{(0.846(\ln(hardness))+0.0554)}$
Selenium, Dissolved	Acute	18.4	µg/l	Numeric standards provided, formula not applicable
	Chronic	4.6	µg/l	Numeric standards provided, formula not applicable
Silver, Dissolved	Acute	8	µg/l	$\frac{1}{2} e^{(1.72(\ln(hardness))-6.52)}$
	Chronic	0.3	µg/l	$e^{(1.72(\ln(hardness))-10.51)}$
	Chronic	1.3	µg/l	$e^{(1.72(\ln(hardness))-9.06)}$
Uranium, Dissolved	Acute	5785	µg/l	$e^{(1.1021(\ln(hardness))+2.7088)}$
	Chronic	3614	µg/l	$e^{(1.1021(\ln(hardness))+2.2382)}$
Zinc, Dissolved	Acute	283	µg/l	$0.978e^{(0.8525(\ln(hardness))+1.0617)}$
	Chronic	245	µg/l	$0.986e^{(0.8525(\ln(hardness))+0.9109)}$

<u>Regulation 93 – 303(d) List and Total Maximum Daily Loads</u>

This stream segment is not listed on the Division's 303(d) list of water quality impacted streams.

Regulation 94 – 305(b) Monitoring and Evaluation List

This stream segment is not listed on the Division's 305(b) list for monitoring and evaluation.

IV. Receiving Stream Information

Low Flow Analysis

The Colorado Regulations specify the use of low flow conditions when establishing water quality based effluent limitations, specifically the acute and chronic low flows. The acute low flow, referred to as 1E3, represents the one-day low flow recurring in a three-year interval, and is used in developing limitations based on an acute standard. The 7-day average low flow, 7E3, represents the seven-day average low flow recurring in a 3 year interval, and is used in developing limitations based on a Maximum Weekly Average Temperature standard (MWAT). The chronic low flow, 30E3, represents the 30-day average low flow recurring in a three-year interval, and is used in developing limitations based on a chronic standard.

To determine the low flows available to the Cripple Creek WWTF, a flow gage measurement immediately upstream of the facility should be used. Because there were no flow gages immediately upstream of the Cripple Creek WWTF, low flows were calculated using flow measurements from comparable watersheds, and then applying a watershed ratio.

Recent flow data from gage stations having natural drainage and with comparable watershed size, nearby locations and comparable elevations were very limited. Previous analyses of low flows for this facility included three comparable stations, but only one of these three is currently operating. Thus, after review of nearby comparable gage stations, the following stations were selected:

- USGS Gage Station 07083000 (Halfmoon Creek Near Malta, CO), with data from October 1, 1995 through September 30, 2005, which was used in previous low flow analyses for this facility
- USGS Gage Station 07105945 (Rock Creek Above Fort Carson Reservation, CO) with data from October 1, 1995 through September 30, 2005, which is located approximately 25 miles east of the facility.

Daily flows from these gage stations were obtained and the watershed weighted daily flows were determined. These daily flows were input to U. S. Environmental Protection Agency (EPA) DFLOW software and the annual 1E3 and 30E3 low flows were calculated. The output from DFLOW also provides calculated acute and chronic low flows for each month.

To estimate the low flows at the Cripple Creek WWTF discharge point, the ratio of the average of the watershed areas above the gage stations to the watershed area above the City of Cripple Creek WWTF was determined. This ratio was multiplied by the low flows calculated by DFLOW to determine the low flows for the Cripple Creek WWTF as presented in Table A-5a. Note that for themonths of April, May, June, July, October and November, the acute low flow exceeded the chronic low flow, and was therefore set equal to the chronic low flow.

Table A-5a
Low Flows for Cripple Creek at the Cripple Creek WWTF WWTF

Low Flow (cfs)	*Annual*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
1E3 Acute	0.58	0.58	0.64	0.61	0.67	1.10	2.80	1.60	1.40	1.30	1.20	0.78	0.58
7E3 Chronic	0.61	0.64	0.61	0.61	0.69	1.80	4.30	1.80	1.30	1.30	1.50	0.84	0.61
30E3 Chronic	0.67	0.67	0.67	0.67	0.67	1.10	2.80	1.60	1.40	1.40	1.20	0.78	0.67

The ratio of the low flow of Cripple Creek to the Cripple Creek WWTF WWTF design flow is 0.45:1

Mixing Zones

The amount of the available assimilative capacity (dilution) that may be used by the permittee for the purposes of calculating the WQBELs may be limited in a permitting action based upon a mixing zone analysis or other factor. These other factors that may reduce the amount of assimilative capacity available in a permit are: presence of other dischargers in the vicinity; the presence of a water diversion downstream of the discharge (in the mixing zone); the need to provide a zone of passage for aquatic life; the likelihood of bioaccumulation of toxins in fish or wildlife; habitat considerations such as fish spawning or nursery areas; the presence of threatened and endangered species; potential for human exposure through drinking water or recreation; the possibility that aquatic life will be attracted to the effluent plume; the potential for adverse effects on groundwater; and the toxicity or persistence of the substance discharged.

Unless a facility has performed a mixing zone study during the course of the previous permit, and a decision has been made regarding the amount of the assimilative capacity that can be used by the facility, the Division assumes that the full assimilative capacity can be allocated. Note that the review of mixing study considerations, exemptions and perhaps performing a new mixing study (due to changes in low flow, change in facility design flow, channel geomorphology or other reason) is evaluated in every permit and permit renewal.

If a mixing zone study has been performed and a decision regarding the amount of available assimilative capacity has been made, the Division may calculate the water quality based effluent limitations (WQBELs) based on this available capacity. In addition, the amount of assimilative capacity may be reduced by T&E implications.

For this facility, 100% of the available assimilative capacity may be used as the facility has not had to perform a mixing zone study, the discharge is not to a T&E stream segment, and is not expected to have an influence on any of the other factors listed above.

