REMEDIATION SYSTEM EVALUATION

SUMMITVILLE MINE SUPERFUND SITE
SUMMITVILLE, COLORADO

Report of the Remediation System Evaluation,
Site Visit Conducted at the Summitville Mine Superfund Site
June 12-13, 2002

US Army
Corps of Engineers

US Environmental
Protection Agency

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Office of Solid Waste
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Remediation System Evaluation
Summitville Mine Superfund Site
Summitville, Colorado

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NOTICE

EXECUTIVE SUMMARY

A Remediation System Evaluation (RSE) involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for up to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

- improvements in remedy effectiveness
- reductions in operation and maintenance costs
- technical improvements
- gaining site closeout

The recommendations are intended to help the site team identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, is required prior to implementation of the recommendation.

This report documents a RSE of the Summitville Mine Superfund Site. The site visit was conducted on June 12-13, 2002. This report therefore describes the status of the site as of that date. Modifications or adjustments to operation at the site , in response to or independent of the RSE, have likely occurred since the site visit.

The Summitville Mine Superfund Site is located in the southeastern portion of the San Juan Mountains, in Rio Grande County, approximately 60 miles west of Alamosa, Colorado and 10 to 15 miles south of Del Norte, Colorado. The site is defined as the permitted 1,231-acre mine site and is located adjacent to the former town of Summitville at an elevation of approximately 11,200 feet. The site addresses impacts due to acid mine drainage that results from mining activities conducted onsite between 1870 and 1992 by a number of parties.

EPA took over the site from the responsible party in 1992, and by 1994 the site was added to the National Priorities List. Interim remedial activities— including excavation, reclamation work, and treatment of impacted water— have taken place at the site since EPA's involvement. A Record of Decision was issued in 2001 for a final remedy that includes design and construction of a new water treatment plant, upgrades to site wide diversions and drainage ditches, and other items for reducing the load of acid mine drainage reaching downgradient surface water.

This RSE provides input to the site managers regarding both the interim remedy and aspects of the final remedy. In general, the RSE team found an extremely well-operated treatment plant and site-wide remedy. The site team has a good conceptual model of the site and have proven that they can prioritize remediation activities effectively. Internal optimization efforts have already lead to increasing the plant capacity from 500 gpm to 1,000 gpm, and the site team provided a number of recommendations that the RSE team has included in Section 6.0 of this report. The site managers and O&M contractor are to be commended for accomplishing several interim remedy goals, including addressing onsite waste areas and reducing contaminant loading to the watershed, in a relatively short period of time.

The RSE team made the following recommendations with respect to the effectiveness of the remedy.

- The RSE team recommends that site managers place particular emphasis on draining the mine pool. Elevated water in the mine pool may increase the hydraulic potential available for pushing impacted water through the bedrock and eventually uncaptured to surface water. Draining the mine pool to the proposed levels may reduce this hydraulic potential. Draining the mine pool should commence immediately with the hope of significant progress to be made by the end of the 2002 operating season.

- The RSE team offers the following considerations for the planned 2002 sediment removal from the impoundment.

    < First, any excavation done this year should be useful for the final remedy impoundment. Investing in modifications that do not provide additional storage volume and further reduces the already limited capacity of the sludge disposal area is not cost-effective, especially if major modifications to the impoundment will be made in a few years as part of the final remedy.

    < Second, if the sediment removal does occur, the site managers should also consider adding to the planned activities the construction a permanent intake for water extraction to replace the existing raft-mounted structure. This permanent structure should be constructed to improve operations for both the interim and final remedies.

    < Third, the sediment to be removed from the impoundment will be placed in the sludge disposal area and will reduce the already limited amount of sludge storage. Therefore, the benefit of sediment removal should be weighed against any negatives associated with reducing the amount of sludge storage.

- As part of further groundwater and seep management, the site managers should conduct a hydrogeological evaluation to determine if the planned interceptor trench along the northern boundary of the site will provide the expected capture of impacted water. Due to flow in both the alluvium and the bedrock, potential exists for flow to bypass the planned interceptor trench. A more effective approach may involve letting the impacted water continue to drain into the valley and diverting this drainage to the impoundment while diverting clean water around this area.

The RSE team made the following recommendations with respect to the reducing the costs of the remedy.

- Reductions in the onsite surface water sampling program could lead to savings as high as $50,000 per year. In addition, reductions in the groundwater and seep monitoring program could help the State meet its goal of reducing the cost of its monitoring contract from $350,000 per year to $200,000 or $150,000 per year.

- Based on costs provided during the RSE site visit, discontinuing snow removal could save the project approximately $275,000 per year in costs for leasing the equipment and for labor. The site contractors report that snow removal is done to allow preventative maintenance to occur over the winter and for security reasons. The specific benefits of this maintenance are unclear to the RSE team and snow removal to allow access specifically for this preventative maintenance is likely not cost effective. A portion of snow removal is supposed to be conducted by the Forest Service, but is done by the EPA contractor. Correspondence subsequent to the RSE site visit indicates that the snow removal equipment has been purchased since the RSE site visit. Though this approach ensures that the costs for leasing the equipment will not be incurred in future, to achieve the full $275,000 per year in savings, snow removal would need to be discontinued. If snow removal does continue, the site managers should seek reimbursement for snow removal done on behalf of the Forest Service.

- The local administration office in Del Norte should be phased out to eliminate costs of approximately $50,000 per year. Other accommodations could be made at lower cost to address those items handled by this local office.

- Vehicles for the site are currently leased due to EPA contracting requirements. At a cost of $66,000 per year, the cost of leasing the vehicles for 2 years more than pays for the cost of purchasing the vehicles. Therefore, the RSE team recommends modifications to allow purchasing of vehicles to reduce long-term costs. If vehicles last for five years, savings of approximately $50,000 per year on average would be saved by purchasing instead of leasing.

- Automation of the new treatment plant and associated reductions in labor are likely required to reduce costs to the projected O&M costs. The RSE team suggests the site managers make a target for costs associated with plant labor and make the necessary modifications to meet this target. Some considerations are provided to help site managers acquire a qualified operations staff in a cost-effective manner.

Recommendations for technical improvement include providing a new potable water supply for polymer mixing, correcting the “dirty power” provided to the site, providing back up for sludge disposal and removal components, and implementing lessons learned from current operations into the design and installation of the proposed water treatment plant.

A single recommendation is made for gaining site closeout. The RSE team recommends that the site managers seriously consider remedial approaches that will not require long-term water treatment. The interim remedy and the proposed changes in the final remedy provide a necessary degree of protection but must also operate in perpetuity at high cost. Various remedial approaches are suggested for the site managers to consider, and the site managers are encouraged to revisit these approaches and others in the future.

A table summarizing the recommendations and the associated annual life-cycle costs of the recommendation is provided in Section 7.0 of this report.

PREFACE

This report was prepared as part of a project conducted by the United States Environmental Protection Agency (USEPA) Office of Emergency and Remedial Response (OERR) and Technology Innovation Office (TIO). The objective of this project is to conduct Remediation System Evaluations (RSEs) of pump and treat systems at Superfund sites that are "Fund-lead" (i.e., financed by USEPA). The following organizations are implementing this project.

Organization	Key Contact	Contact Information
USEPA Office of Emergency and Remedial Response (OERR)	Jennifer Griesert	1235 Jefferson Davis Hwy, 12th floor Arlington, VA 22202 Mail Code 5201G phone: 703-603-8888 griesert.jennifer@epa.gov
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The project team is grateful for the help provided by the following EPA Project Liaisons.

Region 1	Darryl Luce and Larry Brill	**Region 6**	Vincent Malott
Region 2	Diana Cutt and Rob Alvey	**Region 7**	Mary Peterson
Region 3	Kathy Davies	**Region 8**	Richard Muza
Region 4	Kay Wischkaemper	**Region 9**	Herb Levine
Region 5	Dion Novak	**Region 10**	Bernie Zavala

They were vital in selecting the Fund-lead pump and treat systems to be evaluated and facilitating communication between the project team and the Remedial Project Managers (RPMs).

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1.0 INTRODUCTION

1.1 PURPOSE

In the *OSWER Directive No. 9200.0-33, Transmittal of Final FY00 - FY01 Superfund Reforms Strategy, dated July 7, 2000*, the Office of Solid Waste and Emergency Response outlined a commitment to optimize Fund-lead pump and treat systems. To fulfill this commitment, the US Environmental Protection Agency (USEPA) Office of Emergency and Remedial Response (OERR) and Technology Innovation Office (TIO), through a nationwide project, is assisting the ten EPA Regions in evaluating their Fund-lead operating pump and treat systems. This nationwide project is a continuation of a demonstration project in which the Fund-lead pump and treat systems in Regions 4 and 5 were screened and two sites from each of the two Regions were evaluated.

In fiscal year (FY) 2001, the nationwide effort identified all Fund-lead pump and treat systems in the EPA Regions, collected and reported baseline cost and performance data, and evaluated a total of 20 systems. The site evaluations are conducted by EPA-TIO contractors, GeoTrans, Inc. and the United States Army Corps of Engineers (USACE), using a process called a Remediation System Evaluation (RSE), which was developed by USACE and is documented on the following website:

http://www.environmental.usace.army.mil/library/guide/rsechk/rsechk.html

A RSE involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for up to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

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In FY 2002, additional RSEs have been commissioned to address sites either recommended by a Region or selected by OERR. The Summitville Mine Superfund Site was cooperatively selected by OERR and EPA Region 8. Though the site does not have a pump and treat system, site impacts from acid mine drainage are addressed by a long-term remedy including water treatment. This site has high operation costs relative to the cost of an RSE and a long projected operating life. This report provides a brief background on the site and current operations, a summary of the observations made during a site visit, and recommendations for changes and additional studies. The cost impacts of the recommendations are also discussed.

1.2 TEAM COMPOSITION

The team conducting the RSE consisted of the following individuals:

Jim Erickson, Hydrogeologist, GeoTrans, Inc.
Lindsey Lien, Engineer, USACE HTRW CX
Peter Rich, Civil and Environmental Engineer, GeoTrans, Inc.
Doug Sutton, Water Resources Engineer, GeoTrans, Inc.

1.3 DOCUMENTS REVIEWED

Author	Date	Title
Environmental Chemical Corporation		Water Treatment Focused Feasibility Study, Summitville Mine Superfund Site, Summitville, Colorado
US EPA	12/15/1994	Interim Record of Decision for Water Treatment, Summitville Mine Superfund Site, Summitville Colorado
CDM Federal	9/18/2001	Summitville Water Treatment Plant Operations Report - August 2001
Rocky Mountain Consultants	9/2001	Summitville Mine Superfund Site, Remedial Investigation Report, Site-wide Remedial Investigation and Feasibility Study
Rocky Mountain Consultants	9/2001	Summitville Mine Superfund Site, Feasibility Study
CDM Federal	11/2001	Summitville Water Treatment Plant Annual Report - 2001
US EPA	9/28/2001	Record of Decision for Summitville Mine Final Site-wide Remedy, Operable Unit 5, Summitville Mine Superfund Site, Rio Grande County, Colorado

1.4 PERSONS CONTACTED

The following individuals associated with the site were present for the site visit:

Steve Eppelheimer, Senior Plot Operator, CDM
Joe Fox, Lab Manager/Plant Operator, CDM
Robbert-Paul Smit, Project Manager and Environmental Scientist, CDM
Karen Taylor, Senior Project Manager, CDM
Austin Buckingham, Site Manager, CDPHE

The RSE team also contacted Victor Ketellapper and Jim Hanley from EPA Region 8 to discuss the site and remedy.

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

1.5.1 LOCATION AND HISTORY

The Summitville Mine Superfund Site is located in the southeastern portion of the San Juan Mountains, in Rio Grande County, approximately 60 miles west of Alamosa, Colorado and 10 to 15 miles south of Del Norte, Colorado. The location of the site with respect to these landmarks is depicted in Figure 1. The site is defined as the permitted 1,231-acre mine site and is located adjacent to the former town of Summitville at an elevation of approximately 11,200 feet. A map of the site with main features is presented in Figure 2, and a labeled photograph of the site is depicted in Figure 3. The site addresses impacts resulting from mining for precious metals that began at Summitville in 1870 and continued through 1992 by a number of parties.

