

FINAL CONSTRUCTION REPORT

FOREST ROSE MINE RECLAMATION PROJECT
MT DEQ MWCB CONTRACT No. 412001

Prepared for
Montana Department of Environmental Quality
Mine Waste Cleanup Bureau

Prepared by
Herrera Environmental Consultants, Inc.



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Prepared for
Montana Department of Environmental Quality
Mine Waste Cleanup Bureau
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CONTENTS

1.0	Introduction.....	1
1.1	Mining History.....	1
1.2	Project Objectives	2
1.3	Project Description	2
2.0	Responsible Parties	5
2.1	DEQ MWCB Coordination	5
2.2	Reclamation and Engineering Plan.....	5
2.3	Construction Monitoring.....	5
2.4	Contractor.....	5
2.5	Subcontractors.....	6
2.5.1	DS Jr. Trucking Subcontractors.....	6
2.5.2	Mungas Subcontractors	6
2.5.3	DEQ MWCB Subcontractors	7
3.0	Road Improvements Construction Events.....	11
3.1	Pre-bid Conference	11
3.2	Bid Opening	11
3.3	Contract Award.....	11
3.4	Contract Agreement	11
3.5	Construction Start-up.....	11
3.6	Work Directives and Change Orders	12
3.7	Weather Days and Work Suspensions	12
3.8	Closeout Documentation	13
3.9	Final Payment.....	13
4.0	Reclamation Construction Events.....	15
4.1	Pre-bid Conference	15
4.2	Bid Opening	15
4.3	Contract Award.....	15
4.4	Contract Agreement	15
4.5	Construction Start-up.....	16
4.6	Word Directives and Change Orders	16
4.7	Weather Days and Work Suspensions	18
4.8	Requests for Payment	18
4.9	Substantial Completion.....	19
4.10	Closeout Documentation	20
4.11	Final Payment.....	20
5.0	Construction	21
5.1	Major Equipment List.....	21
5.2	Compaction and Moisture Content Testing	22

5.3	Quantities Completed	22
5.3.1	Road Improvements Phase	22
5.3.2	Mine Reclamation Phase.....	22
5.4	Design and As-built Drawings	29
5.5	Construction Activities	29
5.5.1	June 9-15, 2012.....	29
5.5.2	June 16-22, 2012	29
5.5.3	June 23-29, 2012	29
5.5.4	June 30-July 6, 2012	29
5.5.5	July 7-13, 2012.....	30
5.5.6	July 14-20, 2012	30
5.5.7	July 21-27, 2012	30
5.5.8	July 28-August 3, 2012.....	30
5.5.9	August 4-10, 2012	31
5.5.10	August 11-17, 2012	31
5.5.11	August 18-24, 2012	31
5.5.12	August 25-31, 2012	31
5.5.13	September 1-7, 2012.....	31
5.5.14	September 8-14, 2012	32
5.5.15	September 15-21, 2012	32
5.5.16	September 22-28, 2012	32
5.5.17	September 29-October 5, 2012.....	32
5.5.18	October 6-12, 2012.....	32
5.5.19	October 13-19, 2012	32
5.5.20	October 20-26, 2012	32
5.5.21	October 27-November 2, 2012.....	33
5.5.22	November 3-9, 2012.....	33
5.5.23	May 11-17, 2013	33
5.5.24	May 18-24, 2013	33
5.5.25	May 25-31, 2013	33
5.5.26	June 1-7, 2013	34
5.5.27	June 8-14, 2013.....	34
5.5.28	June 15-21, 2013	34
5.5.29	June 22-28, 2013	35
5.5.30	June 29-July 5, 2013	35
5.5.31	July 6-12, 2013.....	35
5.5.32	July 13-19, 2013	36
5.5.33	July 20-26, 2013	36
5.5.34	July 27-August 2, 2013.....	36
5.5.35	August 10-16, 2013	37
5.5.36	August 31-September 6, 2013.....	37
5.5.37	September 7-13, 2013	37
5.5.38	September 14-20, 2013	37
5.5.39	October 5-11, 2013.....	37
5.6	Construction Photos.....	37
5.7	Construction Site Visitation.....	37