Ambient Water Quality

The Division evaluates ambient water quality based on a variety of statistical methods as prescribed in Section 31.8(2)(a)(i) and 31.8(2)(b)(i)(B) of the *Colorado Department of Public Health and Environment Water Quality Control Commission Regulation No. 31*, and as outlined in the Division's Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits (WQP-19). Ambient water quality is evaluated in this WQA analysis for use in determining assimilative capacities and in completing antidegradation reviews for pollutants of concern, where applicable.

To conduct an assessment of the ambient water quality upstream of the Cripple Creek WWTF WWTF, data were gathered from Division Station 7250 located approximately 6 miles downstream from the facility. This station was used as the only station upstream of the facility has only 1 or 2 data points per parameter, from 1998 to 1999. Data from Division Station 7250 were available for a period of record from May 1998 through May 2007. Data from this source was used to reflect upstream water quality. These data are summarized in Table A-6.

Table A-6

Ambient Water Quality for Cripple Creek

Parameter	*Number of Samples*	*15th Percentile*	*50th Percentile*	*85th Percentile*	*Mean*	*Maximum*	*Chronic Stream Standard*	*Notes*
pH (su)	71	7.4	8	8.4	7.9	9.1	6.5-9	
E. coli (#/100 ml)	28	1	17	37	45	461	126	1, 2
NH_3, Tot (mg/l)	77	0	0	0.046	0.019	0.4	TVS	2
As, TR (µg/l)	78	0	0.75	1	0.59	3	100	2
Cd, Dis (µg/l)	80	0	0	0.61	0.27	3.7	0.77	2
Cr, TR (µg/l)	3	0	0	0.21	0.1	0.3	NA	2
Cu, Dis (µg/l)	81	0	4	7	5	86	18	2
CN, Tot (µg/l)	46	0	0	0	0.0012	0.026	NA	2
Fe, Dis (µg/l)	70	0	0	15	6.1	64	NA	2
Fe, TR (µg/l)	77	21	130	1036	723	15000	1000	
Pb, Dis (µg/l)	79	0	0	0	0.33	13	5.90	2
Mn, TR (µg/l)	2	2725	3950	5175	3950	5700	NA	
Mn, Dis (µg/l)	79	4	9	752	340	4700	2152	
Hg, Tot (µg/l)	24	0	0	0	0	0	0.01	2
Ni, Dis (µg/l)	2	15	23	30	23	33	102	
Se, Dis (µg/l)	77	0	0	0.92	0.45	17	4.6	2
Ag, Dis (µg/l)	77	0	0	0	0.0013	0.1	1.3	2
U, Dis (µg/l)	62	0	0	3	1.6	27	3614	2
Zn, Dis (µg/l)	79	14	27	86	57	1200	245	
B, Tot (µg/l)	2	74	80	85	80	88	750	
Hardness as $CaCO_3$ (mg/l)	77	180	220	260	222	350	NA	

Note 1: The calculated mean is the geometric mean. Note that for summarization purposes, the value of one was used where there was no detectable amount because the geometric mean cannot be calculated using a value equal to zero.

Note 2: When sample results were below detection levels, the value of zero was used in accordance with the Division's standard approach for summarization and averaging purposes.

V. Facility Information and Pollutants Evaluated

Facility Information

The Cripple Creek WWTF WWTF is located at NE ¼, NW ¼, S24, T15S, R70W, 6th P.M.; Latitude 38o 44' 26"; Longitude 105o 10' 44", in Teller County. The current design capacity of the facility is 1 MGD (1.5 cfs). Wastewater treatment is accomplished using a mechanical wastewater treatment process. The technical analyses that follow include assessments of the assimilative capacity based on this design capacity.

An assessment of nearby facilities based on EPA's Permit Compliance System (PCS) database found several dischargers in the Teller County area. The nearest permitted dischargers were:

- Scott Blue II Mining Claim (COG-600703), a placer mining operation that discharges to Cripple Creek at its headwaters, which is approximately 1.8 miles upstream from the facility's discharge point. It should be noted that this facility currently has no identified pollutants of concern in common with the Cripple Creek WWTF. Additionally, due to its location at the headwaters of Cripple Creek, this facility would be modeled separately.

- Cripple Creek and Victor Gold Mine, Arequa Gulch Mine (CO-0043648), which discharges to Arequa Gulch at its headwaters, which is approximately 2.2 miles upstream from the confluence with Cripple Creek. The confluence of Arequa Gulch with Cripple Creek is approximately 2.3 miles downstream from the facility's point of discharge. Due to this facility's location at the headwaters of Arequa Gulch, this facility would be modeled separately.

- Cripple Creek and Victor Gold Mine, Carlton Tunnel (CO-0024562) and Fourmile Creek Springs (CO-0046540), which discharges mine and seep springs water, respectively, to Fourmile Creek at a point approximately ¼ mile downstream from the confluence of Cripple Creek with Fourmile Creek, which is approximately 6¼ miles downstream from the facility discharge location. Due to the limited amount of dilution from Cripple Creek, and the distance to the other discharges, there was no need to model these facilities together.

Pollutants of Concern

Pollutants of concern may be determined by one or more of the following: facility type; effluent characteristics and chemistry; effluent water quality data; receiving water quality; presence of federal effluent limitation guidelines; or other information. Parameters evaluated in this WQA may or may not appear in a permit with limitations or monitoring requirements, subject to other determinations such as a reasonable potential analysis, mixing zone analyses, 303(d) listings, threatened and endangered species listings or other requirement as discussed in a permit rationale.

The following parameters were identified by the Division as pollutants to be evaluated for this facility:

- Total Residual Chlorine
- *E. coli*

- Ammonia
- Metals and Cyanide
-

There are no site-specific in-stream water quality standards for BOD_5 or $CBOD_5$, TSS, percent removal, and oil and grease for this receiving stream. Thus, assimilative capacities were not determined for these parameters. The applicable limitations for these pollutants can be found in Regulation No. 62 and will be applied in the permit for the WWTF.

