# Water Quality Assessment
# Purgatoire River, South Fork of the Purgatoire River, Middle Fork of the Purgatoire River, and Canyons above Trinidad Reservoir

**PIONEER CO-0047767, East Spanish Peaks: Wet, Sarcillo, Burro, Cow, Reilly, Santisteven and other Unnamed Canyons**

**PIONEER CO-0048003, West Spanish Peaks: Guajatoyah Creek, North Fork of the Purgatoire, Parras Canyon**

**PIONEER CO-0047776, Lorencito: Lorencito Canyon and its tributaries**

**XTO CO-0048054, Lorencito: Lorencito Canyon and its tributaries**

**XTO CO-0048062, Alamocito: Alamocito, Apache, Cherry, Ciruela, Gallegos and Unnamed Canyons**

**New Elk Mine CO-0000906: The Middle Fork of the Purgatoire**

## Table of Contents

I. WATER QUALITY ASSESSMENT SUMMARY ..... 3
II. INTRODUCTION ..... 13
III. WATER QUALITY STANDARDS ..... 17
*Narrative Standards* ..... *17*
*Standards for Organic Parameters and Radionuclides* ..... *17*
*Temperature* ..... *18*
*Segment Specific Numeric Standard* ..... *19*
*Table Value Standards and Hardness Calculations* ..... *23*
IV. RECEIVING STREAM INFORMATION ..... 32
*Low Flow Analysis* ..... *32*
*Mixing Zones* ..... *37*
*Ambient Water Quality* ..... *38*
V. FACILITY INFORMATION AND POLLUTANTS EVALUATED ..... 42
*Facility Information* ..... *42*
*Pollutants of Concern* ..... *44*
VI. DETERMINATION OF WATER QUALITY BASED EFFLUENT LIMITATIONS (WQBELS) ..... 44
*Technical Information* ..... *44*
*Calculation of WQBELs* ..... *46*
*WQBELs for COARLA06a, Various Canyons (Tables A-7a through A-7e)* ..... *47*
*WQBELs for Parras Canyon (COARLA05b) (Tables A-7e through A-7f)* ..... *50*
*WQBELs for all indirect and direct discharges to the Purgatoire River (COARLA05b) (Tables A-7g through A-7h)* ..... *52*
*WQBELs for the Middle Fork of the Purgatoire River (COARLA05b) (Tables A-7l through A-7m)* ..... *53*
*WQBELs for all indirect and direct discharges to the South Fork of the Purgatoire River (COARLA05b),* ..... *54*
*WQBELs for Lorencito Canyon (COARLA04b) (Tables A-7p through A-7q)* ..... *56*
*WQBELs for Guajatoyah Creek (COARLA05a) (Tables A-7r through A-7s)* ..... *57*
*WQBELs for Tributary To Guajatoyah Creek (COARLA05a) (Tables A-7t through A-7u)* ..... *58*
*WQBELs for North Fork of the Purgatoire River (COARLA05b) (Tables A-7v through A-7w)* ..... *59*
*Whole Effluent Toxicity (WET) Testing:* ..... *60*
*Agricultural Use Parameters (SAR and EC)* ..... *64*
VII. ANTIDEGRADATION EVALUATION ..... 69
*Introduction to the Antidegradation Process* ..... *69*
*Significance Tests for Temporary Impacts and Dilution* ..... *70*
*New or Increased Impact and Non Impact Limitations (NILs)* ..... *71*
*Determination of Baseline Water Quality (BWQ)* ..... *72*
*Bioaccumulative Significance Test* ..... *76*
*Significant Concentration Threshold* ..... *78*
*Determination of the Antidegradation Based Average Concentrations* ..... *79*
*Concentration Significance Tests* ..... *86*
*Antidegradation Based Effluent Limitations (ADBELs)* ..... *93*
*Alternatives Analysis* ..... *100*
VIII. TECHNOLOGY BASED LIMITATIONS ..... 113
*Federal Effluent Limitation Guidelines* ..... *113*
*Pioneer/XTO Regulations for Effluent Limitations* ..... *113*
*Nutrient Effluent Limitation Considerations* ..... *114*
IX. REFERENCES ..... 114

# 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 Monitoring and Evaluation listings; low flow and facility flow summaries; and a list of parameters evaluated.

**Table A-1a**
**WQA Summary**

| Facility Information | | | |
|---|---|---|---|
| **Facility Name** | **Permit Number** | **Design Flow (max 30-day ave, MGD)** | **Design Flow (max 30-day ave, CFS)** |
| F1. Pioneer – East Spanish Peaks (40 outfalls) | CO0047767 | 4.6 | 7.2 |
| F2. Pioneer – Lorencito (7 outfalls) | CO0047776 | 0.41 | 0.63 |
| F3. Pioneer – West Spanish Peaks (3 outfalls) | CO0048003 | 0.46 | 0.71 |
| F4. XTO – Lorencito (39 outfalls) | CO0048054 | 1.0 | 1.5 |
| F5. XTO – Alamocito (38 outfalls) | CO0048062 | 2.1 | 3.3 |
| F6. New Elk Mine (1 outfall, Outfall 001) | CO0000906 | 1.08 | 1.7 |
| Total Flow From All Dischargers | - | 9.7 | 15.0 |
| Total Flow From CBMs (Pioneer/XTO) | - | 8.6 | 13.3 |
| **Total Flow From CBMs (Pioneer/XTO) to the Purgatoire River** | | **7.7** | **11.9** |
| **Total Flow from All discharges to the Purgatoire River** | | **8.8** | **13.5** |

| Receiving Stream Information (Table A-1a continued) | | | | |
|---|---|---|---|---|
| **Receiving Stream Name** | **Total Flow and Facility #'s (outfalls listed in subsequent table)** | **Segment ID** | **Designation** | **Classification(s)** |
| S1. Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon | F1,F4, F5 (12.5 cfs) | COARLA06a | Use Protected | Aquatic Life Cold 2, Recreation E, Agriculture |
| S2.Parras Canyon (tributary of the North Fork of the Purgatoire River) | F3 (0.67 cfs) | COARLA05b | Reviewable | Aquatic Life Cold 1 Recreation E Water Supply Agriculture |
| S3. North Fork of the Purgatoire River | F3 (0.04 cfs) | | | |
| S4. Purgatoire River (total to river, including all indirect discharged from all segments) | All outfalls except F1: 016-A, 022-A, 028-A, 061-A, 063-A, 071- | | | |

| | | | | |
|---|---|---|---|---|
| | A, 090-A, 108-A, 112-A, 152-A, 191-A, 198-A, 210-A, 212-A, 213-A, 222-A (total not going to Purgatoire = 1.27 cfs)<br>(Total to Purgatoire = 13.5 cfs) | | | |
| S5. Middle Fork of the Purgatoire River | F6<br>(1.67 cfs) | | | |
| S6. South Fork of the Purgatoire River, including the tributaries: Alamocito Canyon, Bingham Canyon, Cherry Canyon, Gallegos Canyon, Little Bingham Canyon, Torres Canyon, and unnamed tributaries to Alamocito Canyon | F5<br>(all outfalls for F5 make it to S6.)<br>(3.27 cfs) | | | |

| Low Flows (cfs) (Table A-1a continued) | | | | |
|---|---|---|---|---|
| S7. Lorencito Canyon | F2, F4 (direct discharge = 0.13 cfs Indirect discharge = 2.03 cfs) | COARLA4b | Use Protected | Aquatic Life Warm 2, Recreation E, Agriculture |
| S8. Guajatoyah Creek and unnamed tributary | F3 (0.04 cfs) | COARLA05a | Reviewable | Aquatic Life Cold 1 Recreation E Water Supply Agriculture |
| **Receiving Stream Name** | **1E3 (1-day)** | **7E3 (7-day)** | **30E3 (30-day)** | **Ratio of 30E3 to the Design Flow (cfs)** |
| S1. Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little | 0 | 0 | 0 | 0 |

| | | | | |
|---|---|---|---|---|
| Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon | | | | |
| S2. Parras Canyon | 0 | 0 | 0 | 0 |
| S3. North Fork of the Purgatoire River | 0.5 | 0.5 | 0.5 | 12:1 |
| S4. **Purgatoire River** | 8.4 | 9.2 | 11 | 0.81:1 |
| S5. Middle Fork of the Purgatoire River | 1 | 1 | 1 | 0.59:1 |
| S6. South Fork of the Purgatoire River | 0.5 | 0.5 | 0.5 | 6:1 |

| Low Flows (cfs) (Table A-1a continued) | | | | | |
|---|---|---|---|---|---|
| S7. Lorencito Canyon | | 0 | 0 | 0 | 0 |
| S8. Guajatoyah Creek/unnamed tributary to Guajatoyah Creek | | 0.25/0 | 0.25/0 | 0.25/0 | 6:1/0:1 |
| **Regulatory Information** | | | | | |
| **T&E Species** | **303(d) (Reg 93)** | **Monitor and Eval (Reg 93)** | **Existing TMDL** | **Temporary Modification(s)** | **Control Regulation** |
| No | Se, Fe (trec)-COARLA04, Apishipa River and Timpas Creek | None | None | S7, 6, 5, 4, 3, 2, 1: Temporary modification Type B: Temperature="current conditions" Expiration date of 6/30/2016. S8, 6, 5, 4, 3, 2: Temporary modification: As(ch)=hybrid Expiration date of 12/31/21. | None |
| **Pollutants Evaluated** | | | | | |
| F1-6: Selected Inorganics, Metals, SAR, Electrical Conductivity, Temperature (CBM discharges), Radiological Parameters (CBM discharges) | | | | | |

| Table A-2b<br>List of Outfalls and Associated Facilities, Flows (CFS), and Receiving Streams | | |
|---|---|---|
| Facility | Outfalls | Total Contributing Flow (cfs) |
| **Alamosa Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F2. Pioneer – Lorencito | 059A, 075A | 0.08 |
| **Alamocito Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO – Alamocito | 018A | 0.107 |
| **Apache Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO – Alamocito | 001-G, 007G, 021G | 0.26 |
| **Big Bingham Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO – Alamocito | 019-A | 0.07 |
| **Burro Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F1. Pioneer – East Spanish Peaks | 022-A, 028-A, 079-A, 112-A, 160-A, 183-A, 191-A, 212-A, 220-A, 221-A, 222-A | 0.60 |
| **Cherry Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO – Alamocito | 040-G | 0.32 |
| **Chimney Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F2. Pioneer – Lorencito | 076A | 0.15 |
| **Ciruela Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO – Alamocito | 015G, 016G, 37G, 038G | 0.23 |
| **Cow Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F1. Pioneer – East Spanish Peaks | 071-A | 0.068 |
| **Left Fork of Apache Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO – Alamocito | 060-A | 0.015 |
| **Little Pine Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F2. Pioneer – Lorencito | 027A | 0.04 |
| **Lopez Canyon– COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO-Alamocito | 033-G | 0.15 |

| Table A-2b<br>List of Outfalls and Associated Facilities, Flows (CFS), and Receiving Streams | | |
|---|---|---|
| Facility | Outfalls | Total Contributing Flow (cfs) |
| **Lorencito Canyon– COARLA04b** | | |
| Facility | Outfalls | Total Contributing Flow |
| F4. XTO-Lorencito | 035-A | 0.04 |
| F2. Pioneer – Lorencito | 022A | 0.09 |
| **Middle Fork to the Purgatoire River – COARLA05b** | | |
| Facility | Outfalls | Total Contributing Flow |
| F6. New Elk Mine | 001 | shared flow with 009 = 1.67 |
| **Pancho Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F4. XTO-Lorencito | 031-A | 0.019 |
| **Parras Canyon – COARLA05b** | | |
| Facility | Outfalls | Total Contributing Flow |
| F3. Pioneer – West Spanish Peaks | 005, 245 | 0.67 |
| **Puertecito Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F2. Pioneer – Lorencito | 005A, 010A | 0.27 |
| **Reilly Canyon– COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F1. Pioneer – East Spanish Peaks | 057-A, 060-A, 061-A, 065-A, 090-A, 094-A, 108-A, 152-A, 202-A, 230-A | 2.90 |
| **Santisteven Canyon– COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO-Alamocito | 022-G | 0.14 |
| F1. Pioneer – East Spanish Peaks | 004-A | 0.61 |
| **Sarcillo Canyon– COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F1. Pioneer – East Spanish Peaks | 016-A, 063-A, 075-A, 096-A, 105-A, 147-A, 156-A, 198-A, 210-A, 213-A, 228-A, 238-A, 239-A | 1.67 |
| **Smith Canyon– COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F1. Pioneer – East Spanish Peaks | 215-A | 0.074 |
| **Torres Canyon– COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO-Alamocito | 034-A | 0.11 |
| **Unnamed Tributary to Alamosa Canyon – COARLA06a** | | |
| F4. XTO – Lorencito | 019-A, 021-A, 025-A, 027-A, 028- | 1.08 |

| Table A-2b<br>List of Outfalls and Associated Facilities, Flows (CFS), and Receiving Streams | | |
|---|---|---|
| Facility | Outfalls | Total Contributing Flow (cfs) |
| | A, 036-A, 037-A, 039-A, 040-A, 047-A, 049-A, 050-A, 051-A, 057-A, 066-A, 067-A, 068-A, 069-A, 072-A, 073-A, 074-A, 082-A, 083-A, 084-A, 088-A, 091-A, 093-A | |
| **Unnamed Tributary to Alamosito Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO-Alamocito | 014A, 016A, 017A, 032A, 033A | 0.28 |
| **Unnamed Tributary to Apache Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO-Alamocito | 004G, 028G | 0.19 |
| **Unnamed Tributary to Big Bingham Canyon – COARLA06a** | | |
| F5. XTO-Alamocito | 022A | 0.03 |
| **Unnamed Tributary to Ciruela Canyon – COARLA06a** | | |
| F5. XTO-Alamocito | 042G | 0.051 |
| **Unnamed Tributary of Gallegos Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO – Alamocito | 079-H, 080-H | 0.22 |
| **Unnamed Tributary to Guajatoyah Creek – COARLA05a** | | |
| Facility | Outfall | Total Contributing Flow |
| F3. Pioneer – West Spanish Peaks | 241 | 0.28 |
| **Unnamed Tributary to Little Alamosa Canyon – COARLA06a** | | |
| F4. XTO – Lorencito | 016A | 0.082 |
| **Unnamed Tributary to Little Bingham Canyon – COARLA06a** | | |
| F5. XTO-Alamocito | 001A, 040A | 0.036 |
| **Unnamed Tributary to Lopez Canyon – COARLA06a** | | |
| F5. XTO-Alamocito | 027G, 036G | 0.37 |
| **Unnamed Tributary to Lorencito Canyon – COARLA06a** | | |
| F4. XTO – Lorencito | 045-A, 070-A, 078-A | 0.12 |
| **Unnamed tributary of Unnamed Tributary to Lorencito Canyon – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F4. XTO-Lorencito | 032-A, 034-A, 042-A | 0.105 |
| **Unnamed Tributary to Pancho Canyon – COARLA06a** | | |
| F4. XTO – Lorencito | 012-A, 018-A | 0.086 |
| **Unnamed Tributary to Purgatoire River – COARLA06a** | | |
| Facility | Outfalls | Total Contributing Flow |
| F5. XTO-Alamocito | 007G, 023G, 024G, 031G, 039G | 0.45 |

| Table A-2b<br>List of Outfalls and Associated Facilities, Flows (CFS), and Receiving Streams | | |
|---|---|---|
| Facility | Outfalls | Total Contributing Flow (cfs) |
| F1. Pioneer – East Spanish Peaks | 007-A, 073-A, 217-A | 1.2 |
| **Unnamed Tributary to South Fork of the Purgatoire – COARLA06a** | | |
| F5. XTO-Alamocito | 023G, 043G, 049A | 0.17 |
| **Zamora Canyon – COARLA06a** | | |
| F5. XTO-Alamocito | 023G, 031G | 0.17 |

**Basis for Watershed Approach**

Water Quality Assessments (WQAs) are used to develop the assimilative capacities for pollutants of concern, and to evaluate antidegradation-based limitations, where applicable, from one or more point sources that discharge to one or more receiving stream segments. This evaluation includes the stream receiving the direct discharge, and also downstream waterbodies whose water quality and associated beneficial uses may be impacted by these upstream point sources. The Division frequently prepares WQAs that address two or more point sources within a sub-basin or a small basin. This WQA has been prepared in this watershed approach to efficiently address over a hundred point sources of produced water discharged from coal bed methane (CBM) fields (under two operating companies), and one coal mine (New Elk) to many tributaries and the Purgatoire mainstem within the Purgatoire River basin above the City of Trinidad.

The surface waters of this basin are divided into eight areas for assignment of water-quality standards:

- The main stem of the Purgatoire River, COARLA05b
- The main stem of the Middle Fork of the Purgatoire River, COARLA05b
- The main stem of the South Fork of the Purgatoire River, COARLA05b
- The main stem of the North Fork of the Purgatoire River, COARLA05b
- The zero low flow canyons that are ultimately tributary to the Purgatoire River, COARLA06a
- Parras Canyon, COARLA05b
- Lorencito Canyon, COARLA04b, and;
- Guajatoyah Creek/unnamed tributary to Guajatoyah Creek, COARLA05a

While the majority of pollutants of concern can be addressed with separate sets of effluent limits on outfalls within each of these areas, protections for EC and SAR, TVS metal standards, and an antidegradation analysis apply to the main stem of the Purgatoire River. Considering that most of the outfalls in the tributaries to the Purgatoire River reach the mainstem of the Purgatoire River, all appropriate outfalls must be considered in EC and SAR, TVS metals standards, and the antidegradation analysis. Pioneer submitted (via email September 18, 2014) field notes regarding flows from several outfalls that indicate they do not reach the Purgatoire River. The rationale listed includes the presence of several ponds and mine tailings that would divert or block the drainage to the Purgatoire. The outfalls that Pioneer has indicated (and field notes demonstrate) do not reach the Purgatoire River are as follows;

016-A, 022-A, 028-A, 061-A, 063-A, 071-A, 090-A, 108-A, 112-A, 152-A, 191-A, 198-A, 210-A, 212-A, 213-A, 222-A.

## II. Introduction

The WQA of the Purgatoire River Basin above Trinidad Reservoir, located in Las Animas 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-1a contains the legend for the map of the study area (Figure A-1b) evaluated as part of this WQA.

**FIGURE A-1a**

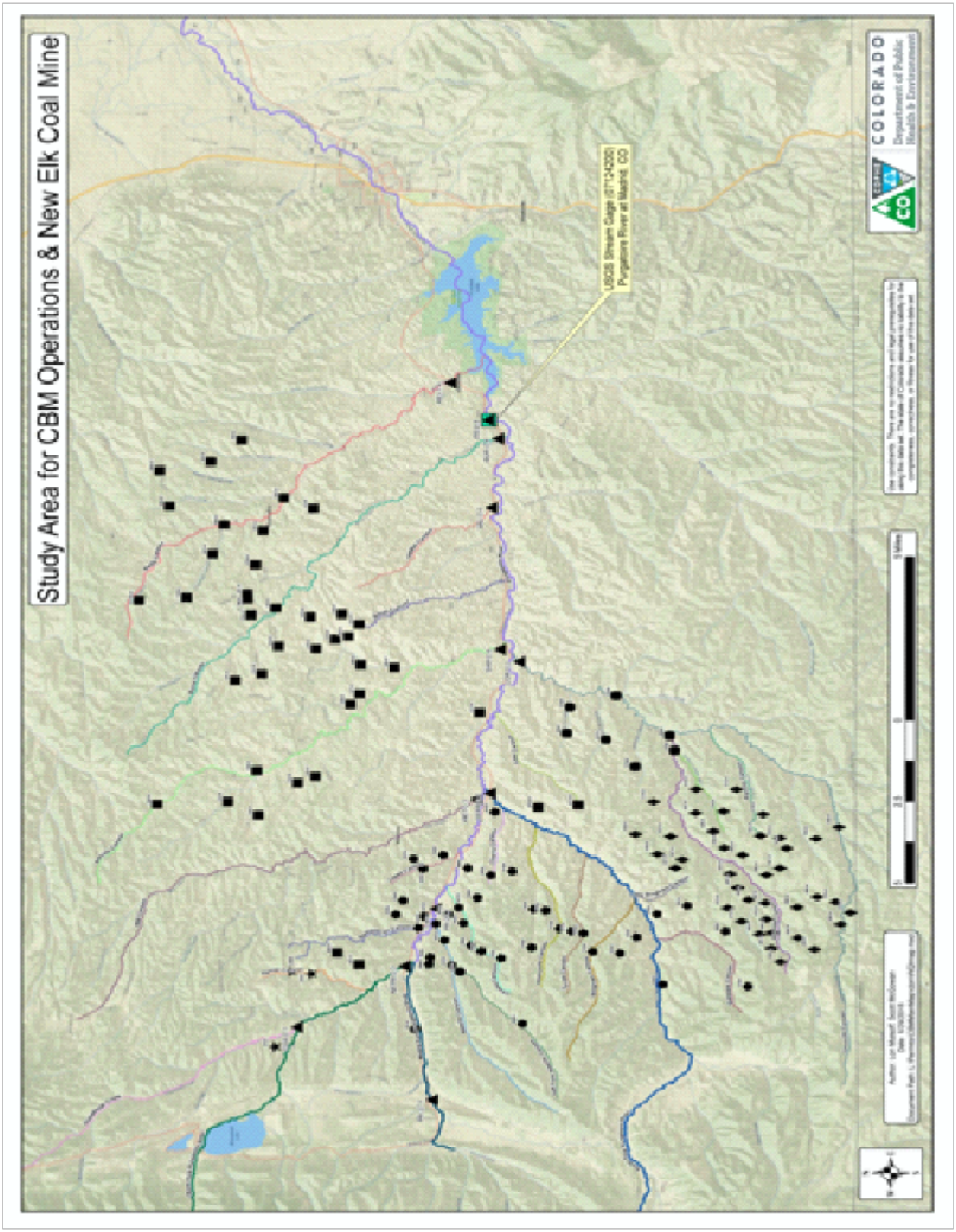
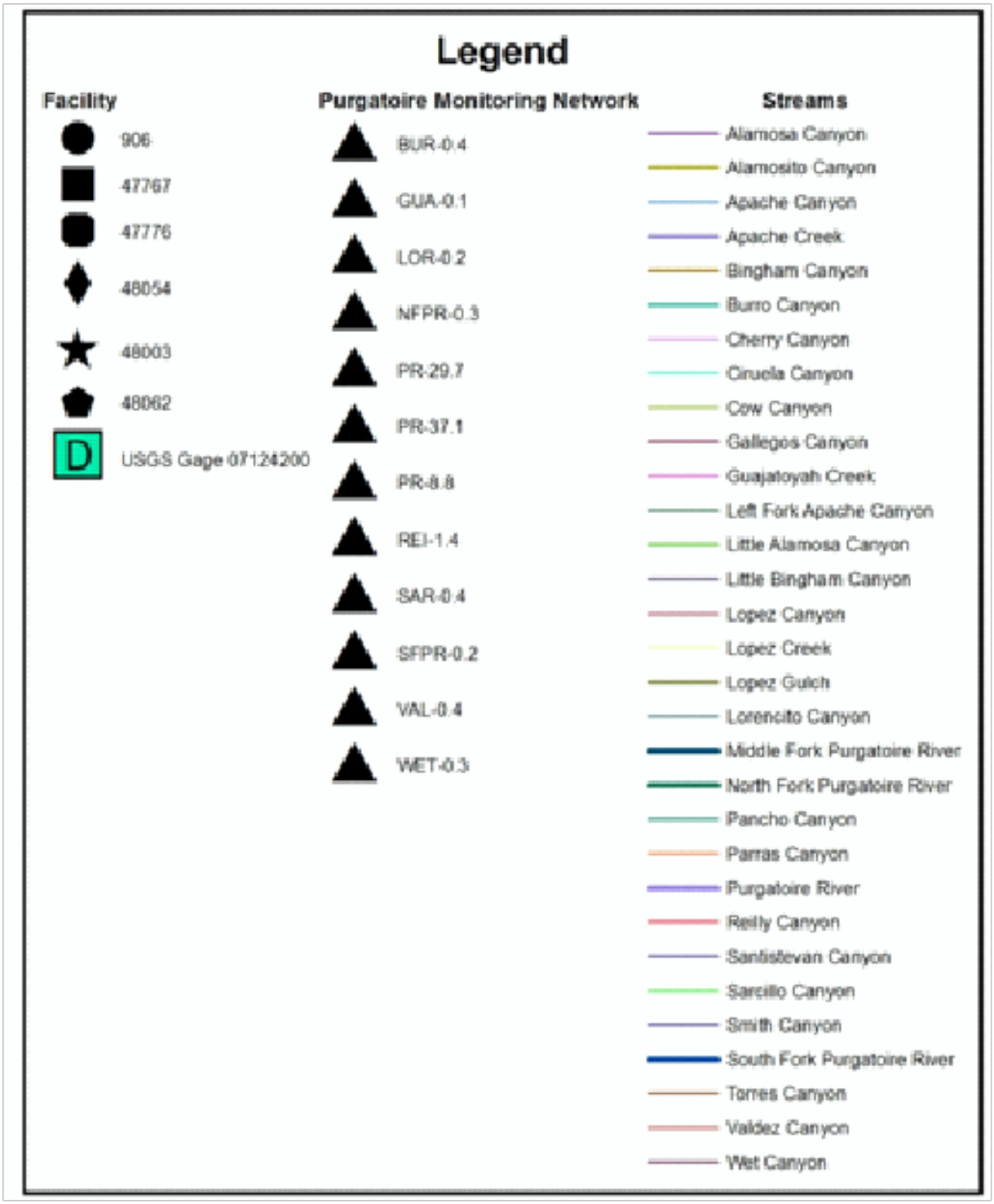

Study Area for CBM Operations & New Elk Coal Mine
USGS Stream Gage
Purgatoire River at Madrid CO
COLORADO
Department of Public Health & Environment

**FIGURE A-1b**


Legend
Facility
906
47767
47776
48054
48003
48062
USGS Gage 07124200
Purgatoire Monitoring Network
BUR-0.4
GUA-0.1
LOR-0.2
NFPR-0.3
PR-29.7
PR-37.1
PR-8.8
REI-1.4
SAR-0.4
SFPR-0.2
VAL-0.4
WET-0.3
Streams
Alamosa Canyon
Alamosito Canyon
Apache Canyon
Apache Creek
Bingham Canyon
Burro Canyon
Cherry Canyon
Ciruela Canyon
Cow Canyon
Gallegos Canyon
Guajatoyah Creek
Left Fork Apache Canyon
Little Alamosa Canyon
Little Bingham Canyon
Lopez Canyon
Lopez Creek
Lopez Gulch
Lorencito Canyon
Middle Fork Purgatoire River
North Fork Purgatoire River
Pancho Canyon
Parras Canyon
Purgatoire River
Reilly Canyon
Santistevan Canyon
Sarcillo Canyon
Smith Canyon
South Fork Purgatoire River
Torres Canyon
Valdez Canyon
Wet Canyon

Three of the five CBM operations (Pioneer East Spanish Peaks, XTO Lorencito, and XTO Alamocito) being considered in this WQA discharge to various tributaries to the Purgatoire River main stem, most of which are in the Water Body Identification (WBID) stream segment COARLA06a.

Two of the five CBM operations (Pioneer Lorencito, XTO Lorencito) discharge to Lorencito Canyon which is in the WBID stream segment COARLA04b.

One of the five CBM operations (Pioneer West Spanish Peaks) discharge via 3 outfalls to tributaries to the North Fork of the Purgatoire River (Guajatoyah Creek/unnamed tributary to Guajatoyah Creek and Parras Canyon), which is in the WBID stream segment COARLA05a (Guajatoyah and the North Fork) and COARLA05b (Parras).

New Elk Coal Mine and one of the five CBM operations (Pioneer West Spanish Peaks) discharges also to the Middle Fork of the Purgatoire River or to tributaries to the North Fork of the Purgatoire - respectively, which are under WBID stream segment COARLA05b.

Of these five CBM operations and the one coal mine, some outfalls have the ability to reach the Middle Fork and the South Fork of the Purgatoire before reaching the main stem of the Purgatoire River, and all have discharges that eventually reach the main stem of the Purgatoire River. Therefore considerations for the protection of the Purgatoire River are included in this WQA. The main stem of the Purgatoire River is included in Water Body Identification (WBID) stream segment COARLA05b.