Recovery of ore was conducted primarily through an underground network of adits until 1984 when operations intensified with open pit mining by Summitville Consolidated Mining Company Incorporated (SCMCI). In 1985 and 1986 the Heap Leach Pad was constructed to process ore from the open pit. Between 1984 and 1992 approximately 10 million tons of ore were processed on the Heap Leach Pad by adding a solution of sodium cyanide to extract gold and silver and processing the resulting "pregnant" solution to recover the precious metals. A leak was detected in the Heap Leach Pad liner a week after its operation began and several cyanide leaks resulted. A water treatment plant was installed and operated to treat water impacted by cyanide and acid mine drainage, but this treatment and subsequent measures were inadequate to sufficiently mitigate environmental impacts. In December 1992, SCMCI announced bankruptcy and informed the State of Colorado that financial support for site operations would not continue. EPA took over the site and modified the water treatment plant to treat site impacts. The site was listed on the National Priorities List in 1994. Figure 4 shows a photograph of the site that is representative of the site conditions at the time EPA took over the site. Site operations are now lead by CDPHE with funding shared by CDPHE and EPA.

A number of emergency and interim remedial responses have taken place since 1992. The following table summarizes the five "primary areas of concern" that were designated as independent operable units (OUs) and were highlighted for emergency response actions and interim remedial actions by a series of 1995 RODs. The final remedy for the site is designated as OU5 in a 2001 ROD and is in the early stages of implementation.

Area of Concern	Op. Unit	Status
Water treatment	OU0	Ongoing - to be modified and to continue as part of OU5
Heap Leach Pad Detoxification/Closure	OU1	Complete - to be maintained as part of OU5
Excavation of Cropsy Waste Pile, Beaver Mud Dump, and Cleveland Cliffs Tailings Pond and Closure of the Mine Pit	OU2	Complete - to be maintained as part of OU5
South Mountain Groundwater	OU3	To be addressed in OU5
Site-wide Reclamation	OU4	To be complete in 2002

The areas described in the above table can be identified on Figure 2. The following remedy components are presented in the 2001 ROD for OU5:

- Onsite contaminated water impoundment upstream of the Wightman Fork-Cropsy Creek confluence
- Construction of a new gravity-fed water treatment plant downstream of the contaminated water impoundment
- Possible breach and removal of the existing Summitville Dam Impoundment (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 Highwall ditch (implementation of OU3)
- Rehabilitation of Reynolds Adit Management of mine pool water
- Continued site maintenance, and groundwater/surface water and geotechnical monitoring onsite
- Surface water, sediment, and aquatic life monitoring in the Alamosa River and Terrace Reservoir

Site managers are currently studying each of these actions and potential modifications that would result in a more effective and efficient remedy. This RSE report focuses on the ongoing water treatment interim action and highlights considerations for the remedial activities to be conducted as part of OU5.

1.5.2 SUMMARY OF SITE CONCEPTUAL MODEL

Contaminant Sources

Acid mine drainage is the predominant form of contamination on site. Due to disturbances associated with mining, an increased amount of sulfide bearing rock is exposed to air and water. In the presence of both air and water, this rock oxidizes, and the reaction yields water with elevated metals concentrations and acidic conditions. Once started, oxidation of the sulfide bearing rock can continue in absence of air using other agents, such as ferric iron, as oxidants. Though these oxidation reactions occur naturally, the disturbances from mining increase the mineral surface area for the oxidizing reactions to occur and severely impacted water results. At the Summiville Mine site, the drainage has elevated iron and copper concentrations and has a pH typically ranging from 2.5 to 4. The following table summarizes the various sources or suspected sources of acid mine drainage at the Summitville Mine site.

Source	Area of source (acres) or Volume of impacted water (acre-feet)	Notes
Bedrock Aquifer	147 acre-feet	• Contaminated water may discharge to underground workings or to surface as seeps • Contamination decreases with depth
Mine Pool	14 acre-feet*	• Resulted from plugging the Reynolds Adit and can be regulated by releases from Reynolds Adit
Highwall	50 acres	• Northern face of South Mountain that was exposed by open-pit mining

* This volume is provided in the 2001 ROD. A greater volume was drained from the mine pool in 2002 suggesting that the mine pool is either larger than originally estimated or that the volume drained includes recharge.

According to the 2001 ROD, other smaller, but notable sources of acid mine drainage that remain at the site include the North and South Mine Pits, the North Waste Dump, and the sludge disposal area. All of these sources generate acid mine drainage, but due to limited infiltration or short-lived saturation, the volumes associated with these sources are minimal. According to the site managers, there does appear to be evidence, however, that these areas are beginning to accumulate water.

Site-related contamination also exists in the water within the Heap Leach Pad. This water is impacted by cyanide and, as reported in the September 2001 Remedial Investigation, has alkaline conditions stemming from the use of sodium cyanide and lime during former processing operations. Though this water remains onsite as a potential source of contamination to groundwater and Wightman Fork, monitoring in 1999 and 2000 showed no cyanide impacts downgradient of the Heap Leach Pad, suggesting that the contamination is contained.

Contaminant Transport

During winter months, snow accumulates throughout the site. On average, approximately 344 inches of snow falls between October and April of each year. The total annual precipitation (i.e., volume of water due to both snow fall and rain) averages approximately 40 to 44 inches per year (nearly three quarters due to snow fall). Over a site of approximately 1,200 acres, this translates to average influx of water to the site of approximately 4,200 acre-feet (approximately 1.4 billion gallons). During the non-winter months (approximately early April to mid October), water may leave the site through evaporation, runoff, or infiltration and subsequent discharge to groundwater and/or surface water. Water that infiltrates into the mine workings and bedrock aquifer, becomes acid mine drainage by the above-mentioned process, and then discharges to groundwater or surface water through adits, groundwater seeps, or bedrock faults. Without the interim remedial efforts to address it, the acid mine drainage would flow into Wightman Fork, which eventually discharges to the Alamosa River. Approximately 4 miles downstream, the Wightman Fork discharges to the Alamosa River. Therefore, contamination in Wightman Fork can impact the downstream segments of the Alamosa River and the Terrace Reservoir, which receives water from the Alamosa River approximately 15 miles downstream from the Wightman Fork confluence. The locations of Wightman Fork, the Alamosa River, and the Terrace Reservoir relative to the site are depicted in Figure 5.

The acidic conditions associated with acid mine drainage helps further mobilize metals and therefore may increase the metals concentrations in both groundwater and surface water. Metals transport may occur in both the dissolved phase, as complexes with organic matter, or adsorbed to other metal oxides suspended in the water or present in sediments.

Receptors

Potential receptors of site-related contamination include aquatic life found in Wightman Fork, the Alamosa River, and the Terrace Reservoir. In addition, potential agricultural and human receptors are also present. Though site-related contaminants are found significantly above background levels, human health is not at risk. Therefore, aquatic life, due to its sensitivity to copper and other site-related contaminants, serves as the primary risk driver. The following table summarizes the contaminants of concern and various representative water quality criteria. This table is not an exhaustive list of water quality criteria. Specific criteria exist for various portions of the Alamosa River, and in many cases, the metals criteria are a function of hardness. Representative values are presented only to demonstrate that the standards for aquatic life are driving the risks at this site.

Contaminant of Concern	Representative Chronic Water Quality Standard (ug/L)	Representative Acute Water Quality Standard (ug/L)	Representative Standard for Human Consumption (ug/L)
Copper	12 (hardness based)	18 (hardness based)	1,220[1] (near Jasper)
Cyanide	5	5	29.4[1] (Phillips University Camp)
Iron (total recoverable)	12,000[2]	none listed	300[3]
Zinc	106 (hardness based)	117 (hardness based)	274 (near Jasper)
pH	6.5 to 9 standard units[4]		

[1] Ingestion of surface water by a recreational user. The ROD provides criteria for 3 geographical areas. The criteria and geographical area listed in the last column of this table represents the most stringent of those 3 criteria.
[2] Chronic standard for total recoverable iron between Wightman Fork and the Terrace Reservoir. The criteria for the Terrace Reservoir are more stringent.
[3] This is a secondary drinking water standard for aesthetic purposes.
[4] This pH criteria is a fixed range established by the State of Colorado. A wider range (4 to 9 standard units) applies to an area of the Alamosa River that is upstream and not impacted by the Summitville Mine site.

1.5.3 CURRENT SITE CONDITIONS

Previous interim remedial actions have included excavating exposed tailings, placing them in the open pit, and then closing the pit. In addition, a network of drainage ditches are in place to direct acid mine drainage to the Summitville Dam Impoundment (SDI) and unimpacted water directly to Wightman Fork. Water stored in the SDI is then pumped to a water treatment plant and treated prior to discharge to Wightman Fork. Though the interim remedial actions have significantly reduced impacts in Wightman Fork and areas downstream, site-related contamination still impacts Wightman Fork and the Alamosa River. These impacts are predominantly due to acid mine drainage discharging from seeps and faults that are not contained by the network of ditches and to controlled releases of water from the SDI that are necessary when the capacity of the water treatment plant and the impoundment are insufficient to address the volume of acid mine drainage.

Because precipitation events, the snow pack, and the snow melt periods are subject to relatively unpredictable variations in weather and the regional climate, the magnitude of impacts reaching Wightman Fork and areas downstream vary from year to year. According to results from the 2001 Remedial Investigation that are summarized in the 2001 ROD, the collective baseline flow of acid mine drainage to the SDI from the seeps, adits, pump house fault, and the French Drain ranges from 170 to 750 gpm depending on the above-mentioned climatic factors. An average of 450 gpm is typically assumed by the site managers. During the snow melt season during May and June when runoff is high, the volume of water entering the SDI is much greater. In years with average or above average snow pack, the combined capacity of the SDI and water treatment plant are insufficient, and controlled releases from the SDI are used to prevent an overtopping of the embankment.

2.0 SYSTEM DESCRIPTION

2.1 REMEDY OVERVIEW

The primary aspects of the long-term remedy are 1) maintaining a network of ditches to manage the flow of acid mine drainage, 2) treating impacted water that is collected in the SDI, 3) otherwise controlling water levels in the impoundment to prevent breaches, and 4) associated monitoring. The water treatment plant was assembled from existing components and treatment plants at the Summitville Mine site by EPA after it took over operations in 1992. Therefore, although water treatment from this facility began in 1995, some components of the system are over 30 years old. The plant operates from early April through October each year and shuts down in the winter due to heavy snow, high winds, and cold temperatures.

All influent to the plant comes from the SDI. The plant was originally designed to treat 500 gpm. This original rate, however, was insufficient and recent optimization efforts have improved the treatment capacity to over 1,000 gpm. The influent concentrations of metals varies throughout the operating season. For example, during the 2001 operating season, the influent copper concentration was generally under 40 mg/L, but increased to approximately 60 mg/L by the end of operations on October 10, 2001. This variation in the metals concentrations is due to dilution of the acid mine drainage during the snow melt season. As the snow melt season comes to an end, dilution of baseline acid mine drainage decreases. In addition, the SDI is stratified with higher metals at depth, and when the SDI is drawn down during the end of the season, the water remaining is with relatively higher metals concentrations.

2.2 SITE DRAINAGE SYSTEM

The network of ditches and proposed additions to the existing network are depicted in Figure 2. In general, the site is divided into three areas with the following discharges:

- Basin A, the northwestern quarter of the site, encompasses the north waste dump, a number of groundwater seeps, and the footprint of the former Beaver Mud Dump. Basin A discharges to the SDI.

- Basin B, the eastern half of the site, encompasses the Heap Leach Pad, the footprint of the former Cropsy Waste Pile, and other areas. Basin B discharges to the Cropsy Creek and Wightman Fork.

- Basin C, the southwestern quarter of the site, encompasses the Highwall, North and South Mine Pits, and Sludge Disposal Area. Basin C discharges to the SDI when analytical results suggest high impacts and the flow is less than 25 cfs. During periods of high flow water from this area is discharged to Wightman Fork.

In addition to the ditches that divert water as described above, ditches are in place to direct water to the SDI from the Reynolds and Chandler Adits, French Drain, and surface water drainage from select site roads.

2.3 TREATMENT SYSTEM

The treatment plant removes metals via hydroxide precipitation. A 120 horsepower raft-mounted ABS pump pumps approximately 1,200 gpm from the SDI to the water treatment plant. Of the approximate 1,200 gpm, about 200 gpm is immediately returned to the SDI, and 1,000 gpm is distributed to two parallel treatment trains consisting of two12,000 gallon tanks aligned in series for feeding lime and anionic polymer and mixing prior to flowing to a single 60-foot diameter thickener/clarifier. Clarified water is discharged directly to Wightman Fork or recycled back to the SDI. Underflow sludge from the thickener (approximately 7% solids) is pumped to the head of the system for seeding at a rate of 20% of the influent (a rate of 10% of the total influent to each treatment train). The remaining sludge is pumped to a sludge holding tank. Settled sludge from the holding tank is dewatered in a 100-cubic foot filter press. The sludge filtrate and decant water is recycled to the head of the plant while the lime sludge (an average of about 25 cubic yards/day) is disposed of onsite in the mine pit area. The plant is operated effectively to remove approximately 60 mg/L of copper at 1,000 gpm.