It is the Division's standard procedure to consider metals and cyanide as potential pollutants of concern for all major domestic WWTFs.

VI. Determination of Water Quality Based Effluent Limitations (WQBELs)

Technical Information

Note that the WQBELs developed in the following paragraphs, are calculations of what an effluent limitation may be in a permit. The WQBELs for any given parameter, will be compared to other potential limitations (federal Effluent Limitations Guidelines, State Effluent Limitations, or other applicable limitation) and typically the more stringent limit is incorporated into a permit. If the WQBEL is the more stringent limitation, incorporation into a permit is dependent upon a reasonable potential analysis.

In-stream background data and low flows evaluated in Sections II and III are used to determine the assimilative capacity of Cripple Creek near the Cripple Creek WWTF WWTF for pollutants of concern, and to calculate the WQBELs. For all parameters except ammonia, it is the Division's approach to calculate the WQBELs using the lowest of the monthly low flows (referred to as the annual low flow) as determined in the low flow analysis. For ammonia, it is the standard procedure of the Division to determine monthly WQBELs using the monthly low flows, as the regulations allow the use of seasonal flows.

The Division's standard analysis consists of steady-state, mass-balance calculations for most pollutants and modeling for pollutants such as ammonia. The mass-balance equation is used by the Division to calculate the WQBELs, and accounts for the upstream concentration of a pollutant at the existing quality, critical low flow (minimal dilution), effluent flow and the water quality standard. The mass-balance equation is expressed as:

$$M_2 = \frac{M_3 Q_3 - M_1 Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3)
Q_2 = Average daily effluent flow (design capacity)
Q_3 = Downstream flow (Q_1 + Q_2)
M_1 = In-stream background pollutant concentrations at the existing quality
M_2 = Calculated WQBEL

M_3 = Water Quality Standard, or other maximum allowable pollutant concentration

The upstream background pollutant concentrations used in the mass-balance equation will vary based on the regulatory definition of existing ambient water quality. For most pollutants, existing quality is determined to be the 85th percentile. For metals in the total or total recoverable form, existing quality is determined to be the 50th percentile. For pathogens such as fecal coliform and *E. coli*, existing quality is determined to be the geometric mean.

Calculation of WQBELs

Where a WQBEL is calculated to be a negative number and interpreted to be zero the Division standard procedure is to allocate the water quality standard to prevent further degradation of the receiving waters. The Division's Restoration and Protection Unit investigates issues of water quality standard exceedances. This Unit is tasked with determining if the exceedances are valid and placing the receiving stream on the Clean Water Act Section 303(d) list of impaired waters, if appropriate. If the receiving water is placed on the State's 303(d) list, the Assessment Unit is tasked with developing the Total Maximum Daily Loads (TMDLs) and the Waste Load Allocations (WLAs) to be distributed to the affected facilities.

Chlorine: The mass-balance equation was used to determine the WQBELs for chlorine. There are no point sources discharging total residual chlorine within one mile of the Cripple Creek WWTF WWTF. Because chlorine is rapidly oxidized, in-stream levels of residual chlorine are detected only for a short distance below a source. Ambient chlorine was therefore assumed to be zero.

Using the mass-balance equation provided in the beginning of Section VI, the acute and chronic low flows set out in Section IV, the chlorine background concentration of zero as discussed above, and the in-stream standards for chlorine shown in Section III, the WQBELs for chlorine were calculated. The data used and the resulting WQBELs, M_2, are set forth in Table A-7.

Table A-7

Chlorine Assimilative Capacities

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1 (mg/l)***	***M_3 (mg/l)***	***M_2 (mg/l)***
Acute Chlorine	0.58	1.5	2.08	0	0.019	***0.026***
Chronic Chlorine	0.67	1.5	2.17	0	0.011	***0.016***

E. coli**:** Available studies indicate that *Escherichia coli (E. coli)*, which is a subset of fecal coliform, is a better predictor of potential human health impacts from waterborne pathogens. The Water Quality Control Commission is replacing all standards for fecal coliform with standards for E. coli. There are no point sources discharging E. coli within one mile of the Cripple Creek WWTF WWTF. Thus, WQBELs were evaluated separately.

Using the mass-balance equation provided in the beginning of Section VI, the chronic low flow set out in Section IV, the background concentration contained in Section IV, and the chronic in-stream standard for *E. coli* shown in Section III, the WQBELs for *E. coli* were calculated. The data used and the resulting WQBELs, M_2, are set forth in Table A-8.

Table A-8

***E. coli* Assimilative Capacities**

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1 (#/100 ml)	M_3 (#/100 ml)	M_2 (#/100 ml)
E. coli	0.67	1.5	2.17	45	126	***162***

Temperature: A WQBEL for temperature can only be calculated if there is representative data, in the proper form, to determine what the background Maximum Weekly Average Temperature and Daily Maximum ambient temperatures are. As this data is not available at this time, the temperature limitation will be set at the water quality standard and will be revisited in the future when representative temperature data becomes available.

Metals and Cyanide: Using the mass-balance equation provided in the beginning of Section VI, the low flows and background concentrations contained in Section IV, and the in-stream standards for metals and cyanide as shown in Section III, the WQBELs were calculated. The data used and the resulting WQBELs, M_2, are set forth in Table A-9a for chronic standards and in Table A-9b for acute standards.

Ammonia: The Ammonia Toxicity Model (AMMTOX) is a software program designed to project the downstream effects of ammonia and the ammonia assimilative capacities available to each discharger based on upstream water quality and effluent discharges. To develop data for the AMMTOX model, an in-stream water quality study should be conducted of the upstream receiving water conditions, particularly the pH and corresponding temperature, over a period of at least one year.