6.0 Project Costs.....	39
6.1 Total Project Costs.....	39
7.0 Project Summary	43
8.0 References	45
Appendix A	Pre-bid Conference Sign-in Sheets and Questions
Appendix B	Bid Tabulations
Appendix C	Project Start-up Documents
Appendix D	Meeting Minutes
Appendix E	Work Directives and Change Orders
Appendix F	Project Completion Documents
Appendix G	Payment Requests
Appendix H	Testing Results
Appendix I	Material Submittals
Appendix J	Weigh Tickets
Appendix K	Design and As-built Drawings
Appendix L	Daily Construction Reports
Appendix M	Construction Photos
Appendix N	Construction Site Visitor Logs
Appendix O	DEQ Invoices

TABLES

Table 5.1.	Major Equipment List.....	21
Table 5.2.	Road Improvements Estimated and Actual Bid Quantity Comparison.	24
Table 5.3.	Mine Reclamation Estimated and Actual Bid Quantity Comparison.....	25
Table 5.4.	Road Improvements Estimated and Actual Bid Price Comparison.	27
Table 5.5.	Mine Reclamation Estimated and Actual Bid Price Comparison.	28
Table 6.1.	Engineering Services Cost Summary.....	39
Table 6.2.	Construction Cost Summary.	40
Table 6.3.	Analysis of Engineering and Construction Costs Incurred.	41

1.0 INTRODUCTION

Forest Rose Mine is located in Granite County, within the Beaverhead-Deerlodge National Forest. The site is accessible from Interstate 90, approximately 8 miles east of Drummond. The mine is located at an elevation of approximately 5,500 feet above sea level and included approximately 4 acres of metal mining-impacted land along Dunkleberg Creek.

The impacted area included a waste rock pile and three tailings impoundments, a collapsed adit, and dilapidated buildings and concrete foundations. Tailings were placed in the Dunkleberg Creek bed creating three relatively flat terraces bound by steep ravine walls to the east and west. Waste rock was deposited immediately upstream of the three tailings impoundments. Dunkleberg Creek flowed into the waste rock pile and went subsurface, emerging and head cutting through the third tailings impoundment (T3). This water ponded on top of the second tailings impoundment (T2) and was collected by decant towers and piped to the northern most impoundment (T1). The water pooled and was then piped to Dunkleberg Creek, where it combined with water emanating from the toe of T1, eventually reaching the Clark Fork River.

Herrera Environmental Consultants (HEC) received five task orders pursuant to Contract No. 407032 from the Montana Department of Environmental Quality (DEQ) Mine Waste Cleanup Bureau (MWCB) for the Forest Rose Mine. Task Order No. 7 was received on February 6, 2010, to prepare a Reclamation Work Plan, complete a site inspection, collect field and laboratory data, and write a Reclamation Investigation Report. HEC received Task Order No. 8 on November 30, 2010, to conduct a repository investigation and prepare an Expanded Engineering Evaluation and Cost Analysis (EEE/CA). Task Order No. 11 was received on April 8, 2011, to provide engineering services and prepare bid documents. On November 21, 2011, HEC received Task Order No. 14 to provide engineering services, technical support, and update bid documents for road improvements to the site. Task Order No. 17 was received on April 16, 2012, to provide construction oversight and prepare a construction report for reclamation activities involved with the Forest Rose Mine Reclamation Project (Project). This report includes documentation of reclamation activities implemented during the reclamation of the Forest Rose Mine.

1.1 MINING HISTORY

Lode mining in the Dunkleberg mining district began in the early 1880s. Forest Rose and several other claims were staked in 1884, and the Forest Rose Mine operated intermittently through the 1940s. Approximately \$200,000 in silver and lead were produced by 1916 in the Dunkleberg mining district, of which about half was produced by the Forest Rose Mine. Other mines in the district included the Hatta, Jackson, Monarch or Old Tanglefoot, Pearl or Happy New Year, Summit, Sunset, and Wasa. The majority of production came from the Forest Rose, Wasa, and Jackson Mines (DEQ 2002).

The Forest Rose Mine is located north of the Wasa Mine, on the steep western slope of the Dunkleberg Creek ravine. The mine was first claimed by Frank Carnes and is on the patented Forest Rose and Acrobat claims. J.T. Pardee visited the mine in 1916 and, according to his notes, the size of the dumps indicated extensive underground development. The ore consists of quartz, limonite, galena, and pyrite (DEQ 2002).