2.4 MONITORING PROGRAM

At the time of the RSE, the operations contractor was sampling 13 locations on a weekly basis. In previous years, this sampling included up to 32 locations on a weekly basis. Correspondence subsequent to the site visit indicates that the monitoring frequency has been reduced from weekly to biweekly. The sampling program includes following locations:

- Inflows to the SDI from the Reynolds Adit, Reynolds Pipe, and French Drain
- Surface water flows from onsite ditches (SC-7, L3-1, and Ditch R)
- Surface water flows in Cropsy Creek (CC-1 and CC-5), Wightman Fork (WF-1, WF-2.5, WF-5 and WF-5.5), and the North Waste Dump Unnamed Tributary.

These samples are submitted for onsite analysis of copper, iron, manganese, and zinc. In addition, flow, pH, and conductivity are measured. Sample collection and analysis requires approximately 2 days for field personnel and the onsite chemist. The results of this monitoring are used to help determine what flow should be diverted to the SDI and what flow should be diverted to Cropsy Creek and Wightman Fork. Monitoring results are also used to determine the surface water quality downgradient from the site.

In addition to this sampling, automated samplers collect 12-hour composite samples for onsite analysis from both the influent and effluent. Occasional manual samples, perhaps those conducted on a weekly basis, are used for quality assurance.

Groundwater monitoring and offsite monitoring of surface water, sediments, and biota are also conducted on and offsite as part of a separate contract through CDPHE. In 2000, up to 26 wells were monitored for major ions and metals, and in 1999 and 2000 groundwater seeps were monitored at 31 and 37 locations, respectively.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT REMEDY OBJECTIVES AND CLOSURE CRITERIA

The 2001 ROD for the OU5 remedy highlights the following Remedial Action Objectives:

- Control and treat surface water, groundwater, and leachate as necessary, to meet State and Federal 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
- Control airborne contaminants from the site

Representative water quality criteria for the Alamosa River are summarized in the table in Section 1.5.2 of this report. Aquatic biota is the primary receptor driving risks at the site, and copper is the primary contaminant driving risks at the site.

3.2 TREATMENT PLANT OPERATION GOALS

The following table presents the discharge criteria for the treatment plant.

Contaminant/Parameter	Discharge Criteria (mg/L)
Copper	0.1
Iron	50
Manganese	5.6
pH	6.5 to 9 standard units

The contractor is working on a fee/award system where outstanding performance can increase their award. Outstanding performance requires that plant effluent has a copper concentration below 0.05 mg/L, the average monthly flow exceeds 1,000 gpm, and uptime exceeds 97% during the operating season. The treatment plant often meets these criteria, but during dry years, regardless of performance, the treatment plant may not meet the flow criteria due to a lack of water.

4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

The RSE team found an extremely well-operated treatment plant and site-wide remedy. The site team has a good conceptual model of the site and have proven that they can prioritize remediation activities effectively. Internal optimization efforts have already lead to increasing the plant capacity from 500 gpm to 1,000 gpm, and the site team provided a number of recommendations that the RSE team has included in Section 6.0 of this report. The site managers and O&M contractor are to be commended for accomplishing several interim remedy goals, including addressing onsite waste areas and reducing contaminant loading to the watershed, in a relatively short period of time.

The observations provided below are not intended to imply a deficiency in the work of the system designers, system operators, or site managers but are offered as constructive suggestions in the best interest of the EPA and the public. These observations obviously have the benefit of being formulated based upon operational data unavailable to the original designers. Furthermore, it is likely that site conditions and general knowledge of groundwater remediation have changed over time.

4.2 OVERALL REMEDY PERFORMANCE

4.2.1 CAPTURE OF SITE-RELATED CONTAMINATION

Site conditions are dependent on the weather and regional climate and therefore vary significantly both during the operating season and from season to season. The following table is taken from the 2001 ROD and shows the yearly variability in the site conditions due to regional climate.

Year	Volume of Water Released from SDI		Estimated Mass of Copper Released (pounds)	Percent Snow Pack Compared to Normal
	Gallons	Acre-feet		
1996	0	0	0	28%
1997	169,000,000	518	35,000	208%
1998	9,800,000	30	1,500	107%
1999	53,000,000	164	5,600	131%
2000	0	0	0	67%
2001	11,700,000	36	1,400	108%

Drought conditions during the 2001-2002 winter resulted in below average snow fall, and no water was released from the SDI during the 2002 operating season. The snow pack data from 1996 through 2001 show that the average snow pack of these 6 six years is close to a previously determined average. The average for these 6 years is 108% of normal. However, this data also shows great variability with only 2 of 6 years within +/-10% of that normal range. Two of the years (3 years if 2002 is included) were very dry and the volume of water was easily handled by the remedy, but another 2 of the years greatly exceeded the average and large volumes of water from the SDI needed to be released. Based on this snow pack data and the estimated volume released from the SDI (including 2002), the combined capacity of the treatment plant and SDI will accommodate the runoff in less than half of the operating seasons.

The above analysis does not consider the volume of untreated acid mine drainage discharging directly to surface water from seeps, faults, or groundwater. In 1999, approximately 72 gpm of the discharge from seeps (approximately 24% of the total discharge from seeps) was directed to Wightman Fork untreated. The associated iron and copper loading discharged to Wightman Fork was 1,010 pounds per day and 252 pounds per day, respectively. Also in 1999, an estimated 45 gpm discharged to Wightman Fork directly from groundwater. The associated iron and copper loading was approximately 78 pounds per day and 1 pound per day, respectively.

Water quality criteria at station AR41.2 of Segment 3c of the Alamosa River were exceeded in all 7 of the sampling events conducted in 1999. Of the 7 sampling events, there were 6 exceedances of the acute level and 1 exceedence of the chronic level. One of the acute exceedances occurred in mid April during the early snow melt period when the water treatment plant was not running, and the chronic exceedence was attributed to an SDI release in late May. The remaining 4 exceedances were due to acid mine drainage that is not intercepted by the current network of ditches and interceptor trenches. The pH was below the 6.5 criteria in 4 of the 7 samples at the same sampling station. Further downstream in Segment 3c at station AR34.5 (Phillips University Camp) there were 2 exceedances of the acute copper standard, 2 exceedances of the chronic copper standard, and 4 exceedances of the pH standard in 7 sampling events. Additional exceedances were noted further downstream in segments 8 and 9 as well.

Given that exceedances occur both during and after the snow melt period, it is evident that the uncaptured seeps and discharging groundwater are impacting the river. Though the interim remedy is not capable of meeting the standards in the Alamosa River, conditions have greatly improved since remedial efforts began. Although the proposed final remedy will reduce the number and volume of SDI releases, it is unclear to the RSE team from currently available analyses that the proposed remedy will eliminate or significantly reduce uncaptured groundwater discharge and seeps that cause frequent exceedances of the downstream water quality criteria.

4.2.2 PROGRESS TOWARD REMEDIATION

Acid mine drainage at the site will likely continue indefinitely unless water from precipitation and snow melt ceases or the sulfide-bearing material is eliminated. Remedial efforts presented in the ROD include long-term operation of a containment system including the network of ditches, increased water storage in a larger impoundment, and construction and operation of a new treatment plant. Therefore, the current remedial approach at the site will not remove the source of impacts and will not result in site closure. EPA and CDPHE are aware of the limitations of the current remedial approach and are open to evaluating other technologies or approaches in the future.

4.3 COMPONENT PERFORMANCE

4.3.1 POWER SOURCE

With the exception of the influent pump, the site is provided by electricity from offsite. Power frequency distortion and voltage spikes have been problematic. The electrical power is deemed “dirty” because it is outside the specifications for power delivered by most utilities. Fluctuations in voltage lead to power surges that can lead to temporary system shutdowns. Bad weather is the primary cause of voltage fluctuations and power disruption to the treatment plant.

4.3.2 INFLUENT PUMP

The 120 horsepower ABS pump was installed for the 2000 operating season as a replacement to the previous problematic unit. This new pump has provided significant improvement to operations and is no longer a primary reason for system shutdown. This raft-mounted pump is located to extract water from the SDI from various locations; however, movement of the pump early in the season is difficult due to ice buildup on the SDI. There is difficulty in adjusting the pump intake point. The extracted water is pumped at a rate of 1,200 gpm over 1,000 feet and an increase in elevation of over 100 feet though a 12-inch diameter pipe. The pump is powered by a 350 KW Caterpillar diesel generator. Approximately 200 gpm of the 1,200 gpm of pumped water is returned directly to the SDI because the treatment plant is not capable of treating the additional capacity. With current pump and generator, reducing the amount of pumped water to 1,000 gpm would not reduce power consumption or reduce costs.

4.3.3 LIME FEED SYSTEM

The lime silo has bridging problems, and the silo vibrators require continuous operation to avoid stoppage of the system. The eductor system has been working well provided the lime quality meets industry standards. The silo has a capacity of 25,000 pounds, and the plant uses approximately 9,000 pounds per day. Lime is brought in by truck approximately two times per week.

4.3.4 TANKS FOR LIME AND POLYMER FEED AND MIXING

The tanks within the water treatment plant used for lime and polymer addition and mixing have capacities of 12,000 gallons each. Because the plant capacity has been improved from 500 gpm to over 1,000 gpm, the open tanks are operating within two to three inches of overflowing. High water levels within the tanks are necessary because water flows by gravity from tank to tank, but at 1,030 gpm high water elevation in the tanks results in frequent splashing that complicates plant maintenance and cleaning.

4.3.5 POTABLE WATER AND POLYMER MIXING

Clean water, referred to as “potable” water onsite (though it is not used for drinking), is necessary for mixing and diluting the polymer prior to adding it to the process stream. Approximately 4.5 gpm of potable water is required to mix the polymer to a 0.15% solution. This potable water is obtained from three wells (the ABC well, the 17-mile well, and the “Inside” well). It is stored in both a 9,000 gallon and a 3,000 gallon storage tank. Prior to the RSE site visit, the Inside well and 17-mile wells went offline, suggesting the need for a new potable water source. Correspondence subsequent to the RSE site visit indicates that the Inside well and the 17-mile wells are still the primary sources of potable water. After mixing with potable water, approximately 22 gpm of plant effluent is used to further dilute the polymer prior to addition to the process water. In the past, the plant operators attempted to use plant effluent for the initial mixing of the polymer, but treatment effectiveness was compromised.

Mixing of the polymer is done manually every 1.5 hours. An automated mixing unit is onsite, but the unit has insufficient capacity when the treatment plant is operating above 800 gpm. Part of the automated unit is used for the secondary dilution. The operators have conducted jar tests with different polymers at various concentrations to determine which polymers are best for various operating conditions. Turbidity, effluent copper concentrations, and floc size are used to determine when polymer should be switched or the concentration should be adjusted. The other indicator for switching polymer is the percent solids of the sludge, which operators try to maintain at 7 to 8% solids.

4.3.6 SLUDGE THICKENER/CLARIFIER

Water from the mixing and reaction tanks is sent by gravity to the sludge thickener/clarifier. The unit is 60 feet in diameter and has a capacity of 348,000 gallons. Operations staff keep the sludge bed at the bottom of the clarifier at approximately 4 feet thick. An automated rake keeps the sludge bed properly conditioned for the sludge pumps that transfer the settled sludge to a holding tank. There is no mechanism for raising the rake when high torque is experienced (i.e., when the sludge at the bottom of unit exceeds 10% solids). Therefore, maintaining the sludge at the proper density is of paramount concern for the operators.

4.3.7 SLUDGE PROCESSING AND DISPOSAL

Sludge pumps transfer the sludge from the thickener to a sludge holding tank and to the head of the plant for seeding. Sludge from the holding tank is dewatered in a 100 cubic foot filter press that is operated at a maximum of 12 times per day. This maximum number of press cycles is reached when metals influent is the greatest, which is typically at the end of an operating season when water levels in the SDI are low and undiluted. During the operating season approximately 7 press cycles are done per day. Sludge is carried by dump truck to the former mine pit area for sludge disposal. The sludge pumps and filter press are powered by a 125 horsepower rotary screw compressor.

4.3.8 ONSITE VEHICLES

Seven vehicles plus additional heavy machinery are maintained onsite. The vehicles include an ambulance (an EMT is onsite at all times), dump truck (for sludge disposal), utility/mechanics trucks, sport utility vehicles for transport to and from the site, and three state-owned trucks. By EPA order, the vehicles are to be leased and not purchased, even though the cost of leasing the vehicles for two years would equal the cost of purchasing them.

4.3.9 FORMER CYANIDE DESTRUCTION PLANT (OFFICES AND LABORATORY)

The former cyanide destruction plant is used for office space and the onsite laboratory. Drinking water is brought to the site, electricity is provided from an offsite source, and natural gas is piped to the plant, office space, and laboratory for heating.