Ammonia plus temperature and corresponding pH data sets reflecting upstream ambient receiving water conditions were available for Cripple Creek based on a study conducted by the Cripple Creek WWTF. The data, reflecting a period of record from April 1994 through June 1998, were used to establish the setpoint and average headwater conditions in the AMMTOX. Effluent pH and temperature data were also available from the Cripple Creek WWTF study, as well as from DMR data and were used to establish the average facility contributions in the AMMTOX.

Flows contributed by Squaw Gulch to Cripple Creek approximately 1.5 miles downstream of the City of Cripple Creek WWTP and flows contributed by Arequa Gulch to Cripple Creek approximately 2.5 miles downstream were also incorporated into the AMMTOX. The pH and temperature contributions from these sources were not available and thus were assumed to be comparable to upstream headwater conditions.

Table A-9a

Chronic WQBELs for Metals and Cyanide

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***
As, TR (µg/l)	0.67	1.5	2.17	0.75	100	***100***
Cd, Dis (µg/l)	0.67	1.5	2.17	0	0.77	***1.1***
Cr+3, TR (µg/l)	0.67	1.5	2.17	0	100	***145***
Cr+3, Dis (µg/l)	0.67	1.5	2.17	0	142	***205***
Cr+6, Dis (µg/l)	0.67	1.5	2.17	0	11	***16***
Cu, Dis (µg/l)	0.67	1.5	2.17	7	18	***23***
Fe, TR (µg/l)	0.67	1.5	2.17	130	1000	***1389***
Pb, Dis (µg/l)	0.67	1.5	2.17	0	5.9	***8.5***
Mn, Dis (µg/l)	0.67	1.5	2.17	752	2152	***2777***
Hg, Tot (µg/l)	0.67	1.5	2.17	0	0.01	***0.014***
Ni, Dis (µg/l)	0.67	1.5	2.17	30	102	***134***
Se, Dis (µg/l)	0.67	1.5	2.17	0.92	4.6	***6.2***
Ag, Dis (µg/l)	0.67	1.5	2.17	0	1.3	***1.9***
U, Dis (µg/l)	0.67	1.5	2.17	3	3614	***5227***
Zn, Dis (µg/l)	0.67	1.5	2.17	86	245	***316***
B, Tot (µg/l)	0.67	1.5	2.17	85	750	***1047***

Table A-9b

Acute WQBELs for Metals and Cyanide

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***
As, Dis (µg/l)	0.58	1.5	2.08	0	340	***471***
Cd, Dis (µg/l)	0.58	1.5	2.08	0	5.5	***7.6***
Cr+6, Dis (µg/l)	0.58	1.5	2.08	0	16	***22***
Cu, Dis (µg/l)	0.58	1.5	2.08	7	28	***36***
CN, Free (µg/l)	0.58	1.5	2.08	0	5	***6.9***
Pb, Dis (µg/l)	0.58	1.5	2.08	0	152	***211***
Mn, Dis (µg/l)	0.58	1.5	2.08	752	3894	***5109***
Ni, Dis (µg/l)	0.58	1.5	2.08	30	919	***1263***
Se, Dis (µg/l)	0.58	1.5	2.08	0.92	18.4	***25***
Ag, Dis (µg/l)	0.58	1.5	2.08	0	8	***11***
U, Dis (µg/l)	0.58	1.5	2.08	3	5785	***8021***
Zn, Dis (µg/l)	0.58	1.5	2.08	86	283	***359***

AMMTOX may be calibrated for a number of variables in addition to the data discussed above. The values used for the other variables in the model are listed below:

- Stream velocity = $0.3Q^{0.4d}$
- Default ammonia loss rate = 6/day
- pH amplitude was assumed to be medium
- Default times for pH maximum, temperature maximum, and time of day of occurrence
- pH rebound was set at the default value of 0.2 su per mile
- Temperature rebound was set at the default value of 0.7 degrees C per mile.
- Note that the site specific standards state that salmonids and early life stages are absent

The results of the ammonia analyses for the Cripple Creek WWTF WWTF are presented in Table A-10.

Table A-10

AMMTOX Results for Cripple Creek
at the Cripple Creek WWTF **WWTF**

Design of 1 MGD (1.5 cfs)

Month	*Total Ammonia Chronic (mg/l)*	*Total Ammonia Acute (mg/l)*
January	14	54
February	14	52
March	13	50
April	13	58
May	14	93
June	20	155
July	12	114
August	10	75
September	10	65
October	12	66
November	13	48
December	13	45

VII. Antidegradation Evaluation

As set out in *The Basic Standards and Methodologies for Surface Water*, Section 31.8(2)(b), an antidegradation analysis is required except in cases where the receiving water is designated as "Use Protected." Note that "Use Protected" waters are waters "that the Commission has determined do not warrant the special protection provided by the outstanding waters designation or the antidegradation review process" as set out in Section 31.8(2)(b). The antidegradation section of the regulation became effective in December 2000, and therefore antidegradation considerations are applicable to this WQA analysis.

According to the *Classifications and Numeric Standards for Arkansas River Basin*, stream segment COARUA21a is Undesignated. Thus, an antidegradation review is required for this segment if new or increased impacts are found to occur.

Introduction to the Antidegradation Process

The antidegradation process conducted as part of this water quality assessment is designed to determine if an antidegradation review is necessary and if necessary, to complete the required calculations to determine the limits that can be selected as the antidegradation-based effluent limit (ADBEL), absent further analyses that must be conducted by the facility.

As outlined in the *Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance* (AD Guidance), the first consideration of an antidegradation evaluation is to determine if new or increased impacts are expected to occur. This is determined by a comparison of the newly calculated WQBELs verses the existing permit limitations in place as of September 30, 2000, and is described in more detail in the analysis. Note that the AD Guidance refers to the permit limitations as of September 30, 2000 as the existing limits.

If a new or increased impact is found to occur, then the next step of the antidegradation process is to go through the significance determination tests. These tests include: 1) bioaccumulative toxic pollutant test; 2) temporary impacts test; 3) dilution test (100:1 dilution at low flow) and; 4) a concentration test.