These codes mean the Arkansas River Basin, Lower Arkansas River Sub-basin, Stream Segments 04b, 05a, 06a, 05a, or 05b.

**Segment 06a** is composed of the "All tributaries to the Purgatoire River, including all wetlands, from the source to Interstate 25, except for specific listings in segments 4b, 5a, 5b, 5c and 6b." Stream segment COARLA06a is classified for Cold Water Aquatic Life Class 2, Recreation Class E, and Agriculture.

**Segment 05a** is composed of the "Mainstem of the North Fork of the Purgatoire River, including all tributaries and wetlands, from the source to a point immediately below the confluence with Guajatoyah Creek; mainstem of the Middle Fork of the Purgatoire River, including all tributaries and wetlands, from the source to the Bar Ni Ranch Road at Stonewall Gap; Mainstem of the South Fork of the Purgatoire River, including all tributaries and wetlands, from the source to Tercio." Stream segment COARLA05a is classified for Cold Water Aquatic Life Class 1, Recreation Class E, Water Supply and Agriculture.

**Segment 04b** is composed of the "Mainstem of Lorencito Canyon, from the source to the confluence with the Purgatoire River." Stream segment COARLA04b is classified for Warm Water Aquatic Life Class 2, Recreation Class E, and Agriculture.

**Segment 05b** is composed of the "Mainstem of the North Fork of the Purgatoire River, including all tributaries and wetlands, from a point immediately below the confluence with Guajatoyah Creek to the confluence with the Purgatoire River. Mainstem of the Middle Fork of the Purgatoire River from the Bar Ni Ranch Road at Stonewall Gap to the confluence with the North Fork of the Purgatoire River.

Mainstem of the South Fork of the Purgatoire River from Tercio to the confluence with the Purgatoire River. Mainstem of the Purgatoire River to Trinidad Lake. Mainstem of Long Canyon Creek from the source to Trinidad Reservoir." Stream segment COARLA05b is classified for Cold Water Aquatic Life Class 1, Recreation Class E, Water Supply and Agriculture.

Information used in this assessment includes data gathered from Pioneer Natural Resources, XTO Energy, the Division, the Colorado Division of Water Resources (DWR), the Purgatoire Watershed Monitoring Network (maintained by Tetra Tech), the U.S. Geological Survey (USGS), and discussions with the local water commissioner. 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<br>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 |

*Must be analyzed unfiltered (total) samples. These Human Health standards are 30-day averages.

**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).

The aquatic life standards for organics 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 the Water Quality Control Commission has made such determination.

Because segment **COARLA06a** is classified for Cold Class 2, without a water supply designation, aquatic life standards apply to this discharge.

Because segment **COARLA05a** and **05b** are classified for Cold Class 1, with a water supply designation, the water supply, water + fish, and aquatic life standards apply to this discharge.

Because segment **COARLA04b** is classified for Warm Class 2, without a water supply designation, aquatic life standards apply to this discharge.

**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.

\

**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. The standards in Table A-3a are assigned to stream segment COARLA06a. The standards in Table A-3b are assigned to stream segment COARLA06b. The standards in table A-3c are assigned to stream segment COARLA05a and 05b. The standards in table A-3d are assigned to stream segment COARLA04b. All standards are in accordance with the Classifications and Numeric Standards for Arkansas River Basin, Regulation 32.

| **Table A-3a**<br>Standards for Stream Segment COARLA06a –**Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon** |
|---|
| ***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* April-Oct =18.3° C MWAT and 23.9° C DM |
| Temperature* Nov-March = 9° C MWAT and 13° C DM |
| ***Inorganic*** |
| Chlorophyll = 150 $mg/m^2$ |
| Free Cyanide acute = 0.0002 mg/l |
| Sulfide chronic = 0.002 mg/l |
| Boron chronic = 4 mg/l |
| Nitrite acute = 10 mg/l |
| Nitrate acute = 100 mg/l |
| Total Phosphorous = 110 µg/l |
| ***Metals*** |
| Dissolved Trivalent Chromium acute and chronic = TVS |
| Total Recoverable Arsenic chronic = 100 µg/l |
| Total Recoverable Beryllium chronic = 100 µg/l |
| Total Recoverable Cadmium chronic = 10 µg/l |
| Total Recoverable Trivalent Chromium chronic = 100 µg/l |
| Total Recoverable Hexavalent Chromium chronic = 100 µg/l |
| Total Recoverable Copper chronic = 200 µg/l |
| Total Recoverable Lead chronic = 100 µg/l |
| Total Recoverable Molybdenum chronic =160 µg/l |
| Total Recoverable Nickel chronic = 200 µg/l |
| Total Recoverable Selenium chronic = 20 µg/l |
| Total Recoverable Zinc chronic = 2000 µg/l |

*Temporary modification Type B: Temperature= "current conditions" Expiration date of 6/30/2016.

**Table A-3b**

**In-stream Standards for Stream Segment COARLA05a* (Guajatoyah Creek/unnamed tributary to Guajatoyah Creek)and 05b** – the North Fork, Middle Fork, and South Fork of the Purgatoire, including all tributaries to the North Fork (Parras Canyon), and the Purgatoire main stem (Unnamed Tributary to Purgatoire River)**

| |
|---|
| ***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 June-Sept = 17° C MWAT* and 21.7° C DM*, April-Oct = 18.3° C MWAT**[B] and 23.9° C DM**[B] |
| Temperature Oct-May = 9° C MWAT* and 13° C DM*, Nov-March = 9° C MWAT** and 13° C DM** |
| Chlorophyll = 150 $mg/m^2$ |
| ***Inorganic*** |
| Total Ammonia acute and chronic = 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 = 4 mg/l |
| Nitrite acute = 0.05 mg/l |
| Nitrate acute = 10 mg/l |
| Chloride chronic = 250 mg/l |
| Sulfate chronic = For WS, the greater of ambient water quality as of January 1, 2000 or 250 mg/l |
| Phosphorous = 110 µg/l (tot) |
| ***Metals*** |
| Dissolved Arsenic acute = 340 µg/l |
| Total Recoverable Arsenic chronic = 0.02 µg/l[A] |
| Dissolved Cadmium acute for trout and Dissolved Cadmium chronic = TVS |
| Total Recoverable Trivalent Chromium acute = 50 µg/l |
| Dissolved Trivalent Chromium chronic = TVS |
| Dissolved Hexavalent Chromium acute and chronic = TVS |
| Dissolved Copper acute and chronic = TVS |
| Dissolved Iron chronic = For WS, the greater of ambient water quality as of January 1, 2000, or 300 µg/l |
| Total Recoverable Iron chronic = 1000 µg/l |
| Dissolved Lead acute and chronic = TVS |
| Dissolved Manganese chronic = For WS, the greater of ambient water quality as of January 1, 2000, or 50 µg/l |
| Dissolved Manganese acute and chronic = TVS |
| Total Recoverable Molybdenum chronic = 160 µg/l |
| Total Mercury chronic = 0.01 µg/l |
| Dissolved Nickel acute and chronic = TVS |
| Dissolved Selenium acute and chronic = TVS |
| Dissolved Silver acute and Dissolved Silver chronic for trout = TVS |
| Dissolved Zinc acute and chronic = TVS |

[A] Temporary modification: As(ch)=hybrid Expiration date of 12/31/21.

[B] Temporary modification Type B: Temperature= "current conditions" Expiration date of 6/30/2016. COARLA05b only.

| **Table A-3c**<br>**In-stream Standards for Stream Segment COARLA04b –** Lorencito Canyon |
|---|
| ***Physical and Biological*** |
| Dissolved Oxygen (DO) = 5 mg/l, minimum |
| pH = 6.5 - 9 su |
| E. coli chronic = 126 colonies/100 ml |
| Temperature* March-Nov = 27.5° C MWAT and 28.6° C DM |
| Temperature* Dec-Feb = 13.8° C MWAT and 14.3° C DM |
| ***Inorganic*** |
| Total Ammonia acute and chronic = 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 = 4 mg/l |
| Nitrite acute = 0.5 mg/l |
| Nitrate acute = 100 mg/l |
| Chlorophyll = 150 $mg/m^2$ |
| Total Phosphorous = 170 µg/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 Trivalent Chromium acute and chronic = TVS |
| 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 Recoverable Molybdenum chronic = 160 µg/l |
| 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 |

* Temporary modification Type B: Temperature= "current conditions" Expiration date of 6/30/2016.

## 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.

A regression analysis was conducted using data from various sampling locations.

Although there is zero low flow for many of these canyons and creeks, the Purgatoire Watershed recorded enough flow to do a regression analysis, likely due to outfall flow and seasonal precipitation.

All TVS calculations below are based on the Table Value Standards Contained in the Colorado Department of Public Health and Environment Water Quality Control Commission *Regulation 32*

For Guajatoyah Creek/unnamed tributary to Guajatoyah Creek, the **GUA-0.1** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. GUA-0.1 is located on Guajatoyah Creek just above the confluence of the Guajatoyah Creek with the North Fork of the Purgatoire River, and downstream of the outfall. Thirty-two paired flow and hardness data points were available based on a period of record from April 14, 2010 to December 12, 2012. A regression analysis was computed to a low flow of 0.06 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to 151 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4a.

**Table A-4a**

**TVS-Based Metals Water Quality Standards for In-stream Standards for Guajatoyah Creek/unnamed tributary to Guajatoyah Creek (COARLA05a)**

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** **151** |
|---|---|---|---|---|
| Cadmium, Dissolved | Acute | 2.4 | µg/l | $[1.136672-0.041838\ln(\text{hardness})]e^{(0.9151(\ln(\text{hardness}))-3.6236)}$ |
| | Chronic | 0.58 | µg/l | $[1.101672-0.041838\ln(\text{hardness})]e^{(0.7998(\ln(\text{hardness}))-4.4451)}$ |
| Trivalent Chromium, Dissolved | Chronic | 104 | µg/l | $e^{(0.819(\ln(\text{hardness}))+0.5340)}$ |
| 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 | 20 | µg/l | $e^{(0.9422(\ln(\text{hardness}))-1.7408)}$ |
| | Chronic | 13 | µg/l | $e^{(0.8545(\ln(\text{hardness}))-1.7428)}$ |
| Lead, Dissolved | Acute | 101 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-1.46)}]$ |
| | Chronic | 3.9 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-4.705)}]$ |
| Manganese, Dissolved | Acute | 3425 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+6.4676)}$ |
| | Chronic | 1892 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+5.8743)}$ |
| Nickel, Dissolved | Acute | 664 | µg/l | $e^{(0.846(\ln(\text{hardness}))+2.253)}$ |
| | Chronic | 74 | µg/l | $e^{(0.846(\ln(\text{hardness}))+0.0554)}$ |
| 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 | 4.1 | µg/l | $\frac{1}{2}\, e^{(1.72(\ln(\text{hardness}))-6.52)}$ |
| | Chronic | 0.15 | µg/l | $e^{(1.72(\ln(\text{hardness}))-10.51)}$ |
| Zinc, Dissolved | Acute | 242 | µg/l | $0.978e^{(0.9094(\ln(\text{hardness}))+0.9095)}$ |
| | Chronic | 176 | µg/l | $0.986\, e^{(0.9094(\ln(\text{hardness}))+0.6235)}$ |

For Parras Canyon, the **NFPR-0.3** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. **NFPR-0.3** is located on the North Fork of the Purgatoire River Creek just above the confluence of the North Fork of the Purgatoire River with the Purgatoire River, and downstream of the outfalls. Thirty-two paired flow and hardness data points were available based on a period of record from April 14, 2010 to December 12, 2012. A regression analysis was computed to a low flow of 0.80 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to 151 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results

shown in Table A-4b.

Parras Canyon is a tributary of the North Fork of the Purgatoire River like Guajatoyah Creek, and the resulting hardnesses used for each of the waterbodies are exactly the same. Thus, the sampling location for Guajotoyah Creek could also have been used, but the results would be the same as utilizing station NFPR-0.3. Although NFPR-0.3 is not situated on Parras Canyon, the proximity of the canyon to the station and the similarity of this tributary with Guajatoyah Creek deems that it is representative data for Parras Canyon.

**Table A-4b**

**TVS-Based Metals Water Quality Standards for In-stream Standards for Parras Canyon/North Fork of the Purgatoire River (COARLA05b)**

| ***Parameter*** | ***In-Stream Water*** | | | ***TVS Formula:*** **151** |
|---|---|---|---|---|
| Cadmium, Dissolved | Acute | 2.4 | µg/l | $[1.136672-0.041838\ln(\text{hardness})]e^{(0.9151(\ln(\text{hardness}))-3.6236)}$ |
| | Chronic | 0.58 | µg/l | $[1.101672-0.041838\ln(\text{hardness})]e^{(0.7998(\ln(\text{hardness}))-4.4451)}$ |
| Trivalent Chromium, | Chronic | 104 | µg/l | $e^{(0.819(\ln(\text{hardness}))+0.5340)}$ |
| 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 | 20 | µg/l | $e^{(0.9422(\ln(\text{hardness}))-1.7408)}$ |
| | Chronic | 13 | µg/l | $e^{(0.8545(\ln(\text{hardness}))-1.7428)}$ |
| Lead, Dissolved | Acute | 101 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-1.46)}]$ |
| | Chronic | 3.9 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-4.705)}]$ |
| Manganese, Dissolved | Acute | 3425 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+6.4676)}$ |
| | Chronic | 1892 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+5.8743)}$ |
| Nickel, Dissolved | Acute | 664 | µg/l | $e^{(0.846(\ln(\text{hardness}))+2.253)}$ |
| | Chronic | 74 | µg/l | $e^{(0.846(\ln(\text{hardness}))+0.0554)}$ |
| 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 | 4.1 | µg/l | $\frac{1}{2}\, e^{(1.72(\ln(\text{hardness}))-6.52)}$ |
| | Chronic | 0.15 | µg/l | $e^{(1.72(\ln(\text{hardness}))-10.51)}$ |
| Zinc, Dissolved | Acute | 242 | µg/l | $0.978e^{(0.9094(\ln(\text{hardness}))+0.9095)}$ |
| | Chronic | 176 | µg/l | $0.986\, e^{(0.9094(\ln(\text{hardness}))+0.6235)}$ |

For the Purgatoire River Mainstem (COARLA05b), the **PR-8.8** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. PR-8.8 is located near the western end of Trinidad Reservoir (approximately one mile downstream of the confluence of Burro Canyon and the Purgatoire River) and downstream of almost all outfalls. Forty-four paired flow and hardness data points were available based on a period of record from April 15, 2010 to November 13, 2013. A regression analysis was computed to a low flow of 4.6 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to 217 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4c.

**Table A-4c**

**TVS-Based Metals Water Quality Standards for In-stream Standards for Mainstem of the Purgatoire River (COARLA05b)**

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** **217** |
|---|---|---|---|---|
| Cadmium, Dissolved | Acute | 3.3 | µg/l | $[1.136672-0.041838\ln(\text{hardness})]e^{(0.9151(\ln(\text{hardness}))-3.6236)}$ |
| | Chronic | 0.76 | µg/l | $[1.101672-0.041838\ln(\text{hardness})]e^{(0.7998(\ln(\text{hardness}))-4.4451)}$ |
| Trivalent Chromium, Dissolved | Chronic | 140 | µg/l | $e^{(0.819(\ln(\text{hardness}))+0.5340)}$ |
| 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 | $e^{(0.9422(\ln(\text{hardness}))-1.7408)}$ |
| | Chronic | 17 | µg/l | $e^{(0.8545(\ln(\text{hardness}))-1.7428)}$ |
| Lead, Dissolved | Acute | 148 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-1.46)}]$ |
| | Chronic | 5.8 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-4.705)}]$ |
| Manganese, Dissolved | Acute | 3865 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+6.4676)}$ |
| | Chronic | 2135 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+5.8743)}$ |
| Nickel, Dissolved | Acute | 902 | µg/l | $e^{(0.846(\ln(\text{hardness}))+2.253)}$ |
| | Chronic | 100 | µg/l | $e^{(0.846(\ln(\text{hardness}))+0.0554)}$ |
| 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 | 7.7 | µg/l | $\frac{1}{2}\, e^{(1.72(\ln(\text{hardness}))-6.52)}$ |
| | Chronic | 0.28 | µg/l | $e^{(1.72(\ln(\text{hardness}))-10.51)}$ |
| Zinc, Dissolved | Acute | 337 | µg/l | $0.978e^{(0.9094(\ln(\text{hardness}))+0.9095)}$ |
| | Chronic | 245 | µg/l | $0.986\, e^{(0.9094(\ln(\text{hardness}))+0.6235)}$ |

For the South Fork of the Purgatoire River, the **SFPR-0.2** was used for the regression analysis for hardness. SFPR-0.2 is located on the South Fork of the Purgatoire located just upstream of the confluence of the South Fork with the Purgatoire River and downstream of all associated outfalls. Thirty-three paired flow and hardness data points were available based on a period of record from April 14, 2010 to November 14, 2012. A regression analysis was computed to a low flow of 1.4 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to 117 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4d.

**Table A-4d**

**TVS-Based Metals Water Quality Standards for In-stream Standards for South Fork of the Purgatoire River (COARLA05b)**

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** **117** |
|---|---|---|---|---|
| Cadmium, Dissolved | Acute | 2 | µg/l | $[1.136672-0.041838\ln(\text{hardness})]e^{(0.9151(\ln(\text{hardness}))-3.6236)}$ |
| | Chronic | 0.48 | µg/l | $[1.101672-0.041838\ln(\text{hardness})]e^{(0.7998(\ln(\text{hardness}))-4.4451)}$ |
| Trivalent Chromium, Dissolved | Acute | 648 | µg/l | $e^{(0.819(\ln(\text{hardness}))+2.5736)}$ |
| | Chronic | 84 | µg/l | $e^{(0.819(\ln(\text{hardness}))+0.5340)}$ |
| 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 | 16 | µg/l | $e^{(0.9422(\ln(\text{hardness}))-1.7408)}$ |
| | Chronic | 10 | µg/l | $e^{(0.8545(\ln(\text{hardness}))-1.7428)}$ |
| Lead, Dissolved | Acute | 77 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-1.46)}]$ |
| | Chronic | 3 | µg/l | $[1.46203-0.145712\ln(\text{hardness})][e^{(1.273(\ln(\text{hardness}))-4.705)}]$ |
| Manganese, Dissolved | Acute | 3146 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+6.4676)}$ |
| | Chronic | 1738 | µg/l | $e^{(0.3331(\ln(\text{hardness}))+5.8743)}$ |
| Nickel, Dissolved | Acute | 535 | µg/l | $e^{(0.846(\ln(\text{hardness}))+2.253)}$ |
| | Chronic | 59 | µg/l | $e^{(0.846(\ln(\text{hardness}))+0.0554)}$ |
| 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 | 2.7 | µg/l | $\frac{1}{2}\, e^{(1.72(\ln(\text{hardness}))-6.52)}$ |
| | Chronic | 0.098 | µg/l | $e^{(1.72(\ln(\text{hardness}))-10.51)}$ |
| Zinc, Dissolved | Acute | 192 | µg/l | $0.978e^{(0.9094(\ln(\text{hardness}))+0.9095)}$ |
| | Chronic | 140 | µg/l | $0.986\, e^{(0.9094(\ln(\text{hardness}))+0.6235)}$ |

For the Middle Fork of the Purgatoire River, the **PR-29.7** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. **PR-29.7** is located on the Purgatoire River approximately ½ mile downstream of the confluence of Apache Canyon with the Purgatoire River. Thirty-one paired flow and hardness data points were available based on a period of record from April 14, 2010 to November 14, 2012. A regression analysis was computed to a low flow of 1.8 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to137 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4e.

**Table A-4e**

**TVS-Based Metals Water Quality Standards for In-stream Standards for Middle Fork of the Purgatoire River (COARLA05b)**

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** **137** |
|---|---|---|---|---|
| Cadmium, Dissolved | Acute | 2.2 | µg/l | $[1.136672-0.041838\ln(hardness)]e^{(0.9151(\ln(hardness))-3.6236)}$ |
| | Chronic | 0.54 | µg/l | $[1.101672-0.041838\ln(hardness)]e^{(0.7998(\ln(hardness))-4.4451)}$ |
| Trivalent Chromium, Dissolved | Chronic | 96 | µg/l | $e^{(0.819(\ln(hardness))+0.5340)}$ |
| 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 | 18 | µg/l | $e^{(0.9422(\ln(hardness))-1.7408)}$ |
| | Chronic | 12 | µg/l | $e^{(0.8545(\ln(hardness))-1.7428)}$ |
| Lead, Dissolved | Acute | 91 | µg/l | $[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-1.46)}]$ |
| | Chronic | 3.5 | µg/l | $[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-4.705)}]$ |
| Manganese, Dissolved | Acute | 3316 | µg/l | $e^{(0.3331(\ln(hardness))+6.4676)}$ |
| | Chronic | 1832 | µg/l | $e^{(0.3331(\ln(hardness))+5.8743)}$ |
| Nickel, Dissolved | Acute | 611 | µg/l | $e^{(0.846(\ln(hardness))+2.253)}$ |
| | Chronic | 68 | 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 | 3.5 | µg/l | $\frac{1}{2}\, e^{(1.72(\ln(hardness))-6.52)}$ |
| | Chronic | 0.13 | µg/l | $e^{(1.72(\ln(hardness))-10.51)}$ |
| Zinc, Dissolved | Acute | 222 | µg/l | $0.978e^{(0.9094(\ln(hardness))+0.9095)}$ |
| | Chronic | 161 | µg/l | $0.986\, e^{(0.9094(\ln(hardness))+0.6235)}$ |

For Sarcillo Canyon (COARLA06a), the **SAR-0.4** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. **SAR-0.4** is located on Sarcillo Canyon just upstream of the confluence of Sarcillo with the Purgatoire River. Thirty-one paired flow and hardness data points were available based on a period of record from April 15, 2010 to December 13, 2012. A regression analysis was computed to a low flow of 0.095 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to154 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4f.

Note that for the remaining canyons not in the Lorencito Canyon watershed listed under COARLA06a that do not have any available data regarding the hardness on the canyons themselves, the hardness

calculated for Sarcillo Canyon will be used as a conservative estimate for the hardness on these canyons. Considering that most of these remaining canyons are located on the western half of the site, Sarcillo Canyon was used due to the close proximity of these canyons to Sarcillo.

**Table A-4f**

**TVS-Based Metals Water Quality Standards for In-stream Standards for Sarcillo Canyon, Alamocito Canyon, Apache Canyon, Bingham Canyon, Cherry Canyon, Ciruela Canyon, Cow Canyon, Gallegos Canyon, Left Fork of the Apache Canyon, Little Bingham Canyon, Lopez Canyon, Santisteven Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Apache Canyon, and Unnamed Tributaries to Purgatoire River(COARLA06a)**

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** | **154** |
|---|---|---|---|---|
| Trivalent Chromium, Dissolved | Acute | 811 µg/l | $e^{(0.819(\ln(\text{hardness}))+2.5736)}$ | |
| | Chronic | 106 µg/l | $e^{(0.819(\ln(\text{hardness}))+0.5340)}$ | |

For the Burro Canyon (COARLA06a), the **BUR-0.4** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. **BUR-0.4** is located on Burro Canyon just upstream of the confluence of Burro Canyon with the Purgatoire River. Thirty-three paired flow and hardness data points were available based on a period of record from April 15, 2010 to December 12, 2012. A regression analysis was computed to a low flow of 0.0068 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to 232 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4g.

**Table A-4g**

**TVS-Based Metals Water Quality Standards for In-stream Standards for Burro Canyon (COARLA06a)**

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** | **232** |
|---|---|---|---|---|
| Trivalent Chromium, Dissolved | Acute | 1135 µg/l | $e^{(0.819(\ln(\text{hardness}))+2.5736)}$ | |
| | Chronic | 148 µg/l | $e^{(0.819(\ln(\text{hardness}))+0.5340)}$ | |

For Reilly Canyon (COARLA06a), the **REI-1.4** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. **REI-1.4** is located on Reilly Canyon just upstream of the confluence of Reilly Canyon with the Purgatoire River. Thirty-three paired flow and hardness data points were available based on a period of record from April 15, 2010 to December 13, 2012. A regression analysis was computed to a low flow of 0.78 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated,

resulting in a hardness value equal to 133 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4h.

**Table A-4h**

**TVS-Based Metals Water Quality Standards for In-stream Standards for Reilly Canyon (COARLA06a)**

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** | **133** |
|---|---|---|---|---|
| Trivalent Chromium, Dissolved | Acute | 720 µg/l | $e^{(0.819(\ln(\text{hardness}))+2.5736)}$ | |
| | Chronic | 94 µg/l | $e^{(0.819(\ln(\text{hardness}))+0.5340)}$ | |

For Lorencito Canyon (COARLA04b), including tributaries Little Alamosa Canyon, Pancho Canyon, Alamosa Canyon, and unnamed tributaries, ( COARLA06a) , the **LOR-0.2** sampling location, provided by the Purgatoire Watershed Monitoring Program, was used for the regression analysis for hardness. **LOR-0.2** is located on Lorencito Canyon approximately one fifth mile upstream of the confluence of Lorencito Canyon with the Purgatoire River, and downstream of the discharge locations. Thirty-two paired flow and hardness data points were available based on a period of record from April 15, 2010 to November 14, 2012. A regression analysis was computed to a low flow of 0.2 cfs, which was the lowest of the measured flows in the data set. The 95$^{th}$ confidence interval was then calculated, resulting in a hardness value equal to 109 mg/l. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals with the results shown in Table A-4k. Note that for those tributaries under COARLA06a, only dissolved trivalent chromium applies.

**Table A-4k**

**TVS-Based Metals Water Quality Standards for** Lorencito Canyon (COARLA04b), including tributaries Little Alamosa Canyon, Pancho Canyon, Alamosa Canyon, and unnamed tributaries (COARLA006a*)

| ***Parameter*** | ***In-Stream Water Quality Standard*** | | | ***TVS Formula: Hardness (mg/l) as CaCO3 =*** **109** |
|---|---|---|---|---|
| Cadmium, Dissolved | Acute | 3 | µg/l | $[1.136672-0.041838\ln(hardness)]e^{(0.9151(\ln(hardness))-3.1485)}$ |
| | Chronic | 0.45 | µg/l | $[1.101672-0.041838\ln(hardness)]e^{(0.7998(\ln(hardness))-4.4451)}$ |
| Trivalent Chromium, Dissolved* | Acute | 611 | µg/l | $e^{(0.819(\ln(hardness))+2.5736)}$ |
| | Chronic | 80 | µg/l | $e^{(0.819(\ln(hardness))+0.5340)}$ |
| 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 | 15 | µg/l | $e^{(0.9422(\ln(hardness))-1.7408)}$ |
| | Chronic | 9.6 | µg/l | $e^{(0.8545(\ln(hardness))-1.7428)}$ |
| Lead, Dissolved | Acute | 71 | µg/l | $[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-1.46)}]$ |
| | Chronic | 2.8 | µg/l | $[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-4.705)}]$ |
| Manganese, Dissolved | Acute | 3073 | µg/l | $e^{(0.3331(\ln(hardness))+6.4676)}$ |
| | Chronic | 1698 | µg/l | $e^{(0.3331(\ln(hardness))+5.8743)}$ |
| Nickel, Dissolved | Acute | 504 | µg/l | $e^{(0.846(\ln(hardness))+2.253)}$ |
| | Chronic | 56 | 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 | 2.4 | µg/l | $\frac{1}{2} e^{(1.72(\ln(hardness))-6.52)}$ |
| | Chronic | 0.37 | µg/l | $e^{(1.72(\ln(hardness))-9.06)}$ |
| Zinc, Dissolved | Acute | 180 | µg/l | $0.978e^{(0.9094(\ln(hardness))+0.9095)}$ |
| | Chronic | 131 | µg/l | $0.986\ e^{(0.9094(\ln(hardness))+0.6235)}$ |

## Total Maximum Daily Loads and Regulation 93 – Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List

Stream segments COARLA05a, 05b, and 06a are not listed on the Division's 303(d) list of water quality impacted streams and is not on the monitoring and evaluation list.

