1267444 - R8 SDMS

PRELIMINARY CLOSE-OUT REPORT
Summitville Mine Superfund Site
Rio Grande County, Colorado

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LIST OF ACRONYMS

AMD	Acid Mine Drainage
ARD	Acid Rock Drainage
ARAR	Applicable or Relevant and Appropriate Requirement
BMD	Beaver Mud Dump
BOR	United States Bureau of Reclamation
CCTP	Cleveland Cliffs Tailing Pond
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	Contaminants of Concern
CSU	Colorado State University
CWP	Cropsy Waste Pile
ESD	Explanation of Significant Differences
EPA	United States Environmental Protection Agency
FCOR	Final Close-Out Report
g/m^2	Grams per square meter
HLP	Heap Leach Pad
IAs	Interagency Agreements
ICs	Institutional Controls
LTRA	Long-Term Response Action
mg/L	Milligrams per liter
msl	Mean Sea Level
NCP	National Contingency Plan
NPL	National Priorities List
NWD	North Waste Dump
O&F	Operational and Functional
O&M	Operation and Maintenance
OM&M	Operation, Maintenance, and Monitoring
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PCOR	Preliminary Close-Out Report
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
ROD	Record of Decision
SCMCI	Summitville Consolidated Mining Company, Inc.
SDI	Summitville Dam Impoundment
SEO	Colorado State Engineer's Office

SMSS	Summitville Mine Superfund Site
TSS	Total Suspended Solids
WFD	Wightman Fork Diversion
WTP	Water Treatment Plant

1 INTRODUCTION

This document represents the Preliminary Close-Out Report (PCOR) for the Summitville Mine Superfund Site (SMSS or the Site). The contents of this PCOR are based on guidance in the U.S Environmental Protection Agency (EPA) directive: *Close-Out Procedures for National Priorities List Sites* (OSWER Directive 9320.2-22, May 2011).

The scope of this report includes a description of the emergency response actions and remedial response actions implemented at the SMSS for these operable units (OUs):

Plugging of the Reynolds and Chandler Adits (Emergency Response)

- OU0: Interim Water Treatment
- OU1: Heap Leach Pad Detoxification/Closure
- OU2: Mine Waste Excavation and Mine Pit Closure
- OU3: South Mountain Groundwater (incorporated into OU5)
- OU4: Site-Wide Reclamation
- OU5: Final Site-Wide Remedy (including the Wightman Fork Diversion reconstruction).

Interim Records of Decision (RODs) were issued for OU0, OU1, OU2 and OU4 in December 1994. An interim ROD was not issued for OU3, South Mountain Groundwater, but OU3 was included in the subsequent scope of work for OU5. The ROD for OU5, Final Site-Wide Remedy, was issued in September 2001. An Explanation of Significant Differences (ESD) to the OU5 ROD was issued in August 2003, which addressed a change in the location for the proposed water treatment plant (WTP). An additional ESD to the OU5 ROD is under development, which will document the postponement of the construction of a new repository for WTP sludge disposal and the reconstruction of the Wightman Fork Diversion (WFD) rundown structure. This future ESD, to the extent deemed necessary, also will incorporate additional Institutional Controls (ICs) at the Site.

From 1992 through the late 1990s, work at the Site was performed under Time-Critical Removal Actions under the direction of the EPA. Many of the remedial actions implemented at the Site through the early 2000s were overseen by the U.S. Bureau of Reclamation (BOR) through Interagency Agreements (IAs) between the two agencies. In 1996, the EPA began transferring the lead for OU4 and OU5 to the Colorado Department of Public Health and Environment (CDPHE). Since the transfer, the CDPHE and its contractors have constructed all the remedies for OU4 and OU5 in accordance with the 1994 and 2001 RODs, the 2003 ESD, the National Contingency Plan (NCP), and remedial design (RD) plans and specifications. Final inspections for remedial actions performed at the Site began in the late 1990s and were completed on July 11, 2013, with the final inspection of the Wightman Fork Diversion reconstruction project.

2 SUMMARY OF SITE CONDITIONS

The SMSS is located at an elevation of 11,500 feet above mean sea level (msl) on South Mountain in the San Juan Mountains in the southwest corner of Rio Grande County, Colorado (Figure 1). South Mountain has been the location of intermittent mining activities since the 1870s. This mining history left South Mountain with an extensive network of interconnected underground mine workings, many of which ultimately connected to the Reynolds Adit.