As the determination of new or increased impacts, and the bioaccumulative and concentration significance determination tests require more extensive calculations, the Division will begin the antidegradation evaluation with the dilution and temporary impact significance determination tests. These two significance tests may exempt a facility from further AD review without the additional calculations.

Note that the antidegradation requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the antidegradation review; however, where there is only an acute standard, the acute standard should be used. The appropriate standards are used in the following antidegradation analysis.

Significance Tests for Temporary Impacts and Dilution

This is not a temporary discharge and therefore exclusion based on a temporary discharge cannot be granted and the AD evaluation must continue.

The ratio of the chronic (30E3) low flow to the design flow is 0.44:1, and is less than the 100:1 significance criteria. Therefore this facility is not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

For the determination of a new or increased impact and for the remaining significance determination tests, additional calculations are necessary. Therefore, at this point in the antidegradation evaluation, the

Division will go back to the new or increased impacts test. If there is a new or increased impact, the last two significance tests will be evaluated.

New or Increased Impact

To determine if there is a new or increased impact to the receiving water, a comparison of the new WQBEL concentrations and loadings verses the concentrations and loadings as of September 30, 2000, needs to occur. If either the new concentration or loading is greater than the September 2000 concentration or loading, then a new or increased impact is determined. If this is a new facility (commencement of discharge after September 30, 2000) it is automatically considered a new or increased impact.

Note that the AD Guidance document includes a step in the New or Increased Impact Test that calculates the Non-Impact Limit (NIL), which is defined as the permit limit as of September 2000, divided by the new design flow (and the conversion factor given below). The permittee may choose to retain a NIL if certain conditions are met, and therefore the AD evaluation for that parameter would be complete. However in practice, the Division calculates both the NIL and the AD limitation, so that the permittee can compare the two potential limitations and determine which of the two limits they would prefer, one which does not allow any increased impact (NIL), or the other which allows an insignificant impact (AD limit). As the design flow for this facility is the same as it was in September 2000, the NILs are equal to the permit limitations as of September 2000.

If a parameter is being evaluated in this WQA, where the September 2000 permit did not contain a limitation for that parameter, then an implicit limitation may be substituted. Consistent with the First Update to the AD Guidance of April 2002, an implicit limit is determined based on the approach that specifies that the implicit limit is the maximum concentration of the effluent from October 1998 to September 2000, if such data is available. If this data is unavailable, the Division may substitute more recent representative data, if appropriate, on a case by case basis.

This facility was in place as a discharger prior to September 30, 2000, and therefore the new or increased impacts test must be conducted.

For total residual chlorine, the limitations as of September 2000 were used in the evaluation of new or increased impacts.

For ammonia, the September 2000 limitations were based on an approach that is no longer used by the Division. The approach used in the permit that was effective in 2000 (drafted in 1993) was a mass-balance type which referred back to the 1988 permit and a 1976 EPA policy for changing unionized ammonia to total ammonia. This methodology was incorrect in that the Colorado Ammonia Model (CAM) should have been used. In the 2001 permit renewal, the CAM was used to develop the permit limitations, in line with Division procedure dating back to the 1990s. Since the limitations in 2000 were calculated incorrectly, for the purposes of this permit renewal and WQA, the permit limitations that were calculated in 2001 will be considered representative of the limitations as of September 2000. For the months of May, June and July, the limitation was “Report” only as the CAM results were all greater than 30 mg/l, higher than that expected from a WWTF. Therefore for these months, 30 mg/l will be used as the limitation.

For metals, no limitations were included in the September 2000 permit, however, monitoring was included in the previous permit (August 2001 – July 2006). Therefore, implicit limits were determined based on the maximum concentration reported during this timeframe, and were used in the evaluation of new or increased impacts. In accordance with Division practice, an implicit limit for *E. coli* is determined as 0.32 times the permit limit for fecal coliform.

Note that for arsenic and selenium, the available data were in the total form, and this data was used for comparison against the dissolved standard. For Trivalent and hexavalent chromium, the data used was for total chromium. This is a conservative estimate of these two parameters. For iron, the available data was in the dissolved form against a standard in the total form.

Calculation of Loadings for New or Increased Impact Test and Non Impact Limits

The equations for the loading calculations are given below. Note that the AD requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the AD review; however, where there is only an acute standard, the acute standard should be used. Thus, the chronic low flows will be used later in this AD evaluation for all parameters with a chronic standard, and the acute low flows will be used for those parameters with only an acute standard.

$$\text{Previous permit load} = M_{permitted}\ (mg/l) \times Q_{permitted}\ (mgd) \times 8.34$$
$$\text{New WQBELs load} = M_2\ (mg/l) \times Q_2\ (mgd) \times 8.34$$

Where,

$M_{permitted}$ = September 2000 permit limit (or implicit limit) **(mg/l)**
$Q_{permitted}$ = design flow as of September 2000 **(mgd)**
Q_2 = current design flow (same as used in the WQBEL calculations)
M_2 = new WQBEL concentration **(mg/l)**
8.34 = unit conversion factor

The NIL is calculated as the September 2000 loading, divided by the new design flow, and divided by a conversion factor of 8.34. If there is no change in design flow, then the NIL is equal to the September 2000 permit limitation. The equations for the NIL calculations are shown below.

$$\text{September 2000 permit load} = M_{permitted} \times Q_{permitted} \times 8.34$$
$$\text{Non Impact Limit (NIL)} = \text{September 2000 permitted load} \div \text{New Design Flow} \div 8.34$$

Where,

$M_{permitted}$ = September 2000 permit limit or implicit limit **(mg/l)**
$Q_{permitted}$ = September 2000 design flow **(mgd)**
Q_2 = new or current design flow **(mgd)**
8.34 = Unit conversion factor

Table A-11 shows the results of these calculations and the determination of a new or increased impact.