4.4 COMPONENTS OR PROCESSES THAT ACCOUNT FOR MAJORITY OF MONTHLY COSTS

The following cost breakdown was provided to the RSE team by the site contractor during the site visit. In addition to the listed operating costs, the State has a contract for well, sediment, and seep sampling and data management for $350,000 per year. The State is currently attempting to cut these costs to approximately $150,000 to $200,000 per year. Colorado State University also has a contract for maintaining and monitoring the health of vegetation being planted as part of the remedy. Major cost categories are furthered discussed in the following subsections.

Cost Category	Annual Cost
Labor (operators, mechanics, sampling, chemists)	$703,000
Project management	$94,000
Lime	$96,000
Polymer	$42,000
Parts/maintenance (pump rebuilds and heavy equipment)	$101,000
Lab supplies	$23,000
Facilities maintenance (drinking water, diesel for generator, electricity, office trailers, heating, phones, fuel for vehicles, etc.)	$300,000
Electrical contractor	$15,000
Snow removal equipment (leased)	$155,000
Vehicle leases	$66,000
Snow removal labor	$60,000
Funds to cover State tasks if additional costs are incurred	$100,000
Del Norte office administration	$52,000
Subtotal	$1,807,000
Approximately 33% for overhead and profit	~$600,000
	~$2.4 million per year

4.4.1 UTILITIES

Utility costs were not specifically broken down during the RSE visit; however, the facilities maintenance category covers utilities and related costs. For example, this category, which has a cost of approximately $300,000 per year, includes electricity, propane tanks for heating trailers, natural gas for heating office space and the water treatment plant, diesel fuel for running the generator for the influent pump, fuel for the site vehicles, drinking water, and phone service. This category also includes rental fees for the guard trailer and other items, but the bulk of the $300,000 per year is used for utility-related items. An electrical contractor is also used each year for items within the treatment plant. During the 2002 operating season the cost for this contractor was $25,000; however, future costs are likely to be approximately $15,000 per year.

4.4.2 NON-UTILITY CONSUMABLES

Approximately $328,000 per year is spent on materials or consumables, including lime, polymer, parts, lab supplies, and vehicles. Vehicles have been included in this category because the costs re-occur each year due to leasing them rather than purchasing them.

4.4.3 LABOR

Labor for the long-term remedy (excluding offsite monitoring, vegetation, and other contracts) is comprised of field labor, snow removal labor, office project management, and local project administration. The costs for these for categories combined is over $900,000 per year ($703,000+$94,000+$60,000+$52,000), excluding the associated overhead and profit. Thus, labor represents approximately half of the annual costs for long-term remedy.

For field labor, a total of 8 operators, 3 mechanics, and 2 laboratory chemists are employed full time during the operating season. All of these individuals are not onsite at the same time, there are rotating 12-hour shifts for the operators because the treatment plant requires continuous attention 24 hours per day. The operator labor is predominantly associated with the water treatment plant. The mechanics and chemists spend time on both water treatment activities in addition to other items at the State's request. In addition to labor during the operating season, 4 staff are maintained through the winter for snow removal. Office project management is approximately $94,000 per year (excluding overhead and profit). It includes health and safety issues, community relations, general project management, and technical support. Local project administration is conducted through the Del Norte Office. Approximately $52,000 per year is spent maintaining that local office where paper work for the field labor is maintained.

4.4.4 CHEMICAL ANALYSIS

Little cost is incurred for offsite chemical analysis because the majority of analysis conducted for water treatment activities is done through the onsite lab. Lab personnel labor and lab supplies comprise the majority of the costs for onsite analysis. Lab personnel labor is approximately $57,000 of the $703,000 per year for labor, and recent lab supplies have costed approximately $23,000 per year (including an atomic adsorption spectrophotometer with a lease rate of$14,000). Including overhead and profit, the total cost for onsite analysis is approximately $106,000 per year.

4.5 RECURRING PROBLEMS OR ISSUES

The plant operators and RSE team note the following recurring technical issues, some of which have been discussed in Section 4.3 of this report.

- Absence of quality "potable" water for polymer mixing
- "Dirty power"
- Lime feed silo bridging
- Absence of a lifting mechanism for the rake in the sludge thickener
- Poor building and roof insulation
- Cramped conditions in the treatment plant complicating maintenance and cleaning
- Absence of process water piping labeling and identification
- Temporary pipe supports
- Slip hazards surrounding the filter press
- Absence of a cover on the sludge thickener (delays startup due to snow accumulation within the thickener)
- Inability to maneuver the pump intake point in the SDI in early operating season due to ice buildup
- Inclement weather delays system startup, hastens system shutdown, or interrupts power causing shutdowns

Many of the above issues are due to constructing a plant piecemeal from old, existing equipment. The O&M contractor has taken steps to address many of these concerns. However, some of these concerns will persist until a new plant is installed.

4.6 REGULATORY COMPLIANCE

The treatment plant regularly meets the discharge criteria. However, the interim remedy as whole frequently does not meet the surface water quality criteria in segments 3c, 8, and 9 of the Alamosa River. The final remedy presented in the 2001 ROD is planned to meet both the discharge and water quality criteria.

4.7 TREATMENT PROCESS EXCURSIONS AND UPSETS, ACCIDENTAL CONTAMINANT/REAGENT RELEASES

Controlled releases from the SDI are required in years when there is greater than average snow pack. Such releases have occurred in 4 of the 7 operating years from 1996 through 2002. These releases result in discharge of water with low pH and high metals concentrations to Wightman Fork. These releases do not represent a shortcoming of remedy operations; rather, they represent a shortcoming of the interim remedy as a whole. The final remedy will be designed to avoid or minimize such releases.

4.8 SAFETY RECORD

There have been two slip/falls around the filter press since operations began in 1996 and a few near misses with men working on ice over the SDI. Neither of the trips resulted in lost time, and placement of a slip guard near the filter press has reduced the slipping hazard.

5.0 EFFECTIVENESS OF THE SYSTEM TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT

The 2001 ROD states, "The Human Health risk assessments for the site and downstream study areas found there to be no adverse health risk to humans. However, sufficient acute and chronic risks occur to severely limit aquatic life in the Alamosa River downstream of Wightman Fork." Therefore, the primary effectiveness issues regarding the site are ecological.

5.1 GROUNDWATER

Groundwater beneath the site is an effectiveness concern in that it discharges to the surface through seeps or directly to surface water. Groundwater is and will continue to be impacted by acid mine drainage, and impacted groundwater requires containment to meet surface water quality criteria in Wightman Fork and the Alamosa River. It is unclear from existing analyses if the remedial activities planned for the final remedy will eliminate or sufficiently reduce impacts to surface water from the seeps such that water quality criteria for aquatic life are met.

Drinking water quality in potable wells located downstream along the Alamosa River near Jasper have not been adversely impacted by site related contaminants.

5.2 SURFACE WATER

A number of surface water receptors have been and will potentially continue to be impacted by site-related contamination. Wightman Fork is the surface water body directly impacted by the site, but contamination from Wightman Fork impacts the Alamosa River and potentially the Terrace Reservoir. Due to the relatively high magnitudes of the water quality standards for Wightman Fork, the surface water quality criteria for this water body are rarely exceeded due to site-related contamination. However, the more strict water quality criteria for Segments 3a, 3b, 3c, 8 and 9 of the Alamosa River are frequently exceeded for aluminum, pH, iron, zinc, copper, and cadmium. These exceedances are due to both continued discharge from uncaptured groundwater and seeps as well as periodic controlled releases from the SDI during the snow melt season. Background conditions also contribute to exceedances. For example, Segment 3a is upstream of the site but is impacted predominantly by background conditions.

5.3 AIR

Control of airborne contaminants from the site is an objective of the 2001 ROD. Cyanide is likely the greatest contaminant of concern for exposure via air; however, this contaminant of concern is isolated from the air and should not present a risk. The possibility also exists for airborne transport of metals from the site, however, this form of transport is likely negligible compared to transport via water, especially given coverage by snow or vegetation over most of the site for the majority of the year.

5.4 SOILS

There are two primary concerns regarding soils at the site. The first is that sulfide bearing compounds in the soils and rock provide a continuing source of acid mine drainage. The second is that high volume runoff during the snow melt season or during precipitation events may result in erosion and transport of sediments to Wightman Fork. As part of the remedy, vegetation has been planted to prevent erosion and decrease water infiltration. However, site managers report that due to recent drought conditions, the new vegetation is struggling and additional attempts may be required for the vegetation to take hold.

5.5 WETLANDS AND SEDIMENTS

Sediment impacts were not reviewed by the RSE team. Wetlands to the north of site alongside Wightman Fork have been adversely impacted by acid mine drainage. Vegetation in this area cannot be sustained until acid mine drainage from seeps is prevented from discharging to this area.

6.0 RECOMMENDATIONS

Remedial activities at the Summitville Mine site are in a transition from the interim remedy to the final remedy. Though most of the interim remedial activities have been completed, the water treatment component is ongoing and the existing system will eventually be replaced by an updated water treatment facility as part of the final remedy. Due to funding and other issues, the time frame for implementing the final remedy is unclear. Implementation may occur within as little as 2 to 3 years but could take much longer. The RSE team, therefore, provides recommendations to improve the existing interim remedy as well as recommendations to consider during implementation of the final remedy. The RSE recommendations and considerations are presented in the following four categories:

- recommendations to enhance effectiveness of the site remedy
- recommendations to reduce remedy life-cycle costs
- recommendations for technical improvement
- considerations for gaining site closeout

The four categories are presented in four separate sections. In each of the section, the recommendations with relevance for either the interim remedy or both the interim and proposed final remedies are provided first. These recommendations are followed by those recommendations or considerations that are only relevant to planning the final remedy.

Cost estimates provided herein have levels of certainty comparable to those done for CERCLA Feasibility Studies (-30/+50%), and these cost estimates have been prepared in a manner consistent with EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000.

6.1 RECOMMENDATIONS TO ENHANCE EFFECTIVENESS

6.1.1 CONSIDERATIONS FOR MANAGEMENT OF THE MINE POOL

The Reynolds and Chandler Adits were plugged in 1994 to reduce acid mine drainage from the adits. As a result, the underground workings of the mine were flooded creating a pool of acidic water with high metals concentrations. As documented in the 2001 ROD, the estimated volume of water in the mine pool is 14 acre-feet (approximately 4.6 million gallons) with a current water level of 250 feet above the Reynolds Adit floor. The amount of water drained from the mine pool during 2002 was greater, suggesting that the mine pool may have a greater volume than originally estimated or that the amount drained included recharge. The water level of the mine pool can be controlled by releasing water from the Reynolds Adit pipeline that penetrates the plug. By increasing flow through the pipeline and thereby lowering the level of the mine pool, the seep discharge will decrease. The long-term plans of the site managers are to maintain the plugs, which may require replacement within the next 10 to 15 years, and maintain the water level at approximately 20 to 30 feet above the Reynolds Adit floor. By reducing the water level in the mine pool and maintaining it at this lower level some of the hydraulic potential that is responsible for pushing impacted water into the bedrock, and potentially into surface water, could be eliminated. This could reduce some of the continual impacts to surface water that cause exceedances. Therefore, the RSE team encourages the site managers to make draining the mine pool to the proposed level (i.e., 20 to 30 feet above the Reynolds Adit floor) a priority and to correlate surface water quality with elevation of the mine pool. Given the exceptionally low snow pack during the 2001-2002 winter, significant progress towards this goal should be made during the remaining portion of the 2002 operating season. Draining the mine pool may be one of the few practicable solutions to reducing continual loading of acid mine drainage to surface water. Some water should be left in the mine pool to reduce the air exposure of sulfide bearing ore.

6.1.2 CONSIDERATIONS FOR THE 2002 SDI SEDIMENT REMOVAL

The site managers mentioned that due to the light snow pack this year the water treatment plant will likely be shut down early in the season leaving resources available to conduct other activities onsite. Specifically, the site managers mentioned a program to remove sediments from the SDI and to place those sediments in the sludge disposal area. The specific plans or goals for the sediment removal were not discussed with the RSE team, but the RSE team understands that approximately 70,000 cubic yards of material will be excavated and placed in the sludge disposal area presumably to increase the storage capacity of the SDI and to facilitate extraction from the SDI with the raft-mounted pump. Though this excavation will occur in and around the SDI, not all of the removed volume (approximately 14 million gallons) will translate to extra storage volume for water during the operating season.

The RSE team encourages the site managers to consider three items in relation to this proposed sediment removal program.