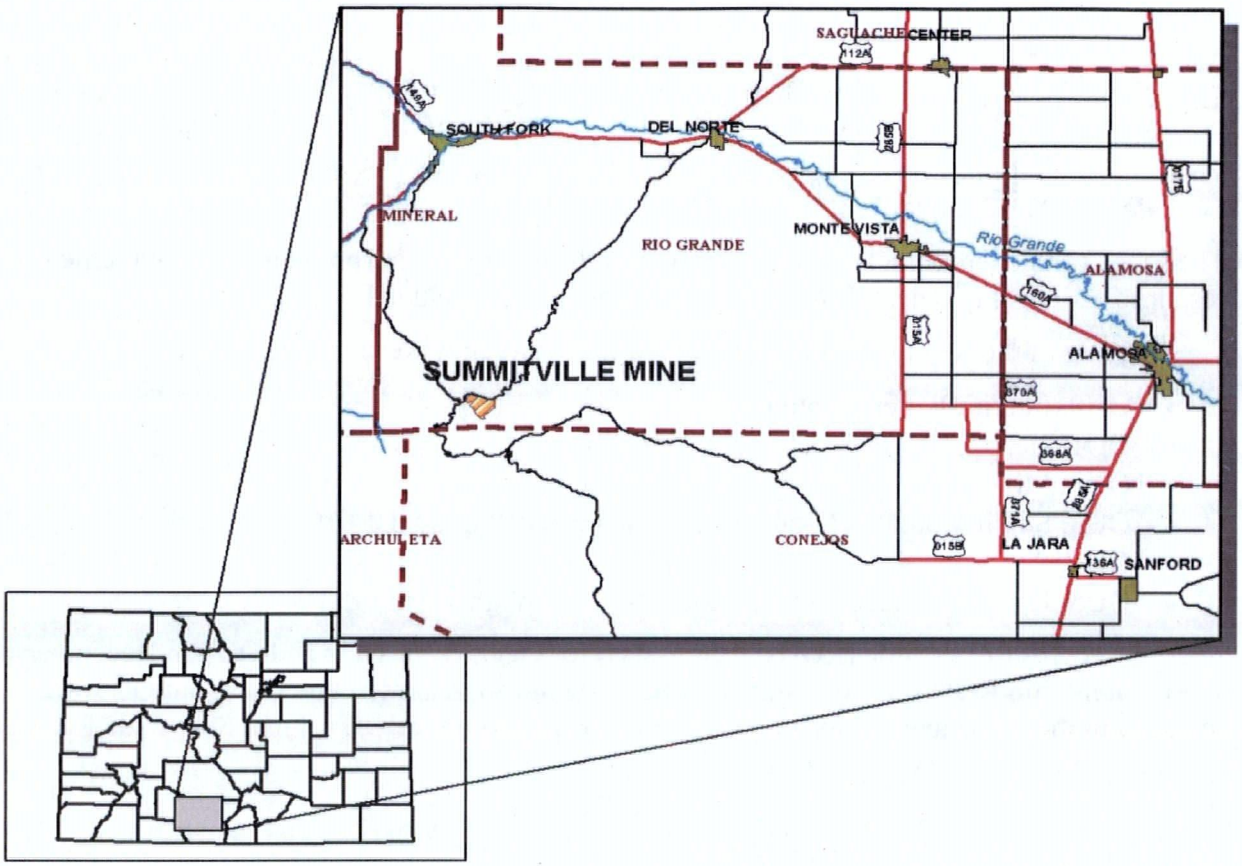

Figure 1. Summitville Mine Location

The most recent mining at the Site occurred between 1984 and 1992, when Summitville Consolidated Mining Company, Inc. (SCMCI) mined 10 million tons of low-grade ore from open pits, crushed the ore and placed it on a heap leach pad (HLP), and then extracted precious metals from the ore using a cyanide solution. Seepage of cyanide and metal-bearing fluids from the HLP, combined with acid mine drainage (AMD) from waste rock piles, AMD from the Reynolds Adit and other Site features, impacted the downstream waters in Wightman Fork and the Alamosa River throughout the period of SCMCI operations.

In December 1992, SCMCI declared bankruptcy and the State of Colorado requested and received emergency assistance from the federal government. The EPA took control of the Site in December 1992 and began to address the existing and threatened releases from the Site. The EPA proposed the SMSS to the National Priorities List (NPL) on May 10, 1993, and finalized the listing on May 31, 1994. The EPA ID number for the Site is COD983778432.

The sections that follow present information regarding the remedial and emergency response actions taken at the Site. The various site features are shown in Figure 2.