The mine reopened in 1918 and recorded production until 1927. The Forest Rose and Wasa mines were reopened again during World War II. Together, the mines produced 113,000 tons of ore. The main adit is at 5,150 feet above sea level. It is driven 480 feet west into the hill, with 3,000 feet of underground workings located off the adit. In 1941, the Forest Rose Syndicate built a 100-ton concentrator to work the mine's ore. The product was conditioned for lead flotation and then the ore was reconditioned for the zinc circuit. Lead concentrates were sent to East Helena and zinc concentrates were sent to Anaconda (DEQ 2002). The Forest Rose Mine stopped its operations in 1946 but ran intermittently through the 1950s; it has been inactive since 1958.

1.2 PROJECT OBJECTIVES

The primary goal of the Project was to protect human health and the environment by isolating mine wastes from direct human and ecological contact. A secondary goal was to restore the Dunkleberg Creek channel to support a native westslope cutthroat fish population.

1.3 PROJECT DESCRIPTION

The Project encompassed the investigation, assessment, design of reclamation alternatives, and reclamation construction oversight of the Forest Rose abandoned hard rock mine in Granite County, Montana. Waste rock and mine tailings were the two sources of contaminated material present at the Forest Rose Mine, accounting for a total of approximately 109,000 cubic yards (CY). An EEE/CA identified contaminants present in the soil, tailings, waste rock, sediment, and surface water that exceeded DEQ Risk-Based Cleanup Guidelines (RBCG). Arsenic, cadmium, lead, and manganese exceeded DEQ RBCG in the solid matrix samples (soil, tailings, waste rock, and sediment). Similarly, arsenic, cadmium, manganese, and zinc exceeded the DEQ RBCG in the water samples collected from Dunkleberg Creek.

The Project was divided into two phases: a road improvements contract to provide access to the mine site and the mine reclamation contract.

The road improvements phase of the Project was performed under a limited construction contract (IFB 412021). DS Jr. Trucking was awarded the road improvement contract, which included resurfacing 7.1 miles of road in Powell and Granite counties, widening and resurfacing 1.9 miles of road on USFS-administered lands, and replacing six culverts in Powell and Granite counties. This phase of the Project was necessary because the original access road, Douglas Creek Road, washed out in 2011 during heavy rains and snow pack runoff. The secondary access road, USFS Road 707, was selected because it provided short access to the site from I-90; however, the road lacked maintenance and work was necessary to provide access to the mine site. Road improvement construction activities commenced on June 12, 2012, and were completed on July 1, 2012. Road improvement activities consisted of clearing and grubbing along USFS Road 707; culvert removal and replacement; widening sections of

Dunkleberg Creek Road in Granite County and USFS Road 707; and resurfacing Dunkleberg Creek Road in Powell County and Granite County and USFS Road 707. Specific construction activities are listed below:

- Installing four culverts in Powell County and two culverts in Granite County
- Clearing and grubbing of brush and trees along USFS Road 707 up to the mine site
- Resurfacing 1.8 miles of road in Powell County and 5.3 miles of road in Granite County
- Widening 1.9 miles of USFS Road 707 and resurfacing with gravel

The mine reclamation contract (IFB 412001) was awarded to Mungas Company, Inc. (Mungas). Mine reclamation activities commenced on June 29, 2012 and continued until shutting down for the winter on November 7, 2012. Activities then resumed on May 14, 2013, until substantial completion was obtained on July 30, 2013, with final completion obtained on October 9, 2013.

Reclamation activities consisted of clearing and grubbing; diverting Dunkleberg Creek; excavating tailings and waste rock; constructing an onsite repository; hauling and placing tailings and waste rock in the repository; demolishing and removing mine structures that impeded construction activities; reconstructing the Dunkleberg Creek channel and installing log and boulder weirs; widening and resurfacing USFS Road 707; and revegetating disturbed areas. Specific construction activities are listed below:

- Clearing and grubbing of brush and trees in the waste removal and repository areas
- Widening 1.7 miles of USFS Road 707 from the mine site to the repository and resurfacing with gravel
- Installation of two corrugated metal pipes (CMP) culverts under USFS Road 707
- Constructing and decommissioning temporary access roads in the waste removal area
- Excavation of 76,340 CY of native soil from the repository site
- Excavation, loading, hauling, and placement of 108,922 CY of mine waste in the repository
- Installing 21,447 square yards of 80-mil HDPE geomembrane and composite drainage net (CDN) over the mine waste as part of the repository cover
- Constructing a 5-foot thick soil cap over the liner system
- Grading the waste removal and repository areas to tie-in with the surrounding natural terrain
- Installing 2,578 LF of farm fence around the repository
- Fertilizing, hydroseeding, and mulching 15.9 acres of disturbance

- Reconstructing Dunkelberg Creek channel with the placement of:
 - 44 salvaged log weirs
 - 1,300 willows and 1,300 tree protectors
- Installation of Best Management Practices for stormwater and erosion control including:
 - 1,344 LF of silt fence
 - 5,180 LF of straw wattles

2.0 RESPONSIBLE PARTIES

The following sections provide an outline of responsible parties for the Project, including state coordinators and private contractors.