- First, any excavation done this year should be useful for the final remedy impoundment. Investing in modifications that do not provide significant additional storage volume and further reduces the already limited capacity of the sludge disposal area is not cost-effective, especially if major modifications to the impoundment will be made in a few years as part of the final remedy.

- If major modifications to the impoundment will not be made during the final remedy and pumping will still be required to transport water from the impoundment to the water treatment plant, then during the excavation efforts, a permanent structure for intake with multiple draw off levels could be constructed. The use of a permanent structure would facilitate system start up each April because water could be extracted from below the ice. Currently, system startup is delayed because the ice must thaw or be broken to properly place the raft-mounted pump for water extraction. Therefore, a permanent structure could extend the operating season by a few days or longer and reduce dependence of system startup on favorable weather. Extra treatment time afforded by earlier startup will further drawdown the SDI and provide more volume for water storage during the snow melt period operating period. This will not be of particular benefit for the 2003 operating season because the snow pack in 2002 was so light and the SDI will be as low as possible at the end of 2002; however, in future years a permanent intake could provide a substantial benefit. The cost to design and construct such a structure may increase the costs of the activity by $50,000 to $100,000.

- The site managers should carefully consider the value and potential drawbacks of SDI excavation. Because the sludge disposal area is reaching capacity, the placement of excavated sediments in that area will use valuable storage space for sludge generated by water treatment. Assuming water treatment results in 7 loads per day of 100 cubic feet per load, 70,000 cubic yards (approximately 1.89 million cubic feet) of storage space translates to 1,040 days of sludge storage. Given a typical operating season is approximately 7 months long, 1,040 days of sludge storage is equivalent to 5 operating seasons. Therefore, placement of excavated sediments will hasten the need for the site managers to determine a new location for sludge disposal. The need for new sludge disposal locations has been discussed, but the site managers suggested that a favorable location has not yet been determined. The RSE team therefore suggests that the site managers carefully consider the volume of sediment to be removed. The RSE team suggests the excavated sediment should be limited to that required to increase the volume of the SDI or to construct a permanent intake structure.

6.1.3 CONSIDERATIONS FOR GROUNDWATER AND SEEP MANAGEMENT AS PART OF THE FINAL REMEDY

Knight Piésold has been contracted with design and installation of the water management structures for the final remedy. Their work will include diverting unimpacted surface runoff from the site and capturing impacted groundwater seeps that are currently discharging to Wightman Fork. The following three interceptor drains/trenches (depicted on Figure 2) are proposed for the site to divert impacted water to the SDI:

- Interceptor drain along the valley on the northern end of the site
- Interceptor trench along the Highwall
- Interceptor drain below the Heap Leach Pad area

In addition, collection of the seeps at the base of the SDI dam are also planned, and site ditches will be improved to divert clean water from the site.

Although the Wightman Fork Diversion routes water around the SDI, the Wightman Fork between WF-1.5 and the diversion still receives acid mine drainage from groundwater underflow and the wetlands area seeps. Groundwater impacted with acid mine drainage discharges to the valley through both the alluvium and the bedrock, which is approximately 34 feet deep near the location of the proposed trench. Therefore, as part of the seep management work, the RSE team recommends that site managers characterize the hydrogeology of the seep areas along the northern boundary of the site to evaluate groundwater seep volumes, the potential for groundwater to bypass the proposed trenches, and the potential volume of unimpacted groundwater and runoff that would be intercepted. Without proper evaluation, interceptor trenches may capture the impacted water in the upper portion of the alluvium but miss the majority impacted water that is located in the lower alluvium and bedrock. The original plan in the ROD was to trench to bedrock; however, because of the greater than expected depth, this will not likely occur. Therefore, capture provided by the proposed trenches will not likely be as significant as originally thought.

The results of a hydrogeologic evaluation may therefore suggest that an alternative is more appropriate. If groundwater with acid mine drainage that is supposed to be intercepted by the proposed trenches ultimately discharges to the current Wightman Fork, the RSE team suggests beginning the diversion of the Wightman Fork at WF-1.5 rather than its current location near the site entrance. This would further isolate the relatively clean water at WF-1.5 from the acid mine drainage that is discharging to Wightman Fork from the wetland area seeps and groundwater underflow. The discharge from the seeps could then be routed to the SDI through Pond 6 and the Ditch S. Given that the estimated cost of the interceptor drain is approximately $500,000, the cost of this evaluation should be limited to $100,000 so as not to significantly increase the total cost of the drain if it is installed.

It should be noted that the proposed interceptor drain along this northern portion of the site would primarily serve to reduce the volumes of unimpacted water flowing into the SDI. The Highwall interceptor trench will also serve to reduce the flow of unimpacted water to the SDI. Therefore, these proposed items will reduce the controlled releases of impacted water from the SDI but will have a limited effect on reducing loading to surface water that is responsible for exceedances not due to SDI releases.

The interceptor drain near the Heap Leach Pad and collection of the seeps at the base of the SDI dam, on the other hand, should reduce the continual flow of acid mine drainage to surface water.

6.2 RECOMMENDATIONS TO REDUCE COSTS

Acid mine drainage will likely continue at the site indefinitely, and the proposed final remedy does not attempt to eliminate the contaminant source. Therefore, long-term operations to contain the contamination will likely continue indefinitely. To minimize annual costs, and therefore life-cycle costs, the site managers should focus on items that are required for operating the remedy and eliminate those items that are not required. Overtime, changes in technology, changes in site conditions, or long-term data records will allow further reductions in the costs required to maintain the remedy's performance.

6.2.1 REDUCE WEEKLY ENVIRONMENTAL SURFACE WATER SAMPLING

At the time of the RSE site visit, the onsite contractor was sampling up to 13 locations on a weekly basis, which is a reduction from 32 sampling locations during 2000. Sampling of the water treatment plant influent and effluent is conducted to monitor its performance, sampling of water in the ditches is used to make decisions on diverting runoff to either Wightman Fork or the SDI, and sampling of Cropsy Creek and Wightman Fork is conducted to determine the water quality downgradient of the site. Water is also sampled from the Reynolds Adit, Reynolds Pipe, and French Drain to inform the plant operators of the expected water quality in the SDI.

The RSE team sees the following opportunities for reductions in this sampling program. If implemented, these reductions could lead to a reduction in chemist and/or sampling labor, which may translate to a savings of over $50,000 per year.

- The sample collection frequency of water from the Reynolds Adit, Reynolds Pipe, and French Drain can be reduced to quarterly or semi-annually. The approximate 10 years of monitoring records for these locations have established weekly fluctuations resulting from changes in flow rates. Weekly concentration data are not needed for operation of the water treatment plant, since water treatment influent concentrations are measured on a daily basis. Furthermore, the water treatment plant is operated based on measurements of turbidity, sludge density, and the clarity of the water in the sludge thickener/clarifier. Quarterly or semi-annual data will provide long-term metal concentration trends for these sources.

- Given the vast amount of historical weekly data available for the onsite ditches, it is questionable if new data are needed to make real-time decisions on diversions of runoff flow. Routine sampling of the ditches could be eliminated, and sample collection can be performed on an as-needed-basis to document peak flow concentrations when spring runoff water is being diverted around the SDI.

- The weekly data collected for Cropsy Creek and Wightman Fork are not being used to make operating decisions. Rather, they are being used to determine surface water quality downgradient of the site. Because a comprehensive offsite surface water sampling program is being performed on Wightman Fork and the Alamosa River, these additional weekly data appear redundant. Reducing the sampling frequency from weekly to monthly for Cropsy Creek and Wightman Fork would allow the site team to continue documenting metals discharges immediately downgradient of the site.

Correspondence with the operations contractor subsequent to the RSE site visit indicates that the frequency of sampling has been reduced from weekly to biweekly since June 15, 2002. This should represent cost savings to the project. Further savings may be realized if the sampling reductions suggested in this section are implemented.

6.2.2 REDUCE GROUNDWATER AND SEEP SAMPLING

The RSE team acknowledges CDPHE's plan to reduce the monitoring from approximately $350,000 per year to a cost of approximately $150,000 to $200,000 per year. The RSE team agrees with reducing monitoring to reduce costs if remedy effectiveness is not sacrificed. The RSE team highlights the following three areas where reductions could occur.

- The characterization phase of this project is likely complete. Only those wells that directly monitor the performance of the remedy should be sampled, and an annual sampling schedule is more appropriate. Wells to remain in the sampling program include those in the Cropsy Drainage, Heap Leach Pad, North Waste Dump, and mine workings/mine pit backfills. It appears that more than 12 wells can be eliminated from the sampling program that currently includes 26 wells. In particular, the following wells could likely be eliminated from the monitoring program: NPDMW-3, NPDMW-3A, RMCMW-5A, ABCMW-1, ABCMW-3, RMCMW-3, MRFMW-1, OC-27, OC-25, PW-1, RMCMW-2, and GWFDW-3. Approximately 3 to 4 days of field labor, 1 day of database management, and approximately $5,000 in analytical costs could likely be eliminated as a result.

- Seep-monitoring occurs annually; however, detailed monitoring of individual seeps should be discontinued given that the characterization phase of this program is complete. One composite sample should be taken each of the seep areas, such as the Cropsy Footprint, Heap Leach Pad, and the combined Missionary-Chandler-North Waste Dump areas. Approximately 5 days of field labor, 2 to 3 days of database management, and approximately $5,000 in analytical costs could likely be eliminated as a result.

Assuming approximately $2,500 per day for field labor and $500 per day for data management, these reductions may result in a cost savings of approximately $32,500 per year. Thus, additional reductions in this program would likely be required to reach the cost reduction goals of CDPHE.

6.2.3 ELIMINATE UNNECESSARY SNOW REMOVAL AND/OR OBTAIN REIMBURSEMENT FOR CONDUCTING NATIONAL PARK SERVICE SNOW REMOVAL

The O&M contractor is tasked with snow removal and maintenance of Park Creek Road, which is approximately 18 miles in length, throughout the year. The Forest Service indicated that the site is only responsible for snow removal of the last 15 miles of the road near the site, if the road is needed for site operations. The first few miles would generally be the responsibility of the Forest Service due to other users of that beginning portion of the road. However, the snow removal of the entire stretch is conducted by the site contractor throughout the year as a goodwill gesture. The site staff perform preventative maintenance at the site throughout the winter and therefore need to clear snow and maintain the roads throughout the winter. Maintenance of the additional 15 miles is not significant increase in effort.

Snow removal is a significant site expense. Excluding overhead and profit, snow removal requires an annual cost of $60,000 per year for labor and $200,000 per year for leasing the heavy equipment for five months (December through April). Thus, the total cost is approximately $345,000 per year including $85,000 for overhead and profit.

Though not discussed in detail during the RSE site visit, the benefits of winter preventative maintenance likely do not outweigh the costs associated with snow removal. The RSE team recommends that appropriate measures be taken to avoid winter trips to the site and to discontinue snow removal and road maintenance during the winter. With no winter trips to the site required, snow removal of the last 15 miles of road will not be required, and the Forest Service can resume responsibility for snow removal of the beginning 3 miles of road. Snow removal and road maintenance will likely be required in early April to ensure enough time for system startup before the snow melt season begins but this may be accomplished by the Forest Service through negotiations. Therefore, approximately $275,000 of the $345,000 per year for snow removal should be eliminated.

Correspondence subsequent to the RSE site visit indicates that the snow removal equipment has been purchased since the RSE visit. Though this approach ensures that the costs for leasing the equipment will not be incurred in future, to achieve the full $275,000 per year in savings, snow removal would need to be discontinued. If elimination of snow removal is not feasible, EPA should obtain reimbursement for that portion of snow removal and road maintenance conducted on behalf of the Forest Service.

6.2.4 SCALE BACK OR ELIMINATE DEL NORTE OFFICE

The Del Norte office provides a location for business that will not deliver their goods to the site, and it provides a central meeting place for the site team prior to traveling to the site. In addition, administrative work for the field labor is coordinated through this Del Norte Office. Due to the long-term nature of this remedy, efforts should be made to phase out this office. Alternative accommodations can be made for those businesses that do not deliver to the site, the site team can arrange for another meeting place, and the administrative work could likely be conducted out of the contractor’s home office near Denver. Although Del Norte office personnel provide a radio contact offsite, telephones are installed at the site and can be used for communication. Because some of the administrative work would be done in the home office at increased cost, only a portion of the $52,000 per year (approximately $70,000 with overhead and profit) could be eliminated. The RSE team estimates that savings of over $50,000 per year could be realized by eliminating this office.