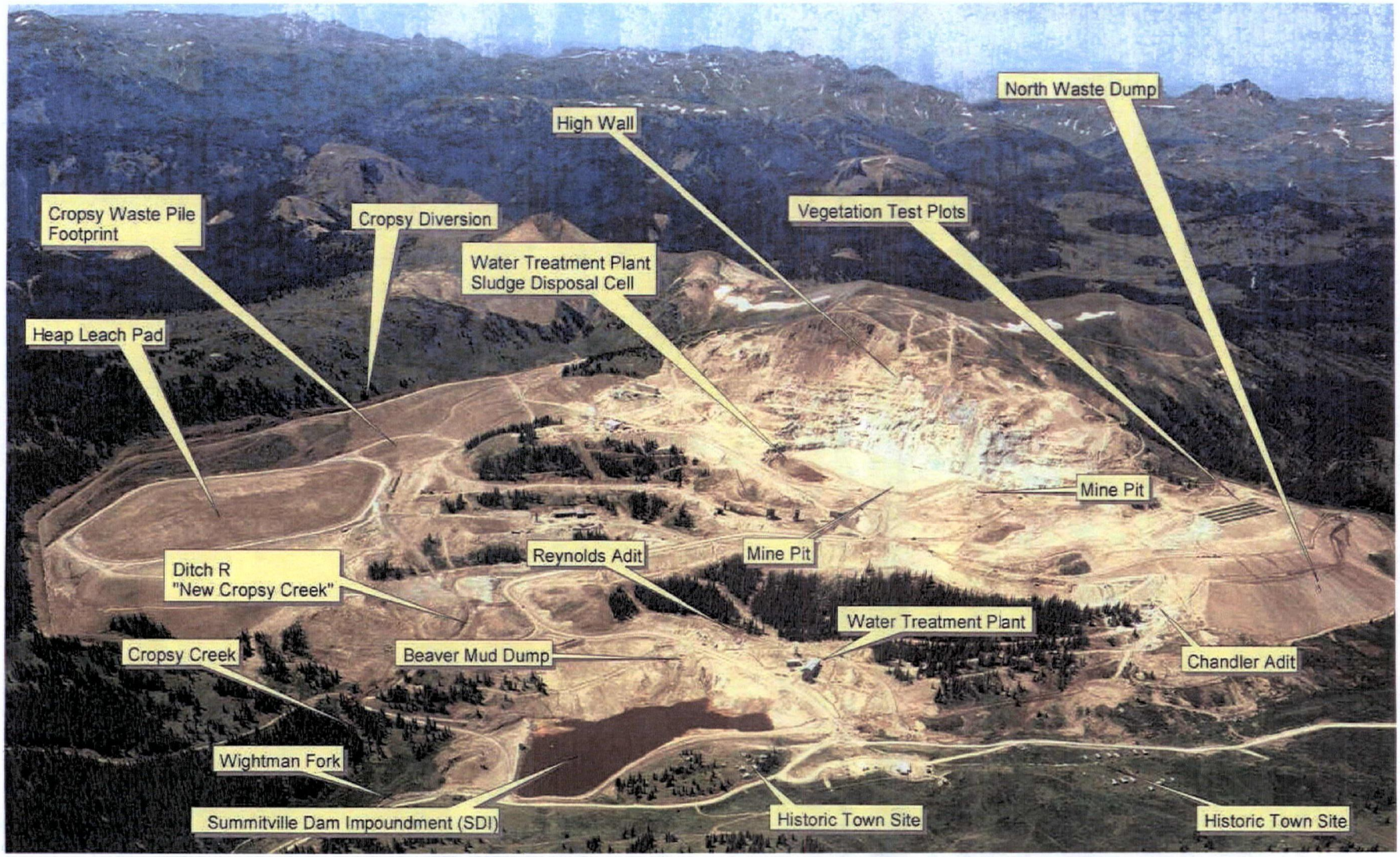

Figure 2. Summitville Mine Site Features

2.1 Reynolds and Chandler Adit Plugging

When the EPA took control of the Site in 1992, AMD discharging from the Reynolds Adit was estimated to account for 143,000 pounds (44.5 percent) of the annual Site copper load. The EPA undertook a number of emergency response activities including plugging the Reynolds Adit to decrease this point-source load. The Chandler Adit also was plugged, because projections indicated that the mine pool expected to form behind the Reynolds Adit bulkhead would inundate the underground mine workings to an elevation above the Chandler Adit.

The Reynolds and Chandler Adits were plugged by installing one bulkhead in each adit during 1993 and 1994. The initial bulkhead installed in the Chandler Adit failed in 1994, but was lengthened and additional grouting was placed in 1995. The initial design for the Reynolds Adit plugging called for the installation of two bulkheads; one at the existing location (approximately 1,265 feet inside the portal) and a second at approximately 625 inside the portal. Following completion of 1,265 foot bulkhead and based upon the low leakage around the bulkhead, the EPA decided to forgo the installation of the second bulkhead in the Reynolds Adit in 1994.

The Reynolds Adit was inspected annually through 2010 by physically entering the adit and inspecting the timber supports, ground conditions, and the conditions at the face of the bulkhead. Similarly, the Chandler Adit and bulkhead were inspected until a collapse at the portal during the winter of 2006/2007. Rehabilitation and further inspections of the Chandler Adit were later deemed unnecessary in the OU5 ROD.

The elevation of the mine pool formed by the plugging of the adits is monitored by pressure transducers and continuous data loggers installed on both bulkheads and in bedrock groundwater monitoring wells immediately adjacent to the mine workings. Samples of the mine water are generally obtained between March and October from the Reynolds Adit pipeline to provide data on the trends of the mine pool chemistry.

The 2001 OU5 ROD included Remedial Action (RA) components to improve the Reynolds Adit, with the objective to enhance the long-term protectiveness of the remedy. In July 2010, the CDPHE selected Deere and Ault Consultants, Inc. to design these improvements, which included strengthening the existing 1,265 foot bulkhead, enhancing the integrity of the Reynolds Adit pipeline, and securing the portal to prevent unauthorized entry. These designs were completed over the winter 2010-2011, and a contractor was selected to perform the construction. Reynolds Adit improvements were completed in November 2011. The CDPHE, the EPA, and contractors performed a final inspection of the Reynolds Adit rehabilitation and accepted it as complete on November 17, 2011, at which time the remedy became operational and functional.

Long-term releases of mine pool water from the Reynolds Adit pipeline were initiated in June 2012 and continue today. The goal of these releases is to keep the mine pool drained and to evaluate the impact on groundwater and Summitville Dam Impoundment (SDI) water levels, groundwater seepage, and ultimately, to evaluate potential improvements of water quality at the SMSS point of compliance, Wightman Fork Station WF5.5.

2.2 Interim Water Treatment (OU0)

The EPA initiated interim water treatment at the Site on an emergency basis after SCMCI declared bankruptcy and abandoned the Site. On December 18, 1992, the EPA issued an Action Memorandum documenting the need for water treatment and source controls as a time-critical response action. The Water Treatment Interim ROD was issued on December 15, 1994.

The major components of the selected interim remedy for OU0 included:

- Continued treatment of the Cropsy Waste Pile (CWP) drainage and the French Drain waters in the Cropsy Water Treatment Plant;
- Continued reduction of cyanide in the water from the heap leach pad in the Cyanide Destruction Plant and Metals Removal Plant until the water quality achieved remedial action objectives (RAOs);
- Completion of HLP remediation, followed by the conversion of the Cyanide Destruction Plant to treat AMD. The Metals Removal Plant would be closed and would remain on-site as a contingency facility; and
- Containment of AMD in the area of the SDI/Beaver Mud Dump (BMD) during peak surface water flows that exceed the Cyanide Destruction Plant capacity (500 gallons per minute). The contained water would be treated before being released into Wightman Fork.