Stream segment COARLA04 is on the 303(d) list of water quality impacted streams for selenium and total recoverable iron; however, the impaired waters are specified to the Apishapa River and Timpas Creek and are not applicable to this WQA. Note that as of the writing of this WQA, Regulation 93 has not been updated to reflect the new stream segmentation adopted in the Regulation 32 Surface Water

Quality Classifications and Standards (effective April 30, 2014) therefore the new stream segment COARLA04b is still a subset of the old stream segment of COARLA04 in Regulation 93.

## 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.

**Low Flows for Various Canyons**

Santisteven Canyon, Sarcillo Canyon, Burro Canyon, Reilly Canyon, Cow Canyon, Smith Canyon, Lil Bingham Canyon, Apache Canyon and its unnamed tributaries, Ciruela Canyon, Alamosito Canyon and its unnamed tributaries, Bingham Canyon, Lopez Canyon, Torres Canyon, Cherry Canyon, Left Fork of Apache Canyon, Gallegos Canyon, unnamed tributaries to the Purgatoire River, Parras Canyon (tributary of the North Fork of the Purgatoire River), Lorencito Canyon, including tributaries Little Alamosa Canyon, Pancho Canyon, Alamosa Canyon, and unnamed tributaries..

The Division utilized the same approach as was taken for the previous WQA. Although there is periodic flow in the canyons, the 1E3, 7E3, and 30E3 monthly low flows are set at zero based on these being high order, short distance canyons that typically contain flow only during snow melt and rainfall events. For this analysis, low flows are summarized in Table A-5a.

**Table A-5a**

**Low Flows for Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon;**
**Unnamed Tributary to Guajatoyah Creek**

| *Low Flow (cfs)* | *Annual* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Oct* | *Nov* | *Dec* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1E3 Acute | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7E3 Chronic | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 30E3 Chronic | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

The ratio of the low flow of these canyons to the design flows of the outfalls that discharge to these receiving waters is 0:1.

Note that since the low flow has been determined to be zero, the ambient water quality discussion for these receiving waters is unnecessary and has been removed from the WQA. This is explained in more detail under the Technical Information discussion in Section VI.

**<u>Low Flows for the Purgatoire River stream segment COARLA05b</u>**

To determine the low flows of the Purgatoire River, USGS gage station 07124200 (Purgatoire River at Madrid, CO) was used, and is the same approach utilized in the development of the previous permit. The period of record is from January 1, 1990 to March 13, 2014. This flow gage is downstream from where most of the discharges from the CBM operations enter the Purgatoire River. Due to the number of agricultural diversions and contributions of tributaries throughout the length of the Purgatoire Watershed, teamed with the lack of flow data either above or below the entire discharge area, the Division has determined that this is currently the best estimate of the low flow of the Purgatoire River. A conservative analysis is adequate for this WQA because the process required to subtract the diversions and add the tributaries to reflect the actual low flow available to the facility would be resource intensive and would not change the outcome of this analysis.

Please note that the USGS gage station 07124200 (Purgatoire River at Madrid, CO) is exactly the same location as the Purgatoire River Monitoring station PR-8.8, and the same location used in the previous WQA to characterize the Purgatoire River. The Purgatoire Watershed Network maintains PR-8.8, and uses the flow from the USGS gate station 07124200 to supplement the chemical data collected at this location. No additional flow is collected from Station PR-8.8.

Also note that once gage station PR-37.1, located above all CBM discharges, collects the required 10 years worth of daily average data to run the DFLOW software, PR-37.1 should be used to determine the low flows for these facilities.

These daily flows were used to calculate the annual lE3, 7E3 and 30E3 low flows using U.S. Environmental Protection Agency (EPA) DFLOW software. The output from DFLOW provides calculated acute and chronic low flows for each month. These low flows are presented in Table A-5b.

**Table A-5b**
**Low Flows for the Purgatoire River, COARLA05b**

| *Low Flow (cfs)* | *Annual* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Oct* | *Nov* | *Dec* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1E3 Acute | 8.4 | 8.7 | 8.7 | 11 | 8.5 | 11 | 8.4 | 8.4 | 8.4 | 8.4 | 11 | 9.0 | 9.0 |
| 7E3 Chronic | 9.2 | 9.3 | 9.3 | 11 | 9.2 | 11 | 9.2 | 9.2 | 9.2 | 9.2 | 11 | 9.5 | 9.2 |
| 30E3 Chronic | 11 | 11 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |

During the months of March, May, and October, the acute low flow calculated by DFLOW exceeded the chronic low flow. In accordance with Division standard procedures, the acute low flow was thus set equal to the chronic low flow for these months.

The ratio of the low flow of the Purgatoire River to the design flows of the outfalls that discharge to these receiving waters is 0.65:1.

**Low Flows for Guajatoyah Creek (COARLA05a)**

While recent flow data is available for this water body, the flow data does not cover the required 10 years per Regulation No. 31 and for use in the DFLOW software, the gage station is located downstream of the dischargers, and the data is not available as a daily average. For future permit renewals, use of the various gage stations in the Purgatoire River Monitoring Network should be revisited. For those stations that are located downstream of the dischargers, flow from the outfalls must be subtracted from the daily averages prior to input into the DFLOW software. Thus, both for DFLOW analysis and to use downstream stations, in stream monitoring for flow should be daily, similar to USGS gage stations.

In previous WQA the canyons and creeks tributary to the mainstem of the Purgatoire River were designated as having a low flow of zero. However, the permittee indicated that there was flow in Guajatoyah Creek year around. The Division contacted the local water commissioner on June 23, 2014 to obtain an estimate of the low flow for this receiving water. According to discussions with the commissioner, Guajatoyah Creek has a critical low flow of 0.25 cfs from October through March, and a critical low flow of 0.5 cfs from April through September. The creek is sourced originally by higher elevation springs and snow melt and does not go dry. These low flows are presented in Table A-5c.

**Table A-5c**
**Low Flows for Guajatoyah Creek**

| *Low Flow (cfs)* | *Annual* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Oct* | *Nov* | *Dec* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1E3 Acute | 0.25 | 0.25 | 0.25 | 0.25 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.25 | 0.25 | 0.25 |
| 7E3 Chronic | 0.25 | 0.25 | 0.25 | 0.25 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.25 | 0.25 | 0.25 |
| 30E3 Chronic | 0.25 | 0.25 | 0.25 | 0.25 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.25 | 0.25 | 0.25 |

The ratio of the low flow of **Guajatoyah Creek** to the design flow of the outfall that discharges to the receiving waters is 6:1.

**Low Flows for Middle Fork of the Purgatoire River (COARLA05b)**

While recent flow data is available for this water body, the flow data does not cover the required 10 years per Regulation No. 31 and for use in the DFLOW software, the gage station is located downstream of the dischargers, and the data is not available as a daily average. For future permit renewals, use of the various gage stations in the Purgatoire River Monitoring Network should be revisited. For those stations that are located downstream of the dischargers, flow from the outfalls must be subtracted from the daily averages prior to input into the DFLOW software. Thus, both for DFLOW analysis and to use downstream stations, in stream monitoring for flow should be daily, similar to USGS gage stations.

In previous WQA the canyons and creeks tributary to the mainstem of the Purgatoire River were designated as having a low flow of zero. The local water commissioner was contacted on August 4, 2014 to obtain an estimate of the low flow for this receiving water. According to discussions with the local water commissioner, the Middle Fork of the Purgatoire River has a critical low flow of 1.0 cfs from October through March, and a critical low flow of 5.0 cfs from April through September. These low flows are presented in Table A-5d.

**Table A-5d**
**Low Flows for Middle Fork of the Purgatoire River**

| *Low Flow (cfs)* | *Annual* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Oct* | *Nov* | *Dec* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Table A-5d<br>Low Flows for Middle Fork of the Purgatoire River | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1E3 Acute | 1.0 | 1.0 | 1.0 | 1.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 1.0 | 1.0 | 1.0 |
| 7E3 Chronic | 1.0 | 1.0 | 1.0 | 1.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 1.0 | 1.0 | 1.0 |
| 30E3 Chronic | 1.0 | 1.0 | 1.0 | 1.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 1.0 | 1.0 | 1.0 |

The ratio of the low flow of the Middle Fork of the Purgatoire River to the design flows of the outfalls that discharge to these receiving waters is 0.18:1.

**Low Flows for the South Fork of the Purgatoire River (COARLA05b)**

While recent flow data is available for this water body, the flow data does not cover the required 10 years per Regulation No. 31 and for use in the DFLOW software, the gage station is located downstream of the dischargers, and the data is not available as a daily average. For future permit renewals, use of the various gage stations in the Purgatoire River Monitoring Network should be revisited. For those stations that are located downstream of the dischargers, flow from the outfalls must be subtracted from the daily averages prior to input into the DFLOW software. Thus, both for DFLOW analysis and to use downstream stations, in stream monitoring for flow should be daily, similar to USGS gage stations.

In previous WQA the canyons and creeks tributary to the mainstem of the Purgatoire River were designated as having a low flow of zero. The local water commissioner was contacted on August 4, 2014 to obtain an estimate of the low flow for this receiving water. According to discussions with the local water commissioner, the South Fork of the Purgatoire River has a critical low flow of 0.5 cfs from October through March, and a critical low flow of 2.0 cfs from April through September. These low flows are presented in Table A-5e.

| Table A-5e<br>Low Flows for the South Fork of the Purgatoire River | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Low Flow (cfs)*** | ***Annual*** | ***Jan*** | ***Feb*** | ***Mar*** | ***Apr*** | ***May*** | ***Jun*** | ***Jul*** | ***Aug*** | ***Sep*** | ***Oct*** | ***Nov*** | ***Dec*** |
| 1E3 Acute | 0.5 | 0.5 | 0.5 | 0.5 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.5 | 0.5 | 0.5 |
| 7E3 Chronic | 0.5 | 0.5 | 0.5 | 0.5 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.5 | 0.5 | 0.5 |
| 30E3 Chronic | 0.5 | 0.5 | 0.5 | 0.5 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.5 | 0.5 | 0.5 |

The ratio of the low flow of the South Fork of the Purgatoire River to the design flows of the outfalls that discharge to these receiving waters is 6:1.

## Low Flows for the North Fork of the Purgatoire River (COARLA05b)

While recent flow data is available for this water body, the flow data does not cover the required 10 years per Regulation No. 31 and for use in the DFLOW software, the gage station is located downstream of the dischargers, and the data is not available as a daily average. For future permit renewals, use of the various gage stations in the Purgatoire River Monitoring Network should be revisited. For those stations that are located downstream of the dischargers, flow from the outfalls must be subtracted from the daily averages prior to input into the DFLOW software. Thus, both for DFLOW analysis and to use downstream stations, in stream monitoring for flow should be daily, similar to USGS gage stations.

In previous WQA the canyons and creeks tributary to the mainstem of the Purgatoire River were designated as having a low flow of zero. The local water commissioner was contacted on August 4, 2014 to obtain an estimate of the low flow for this receiving water, and again on April 15, 2015. The flows discussed with the local water commissioner are summarized in Table A-5f.

**Table A-5f**

**Low Flows for the North Fork of the Purgatoire River**

| *Low Flow (cfs)* | *Annual* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Oct* | *Nov* | *Dec* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1E3 Acute | 0.5 | 1.0 | 0.5 | 0.5 | 1.0 | 1.0 | 3.0 | 3.0 | 2.5 | 1.75 | 1.5 | 1.5 | 1.25 |
| 7E3 Chronic | 0.5 | 1.0 | 0.5 | 0.5 | 1.0 | 1.0 | 3.0 | 3.0 | 2.5 | 1.75 | 1.5 | 1.5 | 1.25 |
| 30E3 Chronic | 0.5 | 1.0 | 0.5 | 0.5 | 1.0 | 1.0 | 3.0 | 3.0 | 2.5 | 1.75 | 1.5 | 1.5 | 1.25 |

The ratio of the low flow of the South Fork of the Purgatoire River to the design flows of the outfalls that discharge to these receiving waters is 12:1.

## 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.

Where dilution is available, 100% of the available assimilative capacity may be used as the facilities have 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). The ambient water quality was not assessed for COARLA04b, COARLA06a, and Parras Canyon (COARLA05b) because the background in-stream low flow condition is zero.

The ambient water quality is evaluated in this WQA analysis for the Purgatoire River, the Middle Fork of the Purgatoire River, the South Fork of the Purgatoire River, Guajatoyah Creek, and Parras Canyon for use in determining assimilative capacities and in completing antidegradation reviews for pollutants of concern, where applicable. Although Parras Canyon is technically a zero flow stream and would not normally require ambient water quality, the data gathered in this section will be used for the antidegradation calculations (baseline water quality) in subsequent sections.

**Purgatoire River and Middle Fork of the Purgatoire River**

To conduct an assessment of the ambient water quality upstream of the CBM operations and the New Elk Coal Mine, data were primarily gathered from the Purgatoire Watershed Monitoring station 37.1, which is located on the Middle Fork of the Purgatoire River approximately ¾ of a mile upstream of the confluence of Crooked Creek with the Middle Fork of the Purgatoire and upstream of all the CBM operations and New Elk Coal Mine. Note that the Middle Fork of the Purgatoire River becomes the Mainstem of the Purgatoire River upon joining with the smaller, North Fork of the Purgatoire River. Therefore the ambient water quality of these two water bodies are considered the same for this water quality assessment. Data were available for a period of record from April 2010 through December 2012. Additionally, data was gathered from CDPHE Stations 7545 Purgatoire River above Weston, and 7545A, Purgatoire River above Weston @ Hwy 12. The period of records for these stations is August and October of 2010, and June 2011, respectively. Temperature data were gathered from WQCD Station 7589 (South Fork Purgatoire River at Bosque del Oso SWA), for a period of record from April 2011 to April 2013.

Dissolved arsenic data were available from Riverwatch Station 468 (Stonewall) from December 2004 through October 2006.

Please note that a statistical outlier analysis was performed on the total recoverable iron data set and one major outlier was eliminated from the data set (1500 µg/l).

**Table A-6a**
**Ambient Water Quality for the Middle Fork of the Purgatoire River and the Purgatoire River**

| *Parameter* | *Number of Samples* | *15th Percentile* | *50th Percentile* | *85th Percentile* | *Mean* | *Maximum* | *Chronic Stream Standard* | *Notes* |
|---|---|---|---|---|---|---|---|---|
| Temp Daily Max (°C) June-Sept | 177 | 18 | 22 | 25 | 22 | 29 | Varied | |
| Temp Daily Max (°C) Oct-May | 177 | 0.051 | 8 | 17 | 9.1 | 22 | Varied | |
| Temp MWAT (°C) June-Sept | 177 | 14 | 18 | 19 | 17 | 20 | Varied | |
| Temp MWAT (°C) Oct-May | 172 | 0.035 | 4.4 | 11 | 5.4 | 14 | Varied | |
| TDS (mg/l) | 32 | 100 | 130 | 160 | 131 | 190 | | |
| As, Dis (µg/l) | 14 | 0 | 0 | 0 | 0 | 0 | 340 | |
| Cd, Dis (µg/l) | 3 | 0 | 0 | 0 | 0 | 0 | 0.76 | 1 |
| Cu, Dis (µg/l) | 21 | 0 | 0 | 1 | 0.36 | 2.1 | 17 | 1 |
| Fe, TR (µg/l) | 32 | 40 | 200 | 419 | 239 | 920 | 1000 | |
| Pb, Dis (µg/l) | 21 | 0 | 0 | 0.1 | 0.067 | 0.4 | 5.80 | 1 |
| Mn, Dis (µg/l) | 3 | 13 | 15 | 26 | 19 | 31 | 50 | |
| Se, Dis (µg/l) | 21 | 0.1 | 0.2 | 0.2 | 0.19 | 0.3 | 4.6 | |
| Ag, Dis (µg/l) | 3 | 0 | 0 | 0 | 0 | 0 | 0.28 | 1 |
| Zn, Dis (µg/l) | 21 | 0 | 0 | 0 | 0 | 0 | 245 | 1 |
| B, Tot (mg/l) | 33 | 0.01 | 0.01 | 0.01 | 0.011 | 0.03 | 4 | |
| Chloride (mg/l) | 33 | 0 | 0 | 1 | 0.48 | 2 | 250 | 1 |
| Sulfate (mg/l) | 33 | 13 | 18 | 25 | 19 | 35 | 250 | |
| Calcium (mg/l) | 33 | 29 | 34 | 42 | 35 | 45 | NA | |
| Magnesium (mg/l) | 33 | 3.8 | 5.1 | 6.8 | 5.2 | 8 | NA | |
| Sodium (mg/l) | 33 | 2.7 | 4.1 | 6.1 | 4.3 | 7.2 | NA | |
| SAR | 33 | 0.12 | 0.17 | 0.22 | 0.18 | 0.26 | NA | |
| EC (dS/m) | 33 | 0.17 | 0.21 | 0.28 | 0.23 | 0.34 | NA | |

Note 1: 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.

**Guajatoyah Creek/unnamed tributary to Guajatoyah Creek and the North Fork of the Purgatoire River**

To conduct an assessment of the ambient water quality of Guajatoyah Creek/unnamed tributary to Guajatoyah Creek and for the North Fork of the Purgatoire River, data were gathered from the Purgatoire Watershed Monitoring station NFPR-5.3. NFPR-5.3 is located on the North Fork of the Purgatoire River upstream of the confluence with Guajatoyah Creek and upstream of Outfall 241 (which discharges to an

unnamed tributary of Guajatoyah Creek.) Given that Guajatoyah Creek/unnamed tributary to Guajatoyah Creek and the North Fork of the Purgatoire River are at the same approximate elevation and have similar low flows, the Division decided to utilize this station as a comparable watershed for Guajatoyah Creek/unnamed tributary to Guajatoyah Creek and as direct ambient data for the North Fork of the Purgatoire River. Data were available for a period of record from April 2010 through December 2012. A summary of these data is presented in Table A-6b.

**Table A-6b**
**Ambient Water Quality for Guajatoyah Creek/unnamed tributary to Guajatoyah Creek and North Fork of the Purgatoire River**

| *Parameter* | *Number of Samples* | *15th Percentile* | *50th Percentile* | *85th Percentile* | *Mean* | *Maximum* | *Chronic Stream Standard* |
|---|---|---|---|---|---|---|---|
| pH (su) | 32 | 7.9 | 8.3 | 8.5 | 8.2 | 8.6 | 6.5-9 |
| TSS (mg/l) | 33 | 0 | 0 | 0 | 0 | 0 | 30 |
| TDS (mg/l) | 31 | 132 | 153 | 171 | 152 | 188 | |
| Cu, Dis (µg/l) | 25 | 0 | 0 | 0 | 0 | 0 | 17 |
| Fe, TR (µg/l) | 33 | 48 | 170 | 556 | 277 | 1230 | 1000 |
| Pb, Dis (µg/l) | 25 | 0 | 0 | 0 | 0 | 0 | 5.80 |
| Mn, Dis (µg/l) | 0 | 0 | 0 | 0 | 0 | 0 | 2135 |
| Se, Dis (µg/l) | 24 | 0 | 0 | 0 | 0.013 | 0.3 | 4.6 |
| Zn, Dis (µg/l) | 25 | 0 | 0 | 0 | 0 | 0 | 245 |
| B, Tot (mg/l) | 33 | 0 | 0 | 0 | 0 | 0 | 4 |
| Chloride (mg/l) | 33 | 0 | 0 | 0 | 0 | 0 | 250 |
| Sulfate (mg/l) | 33 | 16 | 21 | 25 | 20 | 27 | 250 |
| Calcium (mg/l) | 33 | 38 | 46 | 51 | 45 | 56 | NA |
| Magnesium (mg/l) | 33 | 5.6 | 6.9 | 7.7 | 6.7 | 8.6 | NA |
| Sodium (mg/l) | 33 | 2.8 | 3.6 | 4.6 | 3.4 | 5.5 | NA |
| SAR | 33 | 0.11 | 0.13 | 0.17 | 0.13 | 0.2 | NA |
| EC (dS/m) | 33 | 0.23 | 0.28 | 0.33 | 0.28 | 0.42 | NA |
| Radium 226+228 (piC/L) | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Strontium 90 (piC/L) | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Thorium 230+232 (piC/L) | 0 | 0 | 0 | 0 | 0 | 0 | 60 |

**Parras Canyon, tributary to the North Fork of the Purgatoire River**

To conduct an assessment of the ambient water quality of Parras Canyon, tributary to the North Fork of the Purgatoire River data were gathered from the Purgatoire Watershed Monitoring station NFPR-0.3. **NFPR-0.3** is located on the North Fork of the Purgatoire River Creek just above the confluence of the North Fork of the Purgatoire River with the Purgatoire River, and downstream of the outfalls. Data were available for a period of record from April 2010 through December 2012.

In the absence of upstream data, the only nearby data was collected from a downstream location. Ideally, the downstream data would be used in conjunction with available effluent data to remove the effluent's influence on the quality of the water recorded so as to represent true upstream conditions. As appropriate effluent data is not available, the use of the unaltered downstream data are the best available. A summary of these data is presented in Table A-6c.

Please note that a statistical outlier analysis was performed on the total recoverable iron data set and two major outliers were eliminated from the data set (2840 and 2870 µg/l).

**Table A-6c**

**Ambient Water Quality for Parras Canyon**

| *Parameter* | *Number of Samples* | *15th Percentile* | *50th Percentile* | *85th Percentile* | *Mean* | *Maximum* | *Chronic Stream Standard* | *Notes* |
|---|---|---|---|---|---|---|---|---|
| Temp (°C) | 33 | 1.8 | 9.6 | 16 | 9 | 21 | NA | |
| pH (su) | 32 | 8.2 | 8.5 | 8.6 | 8.4 | 8.9 | 6.5-9 | |
| TDS (mg/l) | 31 | 145 | 180 | 215 | 183 | 250 | | |
| Cu, Dis (µg/l) | 25 | 0 | 0 | 0.54 | 0.17 | 1.3 | 13 | 1 |
| Fe, TR (µg/l) | 31 | 100 | 220 | 740 | 367 | 1050 | 1000 | |
| Pb, Dis (µg/l) | 25 | 0 | 0 | 0.04 | 0.032 | 0.3 | 3.90 | 1 |
| Se, Dis (µg/l) | 25 | 0.1 | 0.2 | 0.3 | 0.2 | 0.3 | 4.6 | |
| Zn, Dis (µg/l) | 25 | 0 | 0 | 0 | 0 | 0 | 176 | 1 |
| B, Tot (mg/l) | 33 | 0 | 0.01 | 0.02 | 0.0088 | 0.03 | 4 | 1 |
| Chloride (mg/l) | 33 | 1 | 3 | 5 | 3.2 | 7 | 250 | |
| Sulfate (mg/l) | 33 | 18 | 22 | 25 | 21 | 28 | 250 | |
| Calcium (mg/l) | 33 | 37 | 45 | 48 | 43 | 54 | NA | |
| Magnesium (mg/l) | 33 | 6.6 | 8.1 | 9 | 7.8 | 10 | NA | |
| Sodium (mg/l) | 33 | 7.9 | 15 | 25 | 17 | 39 | NA | |
| SAR | 33 | 0.33 | 0.52 | 0.91 | 0.61 | 1.3 | NA | |
| EC (dS/m) | 33 | 0.25 | 0.33 | 0.42 | 0.34 | 0.53 | NA | |

Note 1: When sample results were below detection levels, the value of zero was used in accordance with the Division's approach for summarization and averaging.

**South Fork of the Purgatoire River**

To conduct an assessment of the ambient water quality of the South Fork of the Purgatoire River, data were gathered from the Purgatoire Watershed Monitoring station SFPR-12.7. S**FPR-12.7** is located on the South Fork of the Purgatoire River Creek approximately 4 ¼ miles upstream of the confluence of the South Fork with Gallegos Canyon. Data were available for a period of record from April 2010 through December 2012.

Please note that a statistical outlier analysis was performed on the total recoverable iron data set and one major outlier was eliminated from the data set (12,600 µg/l).

**Table A-6d**

**Ambient Water Quality for the South Fork of the Purgatoire**

| *Parameter* | *Number of Samples* | *15th Percentile* | *50th Percentile* | *85th Percentile* | *Mean* | *Maximum* | *Chronic Stream Standard* | *Notes* |
|---|---|---|---|---|---|---|---|---|
| TDS (mg/l) | 47 | 99 | 120 | 161 | 127 | 0 | | |
| Cu, Dis (µg/l) | 26 | 0 | 0 | 0.8 | 0.26 | 1.8 | 12 | 1 |
| Fe, TR (µg/l) | 33 | 138 | 200 | 834 | 429 | 1900 | 1000 | |
| Pb, Dis (µg/l) | 26 | 0 | 0 | 0.15 | 0.062 | 0.6 | 3.50 | 1 |
| Se, Dis (µg/l) | 26 | 0 | 0.15 | 0.3 | 0.17 | 0.6 | 4.6 | 1 |
| Zn, Dis (µg/l) | 26 | 0 | 0 | 0 | 0 | 0 | 161 | 1 |
| B, Tot (mg/l) | 34 | 0 | 0 | 0.011 | 0.0047 | 0.03 | 4 | 1 |
| Chloride (mg/l) | 34 | 0 | 1 | 2 | 0.97 | 3 | 250 | 1 |
| Sulfate (mg/l) | 34 | 15 | 23 | 36 | 26 | 64 | 250 | |
| Calcium (mg/l) | 34 | 22 | 29 | 39 | 30 | 46 | NA | |
| Magnesium (mg/l) | 34 | 4.3 | 5.9 | 8.3 | 6.3 | 12 | NA | |
| Sodium (mg/l) | 34 | 4 | 5.5 | 9.3 | 6.4 | 12 | NA | |
| SAR | 34 | 0.2 | 0.27 | 0.34 | 0.27 | 0.43 | NA | |
| EC (dS/m) | 34 | 0.16 | 0.23 | 0.33 | 0.24 | 0.4 | NA | |

Note 1: 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.

## V. Facility Information and Pollutants Evaluated

### Facility Information

The New Elk Mine and the CBM Operations discharge to various canyons tributary to the Purgatoire River, and the Middle and Southforks of the Purgatoire and the Purgatoire River Mainstem above Trinidad Lake, in Las Animas County. Currently, there is either no treatment provided to the CBM discharge water, or minor treatment such as gypsum addition. New Elk provides settling for its discharges currently. The technical analyses that follow include assessments of the assimilative capacity based on the effluent flows discussed below.

The following operations and flow rates are being considered for the different stream segments.

**COARLA04b – Lorencito Canyon**

| **Company** | **Permit Number** | **Facility** | **Flow (cfs)** |
|---|---|---|---|
| Pioneer | CO0047776 | Lorencito | 0.09 |
| XTO | CO0048054 | Lorencito | 0.04 |

**COARLA06a – Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon**

| Company | Permit Number | Facility | Flow (cfs) |
|---|---|---|---|
| XTO | CO0048054 | Lorencito | 0.96 |
| Pioneer | CO0047767 | East Spanish Peaks | 4.6 |
| XTO | CO0048062 | Alamocito | 3.3 |

**COARLA05a – Guajatoyah Creek/unnamed tributary to Guajatoyah Creek**

| Company | Permit Number | Facility | Flow (cfs) |
|---|---|---|---|
| Pioneer | CO0048003 | West Spanish Peaks | 0.04 |

**COARLA05b – Middle Fork of the Purgatoire**

| Company | Permit Number | Facility | Flow (cfs) |
|---|---|---|---|
| New Elk Mine | CO0000906 | New Elk Mine | 1.7 |

**COARLA05b – South Fork of the Purgatoire River (including tribs)**

| Company | Permit Number | Facility | Flow (cfs) |
|---|---|---|---|
| XTO | CO00480062 | Alamocito | 1.3 |

**COARLA05b – Parras Canyon/North Fork of the Purgatoire River**

| Company | Permit Number | Facility | Flow (cfs) |
|---|---|---|---|
| Pioneer | CO0048003 | West Spanish Peaks | 0.43 |

**COARLA05b – Combined effect on the Purgatoire River**

| Company | Facility | Flow (cfs) |
|---|---|---|
| All | All* | 13.5 |

* The following is a list of outfalls that discharge high up in various canyons and the facility has submitted documentation that the discharges from these outfalls do not reach the Purgatoire River. Thus, these outfalls are not considered as contributing flow to the mainstem. This evaluation is consistent with previous permitting actions.

| Company | Permit Number | Facility | Outfalls |
|---|---|---|---|
| Pioneer | CO0047767 | East Spanish Peaks | 016-A, 022-A, 028-A, 061-A, 063-A, 071-A, 090-A, 108-A, 112-A, 152-A, 191-A, 198-A, 210-A, 212-A, 213-A, 222-A |

**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.

There are no site-specific in-stream water quality standards for TSS and oil and grease. Thus, assimilative capacities were not determined for these parameters. The applicable limitations for these pollutants can be found in Regulation No. 62.