6.2.5 IMPROVE CONTRACTING TO ALLOW PURCHASING OF VEHICLES RATHER THAN LEASING

Due to EPA contracting requirements the site contractors must continue to lease the site vehicles because purchasing the vehicles is prohibited. Vehicle leases total $66,000 per year ($88,000 including overhead and profit), and the site managers commented that the cost of vehicles would be paid within two years. Conservatively assuming the vehicles last 5 years, leasing site vehicles translates to excess cost of approximately $264,000 every 5 years or approximately $53,000 per year. The RSE team encourages EPA to modify contracting procedures for this site to allow purchasing the vehicles rather than leasing them.

6.2.6 AUTOMATE TREATMENT PLANT OF THE FINAL REMEDY TO REDUCE LABOR REQUIREMENTS

Many aspects of the current system are passive or automated. Sampling of the influent and effluent is done automatically. The lime eductor system feeds lime at a prescribed rate and does not require substantial attention. Recycling of the filtrate from the filter press to the mixing tanks for seeding is automated and also requires little attention. Water flows through the plant via gravity and also requires little attention. The thickener/clarifier is also a passive system for the most part, but because the sludge rake can get stuck when solids increase beyond 10% and no lifting mechanism is in place, attention is required.

The truly manual parts of the system include selecting and batching the polymer and operating the filter press. Selecting the appropriate polymer is not done daily, but batching the polymer is done manually every 1.5 hours. Operating the filter press is typically done 7 times per day but may be done up to 12 times per day when influent metals concentrations are elevated. Cleaning the plant, general maintenance, and addressing shutdowns due to dirty power also requires manual labor. Because the plant is operating at 1,000 gpm instead of the original capacity of 500 gpm, the tanks are operating within inches of overflowing.

A new treatment plant that would operate at its design capacity could likely operate at reduced labor compared to the existing system and could possibly operate unattended in the evenings during portions of the operating season. Concerns about leaving the system unattended at night during the peak snow melt season are legitimate, but during the other portions of the operating season when sufficient storage is available in the SDI, if the system were to occasionally shutdown while unattended protectiveness would not be sacrificed. Upon visiting the system in the next morning, the operators could restart the system and only a few hours of treatment would have been lost. For a system to operate with reduced labor or to operate for periods of time unattended the following items would be required: a covered thickener/clarifier with a lifting mechanism for the rake, an automated polymer batching and mixing system, and a solution for addressing the dirty power (this is discussed further in Section 6.3.2). In addition, multiple filter presses would allow operators to let the sludge accumulate in a sludge holding tank overnight and conduct additional press cycles during the day to regain the storage capacity in the holding tank. An additional filter press could also serve as a backup to avoid system shutdowns if a single press fails.

The RSE team envisions that the plant could operate effectively during much of the operating season with two operators each working approximately 60 to 80 hours per week. This is equivalent to 4 operators (1 supervisory operator plus 3 other operators) working full time at the site rather than the current 8 operators working at the site. In lieu of having a trained EMT onsite at all times and an ambulance, it might be sufficient to have all site staff trained in CPR and First Aid. During system start up and the peak of the snow melt season, additional time or staff might be required. This arrangement of inconsistent work due to varying time frames and working hours is a complicating factor for finding qualified operators in this relatively remote location. The site contractors expressed to the RSE team that if the operators cannot rely on steady employment that other employment offers become more attractive. Therefore, there may be a conflict between the minimum labor requirements for operating a new plant and the availability of a qualified work force that is willing to meet those minimum requirements. This conflict could result in an overstaffed treatment plant during periods of relatively stable or low flow. On the other hand, minimizing the staffing may result in the treatment plant being understaffed during periods of peak flow. This conflict occurs within a season when additional labor is needed only for the periods of peak snow melt and from year to year depending on the volume of the snow pack when the treatment plant could be shutdown during low snow pack years but must operate as long as possible and with increased operator attention during high snow pack years.

Given that water treatment at the site will continue indefinitely and that labor is a high cost driver, a solution to this conflict must be found for the remedy to operate cost-effectively in the long term. Viewing snow pack and flow data from recent years, there is no typical snow pack year. Rather some of the years have exceptionally low snow packs and other years have relatively (or in some cases exceptionally high) snow packs. The 2002 operating season is one of those low snow pack years and although water treatment can technically be shutdown early, to keep the operating staff, other activities are devised to provide them work through the operating season. During the 2002 operating season these additional activities include the SDI sediment removal. Although this effort might be important for the remedy as a whole, other activities in future years may not be worth the additional cost. Based on this analysis of the snow pack data, and assuming a solution is found to address the conflict between plant requirements and consistent work for operators, labor costs could be substantially reduced over the long-term because less labor would be needed during the years with low snow packs.

To address this fluctuating labor requirements for the plant, the RSE team offers the following considerations. Although these considerations may not provide exact solutions to improve the cost-effectiveness, they may help site managers devise a viable solution.

- It is more cost-effective to hire a smaller baseline staff and either provide overtime or seek additional temporary contract help during periods where increased operator attention is required. Over the years, finding temporary help may become easier as the community learns of the periodically available employment. Based on discussions during the RSE site visit, it is apparent that the current work force frequently opts for overtime.

- If the treatment plant can be shutdown early due to a low snow pack, buy outs of the baseline staff may be an option. Such a buy out would provide the staff with some compensation for the period they are not working, while also providing cost savings to the system in labor in addition to the cost savings in utilities and materials from not operating the plant.

- Another option to account for early shut down due to a low snow pack is to structure the operator wages to account for those years when the system may be shutdown early. Those wages could be based on recent snow pack data and the estimated time that the system could have been shutdown. For example, the snow pack data presented in Section 4.2.1 of this report suggest that of the 7 operating years, 3 had snow pack levels significantly below average. During these years water treatment could likely be discontinued 2 to 3 months early (i.e., in July or August instead of October) resulting in a 4 to 5 month operating season rather than a 7 month operating season. If operations were discontinued 3 months early during the 3 years with light snow pack then the system would have only been operated for a total of 40 months rather than 49 months. This translates to an approximate reduction in O&M costs of 20% (including labor, utilities, and materials). To realize the savings in labor, operator wages could be adjusted for this 20% reduction with the understanding that operations will be shutdown if continued treatment during an operating season is not necessary for remedy effectiveness. If this snow pack data provides an inaccurate forecast of the future, and the baseline staff operates more than expected, then additional compensation could be provided to make up the difference. In this manner, savings is guaranteed for the remedy if the current data accurately forecast or over-predict future snow packs and operating requirements, and the operators are compensated if the forecasts underestimate the future snow packs and operating requirements.

- If the site staff is well diversified in the activities performed at the site then a single staff member could perform sampling, plant operation, laboratory work, or general site maintenance. At least one of the existing staff members have such diversified experience. With a diversified staff, items such as sampling or lab analysis could be postponed by a short time if additional help is required in the treatment plant or other site maintenance. The more activities or responsibilities this diversified staff has, the more flexibility there is in using available staff to address fluctuations in the labor requirements of any one activity.

The RSE team suggests that the site managers set a target for reduced labor costs associated with site activities for when the new plant is operational. Determining a suitable target will require further discussion with the site managers and current contractors as well as consideration of funding availability and the design of the new system. The RSE team suggests a preliminary target that is a 25% to 50% reduction from the current labor costs of the site. This preliminary target accounts for recommended reductions in onsite surface water sampling, laboratory analysis, and plant operation but does not include the recommended reductions in snow removal and the Del Norte office. By setting this target, it will give the site managers a cost-effectiveness goal, that when considered with the protectiveness goals, will help them develop and manage an effective and efficient remedy. Furthermore, making such reductions in the labor will be required if the projected O&M costs for the selected remedy are to be achieved. If such labor reductions cannot be achieved and the O&M costs are greater than those projected, then the life-cycle costs for the selected remedy should be updated.

6.3 RECOMMENDATIONS FOR TECHNICAL IMPROVEMENT

6.3.1 PROVIDE A NEW SOURCE FOR POTABLE WATER

Potable water is needed for mixing the polymer in order to maintain plant effectiveness. A new well is required to provide sufficient potable water during drought years and when other wells have technical problems. Assuming a new well is less than 200 feet deep, the cost for installation should be approximately $30,000.

6.3.2 REMEDIATE DIRTY POWER

The operators of the water treatment plant have indicated that the supplied power has large variability that sometimes falls outside the normal frequency range and causes electrical components to automatically shut down. This requires on site operation 24-hours/day in case a motor kicks out and must be restarted following the power fluctuation. The power supply connection point is located approximately 15 miles away in Del Norte. These fluctuations are likely caused by the source of power rather than its transmission, and redoing the utility lines between Del Norte and the site will not likely correct the problem. A viable solutions is to conduct a small scale study lasting approximately 7 days using a recording meter. For a cost of approximately $5,000, this study will identify the any phase fluctuations in the feed, that will enable a competent electrical engineer to design a filtering system to eliminate the frequency shifts or auto restart the system if shifts are caused by voltage spikes.

A filter, if needed, would be placed just before the main panel distributing the plant power to the various motor control centers/starters. The installed cost of a 480/277 volt 600 amp filter would be approximately $20,000. Retrofitting the controls for major equipment to automatically restart due to voltage spikes would also cost approximately $20,000.

6.3.3 PROVIDE NECESSARY BACKUP TO FILTER PRESS AND DUMP TRUCK

There is no backup unit for the existing filter press or dump truck, and if either fails, plant operations would need to be shutdown until repairs could be made or a replacement could be found. The RSE team has seen a number of pump and treat systems with multiple filter presses that are rarely used. Of all sites, the RSE team has visited, this site merits an additional one for back up or for doing additional press cycles during the day. A new filter press would likely cost $60,000 to $70,000. For backup to the dump truck, the site managers should locate a substitute truck that is available to rent if the current truck is in need of repair. If the current truck breaks down and repair is impracticable, and replacement truck may need to be purchased. A previously-owned and operated dump truck with a value of approximately $30,000 would likely be sufficient.

6.3.4 APPLY LESSONS LEARNED FROM EXISTING WATER TREATMENT PLANT TO DESIGN OF THE FINAL REMEDY WATER TREATMENT PLANT

Most of the water treatment plant was built in the late 1960s. While it is still effectively removing copper at an acceptable flow rate, it requires more attention and maintenance than that of a modern plant. Given the long-term nature of this remedy, the RSE team agrees with the site team that a new plant is justifiable. Though internal EPA and CDPHE deadlines suggest the new plant must be designed, installed, and operating by April 2005, the RSE team does not believe this relatively short time frame is due to the technical shortcomings of the existing treatment plant. Specifically, the planned flow capacity of the new system is equal to that of the current system, and with minor readjustments, the current operations team could likely keep this system operating at the current level of effectiveness for a number of years, if necessary. Therefore, the condition of the current treatment plant does not necessitate the construction of a new treatment plant in the short term.

Five years of plant operation have resulted in valuable information regarding water treatment options and the site in general. The RSE team encourages the site managers to consider this gained experience when designing and installing the new water treatment plant.

Location

The 2001 ROD specifies that the new treatment plant will be located downgradient of the SDI and will receive influent by gravity. At the RSE site visit, the plant operators noted their strong opposition to this plan given the particularly severe snow accumulation that occurs in the proposed location. In addition, this proposed location would require rerouting site roads and utilities at significant expense. The primary benefit would be the elimination of the influent pump, which requires approximately $100 per day in diesel fuel to operate. Two other locations have been proposed for the new treatment plant: alongside the existing plant and at the site entrance where the guard shack is currently located. Locating the plant near the SDI is particularly attractive for two reasons. First, the plant is located near the site entrance and operators can easily identify potential site visitors. This is a cost-effective approach to maintaining a full-time security guard. Full-time security has already been eliminated to save costs. Second, the plant is lower in elevation and less power will be required for pumping water to the plant. Water from certain locations, such as the Reynolds Adit or Reynolds pipe could be directly fed to the treatment plant rather than going to the SDI and requiring pumping to reach the plant. With reduced power needed for pumping, a suitably sized influent pump may be able to operate off of provided electricity rather than requiring the use of the diesel generator and some cost savings could result.

Sludge Thickener/Clarifier

The existing sludge thickener/clarifier is uncovered and allows snow accumulation within it. This significantly delays system startup in April and shortens the operating season with snow storms in October. Enclosing the sludge thickener/clarifier is one feature of a new plant that would reduce operating time and allow for a more flexible operating season.

The rake for the existing sludge thickener/clarifier does not have a lifting mechanisms. This requires the operators to pay particular attention to the percentage of solids in the sludge. If this percentage exceeds 10% then the system requires shutdown to adjust the rake manually. Including a lifting mechanism for the rake in the new thickener/clarifier will be another feature that will reduce operator attention.

Polymer Mixing and Addition

Proper mixing of the polymer requires a reliable source of potable water (in excess of 4 gpm). Without this source of potable water the polymer does not work as effectively and the concentration of copper and other metals in the effluent increase. A new source of potable water is required for the existing plant, and therefore should be in place for the new plant.