Table A-11

Determination of New or Increased Impacts

Pollutant	***Sept 2000 Permit Limit***	***Sept 2000 Permit Load (lbs/day)***	***NIL***	***New WQBEL***	***New WQBEL Load (lbs/day)***	***New or Increased Impact***
Fecal Coliform (#/100	2387	19908	2387	NA	NA	NA
E. coli (#/100 ml)	899	7498	899	162	1351	No
TRC (mg/l)	0.013	0.11	0.013	0.016	0.13	Yes
NH_3, Tot (mg/l) Jan	23	192	23	14	117	No
NH_3, Tot (mg/l) Feb	18	150	18	14	117	No
NH_3, Tot (mg/l) Mar	16	133	16	13	108	No
NH_3, Tot (mg/l) Apr	21	175	21	13	108	No
NH_3, Tot (mg/l) May	30	250	30	14	117	No
NH_3, Tot (mg/l) Jun	30	250	30	20	167	No
NH_3, Tot (mg/l) Jul	30	250	30	12	100	No
NH_3, Tot (mg/l) Aug	18	150	18	10	83	No
NH_3, Tot (mg/l) Sep	12	100	12	10	83	No
NH_3, Tot (mg/l) Oct	17	142	17	12	100	No
NH_3, Tot (mg/l) Nov	13	108	13	13	108	No
NH_3, Tot (mg/l) Dec	14	117	14	13	108	No
As, TR (µg/l)	5	0.042	5	100	0.83	Yes
As, Dis (µg/l)	5	0.042	5	471	3.9	Yes
Cd, Dis (µg/l)	5	0.042	5	1.1	0.0092	No
Cr+3, TR (µg/l)	5	0.042	5	145	1.2	Yes
Cr+6, Dis (µg/l)	5	0.042	5	16	0.13	Yes
Cu, Dis (µg/l)	15	0.13	15	23	0.19	Yes
CN, Free (µg/l)	5	0.042	5	6.9	0.058	Yes
Fe, TR (µg/l)	140	1.2	140	1389	12	Yes
Pb, Dis (µg/l)	10	0.083	10	8.5	0.071	No
Mn, Dis (µg/l)	4600	38	4600	2777	23	No
Hg, Tot (µg/l)	0.2	0.0017	0.2	0.014	0.00012	No
Ni, Dis (µg/l)	10	0.083	10	134	1.1	Yes
Se, Dis (µg/l)	2	0.017	2	6.2	0.052	Yes
Ag, Dis (µg/l)	5	0.042	5	1.9	0.016	No
U, Dis (µg/l)	NA	NA	NA	5227	44	Yes
Zn, Dis (µg/l)	57	0.48	57	316	2.6	Yes

Note that loading for E. coli cannot be calculated; but, for comparison purposes, the approach is sufficient.

As shown in Table A-11, there are no new or increased impacts to the receiving stream based on the new WQBELS for E. coli, ammonia, cadmium, lead, manganese, mercury, and silver. and therefore, for these parameters, the AD evaluation is complete, AD limitations are not necessary, and the WQBELs are the final result of this WQA.

For TRC, arsenic, trivalent and hexavalent chromium, copper, cyanide, iron, nickel, selenium, uranium and zinc, Table A-11 shows that there are new or increased impacts for all parameters. Therefore the AD evaluation must continue for all parameters.

For the parameters that show a new or increased impact, the final two significance determination tests (bioaccumulative and concentration) need to be applied, to determine if AD limits are applicable. For the bioaccumulative test, the determination of the baseline water quality (BWQ), the baseline water quality loading (BWQload), the threshold load (TL) and the threshold load concentration (TL conc) needs to occur. For the concentration test, the BWQ, significant concentration thresholds (SCT) and antidegradation based average concentrations (ADBACs) need to be calculated. These calculations are explained in the following sections, and each significance determination test will be performed as the necessary calculations are complete. The AD low flow may also need to be calculated when determining the BWQ for an existing discharger (as of Sept 2000) when upstream water quality data are used.

Determination of Baseline Water Quality (BWQ)

The BWQ is the ambient condition of the water quality as of September 30, 2000. The BWQ defines the baseline low flow pollutant concentration, and for bioaccumulative toxic pollutants, the baseline load. The BWQ is to take into account the influence of the discharger if the discharge was in place prior to September 30, 2000. In such a case, data from a downstream location should be used to determine the BWQ. If only upstream data is available, then a mass balance equation may be applied, using the facilities effluent data to determine the BWQ. If the discharge was not present prior to September 30, 2000, then the influence of that discharge would not be taken into account in determining the BWQ. If the BWQ has already been determined in a previous WQA AD evaluation, it may not need to be recalculated as the BWQ is the water quality as of September 30, 2000, and therefore should not change unless additional data is obtained or the calculations were in error.

Consistent with current Division procedures, the BWQ concentrations for all pollutants of concern should be established so that it can be used as part of an antidegradation review.

This discharger was in place as of September 30, 2000, and therefore the BWQ will include the influence of the discharger. Data collected at Division Station 7250 located approximately 6 miles downstream from the facility, were determined to be representative of fully mixed condition downstream from the facility, without other influences, and thus the data were used to determine the BWQ concentrations. Since the data were collected downstream of the discharge, it takes into account the contribution of the facility.

Currently, it is the Division's approach to evaluate five years of ambient water quality data, if available, for the five years prior to September 30, 2000, when determining the BWQ. Data from this location were available for a period of record of May 1998 through September 2000 for the remaining pollutants for which the AD evaluation must be performed. A summary of this data is shown in Table A-12.

The BWQ concentrations based on these data, represented by the 50th percentile for total recoverable metals and total metals, the geometric mean for coliforms, and the 85th percentile for dissolved metals and other pollutants, are summarized in Table A-13.