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

- Temperature
- SAR and EC
- Metals
- Beryllium, Radium 226+228, Strontium 90 and Thorium 230+232 (Coal-bed methane facilities)

*Guajatoyah Creek/unnamed tributary to Guajatoyah Creek, Parras Canyon, Middle and South Fork and the Purgatoire Mainstem*
Although stream segments COARLA05a (Guajatoyah Creek/unnamed tributary to Guajatoyah Creek) and 05b (Parras Canyon, Middle Fork, South Fork, and Mainstem of Purgatoire River) are designated for water supply, the *Rationale for Classifications, Standards and Designations of the Arkansas River Basin* indicates that no water supply is currently identified on either segment. Therefore, dissolved iron, dissolved manganese, and sulfate limitations are not further considered.

## 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 the receiving stream segments near the outfalls of the facilities 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

**For COARLA06a (**Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon)**, COARLA04b (**Lorencito Canyon)**, and COARLA05b (Parras Canyon)**, the low flows are zero.

When $Q_1$ equals zero, $Q_2$ equals $Q_3$, the following results: $M_2 = M_3$

Because the low flow ($Q_1$) for **the above mentioned receiving streams** is zero, the WQBELs for these segments for the pollutants of concern are equal to the in-stream water quality standards.

A more detailed discussion of the technical analysis is provided in the pages that follow.

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 85$^{th}$ percentile. For metals in the total or total recoverable form, existing quality is determined to be the 50$^{th}$ percentile. For pathogens such as fecal coliform and *E. coli*, existing quality is determined to be the geometric mean.

For temperature, the highest 7-day mean (for the chronic standard) of daily average stream temperature, over a seven consecutive day period will be used in calculations of the chronic temperature assimilative

capacity, where the daily average temperature should be calculated from a minimum of three measurements spaced equally through the day. The highest 2-hour mean (for the acute standard) of stream temperature will be used in calculations of the acute temperature assimilative capacity. The highest 2-hour mean should be calculated from a minimum of 12 measurements spaced equally through the day.

Because many facilities are in close proximity, they must be modeled together for shared parameters of concern. When facilities are modeled together, the design flow, $Q_2$, reflects the combined design flow of the facilities modeled together for a particular parameter, thereby resulting in the calculation of the WQBELs, $M_2$, applicable to the modeled facilities as set forth below.

**Calculation of WQBELs**

Using the mass-balance equation provided in the beginning of Section VI, the acute and chronic low flows set out in Section IV, ambient water quality as discussed in Section IV, and the in-stream standards shown in Section III, the WQBELs for were calculated. The data used and the resulting WQBELs, $M_2$, are set forth in Table A-7a through 7e for the chronic WQBELs and A-7f though 7j for the acute WQBELs.

When the ambient water quality exceeds the in-stream standard, the Division standard procedure is to allocate the water quality standard to prevent further degradation of the receiving waters.

**Temperature: For COARLA06a (**Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon)**, COARLA04b (**Lorencito Canyon)**, and COARLA05b (Parras Canyon):**

The 7E3 low flow is 0, and the discharge is to an effluent dependent (ephemeral stream without the presence of wastewater) water, therefore in accordance with Regulation 31.14(14), no temperature limitations are required.

All discharges to tributaries are expected to normalize by the time the discharge water reaches the Purgatoire River; therefore only direct discharges to Guajatoyah Creek/unnamed tributary to Guajatoyah Creek, the Purgatoire River, Middle Fork of the Purgatoire River, and South Fork of the Purgatoire River will have temperature limitations applied.

No outfalls directly discharge the Purgatoire River, and the South Fork of the Purgatoire River, and therefore temperature limitations do not apply to any of the CBM facilities.

One outfall directly discharges to the unnamed tributary of Guajatoyah Creek, but as the 7E3 for the receiving stream (tributary) is zero, this outfall is exempt from temperature limitations. Temperature is expected to equilibrate upon reaching the Guajatoyah Creek mainstem.

**Temperature: Middle Fork of Purgatoire River**

*CO0000906*
Outfall 001A for New Elk Mine which directly discharges to the Middle Fork of the Purgatoire River

This discharge does not meet the dilution exemption for the application of temperature.

While temperature data in the proper form were available from April 2011 through April 2013 (station 7589 South Fork Purgatoire River at Bosque del Osa SWA), these data may not be representative of the ambient water conditions in the area considering that the location of station 7589 is downstream or on a different stretch from most other outfalls in the Purgatoire watershed.

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 limits may be set to the segments' standard and will be revisited in the future when upstream ambient temperature data (DM and MWAT) becomes available.

Segment standards for temperature are listed in Table A-3c.

**Temperature Temporary Modification:** For segments COARLA06a, 05b, and 04b, a temporary modification for temperature is as follows: Temporary modification Type B: Temperature= "current conditions" Expiration date of 6/30/2016. No temporary modification is applicable to segment COARLA05a.

Where the temporary modification is applicable, as temperature WQBELs have never been calculated and limitations have never been applied, the "current condition" will be maintained by report only. More details will follow in each facility's Fact Sheet, if applicable.

**Arsenic Temporary Modification:** Segments COARLA05a and 05b have a temporary modification for arsenic as follows: Temporary modification: As(ch)=hybrid Expiration date of 12/31/21. Considering all the associated facilities were in place and operating as of June 1, 2013, the temporary modification is means "As(ch)=current condition, expiring on 12/31/2021."

The current condition for each facility will be defined in its own Fact Sheet.

**WQBELs for COARLA06a, Various Canyons (Tables A-7a through A-7e)**
Please refer to Table A-1b at the beginning of this document for a list of outfalls and associated facilities and receiving streams.

Zero Flow Canyons under segment COARLA06a

Note that only dissolved trivalent chromium (acute and chronic) are TVS (hardness-based) for this segment. The remainder of standards associated with this segment which apply to all discharges are listed in Table A-7e. Besides dissolved trivalent chromium, no acute calculations for this stream segment are applicable at this time.

**Table A-7a**

**Dissolved Trivalent Chromium (chronic and acute) for** For Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| Cr+3, Dis (µg/l) (chronic) | 0 | Varied | Varied | 0 | 106 | ***106*** |
| Cr+3, Dis (µg/l) (acute) | 0 | Varied | Varied | 0 | 811 | ***811*** |

**Table A-7b**

**Chronic and Acute WQBEL for Dissolved Trivalent Chromium** Burro Canyon

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| Cr+3, Dis (µg/l) (chronic) | 0 | Varied | Varied | 0 | 148 | ***148*** |
| Cr+3, Dis (µg/l) (acute) | 0 | Varied | Varied | 0 | 1135 | ***1135*** |

**Table A-7c**

**Chronic and Acute WQBELs for Dissolved Trivalent Chromium** Reilly Canyon

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| Cr+3, Dis (µg/l) (chronic) | 0 | Varied | Varied | 0 | 94 | ***94*** |
| Cr+3, Dis (µg/l) (acute) | 0 | Varied | Varied | 0 | 720 | ***720*** |

**Table A-7d**

**Chronic WQBELs for COARLA06a** Alamosa Canyon, Alamosito Canyon, Apache Canyon, Big Bingham Canyon, Burro Canyon, Cherry Canyon, Chimney Canyon, Cow Canyon, Left Fork of Apache Canyon, Little Pine Canyon, Lopez Canyon, Pancho Canyon, Parras Canyon, Puertecito Canyon, Reilly Canyon, Santisteven Canyon, Santisteven Canyon, Sarcillo Canyon, Smith Canyon, Torres Canyon, Unnamed Tributary of Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Alamocito Canyon, Unnamed Tributary to Alamosa, Unnamed Tributary to Alamosito Canyon, Unnamed Tributary to Apache Canyon, Unnamed Tributary to Big Bingham Canyon, Unnamed Tributary to Ciruela Canyon, Unnamed Tributary to Gallegos Canyon, Unnamed Tributary to Little Alamosa, Unnamed Tributary to Little Bingham, Unnamed Tributary to Lopez Canyon, Unnamed Tributary to Lorencito Canyon, Unnamed Tributary to Pancho Canyon, Unnamed Tributary to Purgatoire River, Unnamed Tributary to South Fork of the Purgatoire River, Zamora Canyon

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0 | Varied | Varied | 0 | 100 | ***100*** |
| Be, TR (µg/l) | 0 | Varied | Varied | 0 | 100 | ***100*** |
| Cd, TR (µg/l) | 0 | Varied | Varied | 0 | 10 | ***10*** |
| Cr+3, TR (µg/l) | 0 | Varied | Varied | 0 | 100 | ***100*** |
| Cr+6, TR (µg/l) | 0 | Varied | Varied | 0 | 100 | ***100*** |
| Cu, TR (µg/l) | 0 | Varied | Varied | 0 | 200 | ***200*** |
| Pb, TR (µg/l) | 0 | Varied | Varied | 0 | 100 | ***100*** |
| Mo, TR (µg/l) | 0 | Varied | Varied | 0 | 160 | ***160*** |
| Ni, TR (µg/l) | 0 | Varied | Varied | 0 | 200 | ***200*** |
| Se, TR (µg/l) | 0 | Varied | Varied | 0 | 20 | ***20*** |
| Zn, TR (µg/l) | 0 | Varied | Varied | 0 | 2000 | ***2000*** |
| B, Tot (mg/l) | 0 | Varied | Varied | 0 | 4 | ***4*** |
| Sulfide as H2S (mg/l) | 0 | Varied | Varied | 0 | 0.002 | ***0.002*** |
| Radium 226+228 (piC/L)* | 0 | Varied | Varied | 0 | 5 | ***5*** |
| Strontium 90 (piC/L)* | 0 | Varied | Varied | 0 | 8 | ***8*** |
| Thorium 230+232 (piC/L)* | 0 | Varied | Varied | 0 | 60 | ***60*** |

*only for the CBMs

## WQBELs for Parras Canyon (COARLA05b) (Tables A-7e through A-7f)

**Table A-7e**

**Chronic WQBELs** for Parras Canyon (COARLA05b)

| *Parameter* | *Q1 (cfs)* | *Q2 (cfs)* | *Q3 (cfs)* | *M1* | *M3* | *M2* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.02 | 0.02 |
| Cd, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.58 | 0.58 |
| Cr+3, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 104 | 104 |
| Cr+6, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 11 | 11 |
| Cu, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.54 | 13 | 13 |
| Fe, TR (µg/l) | 0 | 0.43 | 0.43 | 220 | 1000 | 1000 |
| Pb, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.04 | 3.9 | 3.9 |
| Mn, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 1892 | 1892 |
| Mo, TR (µg/l) | 0 | 0.43 | 0.43 | 0 | 160 | 160 |
| Hg, Tot (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.01 | 0.01 |
| Ni, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 74 | 74 |
| Se, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.3 | 4.6 | 4.6 |
| Ag, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.15 | 0.15 |
| Zn, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 176 | 176 |
| B, Tot (mg/l) | 0 | 0.43 | 0.43 | 0.02 | 4 | 4 |
| Chloride (mg/l) | 0 | 0.43 | 0.43 | 5 | 250 | 250 |
| Sulfide as H2S (mg/l) | 0 | 0.43 | 0.43 | 0 | 0.002 | 0.002 |
| Radium 226+228 (piC/L) | 0 | 0.43 | 0.43 | 0 | 5 | 5 |
| Strontium 90 (piC/L) | 0 | 0.43 | 0.43 | 0 | 8 | 8 |
| Thorium 230+232 | 0 | 0.43 | 0.43 | 0 | 60 | 60 |

**Table A-7f**

**Acute WQBELs** for Parras Canyon (COARLA05b)

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 340 | 340 |
| Cd, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 2.4 | 2.4 |
| Cr+3, TR (µg/l) | 0 | 0.43 | 0.43 | 0 | 50 | 50 |
| Cr+6, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 16 | 16 |
| Cu, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.54 | 20 | 20 |
| Pb, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.04 | 101 | 101 |
| Mn, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 3425 | 3425 |
| Ni, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 664 | 664 |
| Se, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.3 | 18.4 | 18 |
| Ag, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 4.1 | 4.1 |
| Zn, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 242 | 242 |

**WQBELs for all indirect and direct discharges to the Purgatoire River (COARLA05b) (Tables A-7g through A-7h)**

**Table A-7g**

**Chronic WQBELs** for all indirect and direct discharges to the Purgatoire River (COARLA05b)

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.02 | ***0.036*** |
| Cd, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.76 | ***1.4*** |
| Cr+3, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 140 | ***254*** |
| Cr+6, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 11 | ***20*** |
| Cu, Dis (µg/l) | 11 | 13.5 | 24.5 | 1 | 17 | ***30*** |
| Fe, TR (µg/l) | 11 | 13.5 | 24.5 | 200 | 1000 | ***1649*** |
| Pb, Dis (µg/l) | 11 | 13.5 | 24.5 | 0.1 | 5.8 | ***10*** |
| Mn, Dis (µg/l) | 11 | 13.5 | 24.5 | 26 | 2135 | ***3847*** |
| Mo, TR (µg/l) | 11 | 13.5 | 24.5 | 0 | 160 | ***290*** |
| Hg, Tot (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.01 | ***0.018*** |
| Ni, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 100 | ***181*** |
| Se, Dis (µg/l) | 11 | 13.5 | 24.5 | 0.2 | 4.6 | ***8.2*** |
| Ag, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.28 | ***0.51*** |
| Zn, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 245 | ***444*** |
| B, Tot (mg/l) | 11 | 13.5 | 24.5 | 0.01 | 4 | ***7.2*** |
| Chloride (mg/l) | 11 | 13.5 | 24.5 | 1 | 250 | ***452*** |
| Sulfide as H2S (mg/l) | 11 | 13.5 | 24.5 | 0 | 0.002 | ***0.0036*** |
| Radium 226+228 (piC/L)* | 11 | 11.8 | 22.8 | 0 | 5 | ***9.6*** |
| Strontium 90 (piC/L)* | 11 | 11.8 | 22.8 | 0 | 8 | ***15*** |
| Thorium 230+232 (piC/L)* | 11 | 11.8 | 22.8 | 0 | 60 | ***116*** |

*only for the CBMs

**Table A-7h**

**Acute WQBELs** for all indirect and direct discharges to the Purgatoire River (COARLA05b)

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 340 | ***551*** |
| Cd, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 3.3 | ***5.3*** |
| Cr+3, TR (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 50 | ***81*** |
| Cr+6, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 16 | ***26*** |
| Cu, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 1 | 28 | ***45*** |
| Pb, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0.1 | 148 | ***240*** |
| Mn, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 26 | 3865 | ***6245*** |
| Ni, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 902 | ***1461*** |
| Se, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0.2 | 18.4 | ***30*** |
| Ag, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 7.7 | ***12*** |
| Zn, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 337 | ***546*** |

## WQBELs for the Middle Fork of the Purgatoire River (COARLA05b) (Tables A-7l through A-7m)

**Table A-7l**

**Chronic WQBELs for the Middle Fork of the Purgatoire River (COARLA05b)**

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.02 | ***0.032*** |
| Cd, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.54 | ***0.86*** |
| Cr+3, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 96 | ***152*** |
| Cr+6, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 11 | ***17*** |
| Cu, Dis (µg/l) | 1 | 1.7 | 2.7 | 1 | 12 | ***18*** |
| Fe, TR (µg/l) | 1 | 1.7 | 2.7 | 200 | 1000 | ***1471*** |
| Pb, Dis (µg/l) | 1 | 1.7 | 2.7 | 0.1 | 3.5 | ***5.5*** |
| Mn, Dis (µg/l) | 1 | 1.7 | 2.7 | 26 | 1832 | ***2894*** |
| Mo, TR (µg/l) | 1 | 1.7 | 2.7 | 0 | 160 | ***254*** |
| Hg, Tot (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.01 | ***0.016*** |
| Ni, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 68 | ***108*** |
| Se, Dis (µg/l) | 1 | 1.7 | 2.7 | 0.2 | 4.6 | ***7.2*** |
| Ag, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.13 | ***0.21*** |
| Zn, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 161 | ***256*** |
| B, Tot (mg/l) | 1 | 1.7 | 2.7 | 0.01 | 4 | ***6.3*** |
| Chloride (mg/l) | 1 | 1.7 | 2.7 | 1 | 250 | ***396*** |
| Sulfide as H2S (mg/l) | 1 | 1.7 | 2.7 | 0 | 0.002 | ***0.0032*** |

**Table A-7m**

**Acute WQBELs for the Middle Fork of the Purgatoire River (COARLA05b)**

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 340 | ***540*** |
| Cd, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 2.2 | ***3.5*** |
| Cr+3, TR (µg/l) | 1 | 1.7 | 2.7 | 0 | 50 | ***79*** |
| Cr+6, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 16 | ***25*** |
| Cu, Dis (µg/l) | 1 | 1.7 | 2.7 | 1 | 18 | ***28*** |
| Pb, Dis (µg/l) | 1 | 1.7 | 2.7 | 0.1 | 91 | ***144*** |
| Mn, Dis (µg/l) | 1 | 1.7 | 2.7 | 26 | 3316 | ***5251*** |
| Ni, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 611 | ***970*** |
| Se, Dis (µg/l) | 1 | 1.7 | 2.7 | 0.2 | 18.4 | ***29*** |
| Ag, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 3.5 | ***5.6*** |
| Zn, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 222 | ***353*** |

**WQBELs for all indirect and direct discharges to the South Fork of the Purgatoire River (COARLA05b), including: Alamocito Canyon, Bingham Canyon, Cherry Canyon, Gallegos Canyon, Little Bingham Canyon, Torres Canyon, and unnamed tributaries to Alamocito Canyon (Tables A-7n through A-7o)**

**Table A-7n**

**Chronic WQBELs for the South Fork of the Purgatoire River (COARLA05b)**

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.02 | ***0.028*** |
| Cd, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.48 | ***0.66*** |
| Cr+3, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 84 | ***116*** |
| Cr+6, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 11 | ***15*** |
| Cu, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0.8 | 10 | ***14*** |
| Fe, TR (µg/l) | 0.5 | 1.3 | 1.8 | 200 | 1000 | ***1308*** |
| Pb, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0.15 | 3 | ***4.1*** |
| Mn, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 31 | 1738 | ***2395*** |
| Mo, TR (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 160 | ***222*** |
| Hg, Tot (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.01 | ***0.014*** |
| Ni, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 59 | ***82*** |
| Se, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0.3 | 4.6 | ***6.3*** |
| Ag, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.098 | ***0.14*** |
| Zn, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 140 | ***194*** |
| B, Tot (mg/l) | 0.5 | 1.3 | 1.8 | 0.011 | 4 | ***5.5*** |
| Chloride (mg/l) | 0.5 | 1.3 | 1.8 | 2 | 250 | ***345*** |
| Sulfide as H2S (mg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.002 | ***0.0028*** |
| Radium 226+228 (piC/L) | 0.5 | 1.3 | 1.8 | 0 | 5 | ***6.9*** |
| Strontium 90 (piC/L) | 0.5 | 1.3 | 1.8 | 0 | 8 | ***11*** |
| Thorium 230+232 (piC/L) | 0.5 | 1.3 | 1.8 | 0 | 60 | ***83*** |

**Table A-7o**
**Acute WQBELs for the South Fork of the Purgatoire River (COARLA05b)**

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0 | 340 | ***471*** |
| Cd, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0 | 2 | ***2.8*** |
| Cr+3, TR (µg/l) | 0.5 | 1.30 | 1.80 | 0 | 50 | ***69*** |
| Cr+6, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0 | 16 | ***22*** |
| Cu, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0.8 | 16 | ***22*** |
| Pb, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0.15 | 77 | ***107*** |
| Mn, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 31 | 3146 | ***4344*** |
| Ni, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0 | 535 | ***741*** |
| Se, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0.3 | 18.4 | ***25*** |
| Ag, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0 | 2.7 | ***3.7*** |
| Zn, Dis (µg/l) | 0.5 | 1.30 | 1.80 | 0 | 192 | ***266*** |

**WQBELs for Lorencito Canyon (COARLA04b) (Tables A-7p through A-7q)**

**Table A-7p**

Chronic WQBELs for Lorencito Canyon (COARLA04b) (*only for the CBMs)

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0 | 0.59 | 0.59 | 0 | 100 | ***100*** |
| Cd, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 0.45 | ***0.45*** |
| Cr+3, TR (µg/l) | 0 | 0.59 | 0.59 | 0 | 100 | ***100*** |
| Cr+3, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 80 | ***80*** |
| Cr+6, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 11 | ***11*** |
| Cu, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 9.6 | ***9.6*** |
| Fe, TR (µg/l) | 0 | 0.59 | 0.59 | 0 | 1000 | ***1000*** |
| Pb, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 2.8 | ***2.8*** |
| Mn, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 1698 | ***1698*** |
| Mo, TR (µg/l) | 0 | 0.59 | 0.59 | 0 | 160 | ***160*** |
| Hg, Tot (µg/l) | 0 | 0.59 | 0.59 | 0 | 0.01 | ***0.01*** |
| Ni, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 56 | ***56*** |
| Se, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 4.6 | ***4.6*** |
| Ag, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 0.37 | ***0.37*** |
| Zn, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 131 | ***131*** |
| B, Tot (mg/l) | 0 | 0.59 | 0.59 | 0 | 4 | ***4*** |
| Sulfide as H2S (mg/l) | 0 | 0.59 | 0.59 | 0 | 0.002 | ***0.002*** |
| Radium 226+228 (piC/L)* | 0 | 0.59 | 0.59 | 0 | 5 | ***5*** |
| Strontium 90 (piC/L)* | 0 | 0.59 | 0.59 | 0 | 8 | ***8*** |
| Thorium 230+232 (piC/L)* | 0 | 0.59 | 0.59 | 0 | 60 | ***60*** |

**Table A-7q**

**Acute WQBELs for** Lorencito Canyon **(COARLA04b)**

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 340 | ***340*** |
| Cd, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 3 | ***3*** |
| Cr+3, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 611 | ***611*** |
| Cr+6, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 16 | ***16*** |
| Cu, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 15 | ***15*** |
| Pb, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 71 | ***71*** |
| Mn, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 3073 | ***3073*** |
| Ni, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 504 | ***504*** |
| Se, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 18.4 | ***18*** |
| Ag, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 2.4 | ***2.4*** |
| Zn, Dis (µg/l) | 0 | 0.59 | 0.59 | 0 | 180 | ***180*** |

**WQBELs for Guajatoyah Creek (COARLA05a) (Tables A-7r through A-7s)**

**Table A-7r**

**Chronic WQBELs for** Guajatoyah Creek (COARLA05a)

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.02 | ***0.15*** |
| Cd, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.58 | ***4.2*** |
| Cr+3, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 104 | ***754*** |
| Cr+6, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 11 | ***80*** |
| Cu, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 13 | ***94*** |
| Fe, TR (µg/l) | 0.25 | 0.04 | 0.29 | 170 | 1000 | ***6188*** |
| Pb, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 3.9 | ***28*** |
| Mn, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | NA | ***NA*** |
| Mo, TR (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 1892 | ***13717*** |
| Hg, Tot (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 160 | ***1160*** |
| Ni, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.01 | ***0.073*** |
| Se, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 74 | ***537*** |
| Ag, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 4.6 | ***33*** |
| Zn, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.15 | ***1.1*** |
| B, Tot (mg/l) | 0.25 | 0.04 | 0.29 | 0 | 176 | ***1276*** |
| Chloride (mg/l) | 0.25 | 0.04 | 0.29 | 0 | 4 | ***29*** |
| Sulfide as H2S (mg/l) | 0.25 | 0.04 | 0.29 | 0 | 250 | ***1813*** |
| Radium 226+228 (piC/L) | 0.25 | 0.04 | 0.29 | 0 | 0.002 | ***0.015*** |
| Strontium 90 (piC/L) | 0.25 | 0.04 | 0.29 | 0 | 5 | ***36*** |
| Thorium 230+232 (piC/L) | 0.25 | 0.04 | 0.29 | 0 | 8 | ***58*** |

**Table A-7s**

**Acute WQBELs** for Guajatoyah Creek (COARLA05a)

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 340 | ***2465*** |
| Cd, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 2.4 | ***17*** |
| Cr+3, TR (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 50 | ***363*** |
| Cr+6, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 16 | ***116*** |
| Cu, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 20 | ***145*** |
| Pb, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 101 | ***732*** |
| Mn, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 3425 | ***24831*** |
| Ni, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 664 | ***4814*** |
| Se, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 18.4 | ***133*** |
| Ag, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 4.1 | ***30*** |
| Zn, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 242 | ***1755*** |

## WQBELs for Tributary To Guajatoyah Creek (COARLA05a) (Tables A-7t through A-7u)

**Table A-7t**

**Chronic WQBELs for Tributary to** Guajatoyah Creek (COARLA05a)

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.02 | ***0.02*** |
| Cd, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.58 | ***0.58*** |
| Cr+3, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 104 | ***104*** |
| Cr+6, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 11 | ***11*** |
| Cu, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 13 | ***13*** |
| Fe, TR (µg/l) | 0 | 0.04 | 0.04 | 170 | 1000 | ***1000*** |
| Pb, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 3.9 | ***3.9*** |
| Mn, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 1892 | ***1892*** |
| Mo, TR (µg/l) | 0 | 0.04 | 0.04 | 0 | 160 | ***160*** |
| Hg, Tot (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.01 | ***0.01*** |
| Ni, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 74 | ***74*** |
| Se, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 4.6 | ***4.6*** |
| Ag, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.15 | ***0.15*** |
| Zn, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 176 | ***176*** |
| B, Tot (mg/l) | 0 | 0.04 | 0.04 | 0 | 4 | ***4*** |
| Chloride (mg/l) | 0 | 0.04 | 0.04 | 0 | 250 | ***250*** |
| Sulfide as H2S (mg/l) | 0 | 0.04 | 0.04 | 0 | 0.002 | ***0.002*** |
| Radium 226+228 (piC/L) | 0 | 0.04 | 0.04 | 0 | 5 | ***5*** |
| Strontium 90 (piC/L) | 0 | 0.04 | 0.04 | 0 | 8 | ***8*** |
| Thorium 230+232 (piC/L) | 0 | 0.04 | 0.04 | 0 | 60 | ***60*** |

**Table A-7u**

**Acute WQBELs** for Tributary to Guajatoyah Creek (COARLA05a)

| *Parameter* | *$Q_1$ (cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *$M_3$* | *$M_2$* |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 340 | ***340*** |
| Cd, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 2.4 | ***2.4*** |
| Cr+3, TR (µg/l) | 0 | 0.04 | 0.04 | 0 | 50 | ***50*** |
| Cr+6, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 16 | ***16*** |
| Cu, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 20 | ***20*** |
| Pb, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 101 | ***101*** |
| Mn, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 3425 | ***3425*** |
| Ni, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 664 | ***664*** |
| Se, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 18.4 | ***18*** |
| Ag, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 4.1 | ***4.1*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Zn, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 242 | ***242*** |

**WQBELs for North Fork of the Purgatoire River (COARLA05b) (Tables A-7v through A-7w)**

**Table A-7v**

**Chronic WQBELs for** North Fork of the Purgatoire River (COARLA05b)

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.02 | ***0.27*** |
| Cd, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.76 | ***10*** |
| Cr+3, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 140 | ***1880*** |
| Cr+6, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 11 | ***148*** |
| Cu, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 17 | ***228*** |
| Fe, TR (µg/l) | 0.5 | 0.04 | 0.54 | 170 | 1000 | ***11316*** |
| Pb, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 5.8 | ***78*** |
| Mn, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 2135 | ***28671*** |
| Mo, TR (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 160 | ***2149*** |
| Hg, Tot (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.01 | ***0.13*** |
| Ni, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 100 | ***1343*** |
| Se, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 4.6 | ***62*** |
| Ag, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.28 | ***3.8*** |
| Zn, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 245 | ***3290*** |
| B, Tot (mg/l) | 0.5 | 0.04 | 0.54 | 0 | 4 | ***54*** |
| Chloride (mg/l) | 0.5 | 0.04 | 0.54 | 0 | 250 | ***3357*** |
| Sulfide as H2S (mg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.002 | ***0.027*** |
| Radium 226+228 (piC/L) | 0.5 | 0.04 | 0.54 | 0 | 5 | ***67*** |
| Strontium 90 (piC/L) | 0.5 | 0.04 | 0.54 | 0 | 8 | ***107*** |
| Thorium 230+232 (piC/L) | 0.5 | 0.04 | 0.54 | 0 | 60 | ***806*** |

**Table A-7w**

**Acute WQBELs** for North Fork of the Purgatoire River (COARLA05b)

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$*** | ***$M_3$*** | ***$M_2$*** |
|---|---|---|---|---|---|---|
| As, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 340 | ***4566*** |
| Cd, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 3.3 | ***44*** |
| Cr+3, TR (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 50 | ***671*** |
| Cr+6, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 16 | ***215*** |
| Cu, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 28 | ***376*** |
| Pb, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 148 | ***1987*** |
| Mn, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 3865 | ***51902*** |
| Ni, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 902 | ***12113*** |
| Se, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 18.4 | ***247*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ag, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 7.7 | ***103*** |
| Zn, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 337 | ***4526*** |

**Whole Effluent Toxicity (WET) Testing:**

The Water Quality Control Division has established the use of WET testing as a method for identifying and controlling toxic discharges. WET testing is being utilized as a means to ensure that there are no discharges of pollutants "in amounts, concentrations or combinations which are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life" as required by Section 31.11 (1) of the Basic Standards and Methodologies for Surface Waters. The requirements for WET testing are being implemented in accordance with Division policy, Implementation of the Narrative Standard for Toxicity in Discharge Permits Using Whole Effluent Toxicity, September 30, 2010.