The Remedial Action Objectives (RAOs) for OU0 were:

- Compatibility with site-wide RAOs;
- Reduction of contaminated water impacts to the aquatic receptors in Wightman Fork, the Alamosa River, and Terrace Reservoir during interim remedial activities;
- Flexibility in treatment of varied volumes and chemical makeup of water requiring treatment;
- Minimization of water treatment costs;
- Minimization of treatment waste products and waste disposal requirements; and
- Realization of practical resource recovery to lower overall treatment and Site remediation costs.

Consolidation of water treatment into a single facility constructed from donated and surplus equipment was completed in 1995 along with the construction of the SDI (OU2) to serve as the contaminated water storage reservoir.

2.3 Heap Leach Pad Detoxification/Closure (OU1)

Heap leach pad (HLP) operations conducted by SCMCI utilized a sodium cyanide solution to leach gold and silver from crushed ore, followed by the adsorption of metals from the cyanide solution onto columns. Treatment of the cyanide solution contained in the HLP was initiated at the SMSS on an emergency basis after SCMCI declared bankruptcy and abandoned the Site with fluid levels in the HLP threatening to overtop the embankments. As part of the emergency response, detoxification of cyanide in the HLP was accomplished by a rinsing program in 1994 through 1995. The Heap Leach Pad Interim ROD was issued December 15, 1994. The major components of the selected interim remedy for OU1 included:

- Development and implementation of a HLP solution collection system consisting of injection/extraction wells installed in the HLP;
- Pumping and treating of the contaminated leachate;
- Short term biotreatment of waters, in-situ biotreatment of ore and leachate using cyanide-destroying bacteria;
- Grading, recontouring, capping and revegetating the HLP to reduce the volume of water to be treated;
- Installation of a lined surge pond and a bioreactor using sulfate-reducing bacteria to treat acid waters generated after the HLP is remediated; and

- Periodic monitoring of groundwater for cyanide and/or metal concentrations.

The interim RAOs and goals for OU1 were:

- To eliminate or minimize HLP impacts to aquatic receptors in Wightman Fork, the Alamosa River, and Terrace Reservoir;
- To eliminate or minimize the need for continued water treatment at the HLP;
- To reduce or control HLP drainage so that the Alamosa River will continue to be usable for agriculture in the San Luis Valley;
- To reduce or control HLP drainage so that human health will continue to be protected from HLP releases; and
- To implement interim remedial action at the HLP in an accelerated manner, preferably within two years of signing the interim ROD.

Following completion of the rinsing program (Phase I), the EPA decided to forgo the biological treatment of the ore and water, the installation of the lined surge pond, and bioreactor (ESD, EPA June 4, 1997). Therefore, upon completion of the Phase I remediation, the BOR oversaw the grading and capping of the HLP during the 1997 through 1998 construction season (Phase II); however, between the completion of the rinsing program and the completion of the cap (Fall 1998), the HLP refilled with rainwater and snowmelt.

As part of OU5, approximately 13.3 million gallons of water were pumped from the HLP and piped to the SDI in 2000, which resulted in a lowering of the HLP water level by approximately 10 feet. An estimated 80 million gallons of water containing an estimated 900 pounds each of cyanide and copper currently remain in the HLP. The OU1 remedy currently protects human health and the environment, since the HLP water level has been static since 2001 at an elevation of approximately 11,518 ft-msl. As part of the Operations and Maintenance (O&M) for the Site, the CDPHE will continue to monitor the water level elevation in the HLP.

The OU1 remedial actions were largely complete in the fall of 1998; however, replacement inclinometers to monitor potential slope movement of HLP Dike No. 1 were installed during the summer of 2000, marking the completion of OU1 remedial actions.

On June 16, 1999 a final inspection was conducted at the Site on Phase II of the heap leach pad Remedial Action. The CDPHE, the BOR, and the EPA were represented at the final inspection. The remedial action report was signed by the EPA on September 28, 2001.

2.4 Mine Waste Excavation and Pit Closure (OU2)

The Cropsy Waste Pile (CWP), Beaver Mud Dump (BMD)/Summitville Dam Impoundment (SDI) and Mine Pits Interim ROD was issued on December 15, 1994. The major components of the selected interim remedy for OU2 included:

- Excavation of the CWP at an elevation of 11,620 feet;
- Excavation of the BMP and SDI;
- Line the Bottom of the Mine Pits with a layer of pH neutralizing material; and
- Placement and capping of excavated material in the Mine Pits.

Separate interim RAOs were developed for the various features included in OU2. The interim RAOs for the CWP were:

- Reduce and/or eliminate acid rock drainage (ARD) and metals released from the CWP Drainage;

- Ensure compatibility with the site-wide remedy;
- Remove, reduce, stabilize and/or contain significant manmade sources of ARD to prevent further release;
- Divert water from flowing into the HLP, thereby reducing treatment costs;
- Separate or eliminate the CWP drainage impact, including volume and quality of water, on structural integrity of the valley drainage system (e.g., dikes, waters diverting from outside the French Drain underneath the HLP); and
- Implement pre-/post-monitoring programs at the CWP and at subsequent compliance points.