Table A-12

Ambient Water Quality Summary for Potential Pollutants of Concern
May 1998 to September 2000

Parameter	*Number of Samples*	*15th Percentile*	*50th Percentile*	*85th Percentile*	*Mean*	*Location*
As, TR (µg/l)	28	0	0	1	0.35	Downstream
Cr, TR (µg/l)	2	0.045	0.15	0.26	0.15	Downstream
Cu, Dis (µg/l)	30	0	5	8	8.4	Downstream
CN, Tot (µg/l)	8	0	0	0	0.0033	Downstream
Fe, Dis (µg/l)	19	0	0	0	0.63	Downstream
Fe, TR (µg/l)	26	19	150	1650	830	Downstream
Ni, Dis (µg/l)	2	15	23	30	23	Downstream
Se, Dis (µg/l)	26	0	0	1	0.22	Downstream
U, Dis (µg/l)	19	0	0	0	0.053	Downstream
Zn, Dis (µg/l)	28	31	56	150	116	Downstream

Table A-13

BWQ Concentrations for Potential Pollutants of Concern
Based on Downstream Ambient Water Quality Concentrations

Pollutant	*M_{eff}*	*Q_{eff} (cfs)*	*$M_{u/s}$*	*$Q_{u/s}$ (cfs)*	*BWQ*	*WQS*
TRC (mg/l)					0	0.011
As, TR (µg/l)	--	--	--	--	0	100
As, Dis (µg/l)					0	340
Cr+3, TR (µg/l)					0	100
Cr+6, Dis (µg/l)					0	11
Cu, Dis (µg/l)	--	--	--	--	8	18
CN, Free (µg/l)					0	5
Fe, TR (µg/l)	--	--	--	--	150	1000
Ni, Dis (µg/l)	--	--	--	--	30	102
Se, Dis (µg/l)	--	--	--	--	1	4.6
U, Dis (µg/l)	--	--	--	--	0	3614
Zn, Dis (µg/l)	--	--	--	--	150	245

In cases where the BWQ concentration exceeds the water quality standard, the calculated BWQ concentration must then be set equal to the water quality standard. This occurred for none of the pollutants.

Note that the AD requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the antidegradation review; however, where there is only an acute standard, the acute standard should be used. Chronic standards were available for all pollutants except dissolved arsenic, free available cyanide.

Bioaccumulative Significance Test

Parameters associated with the bioaccumulative significance test were not determined to have a new or increased impact and therefore this section is omitted.

Significant Concentration Threshold

The SCT is defined as the BWQ plus 15% of the baseline available increment (BAI), and is calculated by the following equation:

$$SCT = (0.15 \times BAI) + BWQ$$

The BAI is the concentration increment between the baseline water quality and the water quality standard, expressed by the term (WQS – BWQ). Substituting this into the SCT equation results in:

$$SCT = 0.15 \times (WQS-BWQ) + BWQ$$

Where,

WQS = Chronic standard or, in the absence of a chronic standard, the acute standard
BWQ = Value from Table A-13

The SCTs are shown together with the calculations of the ADBACs, in Table A-14.

Determination of the Antidegradation Based Average Concentrations

Antidegradation based average concentrations (ADBACs) are determined for all parameters except ammonia, by using the mass-balance equation, and substituting the SCT in place of the water quality standard, as shown in the following equation:

$$ADBAC = \frac{SCT \times Q_3 - M_1 \times Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3 based on either the chronic or acute standard)

Q_2 = Current design capacity of the facility
Q_3 = Downstream flow ($Q_1 + Q_2$)
M_1 = Current ambient water quality concentration (From Section III)
SCT = Significant concentration threshold

The ADBACs were calculated using the SCTs, and are set forth in Table A-14.

Table A-14

SCTs and ADBACs

Pollutant	Q_1 *(cfs)*	Q_2 *(cfs)*	Q_3 *(cfs)*	M_1	*SCT*	*ADBAC*
TRC (mg/l)	0.67	1.5	2.17	0	0.0017	0.0025
As, TR (µg/l)	0.67	1.5	2.17	0.75	15	21
As, Dis (µg/l)	0.58	1.5	2.08	0	51	71
Cr+3, TR (µg/l)	0.67	1.5	2.17	0	15	22
Cr+6, Dis (µg/l)	0.67	1.5	2.17	0	1.7	2.5
Cu, Dis (µg/l)	0.67	1.5	2.17	7	9.5	11
CN, Free (µg/l)	0.58	1.5	2.08	0	0.75	1
Fe, TR (µg/l)	0.67	1.5	2.17	130	278	344
Ni, Dis (µg/l)	0.67	1.5	2.17	30	41	46
Se, Dis (µg/l)	0.67	1.5	2.17	0.92	1.5	1.8
U, Dis (µg/l)	0.67	1.5	2.17	3	542	783
Zn, Dis (µg/l)	0.67	1.5	2.17	86	164	199

Concentration Significance Tests

The concentration significance determination test considers the cumulative impact of the discharges over the baseline condition. In order to be insignificant, the new or increased discharge may not increase the actual instream concentration by more than 15% of the available increment over the baseline condition. The insignificant level is the ADBAC calculated in Table A-14 above. If the new WQBEL concentration (or potentially the TL Conc for bioaccumulatives) is greater than the ADBAC, an AD limit would be applied. This comparison is shown in Tables A-15.

Table A-15

Concentration Significance Test

Pollutant	*New WQBEL*	*ADBAC*	*Concentration Test Result*
TRC (mg/l)	0.016	0.0025	Significant
As, TR (µg/l)	100	21	Significant
As, Dis (µg/l)	471	71	Significant
Cr+3, TR (µg/l)	145	22	Significant
Cr+6, Dis (µg/l)	16	2.5	Significant
Cu, Dis (µg/l)	23	11	Significant
CN, Free (µg/l)	6.9	1	Significant
Fe, TR (µg/l)	1389	344	Significant
Ni, Dis (µg/l)	134	46	Significant
Se, Dis (µg/l)	6.2	1.8	Significant
U, Dis (µg/l)	5227	783	Significant
Zn, Dis (µg/l)	316	199	Significant

For all parameters, the WQBELs are greater than the ADBACs and therefore, the concentration test results in a significance determination, and the antidegradation based effluent limitations (ADBELs) must be determined.