In-Stream Waste Concentration (IWC) – Where monitoring or limitations for WET are deemed appropriate by the Division, the chronic in-stream dilution is critical in determining whether acute or chronic conditions shall apply. In accordance with Division policy, for those discharges where the chronic IWC is greater than 9.1% and the receiving stream has a Class 1 Aquatic Life use or Class 2 Aquatic Life use with all of the appropriate aquatic life numeric standards, chronic conditions will normally apply. Where the chronic IWC is less than or equal to 9.1, or the stream is not classified as described above, acute conditions will normally apply. The chronic IWC is determined using the following equation:

IWC = [Facility Flow (FF)/(Stream Chronic Low Flow (annual) + FF)] X 100%

In order to be consistent with standard procedure as followed in writing permits for other discharging facilities in Colorado, the approach in deciding facility flows versus the stream chronic low flows for the canyons that fall under segment COARLA06a has changed since the writing of the previous WQA. For this permitting action, the Division will assess the IWC per canyon, utilizing the combined outfall flows per canyon as the facility flow and the low flow of the downstream segment for the stream chronic low flow. The exception is for discharges to the Lorencito, where the combined flows for all discharges in the canyons are considered collectively for each facility.

According to the WET Testing Policy:

> *Regardless of the dilution ratio, acute WET testing will be required where there is an aquatic life designated use, but most of the aquatic life standards…are not in the site-specific segment standards, unless it is determined that chronic WET testing is necessary to protect downstream aquatic life uses, or other evidence exists that would make chronic WET requirements appropriate.*

Stream segment COARLA06a has an aquatic life designated use but does not have most of the aquatic life standards applied. For those outfalls within segment COARLA06a that do not reach the downstream segment (in these permitting actions, this means those outfalls not reaching the Purgatoire River), **only acute WET testing is required. This applies to Pioneer East Spanish**

**Peaks: 016-A, 022-A, 028-A, 061-A, 063-A, 071-A, 090-A, 108-A, 112-A, 152-A, 191-A, 198-A, 210-A, 212-A, 213-A, 222-A.**

All other outfalls under segment COARLA06a that do reach the Purgatoire River (COARLA05b), the South Fork of the Purgatoire (COARLA05b), and Lorencito Canyon (COARLA04b) will have the IWC determined by the above equation to determine whether chronic or acute WET testing is required. The Division has determined that chronic WET testing must be considered for these outfalls in order to protect the downstream aquatic life uses of segments COARLA05b and COARLA04b.

The flows and corresponding IWC for the appropriate discharge point are:

**Table A-8**
List of Outfalls and Associated Facilities, Flows (cfs), Receiving Streams, and IWC

| Facility | Outfalls | Total Contributing Flow (cfs) | IWC |
|---|---|---|---|
| **Lorencito Canyon and associated tributaries – COARLA04b<br>Chronic Low Flow for Lorencito Canyon = 0 cfs** | | | |
| F4. XTO – Lorencito | ALL OUTFALLS | Varied | 100% - CHRONIC |
| F2. Pioneer - Lorencito | ALL OUTFALLS | Varied | 100% - CHRONIC |
| **Alamocito Canyon and Unnamed tributaries to Alamosito Canyon– COARLA06a<br>Chronic Low Flow for South Fork of the Purgatoire = 0.5 cfs** | | | |
| F5. XTO – Alamocito | 014-A, 016-A, 017-A, 018-A, 032-A, 033-A | 0.390 | 44% - CHRONIC |
| **Apache Canyon and tributaries to Apache Canyon – COARLA06a<br>Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F5. XTO – Alamocito | 001-G, 007G, 021G, 060-A, 004G, 028G | 0.46 | 4% - ACUTE |
| **Big Bingham Canyon and tributaries – COARLA06a<br>Chronic Low Flow for South Fork of the Purgatoire = 0.5 cfs** | | | |
| F5. XTO – Alamocito | 019-A, 022-A | 0.10 | 17% - CHRONIC |
| **Burro Canyon – COARLA06a<br>Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F1. Pioneer – East Spanish Peaks | 079-A, 160-A, 183-A, 220-A, 221-A | 0.33 | 3% - ACUTE |
| **Cherry Canyon – COARLA06a<br>Chronic Low Flow for South Fork of the Purgatoire = 0.5 cfs** | | | |
| F5. XTO – Alamocito | 040-G | 0.32 | 39% - CHRONIC |
| **Ciruela Canyon and tributaries– COARLA06a<br>Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |

| **Table A-8**<br>List of Outfalls and Associated Facilities, Flows (cfs), Receiving Streams, and IWC | | | |
|---|---|---|---|
| Facility | Outfalls | Total Contributing Flow (cfs) | IWC |
| F5. XTO – Alamocito | 015G, 016G, 37G, 038G, 042G | 0.28 | 3% - ACUTE |
| **Lopez Canyon– COARLA06a**<br>**Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F5. XTO-Alamocito | 027-G, 033-G, 036-G | 0.51 | 5% - ACUTE |
| **Middle Fork to the Purgatoire River – COARLA05b**<br>**Chronic Low Flow for the Middle Fork of the Purgatoire = 1.0 cfs** | | | |
| F6. New Elk Mine | 001 | 1.67 | 63% - CHRONIC |
| **Parras Canyon – COARLA05b**<br>**Chronic Low Flow for Parras Canyon = 0 cfs** | | | |
| F3. Pioneer – West Spanish Peaks | 005, 245 | 0.67 | 100% - CHRONIC |
| **Reilly Canyon– COARLA06a**<br>**Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F1. Pioneer – East Spanish Peaks | 057-A, 060-A, 065-A, 094-A, 202-A, 230-A | 2.2 | 17% - CHRONIC |
| **Santisteven Canyon– COARLA06a**<br>**Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F5. XTO-Alamocito | 022-G | 0.75 | 6% - ACUTE |
| F1. Pioneer – East Spanish Peaks | 004-A | | |
| **Sarcillo Canyon– COARLA06a**<br>**Chronic Low Flow for the Purgatoire River = 11 cfs**<br>**In order for flows to Sarcillo Canyon to qualify for acute WET testing, the combined flows to the canyon must be at 0.71 MGD/1.1 cfs or less** | | | |
| F1. Pioneer – East Spanish Peaks | 075-A, 096-A, 105-A, 147-A, 156-A, 228-A, 238-A, 239-A | 1.45 | 12% - CHRONIC |
| **Smith Canyon– COARLA06a**<br>**Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F1. Pioneer – East Spanish Peaks | 215-A | 0.074 | 1% - ACUTE |
| **Unnamed tributaries of the South Fork of the Purgatoire River – COARLA06a**<br>**Chronic Low Flow for South Fork of the Purgatoire = 0.5 cfs** | | | |
| F5. XTO-Alamocito | 049-A | 0.087 | 15% - CHRONIC |
| | 023-A | 0.029 | 6% - ACUTE |
| | 043-G | 0.053 | 10% - CHRONIC |
| **Torres Canyon– COARLA06a**<br>**Chronic Low Flow for the South Fork of the Purgatoire River = 0.5 cfs** | | | |
| F5. XTO-Alamocito | 034-A | 0.11 | 18% - CHRONIC |
| **Unnamed Tributary to Purgatoire River – COARLA06a** | | | |

**Table A-8**
List of Outfalls and Associated Facilities, Flows (cfs), Receiving Streams, and IWC

| Facility | Outfalls | Total Contributing Flow (cfs) | IWC |
|---|---|---|---|
| **Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F5. XTO-Alamocito | 002G | 0.0093 | 1% - ACUTE |
| | 006G | 0.12 | 1% - ACUTE |
| | 024G | 0.0077 | 1% - ACUTE |
| | 039G | 0.31 | 3% - ACUTE |
| F1. Pioneer – East Spanish Peaks | 007-A | 0.67 | 6% - ACUTE |
| | 073-A | 0.051 | 1% - ACUTE |
| | 217-A | 0.51 | 4% - ACUTE |
| **Unnamed tributary to Gallegos Canyon – COARLA06a**<br>**Chronic Low Flow for South Fork of the Purgatoire = 0.5 cfs** | | | |
| F5. XTO – Alamocito | 079-H, 080-H | 0.22 | 30% - CHRONIC |
| **Unnamed Tributary to Guajatoyah Creek – COARLA05a**<br>**Chronic Low Flow for Unnamed Tributary to Guajatoyah Creek = 0 cfs** | | | |
| F3. Pioneer – West Spanish Peaks | 241 | 0.04 | 100% - CHRONIC |
| **Unnamed Tributary to Little Bingham Canyon – COARLA06a**<br>**Chronic Low Flow for South Fork of the Purgatoire = 0.5 cfs** | | | |
| F5. XTO – Alamocito | 001-A, 040-A | 0.036 | 7% - ACUTE |
| **Zamora Canyon – COARLA06a**<br>**Chronic Low Flow for the Purgatoire River = 11 cfs** | | | |
| F5. XTO – Alamocito | 023-G, 031G | 0.076 | 1% - ACUTE |

**Agricultural Use Parameters (SAR and EC)**

Section 31.11(1)(a)(iv) of *The Basic Standards and Methodologies for Surface Waters* (Regulation No. 31) includes the narrative standard that State surface waters shall be free of substances that are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life. The interpretation of these conditions (i.e., "no harm to plants" and "no harm to the beneficial uses") and how they were to be applied in permits were contemplated by the Division as part of an Agricultural Work Group, and culminated in the most recent policy entitled *Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops* (hereafter the Ag Policy)

**New Elk Mine (CO0000906)**

Based on the Colorado Decision Support Services, the Dolores Duran Ditch is located immediately downstream of New Elk Mine's Middle Fork of the Purgatoire River outfall (001A) and is the first of numerous diversions from confluence of the North Fork of the Purgatoire River with the Middle Fork of the Purgatoire (to create the Mainstem of the Purgatoire River) all the way downstream to Trindad Reservoir. The water in this segment (COARLA05b), which includes the **Middle Fork of the Purgatoire River,** is used for irrigation water. The evaluation of the suitability (i.e., quality) of irrigation water is complex and involves the detailed understanding of the interactions of plant tolerances, soil types, and agricultural management practices. Irrigation water has two properties – salinity and sodicity – that can have concurrent impacts on the irrigated crop beneficial use. The Division has thus determined that two parameters, specifically electrical conductivity (EC) and sodium absorption ratio (SAR), are the best parameters to regulate in discharge permits to control levels of salts to minimize both the loss of irrigated crop yield and the sodium hazard.

In order to establish "standards" and limits for EC and SAR, the Division must: (1) determine the most sensitive crop usually grown in the area downstream from the discharge and determine the corresponding EC of irrigation water ($EC_w$) threshold value for no reduction in yield below100%; and (2) determine the SAR based on the $EC_w$ value, with consideration of existing water quality, to prevent the exceedance of the SAR.

**Electrical Conductivity:** The electrical conductivity (EC) is also known as specific conductance, conductance, conductivity, or specific conductivity. Crops have varying sensitivity to electrical conductivity. Studies have established the maximum conductivity in the water in the root zone that will result in no reduction of crop yield. This value is referred to as the EC saturation extract or $EC_e$. However, the $EC_e$ is not the same as the EC of the irrigation water ($EC_w$). The $EC_w$ is the maximum conductivity in the irrigation water that will result in no reduction in crop yield.

Common crop $EC_w$ thresholds are reproduced from the Ag Policy or the Colorado State University publication no. 0.506, and are summarized in Table A-8. Note that other $EC_w$ are listed in tables in appendixes to the Ag Policy.

**Table A-9**

**Maximum $EC_w$ That Will Not Reduce The 100% Yield of Selected Irrigated Crops**

| *Common Colorado Crops* | *Irrigation Water Electrical Conductivity ($EC_w$)* |
|---|---|
| Beans | 0.7 |
| Onion | 0.8 |
| Corn (grain) | 1.1 |
| Potato | 1.1 |
| Corn (silage) | 1.2 |
| Alfalfa | 1.3 |
| Wheat | 4.0 |
| Sugarbeet | 4.7 |
| Barley | 5.3 |
| Orchardgrass | 1.5 |

The $EC_w$ that is used in the development of permit limits is determined based on the most sensitive of the $EC_w$'s for the crops grown in the area. According to the local water commissioner, the intake located just downstream of the New Elk Mine is utilized for orchard grass and brome for hay. In addition, the waters on the Purgatoire River upstream of the Trinidad Reservoir are used for alfalfa and grass. Alfalfa was determined to be the most sensitive crop.

The EC limit is calculated using the mass balance equation found at the beginning of Section IV of this analysis. The data used and the resulting calculations of the EC limit, $M_2$, are set forth in the table below. Note that in accordance with the Ag Policy, the EC limit will be imposed as a chronic (30-day average) limit and therefore chronic low flows were used together with 85$^{th}$ percentile EC concentrations when calculating the limit. The EC was calculated both for the Middle Fork of the Purgatoire River with grass and for the Purgatoire River with alfalfa.

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$ (mg/l)*** | ***$M_3$ (mg/l)*** | ***$M_2$ (mg/l)*** |
|---|---|---|---|---|---|---|
| EC, dS/m (Purgatoire) | 11.00 | 13.5 | 24.5 | 0.28 | 1.3 | ***2.1*** |

| ***Parameter*** | ***$Q_1$ (cfs)*** | ***$Q_2$ (cfs)*** | ***$Q_3$ (cfs)*** | ***$M_1$ (mg/l)*** | ***$M_3$ (mg/l)*** | ***$M_2$ (mg/l)*** |
|---|---|---|---|---|---|---|
| EC, dS/m (Middle Fork) | 1.00 | 1.7 | 2.7 | 0.28 | 1.5 | ***2.2*** |

As the WQBEL for the Purgatoire River is more restrictive, the 2.1 dS/m will be used.

Note that in Figure A-2 at an EC value of 0.36 or less, the SAR must be 0. In order to achieve a 0 SAR, any treatment process would have to eliminate all sodium, which is virtually impossible. Therefore, a minimum EC at 0.36 will be instigated in the permit.

**SAR** – SAR means Sodium Adsorption Ratio, which is a representation of the relative proportion of sodium cations to calcium and magnesium cations (also known as the "sodium hazard"). The equation for SAR follows:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

The values for sodium ($Na^{+}$), calcium ($Ca^{++}$) and magnesium ($Mg^{++}$) in this equation are expressed in units of milliequivalents per liter (meq/l). Generally, data for sodium, calcium and magnesium are reported in terms of mg/l, which must then be converted to calculate the SAR. The conversions are:

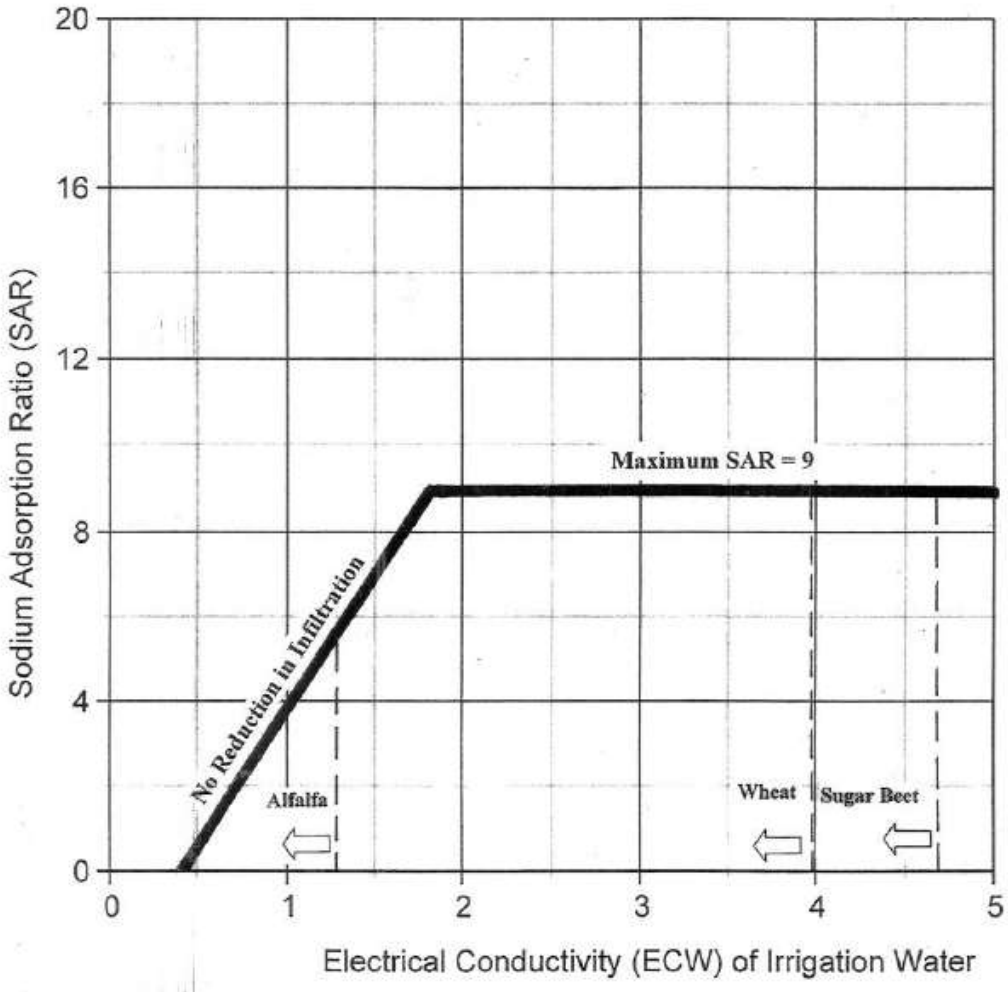
$$\text{meq/l} = \frac{Concentration\ in\ mg/l}{Equivalent\ weight\ in\ mg/meq}$$

Where the equivalent weights are determined based on the atomic weight of the element divided by the ion's charge:

$Na^{+}$ = 23.0 mg/meq (atomic weight of 23, charge of 1)
$Ca^{++}$ = 20.0 mg/meq (atomic weight of 40.078, charge of 2)
$Mg^{++}$ = 12.15 mg/meq (atomic weight of 24.3, charge of 2)

The SAR standard is established using the SAR/EC equation, shown graphically in Figure A-2, which is reproduced herein from the Ag Policy. Specifically, the WQBEL calculated for $EC_w$ was used to establish a SAR standard of 12.43. Since the allowable SAR value is tied to the actual EC of the effluent, the EC/SAR equation (SAR = (7.1 * EC) – 2.48) will be the SAR limit in the permit, however the allowable SAR of the effluent will be capped at the value above or 9, whichever is less. Due to the effect of bicarbonate on the available calcium and magnesium, limitations will be expressed as adjusted SAR, which accounts for bicarbonate. This is explained in more detail in the fact sheet and permit documents.

**Figure A-2: Relative Rate of Water Infiltration as Affected by $EC_w$ and SAR with Modification to Show Upper Limit for SAR = 9**




**<u>For Pioneer (East Spanish Peaks, Lorencito, and West Spanish Peaks) and XTO (Lorencito and Alamocito)</u>**

Limitations for EC and SAR have been developed to implement the narrative standards for permitting discharges to surface waters that are subsequently diverted for crop irrigation. The narrative standards are the protection of beneficial uses (31.11.1.a) and Agriculture (13.13 (2) (i.e. 'no harm to plants' and ' no harm to the beneficial uses) as discussed in the Division Policy #24, Implementing Narrative Standards in Discharge Permits for Protection of Irrigated Crops.

As discussed therein, the evaluation of the quality of water for irrigation is complex and involves a detailed understanding of the interactions of plant tolerances, soil types, and agricultural management practices. The quality considers the salinity of the water in the soil 'root zone', expressed as electrical conductivity (EC), and the sodicity expressed as SAR. Both can alter the soil properties with the outcome

of a reduction in the availability of water in the soil root zone (salinity and sodicity) with a concurrent impact on the irrigated crop. Thus these two measures, EC and SAR in discharge permits, are to control levels of salts to minimize both the loss of irrigated crop yield and the sodium hazard. The latter is a determinant in the long-term ability of soils to support crop yields, since the effect is to limit availability of water in the root zone to plants. As also noted in the policy, the determination of the suitability of irrigation water is dependent upon site-specific interactions between the relative concentrations of several ionic components which are not constant from site to site, and the translation of the quality of a discharge to subsequent impacts on water quality in the root zone of crops.

Site-specific information is not typically available for consideration during permit drafting, but is invaluable for determining appropriate limitations that should be incorporated into a permit to protect the beneficial uses in a specific area. Thus, the levels of EC and SAR discussed in the policy serve as guidance for permit preparation with the recognition that flexibility must exist based on highly variable site-specific conditions, and to implement options to the policy when there is technical justification to do so.

The Pioneer and XTO facilities conducted continuous sampling of EC and SAR in the Purgatoire River from April 2010 to August 2012 at various locations in order to provide site specific conditions for the Division to use in setting appropriate limitations for the Purgatoire. The Division has no evidence of reduction in alfalfa crop yield during the period of CBM influence in the Purgatoire River. Based on the site specific information available in this case and as per a previous permit modification, the Division has determined that it will revise the approach for establishing effluent limitations and no longer use the equation, which defines the boundary between the “no reduction in infiltration” and the “slight to moderate reduction in infiltration” regions of the Hanson diagram. Instead, the Division is relying on information, including the studies and data analysis conducted for the 2010-2011 period of record, and establishes effluent limits designed to characterize initial effluent discharge concentrations. Monitoring requirements are also being included in the permit to continue to verify the water quality condition in the Purgatoire River, and to directly assess the potential for salt accumulation of irrigated parcels downstream of CBM discharges, where the irrigation intakes on the Purgatoire River occur. Special reporting requirements have also been included in the permit so that these site-specific permit conditions, including the effluent limits established for EC and SAR, can be revisited during the permit term in the event that the water quality or soil conditions which provide the scientific basis for effluent limits, change significantly. The special reporting relies on trigger levels/benchmark concentrations that are established using the maximum allowed EC level based on protection of the local irrigated crop, and the corresponding maximum allowed SAR level based on the Hanson diagram. This approach allows the instream EC to stay at a level protective of the crop, and the instream SAR level to be within either the “no reduction in infiltration” or the “slight to moderate infiltration” consistent with both the basline data provided by the permittee (USGS 1972) and the CBM influence time period (2010 through September 30, 2012). .

For EC, the Division has incorporated a limitation for EC set at the maximum recorded value to maintain the initial effluent discharge concentrations. This approach is also discussed in the antidegradation guidance for setting implicit non-impact limitations (NILs) for limiting the degradation of receiving waters. For SAR the Division has incorporated a limit based on an 85$^{th}$ percentile of the recorded values and use of a lower confidence limit (LCL) method for compliance determinations. Additional detail regarding the approach is included in the permit fact sheet.

Although XTO and Pioneer have submitted additional requests for revisions to effluent limitations in the permit, the requests will be addressed through the Fact Sheet, along with more information regarding the specifics on the monitoring requirements for SAR and EC.

## VII. Antidegradation Evaluation

As set out in *The Basic Standards and Methodologies for Surface Water*, Section 31.8(2)(b), anantidegradation 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 section of the regulation became effective in December 2000, and therefore anti degradation considerations are applicable to this WQA analysis.

According to the Classifications and Numeric Standards for Arkansas River Basin, stream segments COARLA04b, COARLA06a, and COARLA06b are Use Protected. Because these receiving waters are designated as Use Protected, no antidegradation review is necessary in accordance with the regulations. Thus, for purposes of this WQA analysis, antidegradation review requirements for the various canyons have been met and no further antidegradation evaluation for these waterbodies is necessary.

According to the *Classifications and Numeric Standards for Arkansas River Basin*, stream segment COARLA05a and 05b are Undesignated. Thus, an antidegradation review is required for these segments if new or increased impacts are found to occur. While the direct discharges of produced-water to the main stem of the rivers are relatively few, there are many that discharge to tributaries and these flows (indirect discharges) reach the main stem. Thus, a consideration of downstream waterbodies is applicable.

The AD review for the Purgatoire River applies to all discharges to be protective of the downstream segment, with the following exceptions that do not reach the Purgatoire River:

- CO0047767, outfalls: 016A, 022A, 028A, 061A, 063A, 071A, 090A, 108A, 112A, 152A, 191A, 198A, 210A, 212A, 213A, 222A

An antidegradation analysis must be performed not only on the Purgatoire River as per the last WQA (2009), but must also be performed for Guajatoyah Creek, Parras Canyon, the Middle Fork of the Purgatoire, and the South Fork of the Purgatoire. Even though the North Fork of the Purgatoire is also reviewable, no specific AD analysis was performed for this waterbody. The outfalls that flow into the North Fork are already subject to ADBELs on their respective canyons, which are within the same stream segment (and subject to the same stream standards). The ADBELs applicable to the canyons will be more restrictive than the North Fork, and thus no specific consideration of the North Fork is warranted at this time.

**<u>Introduction to the Antidegradation Process</u>**

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 versus 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. Additionally, when an outfall discharges to a segment that was previously classified as Use-Protected, but was reclassified as Reviewable after September 30, 2000, then the determination of new or increased impacts is based upon the comparison of the newly calculated WQBELs versus the existing permit limitations in place as of the date that the segment changed to Reviewable. None of the receiving waters changed from Use Protected to Reviewable, therefore the antidegradation set date of September 30, 2000 still applies.

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**

These are not temporary discharges 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 sum of the design flows for the zero flow canyons (COARLA06a, COARLA06b, and COARLA04b) are 0:1, which are less than the 100:1 significance criteria. Therefore these outfalls are not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

The ratio of the chronic (30E3) low flow to the sum of the design flows for the Middle Fork of the Purgatoire River (COARLA05b) are 0.18:1, which are less than the 100:1 significance criteria.

Therefore these outfalls are not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

The ratio of the chronic (30E3) low flow to the sum of the design flows for the Mainstem of the Purgatoire River (COARLA05b) are 0.65:1, which are less than the 100:1 significance criteria. Therefore these outfalls are not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

The ratio of the chronic (30E3) low flow to the sum of the design flows for the South Fork of the Purgatoire River (COARLA05b) are 6:1, which are less than the 100:1 significance criteria. Therefore these outfalls are not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

The ratio of the chronic (30E3) low flow to the sum of the design flows for the Guajatoyah Creek (COARLA05a) are 6:1, which are less than the 100:1 significance criteria. Therefore these outfalls are 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 and Non Impact Limitations (NILs)**

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 (or other date as appropriate), 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 or applicable 'Reviewable' date) 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). The permittee may choose to retain a NIL if certain conditions are met, and therefore the AD evaluation for that parameter would be complete. As the NIL is typically greater than the ADBAC, and is therefore the chosen limit, the Division will typically conclude the AD evaluation after determining the NIL. Where the NILs are very stringent, or upon request of a permittee, the Division will calculate both the NIL and the AD limitation so that the limitations can be compared and the permittee can 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).