Remedial actions, including placement of a 12-inch subsoil in the CWP footprint, were continued through 1998 when revegetation was completed. During the 2000 construction season additional work was performed under OU4 to minimize ponding of surface water in the Cropsy Basin.

The interim RAOs for BMD and SDI were:

- Ensure compatibility with the Site-wide remedy;
- Remove, reduce, stabilize and/or contain significant manmade sources of ARD to prevent further release at or from the Site;
- Implement pre-/post-monitoring programs at the BMD, SDI and at subsequent compliance points; and
- Reduce and/or eliminate ARD and metals released from the BMD and SDI area.

Mine waste material from the BMD and SDI (then known as the Cleveland Cliffs Tailing Pond, or CCTP) was largely excavated and placed in the mine pits during the 1994 and 1995 construction seasons. Minor excavations and remedial actions were performed at the BMD through the end of the 2000 construction season.

In addition to removing solids from the CCTP, the BOR performed work on the downstream embankment of the SDI and the adjacent Wightman Fork bypass. Work on the SDI embankment included the installation of outlet works, construction of a spillway apron in the upper portion of the spillway channel, installation of a gravel drain, buttressing of the downstream face, and armoring of the upstream face. The capacity of the Wightman Fork bypass was increased to handle a 10-year design storm event. Once completed in 1996, the approximately 90 million gallon SDI became the contaminated water storage reservoir for the Site. As further discussed in Section 2.7, the elevation of the SDI emergency spillway was raised three feet during the 2010-2011 construction seasons to increase the SDI capacity approximately 13.7 million gallons (42 acre-feet) to a total of 103.7 million gallons (318 acre-feet). The increase in storage capacity allows the CDPHE more flexibility in managing surface water and minimizes the volume of contaminated water from being turned offsite.

The interim RAOs for Mine Pits were:

- Ensure compatibility with the Site-wide remedy;
- Remove, reduce, stabilize and/or contain significant manmade sources of ARD to prevent further releases at or from the Site;
- Implement pre-/post-monitoring programs at the Mine Pits and at subsequent compliance points; and
- Reduce drainage into the Mine Pits and the consequent AMD loading at the Reynolds Adit.

The initial mine pit closure began in October 1993 through a time-critical removal action with the construction of liners, placement of kiln dust, and placement of waste rock from the CWP. Backfilling of the Mine Pits with mine waste from the CWP, BMD, and the former CCTP continued through 1994 and 1995. The final cap of the Mine Pits was completed in December 1995. Additional materials, including demolition debris, continued to be placed in the South Pit and capped through the end of the Site-Wide Reclamation Project (OU4) in 2002.

2.5 South Mountain Groundwater (OU3)

This non-time critical removal action consisted of characterizing the hydrogeology of South Mountain. The OU3 response activities were incorporated into the Site-wide Remedial Investigation/Feasibility Study in the late 1990s, and groundwater is being addressed as part of OU5 (Section 2.7).

2.6 Site-Wide Reclamation (OU4)

The Site-Wide Reclamation Interim ROD was issued December 1994. The major components of the selected interim remedy for OU4 included:

- Reclamation of approximately 300 acres of disturbed land;
- Rough grading of all areas to be reclaimed to a 33 percent or less grade;
- Using on-site topsoil that was previously stockpiled and stored;
- Adding an optimum amount of amendments needed to produce a topsoil capable of promoting and sustaining plant growth;
- Reconfiguring the areas for slope stabilization, soil erosion and moisture retention;
- Seeding with a seed mixture designed for the diversity of habitat found at the Site; and
- Providing adequate weather protection for the severe Site conditions.

The interim RAOs for the Site-Wide Reclamation were:

- Ensure compatibility with the Site-wide remedy;
- Remove, reduce, stabilize and/or contain non-point sources of ARD to prevent further releases at or from the Site;
- Eliminate or minimize non-point source impacts to aquatic receptors in Wightman Fork, the Alamosa River, and Terrace Reservoir;
- Eliminate or minimize potential water treatment for non-point source contaminated waters; and
- Enhance and/or improve on-site biota habitat.

The scope of OU4 included the reclamation and revegetation of areas not addressed in other OUs. Specifically, these were: the North Waste Dump, roads, the water treatment plant (WTP) site, and other scattered non-point source areas throughout the Site. Numerous mine infrastructure elements were also removed under OU4.

OU4 was implemented in multiple phases over several years, with major earthwork and revegetation beginning in 2000 and continuing through 2001. The BOR oversaw much of the OU4 work, initially under the direction of the EPA, but also later under the CDPHE. Currently, rangeland ecologists from Colorado State University have performed field surveys twice every five years to evaluate the performance of OU4 revegetation efforts and other remedial actions. The rangeland ecologists have documented continual improvements in Site-wide vegetation cover; however, areas of bare ground are present where localized erosion is occurring suggesting that O&M improvements may be needed in limited areas.

2.7 Final Site-Wide Remedy (OU5)

The Final Site-Wide Remedy OU5 ROD was issued on September 28, 2001, and addressed the threats to the environment that remained at the Site after completion of emergency response and interim remedial actions. The affected media and contaminants of concern (COCs) documented in the OU5 ROD are summarized in Table 1.