2.1 DEQ MWCB COORDINATION

The DEQ MWCB project manager for the Project was Ms. Devin Clary. DEQ MWCB's address and phone number are:

DEQ MWCB
P.O. Box 200901
Helena, Montana 59604-59620
Phone: (406) 841-5029

2.2 RECLAMATION AND ENGINEERING PLAN

HEC was responsible for the engineering design and for preparing the reclamation design, specifications, and bid documents. The project manager and engineer was Kevin Houck, P.E. HEC's address and phone number are:

Herrera Environmental Consultants
101 E. Broadway, Suite 610
Missoula, Montana 59802
Phone: (406) 721-4204

2.3 CONSTRUCTION MONITORING

HEC provided full-time construction monitoring throughout the Project. Mr. Kevin Houck, P.E. of HEC was the construction project engineer. Ms. Christina Egger of HEC was the resident project representative (RPR). Ms. Heidi Machel, P.E. and Mr. Len Ballek of HEC provided backup construction monitoring when Mr. Houck and Ms. Egger were unavailable.

2.4 CONTRACTOR

The successful low bidder for the road improvements phase of the Project was DS Jr. Trucking, of Drummond, Montana. The onsite superintendent for the 2012 road improvements was Dave Sheets Jr. The site foreman was Kerry Cross. The Contractor's address and phone numbers are:

DS Jr. Trucking
515 E. Front Street
Drummond, Montana 59832
Phone: (406) 388-3279

The successful low bidder for the mine reclamation phase of the Project was Mungas, of Philipsburg, Montana. The onsite superintendent for the 2012 and 2013 mine reclamation

construction seasons was Ray Bennett. Site foremen and back-up onsite superintendents were Karl Konrad and Barry Vest. The Contractor's address and phone numbers are:

Mungas Company, Inc.
P.O. Box 236
Philipsburg, Montana 59858
Phone: (406) 859-3203

2.5 Subcontractors

2.5.1 *DS Jr. Trucking Subcontractors*

DS Jr. Trucking hired two subcontractors to help complete work during the road improvements phase of the Project.

Don Beck was subcontracted by DS Jr. Trucking to provide and deliver gravel to the site for resurfacing 7.1 miles of road in Powell and Granite counties and 1.9 miles of USFS Road 707. Don Beck's address and phone number are:

Don Beck
1288 Highway 12 E. #5
Garrison, Montana 59731
Phone: (406) 846-2882

Mark Teague was subcontracted by DS Jr. Trucking to haul gravel from Don Beck's gravel pit to the site. Mark Teague's address and phone number are:

Mark Teague
6140 Montana Highway 1
Drummond, Montana 59832
Phone: (406) 240-3220

2.5.2 *Mungas Subcontractors*

Mungas hired six subcontractors to help complete work on the mine reclamation phase of the Project.

Fusion Technologies, Inc. of Billings, Montana was hired to fuse the HDPE pipe that diverted water from Dunkleberg Creek around the project site. Fusion Technologies, Inc.'s address and phone number are:

Fusion Technologies, Inc.
6804 Commercial Avenue
Billings, Montana 59101
Phone: (406) 656-1412

Don Beck was subcontracted by Mungas to provide and deliver gravel to the site for resurfacing USFS Road 707 from the waste removal area to the repository. Don Beck's address and phone number are:

Don Beck
1288 Highway 12 E. #5
Garrison, Montana 59731
Phone: (406) 846-2882

Mungas subcontracted Warren Transport, Inc. from Billings, Montana, to transport Quicklime to the site from Graymont's Indian Creek plant in Townsend, Montana. The subcontractor's address and phone number are:

Warren Transport, Inc.
2348 N. Frontage Road
Billings, Montana 59101
Phone: (406) 245-8833

Mungas subcontracted Northwest Linings to install the 80-mil HDPE liner and the CDN for the repository cover system. Northwest Linings' address and phone number are:

Northwest Linings
21000 77th Avenue S.
Kent, Washington 98032
Phone: (253) 872-0244