The non impact limit (NIL) is defined as the limit which results in no increased water quality impact (no increase in load or limit over the September 2000 or other date as appropriate load or limit). 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.

If the facility was in place, but did not have a limitation for a particular parameter in the September 2000 permit, the Division may substitute an implicit limitation. 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. Note that if there is a change in design flow, the implicit limit/loading is subject to recalculation based on the new design flow. For parameters that are undisclosed by the permittee, and unknown to the Division to be present, an implicit limitation may not be recognized.

**Pioneer/XTO**

Although some of the outfalls incorporated into the Pioneer East Spanish Peaks permit were in place prior to September 30, 2000, (first permitted in February of 2000), the majority were not. For the East Spanish Peaks operation, there were over 200 outfalls in place as of September 30, 2000; the majority of these outfalls are no longer discharging. The renewal permit for the East Spanish Peaks will authorize approximately 24 outfalls that have the potential to reach the Purgatoire River.

For the other facilities, discharges were not in place as of September 30, 2000. Therefore, for the purposes of this AD evaluation, all of the facilities are 'new' facilities and the determination of new or increased impacts is also automatic.

**New Elk Mine**

In the previous WQA, the New Elk Mine was considered an 'existing discharger' and NILs were applied. However, as of September 30, 2000, the New Elk mine discharges were limited to stormwater that were not comingled with "process water." Thus, for AD purposes, this facility is considered a 'new' facility as the "process water" discharges occurred subsequent to September 30, 2000. A determination of new or increased impacts is automatic.

For all facilities, the NILs and implicit limitations do not apply, therefore the ADBAC limitations must be calculated.

**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 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.

***Mainstem of the Purgatoire River, Guajatoyah Creek, and Parras Canyon***

No data are available upstream (without the influence) of the outfalls for Guajatoyah Creek and Parras Canyon. For the Purgatoire River, the BWQ concentrations calculated as a part of the previous WQA (2009, Table A-6) will be used. The BWQ concentrations were appropriately determined for all potential pollutants of concern. For reference, this table has been copied from the previous WQA for ease of review.

**Table A-6 from the 2009 WQA**

| Parameter | Number of Samples | 15th Percentile | 50th Percentile | 85th Percentile | Mean | Maximum | Chronic Stream Standard (as of 2009) | Notes |
|---|---|---|---|---|---|---|---|---|
| As, TR (µg/l) | 5 | 0 | 0 | 0 | 0 | 0 | 0.02 | 2 |
| Cd, Dis (µg/l) | 17 | 0 | 0 | 0.72 | 0.2 | 1. | 0.49 | 2,3 |
| Cu, Dis (µg/l) | 17 | 0 | 0 | 0 | 0.65 | 6 | 11 | 2 |
| Fe, Dis (µg/l) | 6 | 30 | 35 | 41 | 36 | 53 | 300 | |
| Fe, TR (µg/l) | 17 | 62 | 250 | 428 | 295 | 1300 | 1000 | |
| Pb, Dis (µg/l) | 17 | 0 | 0 | 0 | 0.12 | 2 | 3.10 | 2 |
| Mn, Dis (µg/l) | 17 | 0 | 8 | 15 | 8.2 | 17 | 50 | 2 |
| Hg, Tot (µg/l) | 12 | 0 | 0 | 0 | 0 | 0 | 0.01 | 2 |
| Se, Dis (µg/l) | 13 | 0 | 0 | 0.22 | 0.19 | 1.4 | 4.6 | 2 |
| Ag, Dis (µg/l) | 17 | 0 | 0 | 0 | 0 | 0 | 0. | 2 |
| U, Dis (µg/l) | 5 | 0.6 | I | 1.4 | I | 2 | 1851 | |
| Zn, Dis (µg/l) | 17 | 0 | 0 | 9.6 | 3 | 19 | 146 | 2 |
| B, Tot (mg/1) | 9 | 0 | 0 | 0.028 | 0.01 | 0.03 | 0.75 | 2 |
| Chloride (mg/l) | 5 | 0 | 1 | 3 | 1.4 | 3 | 25 | 2 |
| Sulfate (mg/1) | 17 | 16 | 26 | 41 | 27 | 48 | 25 | |
| Calcium (mg/1) | 12 | 33 | 46 | 52 | 43 | 54 | N | |
| Magnesium (mg/1) | 12 | 8.2 | 12 | 13 | II | 17 | N | |
| Sodium (mg/l) | 12 | 7.4 | 17 | 24 | 28 | 174 | N | |
| SAR | 12 | 0.28 | 0.57 | 0.78 | I | 6.3 | N | |
| EC (dS/cm) | 6 | 0.27 | 0.3 | 0.36 | 0.31 | 0.39 | N | |
| Hardness as | 17 | 95 | 120 | 146 | 121 | 160 | N | |

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.

Note 3: The ambient water quality exceeds the water quality standards for these parameters.

***Middle and South Forks of the Purgatoire River***

For the Middle Fork of the Purgatoire and the South Fork of the Purgatoire, data are available upstream of outfall locations on each of these receiving waters, therefore the ambient water quality collected as per Table A-6 of this WQA will be utilized in establishing the BWQ for these water bodies.

These are summarized in Tables A-10a through -10c.

**Table A-10a**

**BWQ Concentrations for the the mainstem of the Purgatoire River, Guajatoyah Creek, and Parras Canyon/North Fork of the Purgatoire River**

| ***Pollutant*** | ***BWQ*** |
|---|---|
| As, TR (µg/l) | 0 |
| As, Dis (µg/l) | 0 |
| Cd, Dis (µg/l) | 0.72 |
| Cr+3, TR (µg/l) | 0 |
| Cr+3, Dis (µg/l) | 0 |
| Cr+6, Dis (µg/l) | 0 |
| Cu, Dis (µg/l) | 0 |
| Fe, TR (µg/l) | 250 |
| Pb, Dis (µg/l) | 0 |
| Mn, Dis (µg/l) | 15 |
| Mo, TR (µg/l) | 0 |
| Hg, Tot (µg/l) | 0 |
| Ni, Dis (µg/l) | 0 |
| Se, Dis (µg/l) | 0.22 |
| Ag, Dis (µg/l) | 0 |
| Zn, Dis (µg/l) | 9.6 |
| B, Tot (mg/l) | 0.028 |
| Chloride (mg/l) | 3 |
| Sulfide as H2S (mg/l) | 0 |
| Radium 226+228 (piC/L) | 0 |
| Strontium 90 (piC/L) | 0 |
| Thorium 230+232 (piC/L) | 0 |

**Table A-10b**
**BWQ Concentrations for the South Fork of the Purgatoire River**

| ***Pollutant*** | ***BWQ*** |
|---|---|
| As, TR (µg/l) | 0 |
| As, Dis (µg/l) | 0 |
| Cd, Dis (µg/l) | 0 |
| Cr+3, TR (µg/l) | 0 |
| Cr+3, Dis (µg/l) | 0 |
| Cr+6, Dis (µg/l) | 0 |
| Cu, Dis (µg/l) | 0.8 |
| Fe, TR (µg/l) | 200 |
| Pb, Dis (µg/l) | 0.15 |
| Mn, Dis (µg/l) | 0 |
| Mo, TR (µg/l) | 0 |
| Hg, Tot (µg/l) | 0 |
| Ni, Dis (µg/l) | 0 |
| Se, Dis (µg/l) | 0.3 |
| Ag, Dis (µg/l) | 0 |
| Zn, Dis (µg/l) | 0 |
| B, Tot (mg/l) | 0 |
| Chloride (mg/l) | 2 |
| Sulfide as H2S (mg/l) | 0 |
| Radium 226+228 (piC/L) | 0 |
| Strontium 90 (piC/L) | 0 |
| Thorium 230+232 (piC/L) | 0 |

| Table A-10c<br>BWQ Concentrations for the Middle Fork of the Purgatoire River | |
|---|---|
| ***Pollutant*** | ***BWQ*** |
| As, Dis (µg/l) | 0 |
| Cd, Dis (µg/l) | 0 |
| Cu, Dis (µg/l) | 0 |
| Fe, TR (µg/l) | 200 |
| Pb, Dis (µg/l) | 0.1 |
| Mn, Dis (µg/l) | 26 |
| Se, Dis (µg/l) | 0.2 |
| Ag, Dis (µg/l) | 0 |
| Zn, Dis (µg/l) | 0 |
| B, Tot (mg/l) | 0.01 |
| Chloride (mg/l) | 1 |

The BWQ concentrations are based on data represented by the 50$^{th}$ percentile for total recoverable metals and total metals, and the 85$^{th}$ percentile for dissolved metals, and other pollutants.

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 Guajatoyah Creek, where the BWQ of 0.72 ug/l exceeded the water quality standard of 0.58 ug/l for dissolved cadmium.

In cases where no data was available for a particular parameter, the BWQ was assumed to be zero.

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 and total recoverable trivalent chromium.

**Bioaccumulative Significance Test**

For mercury, which is a bioaccumulative toxic pollutant, the bioaccumulative significance test can now be completed with some minor additional calculations for the baseline water quality load (BWQload), the threshold load (TL), the new load based on the WQBELs, and the threshold load concentration (TL conc). These terms are defined by the following equations:

BWQload = BWQ (from Table A-10*) * AD low flow (chronic) * 8.34

Threshold Load (TL) = 0.1 * BWQload

Threshold Load Concentration (TL Conc) = TL ÷ new design flow ÷ 8.34

WQBEL Load = new WQBEL (concentration) * new design flow * 8.34

The discharge is considered to be insignificant if the new load (WQBEL load) is less than the threshold load (TL), or if the new WQBEL (concentration) is less than the TL Conc. The results of the calculations and the comparisons are shown in Table A-11a through -11e.

**Table A-11a**
**Bioaccumulative Significance Test: Purgatoire River**

| Parameter | Threshold Load Concentration (TL Conc) | Threshold Load (TL) | WQBEL Conc | WQBEL Load |
|---|---|---|---|---|
| Mercury, Total | 0 | 0 | 0.018 | 1.3 |

**Table A-11b**
**Bioaccumulative Significance Test: South Fork of the Purgatoire River**

| Parameter | Threshold Load Concentration (TL Conc) | Threshold Load (TL) | WQBEL Conc | WQBEL Load |
|---|---|---|---|---|
| Mercury, Total | 0 | 0 | 0.014 | 0.096 |

**Table A-11c**
**Bioaccumulative Significance Test: Middle Fork of the Purgatoire River**

| Parameter | Threshold Load Concentration (TL Conc) | Threshold Load (TL) | WQBEL Conc | WQBEL Load |
|---|---|---|---|---|
| Mercury, Total | 0 | 0 | 0.016 | 0.14 |

| Table A-11d<br>Bioaccumulative Significance Test: Guajatoyah Creek | | | | |
|---|---|---|---|---|
| **Parameter** | **Threshold Load Concentration (TL Conc)** | **Threshold Load (TL)** | **WQBEL Conc** | **WQBEL Load** |
| Mercury, Total | 0 | 0 | 0.017 | 0.0037 |

| Table A-11e<br>Bioaccumulative Significance Test: Parras Canyon/North Fork of the Purgatoire River | | | | |
|---|---|---|---|---|
| **Parameter** | **Threshold Load Concentration (TL Conc)** | **Threshold Load (TL)** | **WQBEL Conc** | **WQBEL Load** |
| Mercury, Total | 0 | 0 | 0.01 | 0.023 |

For mercury, the WQBEL load is greater than the TL, and the WQBEL Conc is greater than the TL Conc, and therefore additional consideration of the TL must occur. If the permittee accepts the TL, the AD evaluation continues with the calculation of the SCT and ADBACs in the same manner as the other non-bioaccumulative parameters, using the TL Conc in place of the WQBEL.

If the TL is not acceptable, an AD Alternatives Analysis must be completed. For more information regarding an Alternatives Analysis, refer to the Antidegradation Guidance and to Regulation 31.8.

**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:

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

Where,

*WQS* = Chronic standard or, in the absence of a chronic standard, the acute standard
BWQ = Value from Table A-10

When the BWQ concentration is equal to zero, the following equation results:

$SCT = 0.15 \times WQS$

**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 Tables A-12a through 12g.

**Table A-12a**

**SCTs and ADBACs for the Mainstem of the Purgatoire River**

| *Pollutant* | *$Q_1$(cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *SCT* | *ADBAC* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.003 | 0.0054 |
| As, Dis (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 51 | 83 |
| Cd, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.73 | 1.3 |
| Cr+3, TR (µg/l) | 8.4 | 13.5 | 21.9 | 0 | 7.5 | 12 |
| Cr+3, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 21 | 38 |
| Cr+6, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 1.7 | 3.1 |
| Cu, Dis (µg/l) | 11 | 13.5 | 24.5 | 1 | 2.6 | 3.9 |
| Fe, TR (µg/l) | 11 | 13.5 | 24.5 | 200 | 363 | 495 |
| Pb, Dis (µg/l) | 11 | 13.5 | 24.5 | 0.1 | 0.87 | 1.5 |
| Mn, Dis (µg/l) | 11 | 13.5 | 24.5 | 26 | 333 | 582 |
| Mo, TR (µg/l) | 11 | 13.5 | 24.5 | 0 | 24 | 43 |
| Hg, Tot (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.0015 | 0.0027 |
| Ni, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 15 | 27 |
| Se, Dis (µg/l) | 11 | 13.5 | 24.5 | 0.2 | 0.88 | 1.4 |
| Ag, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 0.042 | 0.076 |
| Zn, Dis (µg/l) | 11 | 13.5 | 24.5 | 0 | 45 | 82 |
| B, Tot (mg/l) | 11 | 13.5 | 24.5 | 0.01 | 0.62 | 1.1 |
| Chloride (mg/l) | 11 | 13.5 | 24.5 | 1 | 40 | 72 |
| Sulfide as H2S (mg/l) | 11 | 13.5 | 24.5 | 0 | 0.0003 | 0.00054 |
| Radium 226+228 (piC/L) | 11 | 11.8 | 22.8 | 0 | 0.75 | 1.4 |
| Strontium 90 (piC/L) | 11 | 11.8 | 22.8 | 0 | 1.2 | 2.3 |
| Thorium 230+232 (piC/L) | 11 | 11.8 | 22.8 | 0 | 9 | 17 |

*only for CBMs

**Table A-12b**

**SCTs and ADBACs for the Middle Fork of the Purgatoire River**

| *Pollutant* | *$Q_1$(cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *SCT* | *ADBAC* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.003 | 0.0048 |
| As, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 51 | 81 |
| Cd, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.081 | 0.13 |
| Cr+3, TR (µg/l) | 1 | 1.7 | 2.7 | 0 | 7.5 | 12 |
| Cr+3, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 14 | 22 |
| Cr+6, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 1.7 | 2.7 |
| Cu, Dis (µg/l) | 1 | 1.7 | 2.7 | 1 | 1.8 | 2.3 |
| Fe, TR (µg/l) | 1 | 1.7 | 2.7 | 200 | 320 | 391 |
| Pb, Dis (µg/l) | 1 | 1.7 | 2.7 | 0.1 | 0.61 | 0.91 |
| Mn, Dis (µg/l) | 1 | 1.7 | 2.7 | 26 | 297 | 456 |
| Mo, TR (µg/l) | 1 | 1.7 | 2.7 | 0 | 24 | 38 |
| Hg, Tot (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.0015 | 0.0024 |
| Ni, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 10 | 16 |
| Se, Dis (µg/l) | 1 | 1.7 | 2.7 | 0.2 | 0.86 | 1.2 |
| Ag, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 0.02 | 0.032 |
| Zn, Dis (µg/l) | 1 | 1.7 | 2.7 | 0 | 24 | 38 |
| B, Tot (mg/l) | 1 | 1.7 | 2.7 | 0.01 | 0.61 | 0.96 |
| Chloride (mg/l) | 1 | 1.7 | 2.7 | 1 | 38 | 60 |
| Sulfide as H2S (mg/l) | 1 | 1.7 | 2.7 | 0 | 0.0003 | 0.00048 |

**Table A-12c**

**SCTs and ADBACs for the South Fork of the Purgatoire River**

| *Pollutant* | *$Q_1$(cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *SCT* | *ADBAC* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.003 | 0.0042 |
| As, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 51 | 71 |
| Cd, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.081 | 0.11 |
| Cr+3, TR (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 7.5 | 10 |
| Cr+3, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 14 | 19 |
| Cr+6, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 1.7 | 2.4 |
| Cu, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0.8 | 2.5 | 3.2 |
| Fe, TR (µg/l) | 0.5 | 1.3 | 1.8 | 205 | 324 | 370 |
| Pb, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0.15 | 0.65 | 0.84 |
| Mn, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 31 | 275 | 369 |
| Mo, TR (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 24 | 33 |
| Hg, Tot (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.0015 | 0.0021 |
| Ni, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 10 | 14 |
| Se, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0.3 | 0.95 | 1.2 |
| Ag, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.02 | 0.028 |
| Zn, Dis (µg/l) | 0.5 | 1.3 | 1.8 | 0 | 24 | 33 |
| B, Tot (mg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.6 | 0.83 |
| Chloride (mg/l) | 0.5 | 1.3 | 1.8 | 2 | 39 | 53 |
| Sulfide as H2S (mg/l) | 0.5 | 1.3 | 1.8 | 0 | 0.0003 | 0.00042 |
| Radium 226+228 (piC/L) | 0.5 | 1.3 | 1.8 | 0 | 0.75 | 1 |
| Strontium 90 (piC/L) | 0.5 | 1.3 | 1.8 | 0 | 1.2 | 1.7 |
| Thorium 230+232 (piC/L) | 0.5 | 1.3 | 1.8 | 0 | 9 | 12 |

**Table A-12d**

**SCTs and ADBACs for Guajatoyah Creek**

| *Pollutant* | *$Q_1$(cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *SCT* | *ADBAC* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.003 | 0.022 |
| As, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 51 | 370 |
| Cd, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.58 | 4.2 |
| Cr+3, TR (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 7.5 | 54 |
| Cr+3, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 16 | 116 |
| Cr+6, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 1.7 | 12 |
| Cu, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 2 | 15 |
| Fe, TR (µg/l) | 0.25 | 0.04 | 0.29 | 170 | 363 | 1569 |
| Pb, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.59 | 4.3 |
| Mn, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 297 | 2153 |
| Mo, TR (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 24 | 174 |
| Hg, Tot (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.0015 | 0.011 |
| Ni, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 11 | 80 |
| Se, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.88 | 6.4 |
| Ag, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.023 | 0.17 |
| Zn, Dis (µg/l) | 0.25 | 0.04 | 0.29 | 0 | 35 | 254 |
| B, Tot (mg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.62 | 4.5 |
| Chloride (mg/l) | 0.25 | 0.04 | 0.29 | 0 | 40 | 290 |
| Sulfide as H2S (mg/l) | 0.25 | 0.04 | 0.29 | 0 | 0.0003 | 0.0022 |
| Radium 226+228 (piC/L) | 0.25 | 0.04 | 0.29 | 0 | 0.75 | 5.4 |
| Strontium 90 (piC/L) | 0.25 | 0.04 | 0.29 | 0 | 1.2 | 8.7 |
| Thorium 230+232 (piC/L) | 0.25 | 0.04 | 0.29 | 0 | 9 | 65 |

**Table A-12e**

**SCTs and ADBACs for Parras Canyon**

| *Pollutant* | *$Q_1$(cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *SCT* | *ADBAC* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.003 | 0.003 |
| As, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 51 | 51 |
| Cd, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.58 | 0.58 |
| Cr+3, TR (µg/l) | 0 | 0.43 | 0.43 | 0 | 7.5 | 7.5 |
| Cr+3, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 16 | 16 |
| Cr+6, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 1.7 | 1.7 |
| Cu, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.54 | 2 | 2 |
| Fe, TR (µg/l) | 0 | 0.43 | 0.43 | 220 | 363 | 363 |
| Pb, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.04 | 0.59 | 0.59 |
| Mn, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 297 | 297 |
| Mo, TR (µg/l) | 0 | 0.43 | 0.43 | 0 | 24 | 24 |
| Hg, Tot (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.0015 | 0.0015 |
| Ni, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 11 | 11 |
| Se, Dis (µg/l) | 0 | 0.43 | 0.43 | 0.3 | 0.88 | 0.88 |
| Ag, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 0.023 | 0.023 |
| Zn, Dis (µg/l) | 0 | 0.43 | 0.43 | 0 | 35 | 35 |
| B, Tot (mg/l) | 0 | 0.43 | 0.43 | 0.01 | 0.62 | 0.62 |
| Chloride (mg/l) | 0 | 0.43 | 0.43 | 5 | 40 | 40 |
| Sulfide as H2S (mg/l) | 0 | 0.43 | 0.43 | 0 | 0.0003 | 0.0003 |
| Radium 226+228 (piC/L) | 0 | 0.43 | 0.43 | 0 | 0.75 | 0.75 |
| Strontium 90 (piC/L) | 0 | 0.43 | 0.43 | 0 | 1.2 | 1.2 |
| Thorium 230+232 (piC/L) | 0 | 0.43 | 0.43 | 0 | 9 | 9 |

**Table A-12f**

**SCTs and ADBACs for Unnamed Tributary of Guajatoyah Creek**

| *Pollutant* | *$Q_1$(cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *SCT* | *ADBAC* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.003 | 0.003 |
| As, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 51 | 51 |
| Cd, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.58 | 0.58 |
| Cr+3, TR (µg/l) | 0 | 0.04 | 0.04 | 0 | 7.5 | 7.5 |
| Cr+3, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 16 | 16 |
| Cr+6, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 1.7 | 1.7 |
| Cu, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 2 | 2 |
| Fe, TR (µg/l) | 0 | 0.04 | 0.04 | 170 | 363 | 363 |
| Pb, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.59 | 0.59 |
| Mn, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 297 | 297 |
| Mo, TR (µg/l) | 0 | 0.04 | 0.04 | 0 | 24 | 24 |
| Hg, Tot (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.0015 | 0.0015 |
| Ni, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 11 | 11 |
| Se, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.88 | 0.88 |
| Ag, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 0.023 | 0.023 |
| Zn, Dis (µg/l) | 0 | 0.04 | 0.04 | 0 | 35 | 35 |
| B, Tot (mg/l) | 0 | 0.04 | 0.04 | 0 | 0.62 | 0.62 |
| Chloride (mg/l) | 0 | 0.04 | 0.04 | 0 | 40 | 40 |
| Sulfide as H2S (mg/l) | 0 | 0.04 | 0.04 | 0 | 0.0003 | 0.0003 |
| Radium 226+228 (piC/L) | 0 | 0.04 | 0.04 | 0 | 0.75 | 0.75 |
| Strontium 90 (piC/L) | 0 | 0.04 | 0.04 | 0 | 1.2 | 1.2 |
| Thorium 230+232 (piC/L) | 0 | 0.04 | 0.04 | 0 | 9 | 9 |

**Table A-12g**

**SCTs and ADBACs for North Fork of the Purgatoire River**

| *Pollutant* | *$Q_1$(cfs)* | *$Q_2$ (cfs)* | *$Q_3$ (cfs)* | *$M_1$* | *SCT* | *ADBAC* |
|---|---|---|---|---|---|---|
| As, TR (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.003 | 0.04 |
| As, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 51 | 685 |
| Cd, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.73 | 9.8 |
| Cr+3, TR (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 7.5 | 101 |
| Cr+3, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 21 | 282 |
| Cr+6, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 1.7 | 23 |
| Cu, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 2.6 | 35 |
| Fe, TR (µg/l) | 0.5 | 0.04 | 0.54 | 170 | 363 | 2762 |
| Pb, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.87 | 12 |
| Mn, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 333 | 4472 |
| Mo, TR (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 24 | 322 |
| Hg, Tot (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.0015 | 0.02 |
| Ni, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 15 | 201 |
| Se, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.88 | 12 |
| Ag, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.042 | 0.56 |
| Zn, Dis (µg/l) | 0.5 | 0.04 | 0.54 | 0 | 45 | 604 |
| B, Tot (mg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.62 | 8.3 |
| Chloride (mg/l) | 0.5 | 0.04 | 0.54 | 0 | 40 | 537 |
| Sulfide as H2S (mg/l) | 0.5 | 0.04 | 0.54 | 0 | 0.0003 | 0.004 |
| Radium 226+228 (piC/L) | 0.5 | 0.04 | 0.54 | 0 | 0.75 | 10 |
| Strontium 90 (piC/L) | 0.5 | 0.04 | 0.54 | 0 | 1.2 | 16 |
| Thorium 230+232 (piC/L) | 0.5 | 0.04 | 0.54 | 0 | 9 | 121 |

## 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 Tables A-13a through -13g. If the new WQBEL concentration (or potentially the TL Conc for bioaccumulatives) is greater than the ADBAC, an AD limit would be applied.

**Table A-13a**

**Concentration Significance Test for the Mainstem of the Purgatoire River**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Concentration Test Result* |
|---|---|---|---|
| As, TR (µg/l) | 0.036 | 0.0054 | Significant |
| As, Dis (µg/l) | 551 | 83 | Significant |
| Cd, Dis (µg/l) | 1.4 | 1.3 | Significant |
| Cr+3, TR (µg/l) | 81 | 12 | Significant |
| Cr+3, Dis (µg/l) | 254 | 38 | Significant |
| Cr+6, Dis (µg/l) | 20 | 3.1 | Significant |
| Cu, Dis (µg/l) | 30 | 3.9 | Significant |
| Fe, TR (µg/l) | 1649 | 495 | Significant |
| Pb, Dis (µg/l) | 10 | 1.5 | Significant |
| Mn, Dis (µg/l) | 3847 | 582 | Significant |
| Mo, TR (µg/l) | 290 | 43 | Significant |
| Hg, Tot (µg/l) | 0.018 | 0.0027 | Significant |
| Ni, Dis (µg/l) | 181 | 27 | Significant |
| Se, Dis (µg/l) | 8.2 | 1.4 | Significant |
| Ag, Dis (µg/l) | 0.51 | 0.076 | Significant |
| Zn, Dis (µg/l) | 444 | 82 | Significant |
| B, Tot (mg/l) | 7.2 | 1.1 | Significant |
| Chloride (mg/l) | 452 | 72 | Significant |
| Sulfide as H2S (mg/l) | 0.0036 | 0.00054 | Significant |
| Radium 226+228 (piC/L) | 9.6 | 1.4 | Significant |
| Strontium 90 (piC/L) | 15 | 2.3 | Significant |
| Thorium 230+232 (piC/L) | 116 | 17 | Significant |

For all parameters for the Mainstem of the Purgatoire River, 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.

**Table A-13b**

**Concentration Significance Test for the Middle Fork of the Purgatoire River**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Concentration Test Result* |
|---|---|---|---|
| As, TR (µg/l) | 0.032 | 0.0048 | Significant |
| As, Dis (µg/l) | 540 | 81 | Significant |
| Cd, Dis (µg/l) | 0.86 | 0.13 | Significant |
| Cr+3, TR (µg/l) | 79 | 12 | Significant |
| Cr+3, Dis (µg/l) | 152 | 22 | Significant |
| Cr+6, Dis (µg/l) | 17 | 2.7 | Significant |
| Cu, Dis (µg/l) | 18 | 3.7 | Significant |
| Fe, TR (µg/l) | 1471 | 391 | Significant |
| Pb, Dis (µg/l) | 5.5 | 0.91 | Significant |
| Mn, Dis (µg/l) | 2894 | 456 | Significant |
| Mo, TR (µg/l) | 254 | 38 | Significant |
| Hg, Tot (µg/l) | 0.016 | 0.0024 | Significant |
| Ni, Dis (µg/l) | 108 | 16 | Significant |
| Se, Dis (µg/l) | 7.2 | 1.2 | Significant |
| Ag, Dis (µg/l) | 0.21 | 0.032 | Significant |
| Zn, Dis (µg/l) | 256 | 38 | Significant |
| B, Tot (mg/l) | 6.3 | 0.96 | Significant |
| Chloride (mg/l) | 396 | 60 | Significant |
| Sulfide as H2S (mg/l) | 0.0032 | 0.00048 | Significant |

For all parameters for the Middle Fork of the Purgatoire River, 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.