Table 1. Summary of OU5 Affected Media and Contaminants of Concern at the SMSS

Media Affected	Contaminants of Concern	Contamination Source
Surface water, groundwater, stream sediment	Aluminum, copper, cyanide, iron, manganese, pH, and zinc	Mining and mineral processing

The Final Site-Wide Remedy contains several new components or proposed modifications to previously constructed features. Most of these features provide the CDPHE more flexibility in managing runoff and contaminants at the Site. The major components of the Final Site-Wide Remedy include:

- Improvements to the on-Site contaminated water impoundment (i.e., SDI) upstream of the Wightman Fork/Cropsy Creek confluence;
- Construction of a new WTP downstream of the contaminated water impoundment;[1]
- Possible breach and removal of the existing SDI;
- Construction of a sludge disposal repository;
- Upgrade of Wightman Fork Diversion;
- Upgrade of select Site ditches;
- Construction of groundwater interceptor drains;
- Construction of a high wall ditch;
- Rehabilitation of Reynolds Adit;
- Management of mine pool water;
- Continued Site maintenance, and groundwater/surface water and on-site geotechnical monitoring; and
- Surface water, sediment, and aquatic life monitoring in the Alamosa River and Terrace Reservoir.

Several of these components were constructed using residual OU4 funding and were accomplished in the later phases of the OU4 construction. Collectively these elements were incorporated into the Water Management Structures and Improvement Project. These included:

- Upgrade of select Site ditches;
- Construction of groundwater interceptor drains;
- Construction of a high wall ditch; and
- Miscellaneous revegetation projects.

[1] The CDPHE and the EPA modified the location of the new WTP from a location downstream of the SDI (as specified in the ROD) to a location adjacent to the former interim WTP based on a variety of economic and efficiency factors. These changes were documented in the August 8, 2003, ESD to the OU5 ROD and are discussed in the Remedial Design Fact Sheet for the Summitville Mine Superfund Site (CDPHE and U.S. EPA, 2004).

The CDPHE contractor, Knight Piésold and Company, provided design and construction oversight services of these items. Remedial actions were largely completed by late 2003, and a final construction report was prepared by Knight Piésold in March 2004. The final inspection for the Water Management Structures and Improvement Project was performed by the EPA, CDPHE, and contractors on June 23, 2004 (Knight Piésold, 2004).

The RAOs of the Final Site-Wide Remedy addressed migration, exposure pathways and potential receptors of contamination from the Site. The RAOs for the Final Site-Wide Remedy were:

- Control and treat surface water, groundwater and leachate, as necessary, to meet State and Federal applicable or relevant and appropriate requirements (ARARs);
- Re-establish State aquatic use classifications and attainment of water quality numeric criteria in Segment 3c for the Alamosa River and downstream;
- Ensure geotechnical stability of constructed earthen structures and slopes;
- Mitigate erosion and transport of sediment into Wightman Fork and Cropsy Creek; and
- Control airborne contaminants from the Site.

2.7.1 Summitville Dam Impoundment Seepage Capture System

The SDI seepage capture system was originally included as part of the WFD channel and SDI improvements project. The purpose of the system was to capture non-point source metals loading to Wightman Fork upstream of its confluence with Cropsy Creek as a result of seepage through the SDI embankment. Preliminary investigations indicated that the bedrock elevation conditions near the proposed SDI seep capture system were different than anticipated, therefore requiring re-design and more remedial action than envisioned when funding for the project was secured. Consequently, design and construction of the SDI seepage capture system were postponed. Construction of the re-designed SDI seepage capture system began on May 30, 2012, and was substantially complete on August 23, 2012. The CDPHE, the EPA, and CDPHE contractors conducted a final inspection of the SDI seepage capture system on September 21, 2012, at which time this component of the Final Site-Wide Remedy became operational and functional.

2.7.2 New Water Treatment Plant

The OU5 ROD called for the construction of a new single-stage WTP. Construction of the new WTP was initiated in September 2009, substantially completed in November 2011, and commissioned in March 2012. The CDPHE and the EPA performed a joint and final inspection of the WTP on August 23, 2011, and a warranty inspection on May 23, 2012, following the completion of the construction warranty period. The CDPHE, the EPA, and contractors conducted an additional final inspection of the WTP on November 22, 2012, with approval of occupancy on December 13, 2012. The Remedial Action Completion report for the new water treatment facility was completed by Golder Associates, Inc. in June 2012 and was signed by the EPA on September 27, 2012. The EPA notified CDPHE on October 19, 2011, that based on the August 23, 2011, joint and final inspection and the Notice of Partial Substantial Completion Report, dated September 30, 2011, the WTP was functioning and performing as designed and that the September 30, 2011, date established the beginning of the Long-Term Remedial Action (LTRA) period for the OU5 WTP facilities.

2.7.3 Summitville Dam Impoundment

The SDI serves as the storage structure for acid mine drainage-impacted water at the Site. Historically, the storage capacity of the SDI had been insufficient to hold all of the water

generated on-site during the spring snowmelt. Consequently, controlled releases of Site runoff were made via the ditch turnouts during the spring snowmelt to prevent releases through the SDI emergency spillway. Raising the SDI spillway elevation by three feet during the summer of 2010 increased the storage capacity of the reservoir an estimated 16 percent from approximately 260 acre-feet to 318 acre-feet[2]. The increased storage capacity allows the CDPHE more flexibility in managing surface water and minimizes the mass of copper and other metals being turned offsite. With these improvements, breaching or removal of the SDI is no longer considered necessary. The CDPHE, the EPA, the Colorado State Engineer's Office (SEO) and CDPHE contractors performed a final inspection of the SDI emergency spillway on July 20, 2011. The remedy received SEO Final Acceptance on August 15, 2011, and CDPHE final acceptance on October 5, 2011.