<u>Non Impact Limits (NILs) and Antidegradation Based Effluent Limitations (ADBELs)</u>

The ADBEL is defined as the potential limitation resulting from the AD evaluation, and may be either the ADBAC, the NIL, or may be based on the concentration associated with the threshold load concentration (for the bioaccumulative toxic pollutants). ADBACs, NILs and TLs have already been determined in the AD evaluation.

Note that ADBACs and NILs are not applicable when the new WQBEL concentration (and loading as evaluated in the New and Increased Impacts Test) is less than the NIL concentration (and loading), or when the new WQBEL is less than the ADBAC.

Where an ADBAC or NIL applies, the permittee has the final choice between the two limitations. A NIL is applied as a 30-day average (and the acute WQBEL would also apply where applicable) while the ADBAC would be applied as a 2 year rolling average concentration. For the purposes of this WQA, the Division has made an attempt to determine whether the NIL or ADBAC will apply. The end results of this AD evaluation are in Table A-16, including any parameter that was previously exempted from further AD evaluation, with the final potential limitation identified (NIL, WQBEL or ADBAC).

For the following parameters, TRC, hexavalent chromium, copper, cyanide and selenium, the NILs have been established for this facility. The NILs were selected as they are less stringent than the WQBELs and the ADBACs. However, the facility has the final choice between the NILs and ADBACs, and if the ADBAC is preferred, the permit writer should be contacted.

For the following parameters, total recoverable and dissolved arsenic, total recoverable trivalent chromium, total recoverable iron, dissolved nickel, dissolved uranium and dissolved zinc, the ADBACs have been established for this facility. The ADBACs were selected as they are less stringent than the WQBELs and the NILs, or perhaps due to the application as a two-year rolling average. However, the facility has the final choice between the NILs and ADBACs, and if the ADBAC is preferred, the permit writer should be contacted.

Alternatives Analysis

If the permittee does not want to accept an effluent limitation that results in no increased impact (NIL) or in insignificant degradation (ADBAC), the applicant may conduct an alternatives analysis (AA). The AA examines alternatives that may result in no degradation or less degradation, and are economically, environmentally, and technologically reasonable. If the proposed activity is determined to be important economic or social development, a determination shall be made whether the degradation that would result from such regulated activity is necessary to accommodate that development. The result of an AA may be an alternate limitation between the ADBEL and the WQBEL, and therefore the ADBEL would not being applied. This option can be further explored with the Division. See Regulation 31.8 (3)(d), and the Antidegradation Guidance for more information regarding an alternatives analysis.

Table A-16

Final Selection of WQBELs, NILs, and ADBACs

Pollutant	***NIL***	***New WQBEL***	***ADBAC***	***Chosen Limit***
E. coli (#/100 ml)	899	162	NA	WQBEL
TRC (mg/l)	0.013	0.016	0.0025	NIL
NH3, Tot (mg/l) Jan	23	14	NA	WQBEL
NH3, Tot (mg/l) Feb	18	14	NA	WQBEL
NH3, Tot (mg/l) Mar	16	13	NA	WQBEL
NH3, Tot (mg/l) Apr	21	13	NA	WQBEL
NH3, Tot (mg/l) May	30	14	NA	WQBEL
NH3, Tot (mg/l) Jun	30	20	NA	WQBEL
NH3, Tot (mg/l) Jul	30	12	NA	WQBEL
NH3, Tot (mg/l) Aug	18	10	NA	WQBEL
NH3, Tot (mg/l) Sep	12	10	NA	WQBEL
NH3, Tot (mg/l) Oct	17	12	NA	WQBEL
NH3, Tot (mg/l) Nov	13	13	NA	WQBEL
NH3, Tot (mg/l) Dec	14	13	NA	WQBEL
As, TR (µg/l)	5	100	21	ADBAC
As, Dis (µg/l)	5	471	71	ADBAC
Cd, Dis (µg/l)	5	1.1	NA	WQBEL
Cr+3, TR (µg/l)	5	145	22	ADBAC
Cr+6, Dis (µg/l)	5	16	2.5	NIL
Cu, Dis (µg/l)	15	23	11	NIL
CN, Free (µg/l)	5	6.9	1	NIL
Fe, TR (µg/l)	140	1389	344	ADBAC
Pb, Dis (µg/l)	10	8.5	NA	WQBEL
Mn, Dis (µg/l)	4600	2777	NA	WQBEL
Hg, Tot (µg/l)	0.2	0.014	NA	WQBEL
Ni, Dis (µg/l)	10	134	46	ADBAC
Se, Dis (µg/l)	2	6.2	1.8	NIL
Ag, Dis (µg/l)	5	1.9	NA	WQBEL
U, Dis (µg/l)	NA	5227	783	ADBAC
Zn, Dis (µg/l)	57	316	199	ADBAC

VIII. References

Regulations:

The Basic Standards and Methodologies for Surface Water, Regulation 31, Colorado Department Public Health and Environment, Water Quality Control Commission, effective May 31, 2008.

Classifications and Numeric Standards for Arkansas River Basin, Regulation No. 32, Colorado Department Public Health and Environment, Water Quality Control Commission, effective March 30, 2009.

Water-Quality-Limited Segments Requiring Total Maximum Daily Loads, Regulation 93, Colorado Department Public Health and Environment, Water Quality Control Commission, effective April 30, 2006.

Colorado's Monitoring and Evaluation List, Regulation 94, Colorado Department Public Health and Environment, Water Quality Control Commission, effective April 30, 2006.

Policy and Guidance Documents:

Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, December 2001.

Memorandum Re: First Update to (Antidegradation) Guidance Version 1.0, Colorado Department Public Health and Environment, Water Quality Control Division, April 23, 2002.

Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-19, effective May 2002.