**Table A-13c**
**Concentration Significance Test for the South Fork of the Purgatoire River**
**CO0048062- XTO Alamosito Outfall 049**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Concentration Test Result* |
|---|---|---|---|
| As, TR (µg/l) | 0.028 | 0.0042 | Significant |
| As, Dis (µg/l) | 471 | 71 | Significant |
| Cd, Dis (µg/l) | 0.66 | 0.1 | Significant |
| Cr+3, TR (µg/l) | 69 | 10 | Significant |
| Cr+3, Dis (µg/l) | 116 | 18 | Significant |
| Cr+6, Dis (µg/l) | 15 | 2.4 | Significant |
| Cu, Dis (µg/l) | 14 | 2.7 | Significant |
| Fe, TR (µg/l) | 1308 | 366 | Significant |
| Pb, Dis (µg/l) | 4.1 | 0.75 | Significant |
| Mn, Dis (µg/l) | 2395 | 349 | Significant |
| Mo, TR (µg/l) | 222 | 33 | Significant |
| Hg, Tot (µg/l) | 0.014 | 0.0021 | Significant |
| Ni, Dis (µg/l) | 82 | 12 | Significant |
| Se, Dis (µg/l) | 6.3 | 1.2 | Significant |
| Ag, Dis (µg/l) | 0.14 | 0.021 | Significant |
| Zn, Dis (µg/l) | 194 | 29 | Significant |
| B, Tot (mg/l) | 5.5 | 0.83 | Significant |
| Chloride (mg/l) | 345 | 53 | Significant |
| Sulfide as H2S (mg/l) | 0.0028 | 0.00042 | Significant |
| Radium 226+228 (piC/L) | 6.9 | 1 | Significant |
| Strontium 90 (piC/L) | 11 | 1.7 | Significant |
| Thorium 230+232 (piC/L) | 83 | 12 | Significant |

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

**Table A-13d**
**Concentration Significance Test for Guajatoyah Creek**
**CO0048003- Pioneer WSP Outfall 241**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Concentration Test Result* |
|---|---|---|---|
| As, TR (µg/l) | 0.15 | 0.022 | Significant |
| As, Dis (µg/l) | 2465 | 370 | Significant |
| Cd, Dis (µg/l) | 4.2 | 4.2 | Insignificant |
| Cr+3, TR (µg/l) | 363 | 54 | Significant |
| Cr+3, Dis (µg/l) | 754 | 116 | Significant |
| Cr+6, Dis (µg/l) | 80 | 12 | Significant |
| Cu, Dis (µg/l) | 94 | 15 | Significant |
| Fe, TR (µg/l) | 6188 | 1569 | Significant |
| Pb, Dis (µg/l) | 28 | 4.3 | Significant |
| Mn, Dis (µg/l) | 13717 | 2153 | Significant |
| Mo, TR (µg/l) | 1160 | 174 | Significant |
| Hg, Tot (µg/l) | 0.073 | 0.011 | Significant |
| Ni, Dis (µg/l) | 537 | 80 | Significant |
| Se, Dis (µg/l) | 33 | 6.4 | Significant |
| Ag, Dis (µg/l) | 1.1 | 0.17 | Significant |
| Zn, Dis (µg/l) | 1276 | 254 | Significant |
| B, Tot (mg/l) | 29 | 4.5 | Significant |
| Chloride (mg/l) | 1813 | 290 | Significant |
| Sulfide as H2S (mg/l) | 0.015 | 0.0022 | Significant |
| Radium 226+228 (piC/L) | 36 | 5.4 | Significant |
| Strontium 90 (piC/L) | 58 | 8.7 | Significant |
| Thorium 230+232 (piC/L) | 435 | 65 | Significant |

For all parameters for **Guajatoyah Creek**, except dissolved cadmium, the WQBELs are greater than the ADBACs and the concentration test results in a significance determination, and the antidegradation based effluent limitations (ADBELs) must be determined.

For dissolved cadmium, the WQBELs are less than the ADBAC and therefore, the concentration test results in an insignificant determination. The WQBEL is the final result of this WQA for this parameter and AD limitations are not necessary.

**Table A-13e**
**Concentration Significance Test for Parras Canyon**
**CO-0048003 Pioneer WSP Outfalls 005, 245**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Concentration Test Result* |
|---|---|---|---|
| As, TR (µg/l) | 0.02 | 0.003 | Significant |
| As, Dis (µg/l) | 340 | 51 | Significant |
| Cd, Dis (µg/l) | 0.58 | 0.58 | Insignificant |
| Cr+3, TR (µg/l) | 50 | 7.5 | Significant |
| Cr+3, Dis (µg/l) | 104 | 16 | Significant |
| Cr+6, Dis (µg/l) | 11 | 1.7 | Significant |
| Cu, Dis (µg/l) | 13 | 2 | Significant |
| Fe, TR (µg/l) | 1000 | 363 | Significant |
| Pb, Dis (µg/l) | 3.9 | 0.59 | Significant |
| Mn, Dis (µg/l) | 1892 | 297 | Significant |
| Mo, TR (µg/l) | 160 | 24 | Significant |
| Hg, Tot (µg/l) | 0.01 | 0.0015 | Significant |
| Ni, Dis (µg/l) | 74 | 11 | Significant |
| Se, Dis (µg/l) | 4.6 | 0.88 | Significant |
| Ag, Dis (µg/l) | 0.15 | 0.023 | Significant |
| Zn, Dis (µg/l) | 176 | 35 | Significant |
| B, Tot (mg/l) | 4 | 0.62 | Significant |
| Chloride (mg/l) | 250 | 40 | Significant |
| Sulfide as H2S (mg/l) | 0.002 | 0.0003 | Significant |
| Radium 226+228 (piC/L) | 5 | 0.75 | Significant |
| Strontium 90 (piC/L) | 8 | 1.2 | Significant |
| Thorium 230+232 (piC/L) | 60 | 9 | Significant |

For all parameters for **Parras Canyon** except dissolved cadmium, 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.

For dissolved cadmium, the WQBELs are less than the ADBAC and therefore, the concentration test results in an insignificant determination. The WQBELs are the final result of this WQA for these parameters and AD limitations are not necessary.

**Table A-13f**
**Concentration Significance Test for Unnamed Tributary to Guajatoyah Creek**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Concentration Test Result* |
|---|---|---|---|
| As, TR (µg/l) | 0.02 | 0.003 | Significant |
| As, Dis (µg/l) | 340 | 51 | Significant |
| Cd, Dis (µg/l) | 0.58 | 0.58 | Insignificant |
| Cr+3, TR (µg/l) | 50 | 7.5 | Significant |
| Cr+3, Dis (µg/l) | 104 | 16 | Significant |
| Cr+6, Dis (µg/l) | 11 | 1.7 | Significant |
| Cu, Dis (µg/l) | 13 | 2 | Significant |
| Fe, TR (µg/l) | 1000 | 363 | Significant |
| Pb, Dis (µg/l) | 3.9 | 0.59 | Significant |
| Mn, Dis (µg/l) | 1892 | 297 | Significant |
| Mo, TR (µg/l) | 160 | 24 | Significant |
| Hg, Tot (µg/l) | 0.01 | 0.0015 | Significant |
| Ni, Dis (µg/l) | 74 | 11 | Significant |
| Se, Dis (µg/l) | 4.6 | 0.88 | Significant |
| Ag, Dis (µg/l) | 0.15 | 0.023 | Significant |
| Zn, Dis (µg/l) | 176 | 35 | Significant |
| B, Tot (mg/l) | 4 | 0.62 | Significant |
| Chloride (mg/l) | 250 | 40 | Significant |
| Sulfide as H2S (mg/l) | 0.002 | 0.0003 | Significant |
| Radium 226+228 (piC/L) | 5 | 0.75 | Significant |
| Strontium 90 (piC/L) | 8 | 1.2 | Significant |
| Thorium 230+232 (piC/L) | 60 | 9 | Significant |

For all parameters for **Unnamed Tributary to Guajatoyah Creek** except dissolved cadmium, 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.

For dissolved cadmium, the WQBELs are less than the ADBAC and therefore, the concentration test results in an insignificant determination. The WQBELs are the final result of this WQA for these parameters and AD limitations are not necessary.

**Table A-13g**

Concentration Significance Test for North Fork of the Purgatoire River

| *Pollutant* | *New WQBEL* | *ADBAC* | *Concentration Test Result* |
|---|---|---|---|
| As, TR (µg/l) | 0.27 | 0.04 | Significant |
| As, Dis (µg/l) | 4566 | 685 | Significant |
| Cd, Dis (µg/l) | 10 | 9.8 | Significant |
| Cr+3, TR (µg/l) | 671 | 101 | Significant |
| Cr+3, Dis (µg/l) | 1880 | 282 | Significant |
| Cr+6, Dis (µg/l) | 148 | 23 | Significant |
| Cu, Dis (µg/l) | 228 | 35 | Significant |
| Fe, TR (µg/l) | 11316 | 2762 | Significant |
| Pb, Dis (µg/l) | 78 | 12 | Significant |
| Mn, Dis (µg/l) | 28671 | 4472 | Significant |
| Mo, TR (µg/l) | 2149 | 322 | Significant |
| Hg, Tot (µg/l) | 0.13 | 0.02 | Significant |
| Ni, Dis (µg/l) | 1343 | 201 | Significant |
| Se, Dis (µg/l) | 62 | 12 | Significant |
| Ag, Dis (µg/l) | 3.8 | 0.56 | Significant |
| Zn, Dis (µg/l) | 3290 | 604 | Significant |
| B, Tot (mg/l) | 54 | 8.3 | Significant |
| Chloride (mg/l) | 3357 | 537 | Significant |
| Sulfide as H2S (mg/l) | 0.027 | 0.004 | Significant |
| Radium 226+228 (piC/L) | 67 | 10 | Significant |
| Strontium 90 (piC/L) | 107 | 16 | Significant |
| Thorium 230+232 (piC/L) | 806 | 121 | Significant |

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

## Antidegradation Based Effluent Limitations (ADBELs)

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 and TLs have already been determined in the AD evaluation, and therefore to complete the evaluation, a final comparison of limitations needs to be completed. Note that ADBACs are not applicable when the new WQBEL concentration (and loading as evaluated in the New and Increased Impacts Test) is less than the ADBAC.

The end results of this AD evaluation are in Tables A-14a through -14h, including any parameter that was previously exempted from further AD evaluation, with the final potential limitation identified (WQBEL or ADBAC).

**Table A-14a**

**Final Selection of WQBELs and ADBACs for the Purgatoire River Mainstem**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Chosen Limit* |
|---|---|---|---|
| As, TR (µg/l) Beginning 01/01/2022 | 0.036 | 0.0054 | ADBAC |
| As, Dis (µg/l) | 551 | 83 | ADBAC |
| Cd, Dis (µg/l) | 1.4 | 1.3 | ADBAC |
| Cr+3, TR (µg/l) | 81 | 12 | ADBAC |
| Cr+3, Dis (µg/l) | 254 | 38 | ADBAC |
| Cr+6, Dis (µg/l) | 20 | 3.1 | ADBAC |
| Cu, Dis (µg/l) | 30 | 3.9 | ADBAC |
| Fe, TR (µg/l) | 1649 | 495 | ADBAC |
| Pb, Dis (µg/l) | 10 | 1.5 | ADBAC |
| Mn, Dis (µg/l) | 3847 | 582 | ADBAC |
| Mo, TR (µg/l) | 290 | 43 | ADBAC |
| Hg, Tot (µg/l) | 0.018 | 0.0027 | ADBAC |
| Ni, Dis (µg/l) | 181 | 27 | ADBAC |
| Se, Dis (µg/l) | 8.2 | 1.4 | ADBAC |
| Ag, Dis (µg/l) | 0.51 | 0.076 | ADBAC |
| Zn, Dis (µg/l) | 444 | 82 | ADBAC |
| B, Tot (mg/l) | 7.2 | 1.1 | ADBAC |
| Chloride (mg/l) | 452 | 72 | ADBAC |
| Sulfide as H2S (mg/l) | 0.0036 | 0.00054 | ADBAC |
| Radium 226+228 (piC/L) | 9.6 | 1.4 | ADBAC |
| Strontium 90 (piC/L) | 15 | 2.3 | ADBAC |
| Thorium 230+232 (piC/L) | 116 | 17 | ADBAC |

**Table A-14b**

**Final Selection of WQBELs and ADBACs for the Middle Fork of the Purgatoire River**

| ***Pollutant*** | ***New WQBEL*** | ***ADBAC*** | ***Chosen Limit*** |
|---|---|---|---|
| As, TR (µg/l) Beginning 01/01/2022 | 0.032 | 0.0048 | ADBAC |
| As, Dis (µg/l) | 540 | 81 | ADBAC |
| Cd, Dis (µg/l) | 0.86 | 0.13 | ADBAC |
| Cr+3, TR (µg/l) | 79 | 12 | ADBAC |
| Cr+3, Dis (µg/l) | 152 | 22 | ADBAC |
| Cr+6, Dis (µg/l) | 17 | 2.7 | ADBAC |
| Cu, Dis (µg/l) | 18 | 2.3 | ADBAC |
| Fe, TR (µg/l) | 1471 | 391 | ADBAC |
| Pb, Dis (µg/l) | 5.5 | 0.91 | ADBAC |
| Mn, Dis (µg/l) | 2894 | 456 | ADBAC |
| Mo, TR (µg/l) | 254 | 38 | ADBAC |
| Hg, Tot (µg/l) | 0.016 | 0.0024 | ADBAC |
| Ni, Dis (µg/l) | 108 | 16 | ADBAC |
| Se, Dis (µg/l) | 7.2 | 1.2 | ADBAC |
| Ag, Dis (µg/l) | 0.21 | 0.032 | ADBAC |
| Zn, Dis (µg/l) | 256 | 38 | ADBAC |
| B, Tot (mg/l) | 6.3 | 0.96 | ADBAC |
| Chloride (mg/l) | 396 | 60 | ADBAC |
| Sulfide as H2S (mg/l) | 0.0032 | 0.00048 | ADBAC |

**Table A-14c**

**Final Selection of WQBELs and ADBACs for the South Fork of the Purgatoire River**

| ***Pollutant*** | ***New WQBEL*** | ***ADBAC*** | ***Chosen Limit*** |
|---|---|---|---|
| As, TR (µg/l) Beginning 01/01/2022 | 0.028 | 0.0042 | ADBAC |
| As, Dis (µg/l) | 471 | 71 | ADBAC |
| Cd, Dis (µg/l) | 0.66 | 0.1 | ADBAC |
| Cr+3, TR (µg/l) | 69 | 10 | ADBAC |
| Cr+3, Dis (µg/l) | 116 | 18 | ADBAC |
| Cr+6, Dis (µg/l) | 15 | 2.4 | ADBAC |
| Cu, Dis (µg/l) | 14 | 2.7 | ADBAC |
| Fe, TR (µg/l) | 1308 | 366 | ADBAC |
| Pb, Dis (µg/l) | 4.1 | 0.75 | ADBAC |
| Mn, Dis (µg/l) | 2395 | 349 | ADBAC |
| Mo, TR (µg/l) | 222 | 33 | ADBAC |
| Hg, Tot (µg/l) | 0.014 | 0.0021 | ADBAC |
| Ni, Dis (µg/l) | 82 | 12 | ADBAC |
| Se, Dis (µg/l) | 6.3 | 1.2 | ADBAC |
| Ag, Dis (µg/l) | 0.14 | 0.021 | ADBAC |
| Zn, Dis (µg/l) | 194 | 29 | ADBAC |
| B, Tot (mg/l) | 5.5 | 0.83 | ADBAC |
| Chloride (mg/l) | 345 | 53 | ADBAC |
| Sulfide as H2S (mg/l) | 0.0028 | 0.00042 | ADBAC |
| Radium 226+228 (piC/L) | 6.9 | 1 | ADBAC |
| Strontium 90 (piC/L) | 11 | 1.7 | ADBAC |
| Thorium 230+232 (piC/L) | 83 | 12 | ADBAC |

**Table A-14d**

**Final Selection of WQBELs and ADBACs for Guajatoyah Creek**

| ***Pollutant*** | ***New WQBEL*** | ***ADBAC*** | ***Chosen Limit*** |
|---|---|---|---|
| As, TR (µg/l) Beginning 01/01/2022 | 0.15 | 0.022 | ADBAC |
| As, Dis (µg/l) | 2465 | 370 | ADBAC |
| Cd, Dis (µg/l) | 4.2 | NA | WQBEL |
| Cr+3, TR (µg/l) | 363 | 54 | ADBAC |
| Cr+3, Dis (µg/l) | 754 | 116 | ADBAC |
| Cr+6, Dis (µg/l) | 80 | 12 | ADBAC |
| Cu, Dis (µg/l) | 94 | 15 | ADBAC |
| Fe, TR (µg/l) | 6188 | 1569 | ADBAC |
| Pb, Dis (µg/l) | 28 | 4.3 | ADBAC |
| Mn, Dis (µg/l) | 13717 | 2153 | ADBAC |
| Mo, TR (µg/l) | 1160 | 174 | ADBAC |
| Hg, Tot (µg/l) | 0.073 | 0.011 | ADBAC |
| Ni, Dis (µg/l) | 537 | 80 | ADBAC |
| Se, Dis (µg/l) | 33 | 6.4 | ADBAC |
| Ag, Dis (µg/l) | 1.1 | 0.17 | ADBAC |
| Zn, Dis (µg/l) | 1276 | 254 | ADBAC |
| B, Tot (mg/l) | 29 | 4.5 | ADBAC |
| Chloride (mg/l) | 1813 | 290 | ADBAC |
| Sulfide as H2S (mg/l) | 0.015 | 0.0022 | ADBAC |
| Radium 226+228 (piC/L) | 36 | 5.4 | ADBAC |
| Strontium 90 (piC/L) | 58 | 8.7 | ADBAC |
| Thorium 230+232 (piC/L) | 435 | 65 | ADBAC |

**Table A-14e**

**Final Selection of WQBELs and ADBACs for Parras Canyon**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Chosen Limit* |
|---|---|---|---|
| As, TR (µg/l) Beginning 01/01/2022 | 0.02 | 0.003 | ADBAC |
| As, Dis (µg/l) | 340 | 51 | ADBAC |
| Cd, Dis (µg/l) | 0.58 | 0.58 | WQBEL |
| Cr+3, TR (µg/l) | 50 | 7.5 | ADBAC |
| Cr+3, Dis (µg/l) | 104 | 16 | ADBAC |
| Cr+6, Dis (µg/l) | 11 | 1.7 | ADBAC |
| Cu, Dis (µg/l) | 13 | 2 | ADBAC |
| Fe, TR (µg/l) | 1000 | 363 | ADBAC |
| Pb, Dis (µg/l) | 3.9 | 0.59 | ADBAC |
| Mn, Dis (µg/l) | 1892 | 297 | ADBAC |
| Mo, TR (µg/l) | 160 | 24 | ADBAC |
| Hg, Tot (µg/l) | 0.01 | 0.0015 | ADBAC |
| Ni, Dis (µg/l) | 74 | 11 | ADBAC |
| Se, Dis (µg/l) | 4.6 | 0.88 | ADBAC |
| Ag, Dis (µg/l) | 0.15 | 0.023 | ADBAC |
| Zn, Dis (µg/l) | 176 | 35 | ADBAC |
| B, Tot (mg/l) | 4 | 0.62 | ADBAC |
| Chloride (mg/l) | 250 | 40 | ADBAC |
| Sulfide as H2S (mg/l) | 0.002 | 0.0003 | ADBAC |
| Radium 226+228 (piC/L) | 5 | 0.75 | ADBAC |
| Strontium 90 (piC/L) | 8 | 1.2 | ADBAC |
| Thorium 230+232 (piC/L) | 60 | 9 | ADBAC |

**Table A-14f**

**Final Selection of WQBELs and ADBACs for Unnamed Tributary to Guajatoyah Creek**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Chosen Limit* |
|---|---|---|---|
| As, TR (µg/l) Beginning 01/01/2022 | 0.02 | 0.003 | ADBAC |
| As, Dis (µg/l) | 340 | 51 | ADBAC |
| Cd, Dis (µg/l) | 0.58 | NA | WQBEL |
| Cr+3, TR (µg/l) | 50 | 7.5 | ADBAC |
| Cr+3, Dis (µg/l) | 104 | 16 | ADBAC |
| Cr+6, Dis (µg/l) | 11 | 1.7 | ADBAC |
| Cu, Dis (µg/l) | 13 | 2 | ADBAC |
| Fe, TR (µg/l) | 1000 | 363 | ADBAC |
| Pb, Dis (µg/l) | 3.9 | 0.59 | ADBAC |
| Mn, Dis (µg/l) | 1892 | 297 | ADBAC |
| Mo, TR (µg/l) | 160 | 24 | ADBAC |
| Hg, Tot (µg/l) | 0.01 | 0.0015 | ADBAC |
| Ni, Dis (µg/l) | 74 | 11 | ADBAC |
| Se, Dis (µg/l) | 4.6 | 0.88 | ADBAC |
| Ag, Dis (µg/l) | 0.15 | 0.023 | ADBAC |
| Zn, Dis (µg/l) | 176 | 35 | ADBAC |
| B, Tot (mg/l) | 4 | 0.62 | ADBAC |
| Chloride (mg/l) | 250 | 40 | ADBAC |
| Sulfide as H2S (mg/l) | 0.002 | 0.0003 | ADBAC |
| Radium 226+228 (piC/L) | 5 | 0.75 | ADBAC |
| Strontium 90 (piC/L) | 8 | 1.2 | ADBAC |
| Thorium 230+232 (piC/L) | 60 | 9 | ADBAC |

**Table A-14g**

**Final Selection of WQBELs and ADBACs for North Fork of the Purgatoire River**

| *Pollutant* | *New WQBEL* | *ADBAC* | *Chosen Limit* |
|---|---|---|---|
| As, TR (µg/l) Beginning 01/01/2022 | 0.27 | 0.04 | ADBAC |
| As, Dis (µg/l) | 4566 | 685 | ADBAC |
| Cd, Dis (µg/l) | 10 | 9.8 | ADBAC |
| Cr+3, TR (µg/l) | 671 | 101 | ADBAC |
| Cr+3, Dis (µg/l) | 1880 | 282 | ADBAC |
| Cr+6, Dis (µg/l) | 148 | 23 | ADBAC |
| Cu, Dis (µg/l) | 228 | 35 | ADBAC |
| Fe, TR (µg/l) | 11316 | 2762 | ADBAC |
| Pb, Dis (µg/l) | 78 | 12 | ADBAC |
| Mn, Dis (µg/l) | 28671 | 4472 | ADBAC |
| Mo, TR (µg/l) | 2149 | 322 | ADBAC |
| Hg, Tot (µg/l) | 0.13 | 0.02 | ADBAC |
| Ni, Dis (µg/l) | 1343 | 201 | ADBAC |
| Se, Dis (µg/l) | 62 | 12 | ADBAC |
| Ag, Dis (µg/l) | 3.8 | 0.56 | ADBAC |
| Zn, Dis (µg/l) | 3290 | 604 | ADBAC |
| B, Tot (mg/l) | 54 | 8.3 | ADBAC |
| Chloride (mg/l) | 3357 | 537 | ADBAC |
| Sulfide as H2S (mg/l) | 0.027 | 0.004 | ADBAC |
| Radium 226+228 (piC/L) | 67 | 10 | ADBAC |
| Strontium 90 (piC/L) | 107 | 16 | ADBAC |
| Thorium 230+232 (piC/L) | 806 | 121 | ADBAC |

## 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.

Chloride

An AA for the Purgatoire River was previously conducted for the CBM facilities, and was approved by the Division as part of permit modifications that were issued on February 28, 2014 and effective on April 1, 2014. The Division determined that the basis for an alternate ADBEL limit submitted by the permittees was sound and supports a determination of establishing an alternate ADBEL in this case.

For the Purgatoire River, the ADBELs for chloride will be as follows:

- Pioneer Lorencito-CO0047776 – The Division modified the 2 year rolling average limitation of 55 mg/l to 117 mg/l as an Alternative ADBEL level. This limitation remains applicable.
- Pioneer East Spanish Peaks, CO0047767 – For all outfalls that reach the Purgatoire River, the Division assigned the Alternative ADBEL of 368 mg/l based on the WQBEL (then 370 mg/l). This alternative ADBEL remains applicable.
- CO0048003 – The Division modified the 2 year rolling average limitation of 55 mg/l to 56 mg/l as an Alternative ADBEL level. This alternative ADBEL remains applicable.
- CO0048054 – The Division modified the 2 year rolling average limitation of 55 mg/l to 366 mg/l as an Alternative ADBEL level. This limit is established to maintain the current condition as it has been determined that the current condition allows a level of degradation that is necessary to accommodate important economic or social development. This limitation remains applicable and has been retained in this permitting action.
- CO0048062 - The Division modified the 2 year rolling average limitation of 55 mg/l to 287 mg/l as an Alternative ADBEL level. This limit is established to maintain the current condition as it has been determined that the current condition allows a level of degradation that is necessary to accommodate important economic or social development. This limit has been retained in this permitting action.

An AA was conducted for iron and submitted with comments on the draft renewal permit. The Division has incorporated the AA and the basis for allowance of degradation, and has established ADBELs, where applicable. The ADBEL levels are discussed further in the fact sheets and the response to comments.