2.7.4 Summitville Dam Impoundment Spillway Channel Improvements and Plunge Pool

Historically, the SDI emergency spillway channel would not convey flow from the SDI spillway to Wightman Fork. The existing spillway channel terminated at U.S. Forest Service Road 244 prior to reaching Wightman Fork and would have resulted in uncontrolled flow if water had been released via the SDI spillway. Construction of a trapezoidal channel began in 2008 to extend the spillway channel to Wightman Fork. Additionally, a plunge pool was constructed to dissipate the energy from the combined flow from the SDI emergency spillway and the Wightman Fork Diversion Channel. Construction of the SDI spillway and plunge pool was completed by September 2011. The CDPHE, the EPA and CDPHE contractors performed a final inspection of the SDI spillway channel improvements and plunge pool on September 30, 2011.

2.7.5 Wightman Fork Diversion Channel Improvements

The Wightman Fork Diversion (WFD) Channel Improvements project included the upgrade of the WFD to safely convey flows generated by the 100-year rainfall event. Components of the project included modifications/improvements to the upstream channel crossing (Site entrance), main channel and levee (including overflow spillways), downstream channel crossing (U.S. Forest Service Road 244), and the WFD rundown structure channel and plunge pool. Modifications/improvements included channel widening, rip-rap armoring, levee raising, construction of sheet-pile weirs, installation of arch pipe culverts set on concrete and channel stabilization. The WFD headwall and rundown structure was constructed at the end of the 2008 construction season. The WFD rundown structure channel hydraulics were re-evaluated following the 2009 snowmelt run-off and were considered a critical construction element that warranted additional improvements. These improvements were approved and completed in September 2009. The CDPHE, the EPA, and contractors performed a final inspection of the improvements and accepted them as complete on September 30, 2009.

Between 2009 and 2012, CDPHE noted additional issues with the performance of the Wightman Fork rundown structure channel from the arch culvert discharge to the plunge pool. In July 2012, a technical team consisting of the EPA, BOR and CDPHE determined that the original design for the culvert discharge channel was inadequate to contain high flows within Wightman Fork. As a result, a significant storm would likely result in severe erosion, riprap removal from the rundown structure channel, and erosion of the underlying soil, with the potential to compromise the

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[2] Based on SDI survey performed by TOTL Surveys, Inc. in September 2012.

culvert headwall and integrity of the SDI. Additionally, the northern berm of the rundown structure likely would be washed away, cutting a new channel in the direction of the power house and potentially threatening that structure.

The EPA, with CDPHE concurrence, decided to reconstruct the rundown structure channel under removal action authority (U.S. EPA, September 25, 2012). The EPA mobilized to the Site and began reconstruction of the channel on August 6, 2012. Because the re-design of the WFD rundown channel necessitated the relocation of the plunge pool downstream of its existing location, the lower portion of the spillway channel also had to be reconstructed. The removal action was substantially complete at the end of the 2012 construction season, and final construction was completed on July 11, 2013.

2.7.6 Penstock and Power House

The EPA and CDPHE funded design and construction of a penstock to direct flows from Wightman Fork, upstream of the arch culverts installed at the downstream channel crossing, to power a micro-hydroelectric turbine located near the base of the SDI. The micro-hydroelectric turbine provides supplemental power for the WTP and was constructed in two phases. Phase I was funded by the CDPHE and included the construction of a Coanda vault, 16-inch penstock pipeline, and power house foundation. Phase II was funded by the EPA and included design, fabrication, installation, and construction of the turbine powerhouse structure, micro-hydroelectric turbine, electrical infrastructure, and associated equipment. Phase I construction began in June 2008 and was completed in September 2009. Phase II construction began in August 2010 and was completed in May 2012. The CDPHE, the EPA, and contractors conducted a final inspection of the micro-hydroelectric facility on July 27, 2012.

2.7.7 Sludge Disposal Repository

The existing disposal repository for sludge generated by the WTP was constructed on the South Mine Pit (South Pit) in 1995. The South Pit disposal area has a footprint of approximately two acres. The OU5 ROD included the construction of an engineered sludge disposal repository on the North Pit with storage capacity of up to one million cubic yards. As described in Section 2.4, the BOR constructed the North Pit with a liner, kiln dust, and a clay cap in December 1995. According to the OU5 ROD, the North Pit clay cap will be re-compacted to form a clay liner for additional sludge disposal cells. The OU5 ROD provides for sizing the cells for five years of sludge storage capacity and adding more cells as more storage is needed.

Currently, sludge is being disposed in the South Pit. According to a BOR and EPA inspection on June 25, 2013, the remaining South Pit storage capacity could last as long as 15 years, at the current rate of sludge generation. Given the extended period of time the South Pit repository is anticipated to function for sludge disposal, the EPA and CDPHE are developing an ESD to the OU5 ROD documenting the decision to postpone the construction of the North Pit sludge disposal repository.

2.7.8 Mine Pool Management

The OU5 ROD called for maintaining the mine pool at a maximum elevation below the level of the Chandler Adit. The objective of managing the mine pool is to reduce the generation of AMD by: (1) eliminating the fluctuation of the mine pool level thereby minimizing the contact of the mine pool and adjacent groundwater with the oxidized ore zone and wastes disposed in the Mine Pits, (2) reducing the hydraulic gradient thereby decreasing the discharge from seeps and springs, particularly in the Chandler Bowl area, decreasing the

underflow to Wightman Fork, and (3) eliminating the seasonal discharge from unplugged adits above the elevation of the Chandler Adit (e.g., Ida Adit, Dexter Adit).