Mungas hired Valley Landscape, Inc. from Missoula, Montana to apply Gorilla Snot to stabilize material in the waste removal and repository areas prior to closing the Project down for the winter. Valley also hydroseeded the slopes along USFS Road 707, disturbed areas within the construction limits, and the waste removal and repository areas. In addition, Valley planted willow plants on the east and west banks of the reconstructed Dunkleberg Creek channel. The subcontractors' address and phone number are:

Valley Landscape, Inc.
4026 Flynn Lane
Missoula, Montana 59808
Phone: (406) 721-7107

Mungas hired Hillshire from Drummond, Montana, to install the fencing at the repository. The subcontractor's address and phone number are:

Hillshire - Mike Hill
23 Grassland Drive
Drummond, Montana 59832
Phone: (406)288-3490

2.5.3 DEQ MWCB Subcontractors

DEQ MWCB hired three subcontractors to verify work done by Mungas. DEQ also hired one subcontractor to apply magnesium chloride to Granite and Powell County roads to suppress dust during the mine reclamation phase of the Project and one subcontractor to conduct the confirmation shear and peel testing of the HDPE liner.

DJ&A, P.C. was hired by the DEQ MWCB to provide pre and post surveys of the waste removal area, the excavated repository, the waste material in the repository, and the final grading of the repository and embankment fill areas. The subcontractor's address and phone number are:

DJ&A, P.C.
3203 S. Russell Street
Missoula, Montana 59801
Phone: (406) 721-4320

SK Geotechnical was subcontracted by the DEQ MWCB to conduct compaction testing on material placed in the repository and perform moisture content tests on material from the waste removal area. SK Geotechnical performed work in 2012, prior to closing their Missoula office in 2013. SK Geotechnical's address and phone number while they performed the work was:

SK Geotechnical
4041 Whippoorwill Drive
P.O. Box 16123
Missoula, Montana 59808
Phone: (406) 721-3391

Holman Consulting Engineers was subcontracted by the DEQ MWCB to conduct compaction testing on the repository cover system after SK Geotechnical closed their Missoula office. Holman Consulting Engineers' address and phone number are:

Holman Consulting Engineers
2614 Murphy Street
Missoula, Montana 59805
Phone: (406) 543-3100

WE Dust Control and De-icing, Inc. was subcontracted by the DEQ MWCB to apply magnesium chloride to approximately 6 miles of road in Granite and Powell counties. WE Dust Control and De-icing's address and phone number are:

WE Dust Control and De-icing, Inc.
111 W. Legion Street
P.O. Box 893
Whitehall, Montana 59759
Phone: (406) 287-5047

Tri Environmental, Inc. was subcontracted by the DEQ MWCB to conduct shear and peel testing of select HDPE seams to confirm work done by Northwest Linings during the repository lining installation. Tri Environmental's address and phone number are:

Tri Environmental, Inc.
California Laboratory
1160 N. Gilbert Street
Anaheim, California 92801
Phone: (714) 520-9631

3.0 ROAD IMPROVEMENTS CONSTRUCTION EVENTS

The following sections present the notable events and contract dates for the road improvements phase of the Project.

3.1 PRE-BID CONFERENCE

The pre-bid conference for the road improvements phase of the Project was held at the site on May 14, 2012. The purpose of the pre-bid conference was to familiarize prospective bidders with the various locations and aspects of the work and to allow prospective bidders to ask questions about the work. DEQ MWCB, HEC, potential prime contractors, potential subcontractors, and potential material vendors and suppliers attended the conference. The pre-bid sign-in sheet and questions submitted following the conference are included in Appendix A-1.

3.2 BID OPENING

Bids were opened by DEQ MWCB at its office at 1100 North Last Chance Gulch in Helena, Montana, on May 18, 2012. Four qualified bids were received. The bids ranged from \$288,252.34 to \$670,403.00, with the apparent low bid submitted by DS Jr. Trucking in the amount of \$288,252.34. The engineer's estimate was \$517,700.00. The bid tabulations are included in Appendix B-1.

3.3 CONTRACT AWARD

A pre-award meeting between DEQ MWCB, HEC, and DS Jr. Trucking was held on May 24, 2012, at the DEQ's Remediation Building in Helena. The purpose of the pre-award meeting was to discuss unbalanced portions of the Bid as determined by the Engineer and to assure the Bidder's understanding and interpretation of Contract Documents and Specifications. A Notice of Award was issued to the low bidder, DS Jr. Trucking, on May 31, 2012. The Notice of Award is included in Appendix C-1.