## Final Potential Limitations For Facilities
## PIONEER CO-0047767, East Spanish Peaks

**Table A- 15a: Final Potential Limitations for East Spanish Peaks Outfalls (COARLA06a, all reaching the Purgatoire River): 004-A, 007-A, 057-A, 060-A, 065-A, 075-A, 073A, 079-A, 094-A, 096-A, 105-A, 147-A, 156-A, 160-A, 183-A, 202-A, 215-A, 217-A, 220-A, 221-A, 228-A, 230-A, 238-A, 239-A**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average[2] |
| As, TR (µg/l) Beginning 01/01/2022 | 0.036[1] | NA | 0.0054 |
| As, TR (µg/l) Until 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | NA | 551[2] | 83 |
| Be, TR (µg/l) | 100 | NA | NA |
| Cd, TR (µg/l) | 10 | NA | NA |
| Cd, PD (µg/l) | 1.4[2] | 5.3[2] | 1.3 |
| Cr+3, PD (µg/l) Burro Canyon | 94 | 720 | 38 |
| Cr+3, PD (µg/l) Reilly Canyon | 148 | 1135 | 38 |
| Cr+3, PD (µg/l) Sarcillo, Cow, Smith | 106 | 811 | 38 |
| Cr+3, TR (µg/l) | 100 | 81[2] | 12 |
| Cr+6, TR (µg/l) | 100 | NA | NA |
| Cr+6, Dis (µg/l) | 20[2] | 26[2] | 3.1 |
| Cu, TR (µg/l) | 200 | NA | NA |
| Cu, PD (µg/l) | 30[2] | 45[2] | 3.9 |
| Fe, TR (µg/l) | 1649[2] | NA | 495 |
| Pb, TR (µg/l) | 100 | NA | NA |
| Pb, PD (µg/l) | 10[2] | 240[2] | 1.5 |
| Mn, PD (µg/l) | 3847[2] | 6245[2] | 582 |
| Mo, TR (µg/l) | 160 | NA | 43 |
| Hg, Tot (µg/l) | 0.018[2] | NA | 0.0027 |
| Ni, TR (µg/l) | 200 | NA | NA |
| Ni, PD (µg/l) | 181[2] | 1461[2] | 27 |
| Se, TR (µg/l) | 20 | NA | NA |
| Se, PD (µg/l) | 8.2[2] | 30[2] | 1.4 |
| Ag, PD (µg/l) | 0.51[2] | 12[2] | 0.076 |
| Zn, TR (µg/l) | 2000 | NA | NA |
| Zn, PD (µg/l) | 444[2] | 526[2] | 82 |
| B, Tot (mg/l) | 4 | NA | 1.1 |
| Chloride (mg/l) | 452[2] | NA | 368[3] |
| Sulfide as H2S (mg/l) | 0.002 | NA | 0.00054 |
| Radium 226+228 (piC/L) | 5 | NA | 1.4 |
| Strontium 90 (piC/L) | 8 | NA | 2.3 |
| Thorium 230+232 | 60 | NA | 17 |

**[1]Downstream segment (COARLA05b) more restrictive, substituted that value**
**[2]Downstream segment (COARLA05b) has this parameter, not the immediate receiving stream**
**[3]ADBEL based on the Alternatives Analysis**

**Table A- 15b**

**Final Potential Limitations for East Spanish Peaks Outfalls (COARLA06a, does not reach the Purgatoire River):**

**016-A, 022-A, 028-A, 061-A, 063-A, 071-A, 090-A, 108-A, 112-A, 152-A, 191-A, 198-A, 210-A, 212-A, 213-A, 222-A – Burro Canyon, Cow Canyon, Sarcillo Canyon, Reilly Canyon**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | |
|---|---|---|
| | 30-Day Average | Daily Maximum |
| As, TR (µg/l) | 100 | |
| Be, TR (µg/l) | 100 | |
| Cd, TR (µg/l) | 10 | |
| Cr+3, TR (µg/l) | 100 | |
| Cr+6, TR (µg/l) | 100 | |
| Cr+3, PD (µg/l) Reilly 061A, 090-A, 108A, 152A | 94 | 720 |
| Cr+3, PD (µg/l) Burro 022A, 028A, 112A, 191A, 212A, 222-A | 148 | 1135 |
| Cr+3, PD (µg/l) Sarcillo/Cow 016A, 063A, 071A, 198A, 210A, 213A | 106 | 811 |
| Cu, TR (µg/l) | 200 | |
| Pb, TR (µg/l) | 100 | |
| Ni, TR (µg/l) | 200 | |
| Mo, TR (ug/l) | 160 | |
| Se, TR (µg/l) | 20 | |
| Zn, TR (µg/l) | 2000 | |
| B, Tot (mg/l) | 4 | |
| Sulfide as H2S (mg/l) | 0.002 | |
| Radium 226+228 (piC/L) | 5 | |
| Strontium 90 (piC/L) | 8 | |
| Thorium 230+232 | 60 | |

## PIONEER CO-0048003, West Spanish Peaks

| Table A- 15d<br>Final Potential Limitations for West Spanish Peaks Outfalls for Parras Canyon[1]<br>(COARLA05b):<br>005, 245 | | | |
|---|---|---|---|
| **Effluent Parameter** | **Effluent Limitations Maximum Concentrations** | | |
| | **30-Day Average** | **Daily Maximum** | **2-Year Average** |
| As, TR (µg/l) Beginning 01/01/2022 | 0.02 | NA | 0.003 |
| As, TR (µg/l) Until 12/31/2022 | 100 | NA | NA |
| As, PD (µg/l) | NA | 340 | 51 |
| Cd, PD (µg/l) | 0.58 | 2.4 | |
| Cr+3, TR (µg/l) | NA | 50 | 7.5 |
| Cr+3, PD (µg/l) | 104 | NA | 16 |
| Cr+6, Dis (µg/l) | 11 | 16 | 1.7 |
| Cu, PD (µg/l) | 13 | 20 | 2 |
| Fe, TR (µg/l) | 1000 | NA | 363 |
| Pb, PD (µg/l) | 3.9 | 101 | 0.59 |
| Mn, PD (µg/l) | 1892 | 3425 | 297 |
| Mo, TR (µg/l) | 160 | NA | 24 |
| Hg, Tot (µg/l) | 0.01 | NA | 0.0015 |
| Ni, PD (µg/l) | 74 | 664 | 11 |
| Se, PD (µg/l) | 4.6 | 18 | 0.88 |
| Ag, PD (µg/l) | 0.15 | 4.1 | 0.023 |
| Zn, PD (µg/l) | 176 | 242 | 35 |
| B, Tot (mg/l) | 4 | NA | 0.62 |
| Chloride (mg/l) | 250 | NA | 56[2] |
| Sulfide as H2S (mg/l) | 0.002 | NA | 0.0003 |
| Radium 226+228 (piC/L) | 5 | NA | 0.75 |
| Strontium 90 (piC/L) | 8 | NA | 1.2 |
| Thorium 230+232 | 60 | NA | 9 |

[1]The downstream receiving waters (Purgatoire River and North Fork of the Purgatoire River, COARLA05b) had limitations that were less stringent than those calculated for Parras Canyon (which flows into the North Fork of the Purgatoire River, which in turn flows into the Purgatoire River.) Therefore the limitations calculated for Parras Canyon are applicable.
[2] ADBEL based on the Alternatives Analysis

**Table A- 15e**
**Final Potential Limitations for West Spanish Peaks Outfall for Unnamed Tributary to Guajatoyah Creek (COARLA05a): Outfall 241**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average |
| As, TR (µg/l) Beginning 01/01/2022 | 0.02 | NA | 0.003 |
| As, TR (µg/l) Until 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | | 340 | 51 |
| Cd, PD (µg/l) | 0.58 | 2.4 | |
| Cr+3, TR (µg/l) | | 50 | 7.5 |
| Cr+3, PD (µg/l) | 104 | | 16 |
| Cr+6, Dis (µg/l) | 11 | 16 | 1.7 |
| Cu, PD (µg/l) | 13 | 20 | 2 |
| Fe, TR (µg/l) | 1000 | | 363 |
| Pb, PD (µg/l) | 3.9 | 101 | 0.59 |
| Mn, PD (µg/l) | 1892 | 3425 | 297 |
| Mo, TR (µg/l) | 160 | | 24 |
| Hg, Tot (µg/l) | 0.01 | | 0.0015 |
| Ni, PD (µg/l) | 74 | 664 | 11 |
| Se, PD (µg/l) | 4.6 | 18 | 0.88 |
| Ag, PD (µg/l) | 0.15 | 4.1 | 0.023 |
| Zn, PD (µg/l) | 176 | 242 | 35 |
| B, Tot (mg/l) | 4 | | 0.62 |
| Chloride (mg/l) | 250 | | 56[1] |
| Sulfide as H2S (mg/l) | 0.002 | | 0.0003 |
| Radium 226+228 (piC/L) | 5 | | 0.75 |
| Strontium 90 (piC/L) | 8 | | 1.2 |
| Thorium 230+232 | 60 | | 9 |

[1] ADBEL based on the Alternatives Analysis

## PIONEER CO-0047776, Lorencito

**Table A- 15f**
**Final Potential Limitations for outfalls discharging to tributaries to Lorencito Canyon (COARLA06a), that reach Lorencito Canyon (COARLA04b) and the Purgatoire River (COARLA05b):**
**005A, 010A, 027A, 059A, 075A, 076A**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average[2] |
| As, TR (µg/l) Beginning 01/01/2022 | 0.036[1] | NA | 0.0054 |
| As, TR (µg/l) Until 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | NA | 340[3] | 83 |
| Be, TR (µg/l) | 100 | | |
| Cd, TR (µg/l) | 10 | | |
| Cd, PD (µg/l) | 0.45[3] | 3[3] | 1.3 |
| Cr+3, TR (µg/l) | 100 | 81[2] | 12 |
| Cr+3, PD (µg/l) | 80[3] | 611[4] | 38 |
| Cr+6, TR (µg/l) | 100 | | |
| Cr+6, Dis (µg/l) | 11 | 16[3] | 3.1 |
| Cu, TR (µg/l) | 200 | | |
| Cu, PD (µg/l) | 9.6[3] | 15[3] | 3.9 |
| Fe, TR (µg/l) | 1000[3] | | 495 |
| Pb, TR (µg/l) | 100 | | |
| Pb, PD (µg/l) | 2.8[3] | 71[3] | 1.5 |
| Mn, TR (µg/l) | 200 | | |
| Mn, PD (µg/l) | 1698[3] | 3073[3] | 582 |
| Mo, TR (µg/l) | 160 | | |
| Hg, Tot (µg/l) | 0.01[3] | | 0.0027 |
| Ni, TR (µg/l) | 200 | | |
| Ni, PD (µg/l) | 56[3] | 504[3] | 27 |
| Se, TR (µg/l) | 20 | | |
| Se, PD (µg/l) | 4.6[3] | 18[3] | 1.4 |
| Ag, PD (µg/l) | 0.37[3] | 2.4[3] | 0.076 |
| Zn, TR (µg/l) | 2000 | | |
| Zn, PD (µg/l) | 131[3] | 180[3] | 82 |
| B, Tot (mg/l) | 4 | | 1.1 |
| Chloride (mg/l) | 452[2] | | 117[5] |
| Sulfide as H2S (mg/l) | 0.002 | | 0.00054 |
| Radium 226+228 (piC/L) | 5 | | 1.4 |
| Strontium 90 (piC/L) | 8 | | 2.3 |
| Thorium 230+232 | 60 | | 17 |

**[1]Downstream segment (COARLA05b) most restrictive, substituted that value**
**[2]Downstream segment (COARLA05b) has this parameter, not the immediate receiving stream**
**[3] Receiving stream does not have this parameter; downstream segment (COARLA04b) more restrictive than COARLA05b, substituted that value**
**[4]Downstream segment (COARLA04b) has this parameter, not the immediate receiving stream**
**[5] ADBEL based on the Alternatives Analysis**

**Table A- 15g**
**Final Potential Limitations for outfalls discharging to Lorencito Canyon, reaching the Purgatoire River (COARLA04b):**
**022A**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average[2] |
| As, TR (µg/l) Beginning 01/01/2022 | 0.036[1] | NA | 0.0054 |
| As, TR (µg/l) Until 12/31/2021 | 100 | | |
| As, PD (µg/l) | NA | 340 | 83 |
| Cd, PD (µg/l) | 0.45 | 3 | 1.3 |
| Cr+3, TR (µg/l) | 100 | 81[2] | 12 |
| Cr+3, PD (µg/l) | 80 | 611 | 38 |
| Cr+6, Dis (µg/l) | 11 | 16 | 3.1 |
| Cu, PD (µg/l) | 9.6 | 15 | 3.9 |
| Fe, TR (µg/l) | 1000 | NA | 495 |
| Pb, PD (µg/l) | 2.8 | 71 | 1.5 |
| Mn, PD (µg/l) | 1698 | 3073 | 582 |
| Mo, TR (µg/l) | 160 | NA | 43 |
| Hg, Tot (µg/l) | 0.01 | NA | 0.0027 |
| Ni, PD (µg/l) | 56 | 504 | 27 |
| Se, PD (µg/l) | 4.6 | 18 | 1.4 |
| Ag, PD (µg/l) | 0.37 | 2.4 | 0.076 |
| Zn, PD (µg/l) | 131 | 180 | 82 |
| B, Tot (mg/l) | 4 | NA | 1.1 |
| Chloride (mg/l) | 452[1] | NA | 117[3] |
| Sulfide as H2S (mg/l) | 0.002 | NA | 0.0005 |
| Radium 226+228 (piC/L) | 5 | NA | 0.00054 |
| Strontium 90 (piC/L) | 8 | NA | 1.4 |
| Thorium 230+232 | 60 | NA | 2.3 |

**[1]Downstream segment (COARLA05b) more restrictive, substituted that value**
**[2]Downstream segment (COARLA05b) has this parameter, not the immediate receiving stream**
**[3] ADBEL based on the Alternatives Analysis**

## XTO CO-0048054, Lorencito

**Table A- 15h**
**Final Potential Limitations for outfalls discharging to tributaries to Lorencito Canyon (COARLA06a), that reach Lorencito Canyon (COARLA04b) and the Purgatoire River (COARLA05b):**
**010-A, 012-A, 016-A, 018-A, 019-A, 021-A, 025-A, 027-A, 028-A, 031-A, 032-A, 034-A, 036-A, 037-A, 039-A, 040-A, 042-A, 045-A, 047-A, 049-A, 050-A, 051-A, 057-A, 066-A, 067-A, 068-A, 069-A, 070-A, 072-A, 073-A, 074-A, 078-A, 082-A, 083-A, 084-A, 088-A, 091-A, 093-A**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average[2] |
| As, TR (µg/l) Beginning 01/01/2022 | 0.036[1] | NA | 0.0054 |
| As, TR (µg/l) Until 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | NA | 340[3] | 83 |
| Be, TR (µg/l) | 100 | | |
| Cd, TR (µg/l) | 10 | | |
| Cd, PD (µg/l) | 0.45[3] | 3[3] | 1.3 |
| Cr+3, TR (µg/l) | 100 | 81[2] | 12 |
| Cr+3, PD (µg/l) | 80[3] | 611[4] | 38 |
| Cr+6, TR (µg/l) | 100 | | |
| Cr+6, Dis (µg/l) | 11 | 16[3] | 3.1 |
| Cu, TR (µg/l) | 200 | | |
| Cu, PD (µg/l) | 9.6[3] | 15[3] | 3.9 |
| Fe, TR (µg/l) | 1000[3] | | 495 |
| Pb, TR (µg/l) | 100 | | |
| Pb, PD (µg/l) | 2.8[3] | 71[3] | 1.5 |
| Mn, TR (µg/l) | 200 | | |
| Mn, PD (µg/l) | 1698[3] | 3073[3] | 582 |
| Mo, TR (µg/l) | 160 | | |
| Hg, Tot (µg/l) | 0.01[3] | | 0.0027 |
| Ni, TR (µg/l) | 200 | | |
| Ni, PD (µg/l) | 56[3] | 504[3] | 27 |
| Se, TR (µg/l) | 20 | | |
| Se, PD (µg/l) | 4.6[3] | 18[3] | 1.4 |
| Ag, PD (µg/l) | 0.37[3] | 2.4[3] | 0.076 |
| Zn, TR (µg/l) | 2000 | | |
| Zn, PD (µg/l) | 131[3] | 180[3] | 82 |
| B, Tot (mg/l) | 4 | | 1.1 |
| Chloride (mg/l) | 452[2] | | 366[5] |
| Sulfide as H2S (mg/l) | 0.002 | | 0.00054 |
| Radium 226+228 (piC/L) | 5 | | 1.4 |
| Strontium 90 (piC/L) | 8 | | 2.3 |
| Thorium 230+232 | 60 | | 17 |

**[1]Downstream segment (COARLA05b) most restrictive, substituted that value**
**[2]Downstream segment (COARLA05b) has this parameter, not the immediate receiving stream**
**[3] Receiving stream does not have this parameter; downstreawm segment (COARLA04b) more restrictive than COARLA05b, substituted that value**
**[4]Downstream segment (COARLA04b) has this parameter, not the immediate receiving stream**
**[5] ADBEL based on the Alternatives Analysis**

**Table A- 15i**
**Final Potential Limitations for outfalls discharging directly to Lorencito Canyon (COARLA04b) that reach the Purgatoire River (COARLA05b):**
**035-A**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average[2] |
| As, TR (µg/l) Beginning 01/01/2022 | 0.036[1] | NA | 0.0054 |
| As, TR (µg/l) Until 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | NA | 340 | 83 |
| Cd, PD (µg/l) | 0.45 | 3 | 1.3 |
| Cr+3, TR (µg/l) | 100 | 81[2] | 12 |
| Cr+3, PD (µg/l) | 80 | 611 | 38 |
| Cr+6, Dis (µg/l) | 11 | 16 | 3.1 |
| Cu, PD (µg/l) | 9.6 | 15 | 3.9 |
| Fe, TR (µg/l) | 1000 | NA | 495 |
| Pb, PD (µg/l) | 2.8 | 71 | 1.5 |
| Mn, PD (µg/l) | 1698 | 3073 | 582 |
| Mo, TR (µg/l) | 160 | NA | 43 |
| Hg, Tot (µg/l) | 0.01 | NA | 0.0027 |
| Ni, PD (µg/l) | 56 | 504 | 27 |
| Se, PD (µg/l) | 4.6 | 18 | 1.4 |
| Ag, PD (µg/l) | 0.37 | 2.4 | 0.076 |
| Zn, PD (µg/l) | 131 | 180 | 82 |
| B, Tot (mg/l) | 4 | NA | 1.1 |
| Chloride (mg/l) | 452[1] | NA | 366[3] |
| Sulfide as H2S (mg/l) | 0.002 | NA | 0.00054 |
| Radium 226+228 (piC/L) | 5 | NA | 1.4 |
| Strontium 90 (piC/L) | 8 | NA | 2.3 |
| Thorium 230+232 | 60 | NA | 17 |

**[1]Downstream segment (COARLA05b) more restrictive, substituted that value**
**[2]Downstream segment (COARLA05b) has this parameter, not the immediate receiving stream**
**[3] ADBEL based on the Alternatives Analysis**

## XTO CO-0048062, Alamocito

Table A- 15j

**Final Potential Limitations for Alamocito Outfalls tributary to the South Fork of the Purgatoire (COARLA06a): 001A, 014A, 016A, 017A, 018A, 019A, 022A, 023A, 032A, 033A, 034A, 040A, 040G, 043G, 049A, 079H, 080H**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average[2] |
| As, TR (µg/l) Beginning 01/01/2022 | 0.028[1] | NA | 0.0042 |
| As, TR (µg/l) Until 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | NA | 471[2] | 71 |
| Be, TR (µg/l) | 100 | NA | NA |
| Cd, TR (µg/l) | 10 | NA | NA |
| Cd, PD (µg/l) | 0.66[2] | 2.8[2] | 0.1 |
| Cr+3, TR (µg/l) | 100 | 69[2] | 10 |
| Cr+3, PD (µg/l) | 116[2] | 897 | 18 |
| Cr+6, TR (µg/l) | 100 | NA | NA |
| Cr+6, Dis (µg/l) | 15[2] | 22[2] | 2.4 |
| Cu, TR (µg/l) | 200 | NA | NA |
| Cu, PD (µg/l) | 14[2] | 22[2] | 2.7 |
| Fe, TR (µg/l) | 1308[2] | NA | 366 |
| Pb, TR (µg/l) | 100 | NA | NA |
| Pb, PD (µg/l) | 4.1[2] | 107[2] | 0.75 |
| Mn, PD (µg/l) | 2395[2] | 4344[2] | 349 |
| Mo, TR (µg/l) | 160 | NA | 33 |
| Hg, Tot (µg/l) | 0.014[2] | NA | 0.0021 |
| Ni, TR (µg/l) | 200 | NA | NA |
| Ni, PD (µg/l) | 82[2] | 741[2] | 12 |
| Se, TR (µg/l) | 20 | NA | NA |
| Se, PD (µg/l) | 6.3[2] | 25[2] | 1.2 |
| Ag, PD (µg/l) | 0.14[2] | 3.7[2] | 0.021 |
| Zn, TR (µg/l) | 2000 | NA | NA |
| Zn, PD (µg/l) | 194[2] | 266[2] | 29 |
| B, Tot (mg/l) | 4 | NA | 0.83 |
| Chloride (mg/l) | 345[2] | NA | 287[3] |
| Sulfide as H2S (mg/l) | 0.002 | NA | 0.00042 |
| Radium 226+228 (piC/L) | 5 | NA | 1 |
| Strontium 90 (piC/L) | 8 | NA | 1.7 |
| Thorium 230+232 | 60 | NA | 12 |

**[1]Downstream segment (COARLA05b) more restrictive, substituted that value**
**[2]Downstream segment (COARLA05b) has this parameter, not the immediate receiving stream**
**[3] ADBEL based on the Alternatives Analysis**

Table A- 15k

**Final Potential Limitations for Alamocito Outfalls tributary to the Purgatoire (COARLA06a): 001G, 002G, 004G, 006G, 007G, 015G, 016G, 021G, 022G, 023G, 024G, 027G, 028G, 031G, 033G, 036G, 037G, 038G, 039G, 042G, 060A**

| Effluent Parameter | Effluent Limitations Maximum Concentrations | | |
|---|---|---|---|
| | 30-Day Average | Daily Maximum | 2-Year Average[2] |
| As, TR (µg/l) Beginning 01/01/2022 | 0.036[1] | NA | 0.0054 |
| As, TR (µg/l) Until 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | NA | 551[2] | 83 |
| Be, TR (µg/l) | 100 | NA | NA |
| Cd, TR (µg/l) | 10 | NA | NA |
| Cd, PD (µg/l) | 1.4[2] | 5.3[2] | 1.3 |
| Cr+3, TR (µg/l) | 100 | 81[2] | 12 |
| Cr+3, PD (µg/l) | 234 | 1075 | 38 |
| Cr+6, TR (µg/l) | 100 | NA | NA |
| Cr+6, Dis (µg/l) | 20[2] | 26[2] | 3.1 |
| Cu, TR (µg/l) | 200 | NA | NA |
| Cu, PD (µg/l) | 30[2] | 45[2] | 3.9 |
| Fe, TR (µg/l) | 1649[2] | NA | 495 |
| Pb, TR (µg/l) | 100 | NA | NA |
| Pb, PD (µg/l) | 10[2] | 240[2] | 1.5 |
| Mn, PD (µg/l) | 3847[2] | 6245[2] | 582 |
| Mo, TR (µg/l) | 160 | NA | 43 |
| Hg, Tot (µg/l) | 0.018[2] | NA | 0.0027 |
| Ni, TR (µg/l) | 200 | NA | NA |
| Ni, PD (µg/l) | 181[2] | 1461[2] | 27 |
| Se, TR (µg/l) | 20 | NA | NA |
| Se, PD (µg/l) | 8.2[2] | 30[2] | 1.4 |
| Ag, PD (µg/l) | 0.51[2] | 12[2] | 0.076 |
| Zn, TR (µg/l) | 2000 | NA | NA |
| Zn, PD (µg/l) | 444[2] | 546[2] | 82 |
| B, Tot (mg/l) | 4 | NA | 1.1 |
| Chloride (mg/l) | 452[2] | NA | 287[3] |
| Sulfide as H2S (mg/l) | 0.002 | NA | 0.00054 |
| Radium 226+228 (piC/L) | 5 | NA | 1.4 |
| Strontium 90 (piC/L) | 8 | NA | 2.3 |
| Thorium 230+232 | 60 | NA | 17 |

**[1]Downstream segment (COARLA05b) more restrictive, substituted that value**
**[2]Downstream segment (COARLA05b) has this parameter, not the immediate receiving stream**
**[3] ADBEL based on the Alternatives Analysis**

## New Elk Mine: CO-0000906

| Table A- 15l<br>**Final Potential Limitations for New Elk Mine Outfalls directly discharging the Middle Fork of the Purgatoire (COARLA05b):**<br>**001** | | | |
|---|---|---|---|
| **Effluent Parameter** | **Effluent Limitations Maximum Concentrations** | | |
| | **30-Day Average** | **Daily Maximum** | **2-Year Average** |
| pH (su) | 6.5-9 | | |
| As, TR (µg/l) Beginning 01/01/2022 | 0.032 | NA | 0.0048 |
| As, TR (µg/l) 12/31/2021 | 100 | NA | NA |
| As, PD (µg/l) | NA | 530 | 81 |
| Cd, PD (µg/l) | 0.86 | 3.5 | 0.13 |
| Cr+3, TR (µg/l) | NA | 79 | 12 |
| Cr+3, PD (µg/l) | 152 | NA | 22 |
| Cr+6, Dis (µg/l) | 17 | 25 | 2.7 |
| Cu, PD (µg/l) | 18 | 28 | 2.3 |
| Fe, TR (µg/l) | 1471 | NA | 391 |
| Pb, PD (µg/l) | 5.5 | 144 | 0.91 |
| Mn, PD (µg/l) | 2894 | 5251 | 456 |
| Mo, TR (µg/l) | 254 | NA | 38 |
| Hg, Tot (µg/l) | 0.016 | NA | 0.0024 |
| Ni, PD (µg/l) | 108 | 970 | 16 |
| Se, PD (µg/l) | 7.2 | 29 | 1.2 |
| Ag, PD (µg/l) | 0.21 | 5.6 | 0.032 |
| Zn, PD (µg/l) | 256 | 353 | 38 |
| B, Tot (mg/l) | 6.3 | NA | 0.96 |
| Chloride (mg/l) | 396 | NA | 60 |
| Sulfide as H2S (mg/l) | 0.0032 | NA | 0.00048 |

# VIII. Technology Based Limitations

## Federal Effluent Limitation Guidelines

The Federal Effluent Limitation Guidelines (ELGs) for domestic wastewater treatment facilities are the secondary treatment standards. These standards have been adopted into, and are applied out of, Regulation 62, the Regulations for Effluent Limitations.

*For the Coal Bed Methane Facilities (CO0048054, CO0048062, CO0048003, CO0047776, and CO0047767)*
Federal effluent limitations at 40 CFR Part 435, Subpart C (Onshore) & E (Agricultural and Wildlife Water Use Subcategory- west of the 98th meridian for which the produced water has a use in agriculture or wildlife propagation when discharged into navigable waters) explicitly apply to discharge of produced water associated with conventional oil and gas extraction, which does not include discharges of produced water associated with coal bed methane extraction. In September 2014 the EPA published the final *2012 Preliminary ELG Plan* that delisted and discontinued pursuing revisions to the Oil and Gas ELGs to regulated pollutant discharges from CBMs. While CBMs are not regulated under Part 435, the Division has applied the oil and gas extraction ELG to these CBM produced water discharges using the best professional judgment (BPJ) authority provided in the State and Federal Acts and associated regulations. The CBM produced water discharge authorized under this permit will be put to beneficial use for wildlife which are known to be present in the area and for agricultural purposes. Therefore the beneficial use provision of the ELG is implemented in this permit. The effluent limitation for oil and grease will not be implemented in this permit because BP J effluent limitations are superceeded by effluent limitation regulations promulgated by the Commission that are applicable to this discharge.

*For Coal Mining (CO0000906)*
Due to the complexity of the Federal ELG for coal mining, please see the fact sheet for CO0000906 for a full discussion regarding the application of federal effluent limitations and other technology based limitations.

## Pioneer/XTO Regulations for Effluent Limitations

Regulation No. 62, the Regulations for Effluent Limitations, includes effluent limitations that apply to all discharges of wastewater to State waters, with the exception of storm water and agricultural return flows. These regulations are applicable to the discharge from the proposed discharge.

Table A-16 contains a summary of the applicable limitations for pollutants of concern at this facility.

| Table A-16<br>Regulation 62 Based Limitations | | | |
|---|---|---|---|
| ***Parameter*** | ***30-Day Average*** | ***7-Day Average*** | ***Instantaneous Maximum*** |
| TSS | 30 mg/l | 45 mg/l | NA |
| pH | NA | NA | 6.0-9.0 s.u. |
| Oil and Grease | 10 mg/l | NA | NA |

**Nutrient Effluent Limitation Considerations**

WQCC Regulation No. 85, the new *Nutrients Management Control Regulation*, includes technology based effluent limitations for total inorganic nitrogen and total phosphorus that currently, or will in the future, apply to many domestic wastewater discharges to State surface waters.

Requirements in Reg. 85 also apply to non-domestic wastewater for industries in the Standard Industrial Class 'Major Group 20,' and any other non-domestic wastewater where the facility is expected, without treatment, to discharge total inorganic nitrogen or total phosphorus concentrations in excess of the numeric limits listed in 85.5 (1)(a)(iii). Considering that the facilities neither fall under Standard Industrial Class 'Major Group 20,' nor does the Division believe that the facilities will discharge total inorganic nitrogen or total phosphorous in concentrations that exceed the numeric limits listed in the regulation, nutrient effluent limitations will not be included in the final permitting action.

## IX. References

**Regulations:**

*The Basic Standards and Methodologies for Surface Water, Regulation 31*, Colorado Department Public Health and Environment, Water Quality Control Commission, effective January 31, 2013.

*Classifications and Numeric Standards for Arkansas River Basin, Regulation 32*, Colorado Department Public Health and Environment, Water Quality Control Commission, effective September 30, 2013.

*Regulations for Effluent Limitations, Regulation 62*, CDPHE, WQCC, July 30, 2012.

*Nutrients Management Control Regulation, Regulation 85*, Colorado Department Public Health and Environment, Water Quality Control Commission, effective September 30, 2012.

*Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List, Regulation 93*, Colorado Department Public Health and Environment, Water Quality Control Commission, effective March 30, 2012.

**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.

*Rationale for Classifications, Standards and Designations of Segments of the Arkansas River Basin,* Colorado Department Public Health and Environment, Water Quality Control Division, June 2013.

*Policy Concerning Escherichia coli versus Fecal Coliform*, CDPHE, WQCD, July 20, 2005.

*Colorado Mixing Zone Implementation Guidance*, Colorado Department Public Health and Environment, Water Quality Control Division, effective April 2002.

*Policy for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits*, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-23, effective July 3, 2008.

*Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops,* Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-24, effective March 10, 2008.

*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.

**Other:**

Bauder, T.A., Waskom, R.M., Sutherland, P.L., and Davis, J.G. "Irrigation Water Quality Criteria Fact Sheet No. 0.506." *Irrigation Water Quality Criteria*, Colorado State University Extension, October 2014. Web. 5 Feb. 2015.