The existing polymer system requires manual batching every 1.5 hours. This is operator intensive and is one of the aspects of the current plant that requires substantial attention. Although an automated batching and mixing system is available, it does not have sufficient capacity when the plant is operating over 800 gpm. In the new treatment plant, the polymer batching and mixing system should be completely automated to allow plant operators to attend to other aspects of the treatment plant.

Lime Silo

A new lime silo will be required for the new treatment plant. The current silo has complications with bridging of the lime, which complicates lime addition to the process water. Properly placed and functional vibrators or other mechanisms will be need to prevent bridging. The lime eductor system in the existing plant functions well and a similar system is likely appropriate for the new treatment plant. A new silo may be required for the existing system if it continues to operate for a number of years.

Filter Press

The new treatment plant would benefit from an improved filter press foundation. The existing plant filter press is not level and side rail distortion requiring replacement has occurred. A properly designed level foundation should prevent this problem in the new system. The existing treatment plant may require another filter press in the near future.

Power Surge Protection

The solution used for correcting the dirty power in the current plant (described in Section 6.3.2) should also be incorporated into the new plant to avoid unnecessary system shutdowns and damage to equipment.

6.4 CONSIDERATIONS FOR GAINING SITE CLOSE OUT

6.4.1 CONSIDER REMEDIAL ACTIONS THAT COULD REPLACE LONG-TERM CONTAINMENT AND WATER TREATMENT

Acid mine drainage from the Summitville Mine workings, French Drain and potentially the Heap Leach Pad (HLP) will be a long-term O&M problem for this site. The current approach to the problem is to treat the acid mine drainage at the downgradient end of the cycle. Efforts have been made at the site to reduce these impacts and consolidate waste piles into the former open pit; however, a significant volume of acid mine drainage continues to flow from the multiple sources at the site. These sources are essentially infinite, and metal-laden, acidic water will need to be treated into perpetuity unless more effort is made towards stopping the generation of acid mine drainage.

The ultimate goal for the site should be to shut down the water treatment plant by stopping or reducing acid mine drainage generation. A thorough review of the previous geochemical investigations at the site is beyond the scope of an RSE; however, it appears that more effort is needed to characterizing the geochemistry of the site and upgradient areas in terms of developing remediation approaches to stop or reduce the generation of acid mine drainage. Pyrite oxidation is the likely the source as stated in the site documents. Groundwater pH of 5 or less continues to promote pyrite oxidation and acidic water production, and the acidic water accelerates the dissolution of metals from sulfide deposits at this site. The following potential remediation efforts should be considered:

- Backfilling the mine workings and adits with coal-combustion byproducts, especially fly ash, could be done to buffer the pH, limit infiltration capacity, and reduce exposure of sulfide bearing ore to air and water. A number of coal-fired plants are located in Colorado and northern New Mexico providing relatively nearby sources of this material.

- Surface soil amendments of lime or calcium carbonate could be used to inhibit the generation of acid mine drainage.

- Hydrogeologic controls such as reductions in fracture permeability in the vicinity of mine workings would reduce the amount of infiltration and the production of acid mine drainage.

- Reducing the hydraulic gradient upgradient of and beneath the HLP would prevent or reduce groundwater upwelling through breaches in the HLP liner.

Though such remedies may require significant capital costs the selected long-term remedy has a projected net present value cost of approximately $75 million as specified in the 2001 ROD and one of the above approaches might prove to be cost effective.

6.5 SUGGESTED APPROACH TO IMPLEMENTATION

Implementation of any of the ideas presented in Section 6.4 would take a number of years for proper characterization, screening, design, community involvement, and implementation and might also prove impracticable after further evaluation. However, these or similar source control approaches are the only proactive way to avoid high perpetual annual costs associated with water treatment. The interim and selected final remedies, on the other hand, provide a necessary level of protection and a viable long-term solution. These remedies, however, will virtually assure that site closure is not achieved in the foreseeable future. The existing water treatment plant can likely operate for a number of years at the current level of effectiveness with only minor modifications, but if water treatment is to occur for 10 years or longer (which is likely the case), then a new treatment system is appropriate from both the effectiveness and cost perspectives. The best course of action may be to continue with implementing the final remedy but to also investigate the alternatives presented in Section 6.4. The RSE team also encourages the site managers to revisit these alternative source control measures in the future as well as any other technologies that arise even after the new water treatment plant is installed and operating.

7.0 SUMMARY

The RSE team found an extremely well-operated treatment plant and site-wide remedy. The site team has a good conceptual model of the site and have proven that they can prioritize remediation activities effectively. Internal optimization efforts have already lead to increasing the plant capacity from 500 gpm to 1,000 gpm, and the site team provided a number of recommendations that the RSE team has included in Section 6.0 of this report. The site managers and O&M contractor are to be commended for accomplishing several interim remedy goals, including addressing onsite waste areas and reducing contaminant loading to the watershed, in a relatively short period of time.

The observations summarized in this report are not intended to imply a deficiency in the work of the system designers, system operators, or site managers but are offered as constructive suggestions in the best interest of the EPA and the public. These observations obviously have the benefit of being formulated based upon operational data unavailable to the original designers. Furthermore, it is likely that site conditions and general knowledge of groundwater remediation have changed over time.

The RSE team provides considerations for management of the mine pool, the planned excavation of impoundment sediments, and continued groundwater and seep management. These considerations are intended to result in enhancement of the remedy effectiveness. The RSE team also provides recommendations to reduce costs of the existing remedy by proposing reductions in site sampling programs, discontinuing snow removal activities in the winter, phasing out the local administration office, purchasing rather than leasing site vehicles. Future cost reductions could result from ensuring a certain level of automation in the planned treatment plant and reducing labor accordingly. Recommendations for technical improvement for the existing water treatment plant included installing a new supply of potable water for polymer mixing, correcting the “dirty power” provided to the site, and providing back up for sludge handling and disposal equipment. In addition, the RSE team recommends that lessons learned from current operations be applied to the design and installation of the planned treatment plant.

The RSE team also recommends that site managers strongly consider an alternative remedial approach that will not require long-term water treatment. The existing and planned remedies ensure that water treatment will continue in perpetuity at relatively high annual costs (currently approximately $2.4 million per year). Alternative approaches that address the source of acid mine drainage may require substantial capital costs but could likely be more protective and cost-effective in the long term. The RSE team provides various approaches for further consideration.

Table 7-1 summarizes the costs and cost savings associated with each recommendation in Section 6.0. Both capital and annual costs are presented as well as life-cycle costs calculated both with discounting (i.e., net present value) and without it.

Table 7-1. Cost Summary Table

Recommendation	Reason	Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Estimated Change In Lifecycle Costs ($) [1]	Estimated Change In Lifecycle Costs ($) [2]
6.1.1 Considerations for management of the mine pool	Effectiveness	$0	$0	$0	$0
6.1.2 Considerations for the 2002 SDI Sediment Removal	Effectiveness	$75,000[3]	$0	$75,000[3]	$75,000[3]
6.1.3 Considerations for groundwater and seep management	Effectiveness	$100,000	$0	$100,000	$100,000
6.2.1 Reduce Weekly Environmental Surface Water Sampling	Cost Reduction	$0	($50,000)	($5,000,000)	($1,170,000)
6.2.2 Reduce Groundwater and Seep Sampling	Cost Reduction	$0	($32,500)	($3,500,000)	($819,000)
6.2.3 Eliminate Unnecessary Snow Removal and/or Obtain Reimbursement for Conducting National Park Service Snow Removal	Cost Reduction	$0	($275,000)	($25,000,000)	($5,850,000)
6.2.4 Scale Back or Eliminate Del Norte Office	Cost Reduction	$0	($50,000)	($5,000,000)	($1,170,000)
6.2.5 Improve Contracting to Allow Purchasing of Vehicles Rather than Leasing	Cost Reduction	$0	($53,000)	($5,300,000)	($1,240,000)
6.2.6 Automate New Plant to Reduce Labor Requirements	Cost Reduction	not quantified	not quantified	not quantified	not quantified
6.3.1Provide a New Source for Potable Water	Technical Improvement	$30,000	$0	$30,000	$30,000
6.3.2 Remediate Dirty Power	Technical Improvement	$45,000	$0	$25,000	$25,000
6.3.3 Provide Necessary Backup to Filter Press and Dump Truck	Technical Improvement	$70,000	$0	$100,000	$100,000
6.3.4 Apply Lessons Learned from Existing Water Treatment Plant to Design of the New Water Treatment Plant	Technical Improvement	not quantified	not quantified	not quantified	not quantified
6.4.1 Consider Remedial Actions that Could Replace Long-term Containment and Water Treatment	Site Closeout	not quantified	not quantified	not quantified	not quantified

Costs in parentheses imply cost reductions.
[1] assumes 100 years of O&M (consistent with ROD cost estimates), discount rate of 0% (i.e., no discounting)
[2] assumes 100 years of O&M and discount rate of 4.2% (consistent with ROD cost estimates)
[3] the average of the estimated range of $50,000 to $100,000

FIGURES

FIGURE 1. THE LOCATION OF THE SUMMITVILLE MINE SUPERFUND SITE RELATIVE TO NEARBY ROADS AND MUNICIPALITIES.