Long-term releases from the Reynolds Adit pipeline were initiated in June 2012 and continue today. The goal of these releases is to keep the mine pool drained to evaluate the impact on groundwater, groundwater seepage, SDI water levels and, ultimately, to evaluate potential improvements on water quality at the SMSS point of compliance (Wightman Fork Station WF5.5). Depending on these impacts, mine pool management may require continuous releases from the Reynolds Adit pipeline to minimize the mine pool hydraulic gradient. The current water balance study was completed in March 2013 and will be revised based on WTP performance to help the CDPHE and the EPA better manage surface water and the mine pool.

2.7.9 Adit Rehabilitation

As described in Section 2.1, the Reynolds Adit rehabilitation was completed in November 2011, and the Chandler Adit remains inaccessible due to a collapse at the portal. The Chandler Adit rehabilitation was determined to be unnecessary by the final OU5 ROD. The CDPHE, the EPA, and CDPHE contractors performed a final inspection of the Reynolds Adit rehabilitation and accepted it as complete on November 17, 2011, at which time this component of the Final Site-Wide Remedy became operational and functional.

2.7.10 Other Structures

The Ditch R Diversion and new A3 Ditch Turnout were constructed to help the CDPHE better manage surface water at the Site. The Ditch R Diversion was constructed to divert contaminated water originating in the Cropsy Basin and from AMD-producing rock in the Campbell Quarry towards the SDI, limiting contaminated water inflow to Cropsy Creek/Wightman Fork. Similarly, the new A3 Ditch Turnout was constructed to route clean water from the North Waste Dump off-site prior to contacting contaminated water sources and to minimize clean water directed towards the SDI. Construction of the Ditch R Diversion was completed in September 2011. Construction of the new A3 Ditch Turnout was completed in August 2012. The CDPHE, the EPA, and CDPHE contractors performed a final inspection of the A3 Ditch Turnout structure on September 21, 2012, at which time this portion of the Final Site-Wide Remedy became operational and functional.

2.8 Institutional Controls

Institutional controls (ICs) are non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy (U.S. EPA, 2011). These measures help reduce exposure to contamination by limiting land or resource use and guiding human behavior at a site.

There are a number of administrative controls in effect within the Summitville Mine Superfund Site boundary, as well as outside of the mine boundary (i.e., Terrace Reservoir). The CDPHE and on-site contractors are responsible for limiting access to the Site, and human consumption of untreated surface and groundwater at the Site is not permitted. In addition to the administrative controls, engineering controls, such as signs, gates, and lockable doors are present at the Reynolds Adit portal and the water treatment facility to prevent unauthorized entry. Additional signage is in place to warn entrants of confined spaces and to notify the public of the presence of contaminants and to restrict access to the Site.

With respect to legal controls, an Environmental Covenant (EC) was granted to the CDPHE by the Aztec Minerals Corporation, Gray Eagle Mining Corporation, and the South Mountain Minerals Corporation (known collectively as the "Aztec Group") on April 8, 2002, (CDPHE, 2002). The EC contains Environmental Use Restrictions that prohibit the following land uses and activities at the Site:

- Construction of any building, structure, facility or fixture;
- Any disturbance of the ground surface, including any contouring, grading, drilling, excavation, digging, mining or re-mining;
- Any action that impairs or interferes with the growth of vegetation in the re-vegetated areas;
- Any action or use that interferes with the operation or maintenance of any building, structure or facility that is necessary for implementation of the remedial action, including, without limitation: water treatment plants, retaining ponds, adits, dams, roads, ditches, pipelines, utility corridors, and solid waste disposal facilities; and
- Any other uses or activities that would in any manner interfere with or adversely affect the implementation, integrity, or protectiveness of the remedial measures to be performed at the Site.

The OU5 ROD was signed on September 28, 2001, and did not include a requirement for ICs at the Site. The State of Colorado passed a revision to its EC law, which became effective on July 1, 2001, but was not identified as an Applicable or Relevant and Appropriate Requirement (ARAR) in the OU5 ROD. Since the OU5 ROD did not include a requirement for ICs, and the Aztec Group EC was granted after the date of the ROD, to the extent deemed necessary to protect the remedy, the EPA and CDPHE will incorporate such requirements into an ESD to the OU5 ROD for the Site.

3 DEMONSTRATION OF QUALITY ASSURANCE/QUALITY CONTROL

The emergency response actions, interim remedial response actions, and remedial actions for the SMSS all have been conducted in accord with the EPA and the CDPHE quality assurance and quality control guidance and requirements. The CDPHE employed independent construction oversight engineers during all phases of construction activities and documented all variances from design specifications and plans, as well as modifications or other corrective measures taken to address such variances. The WFD rundown channel re-design and reconstruction represent the single significant deviation from the planned remedial response actions at the Site. Additional details are documented in the individual project completion reports and construction oversight reports.

4 SCHEDULE OF ACTIVITIES FOR SITE COMPLETION

The following activities summarized in Table 2 remain to be completed at the Site in order to:

- Assure effectiveness of the remedy;
- Assure consistency with the NCP; and
- Satisfy the requirements for Site completion.

Table 2. Summary of Schedule of Activities for Site Completion

Activity	Lead	Est. Date of Completion
Develop and issue ESD	CDPHE and EPA	March 31, 2014
IC Implementation, if needed, based on ESD	CDPHE and EPA	March 31, 2015
Five-Year Review	CDPHE and EPA	September 30, 2015
Operation and Maintenance of Site and WTP	CDPHE	September 30, 2025
Final Close-Out Report	EPA	September 30, 2025
Site Deletion	EPA	September 30, 2026

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