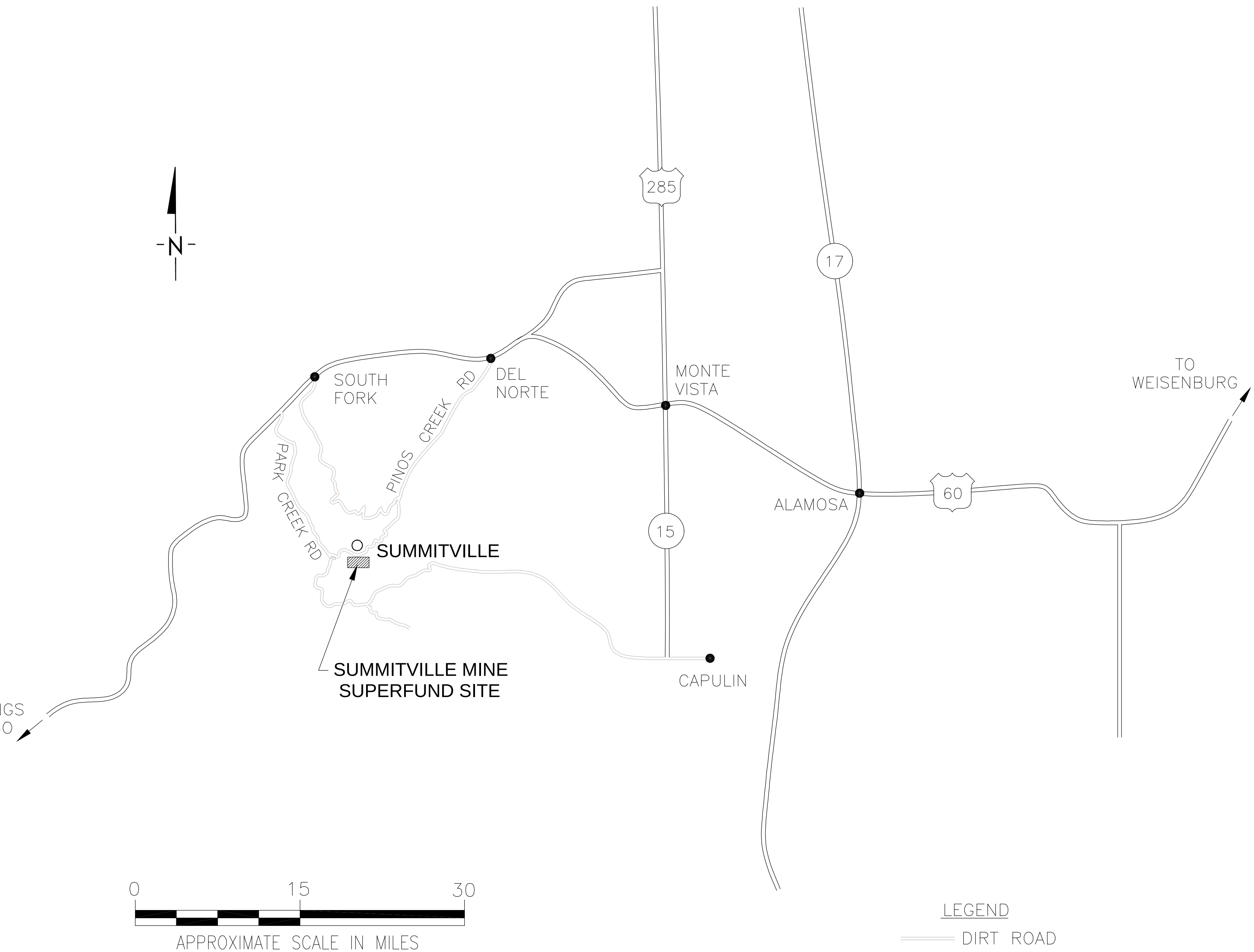
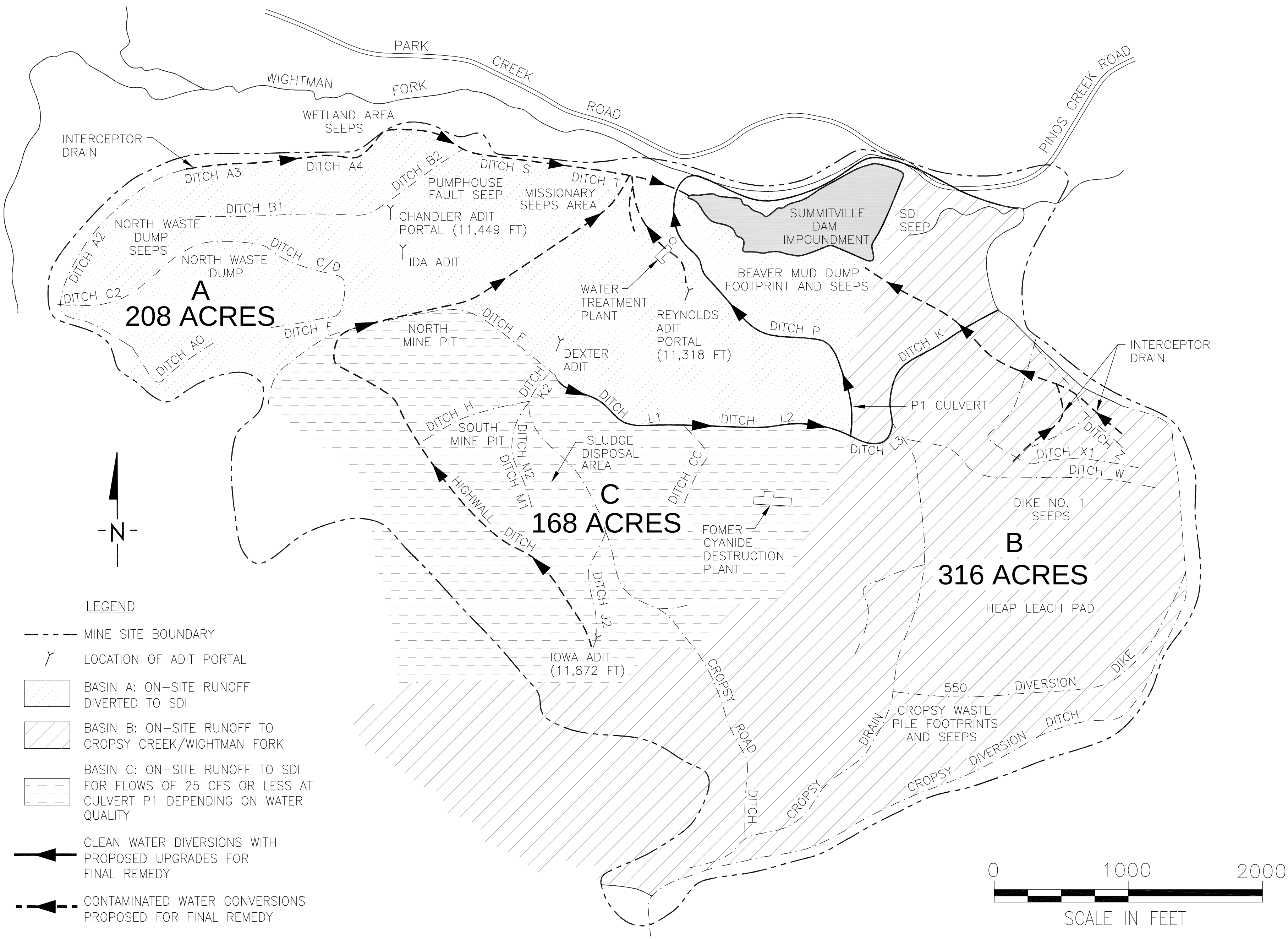
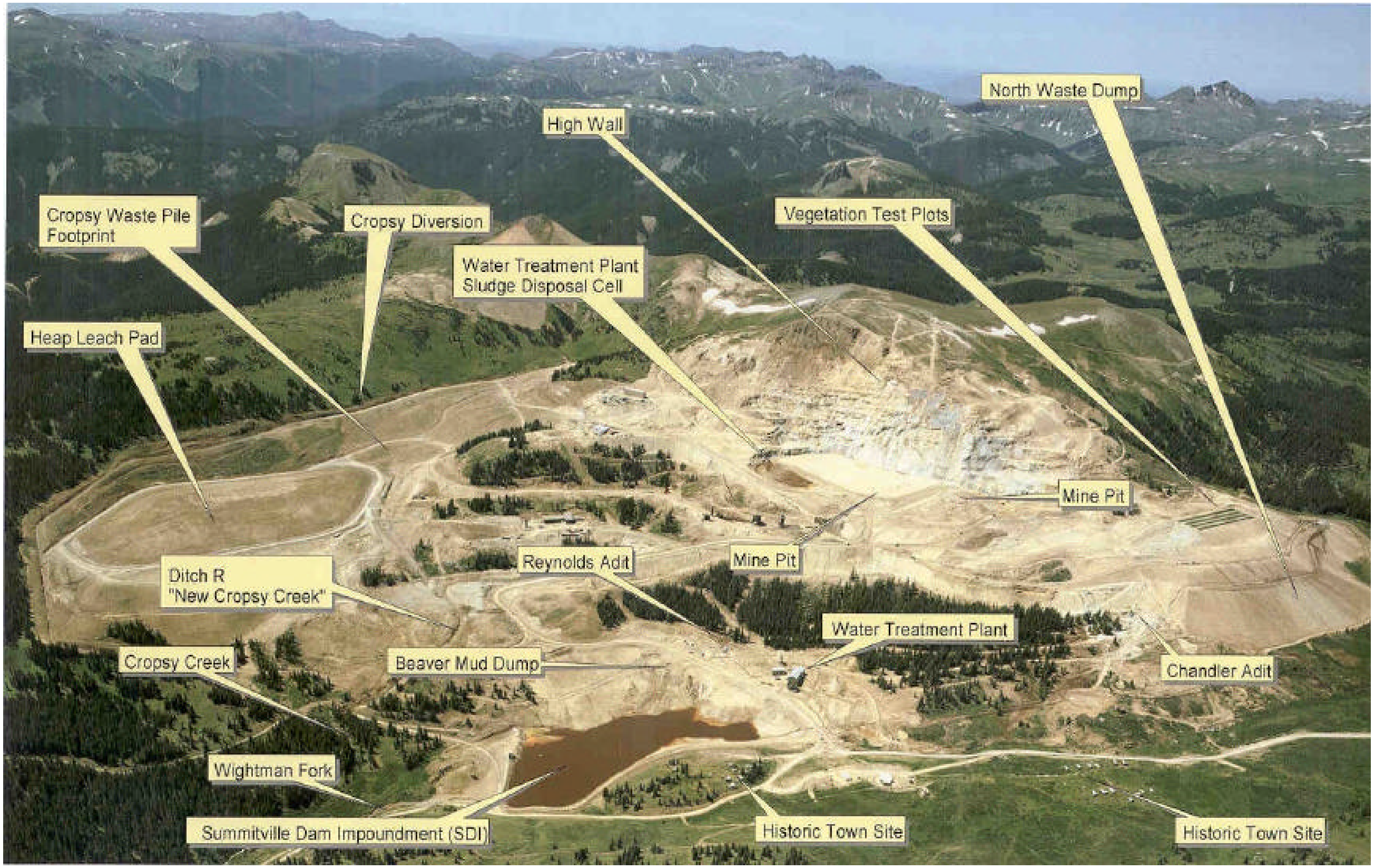


FIGURE 2. SITE LAYOUT SHOWING MAJOR FEATURES, INCLUDING SUB-BASINS, DRAINAGE DITCHES, AND DIVERSIONS.



(Note: This figure is based on figures in the 2001 ROD and the Summitville Mine Site-Wide RI/FS, Rocky Mountain Consultants, 2001).

FIGURE 3 LABELED PHOTOGRAPH OF THE SUMMITVILLE MINE SUPERFUND SITE DEPICTING MAIN SITE FEATURES.

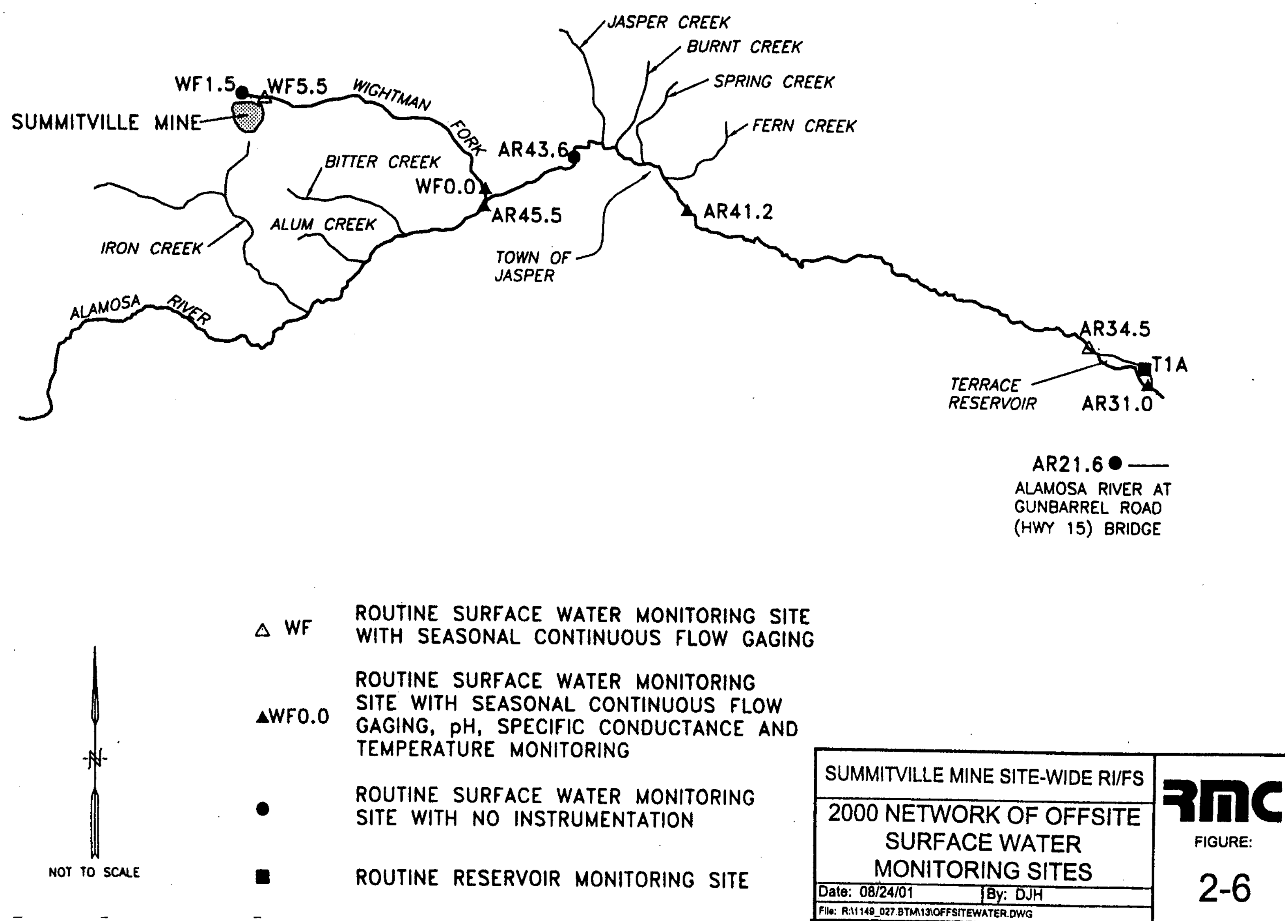


(Note: This figure was provided to the RSE team by CDPHE.)

FIGURE 4 CONDITIONS OF THE SUMMITVILLE MINE SUPERFUND SITE IN 1993 PRIOR TO REMEDIAL ACTION

(Note: This figure was provided to the RSE team by CDPHE.)

FIGURE 5 THE LOCATION OF THE SUMMITVILLE MINE SUPERFUND SITE RELATIVE TO NEARBY SURFACE WATER BODIES.



(Note: This figure is a copy of Figure 2-6 from the Summitville Mine Site-wide RI/FS, Rocky Mountain Consultants, 2001)