3.4 CONTRACT AGREEMENT

An Agreement for Contract No. 412021 was issued on May 31, 2012, between DS Jr. Trucking and DEQ MWCB, and became effective on June 12, 2012. The agreement required that all work be completed within 14 consecutive calendar days with a completion date of June 26, 2012. DEQ MWCB issued the Notice to Proceed to DS Jr. Trucking on June 11, 2012. The Notice of Award and Notice to Proceed are included in Appendix C-1.

3.5 CONSTRUCTION START-UP

A pre-construction meeting between DEQ MWCB, HEC, and DS Jr. Trucking was held on June 11, 2012, at Dave Sheet's shop in Drummond. The purpose of the pre-construction meeting was to establish a mutual understanding of construction activities and review the schedule.

Meeting attendees were:

- Devin Clary, DEQ MWCB
- Hayden Janssen, DEQ MWCB
- Kevin Houck, P.E., HEC
- Heidi Machel, P.E., HEC
- Christina Egger, HEC
- Dave Sheets, DS Jr. Trucking, Owner
- Kerry Cross, DS Jr. Trucking, Foreman
- Amie Angelo, Landowner
- Gary Larson, Powell County

The pre-construction meeting minutes are in Appendix D-1. The Contractor began mobilizing to the site on June 12, 2012.

3.6 WORK DIRECTIVES AND CHANGE ORDERS

Two work directives and one change order were written for the road improvements phase of the Project. Copies of all work directives, change orders, and related documentation are in Appendix E-1.

Work Directive No. 1 was issued on June 14, 2012. It directed the Contractor to proceed with the application of water beyond the contracted quantity for dust suppression and compaction at \$45 per 1,000 gallons.

Work Directive No. 2 was issued on June 26, 2012. It directed the Contractor to install four additional culverts and compensated the Contractor for weather days. This increased the contract cost by \$8,000.00 and extended the contract time by 4 calendar days.

Change Order No. 1, executed on July 7, 2012, compensated the Contractor for applying water for dust suppression and compaction as directed in Work Directive No. 1. It also compensated the Contractor for installing four additional culverts and for weather days as directed in Work Directive No. 2. In addition, Change Order No. 1 compensated the Contractor for additional clearing, grubbing, and cutting along USFS Road 707, widening and surfacing 0.7 miles of USFS Road 707, blending gravel to the edges of the road in Powell and Granite counties, and reconciled the quantity of Bid Item 4c-4, USFS Road Improvements-Select Borrow. This change order increased the contract cost by \$114,102.00 and extended the contract time by 4 days.

3.7 WEATHER DAYS AND WORK SUSPENSIONS

There was 1 weather day during construction in 2012. A weather day was issued when work could not be conducted due to adverse site conditions. The weather and work suspension are listed below.

- Work was halted on June 13, 2012, due to rain and heavy rutting at the site.

3.8 CLOSEOUT DOCUMENTATION

DS Jr. Trucking completed the outstanding work items on July 1, 2012. A final site inspection was conducted on July 1, 2012, by Ms. Clary to ensure the punch-list items were complete.

The following construction closeout forms were executed on the dates outlined below:

- Certificate of Completion, July 1, 2012
- Certificate of Acceptance, July 1, 2012
- Affidavit on Behalf of Contractor, July 2, 2012
- Consent of Guarantor to Final Payment, July 10, 2012

Copies of these executed forms are in Appendix F-1.

3.9 FINAL PAYMENT

The final payment, Payment Request No. 1, of \$398,330.80 to DS Jr. Trucking, was approved by Ms. Devin Clary of DEQ MWCB on July 10, 2012. The final payment request included payment for outstanding work items and Change Order No. 1. Copy of the final payment is included in Appendix G-1.

4.0 RECLAMATION CONSTRUCTION EVENTS

The following sections present the notable events and contract dates for the reclamation phase of the Project.

4.1 PRE-BID CONFERENCE

The pre-bid conference for the mine reclamation phase of the Project was held at the site on May 22, 2012. The purpose of the pre-bid conference was to familiarize prospective bidders with the various locations and aspects of the work and to allow prospective bidders to ask questions about the Project. DEQ MWCB, HEC, potential prime contractors, potential subcontractors, and potential material vendors and suppliers attended the conference. The pre-bid sign-in sheet and questions submitted following the conference are included in Appendix A-2.

4.2 BID OPENING

Bids were opened by DEQ MWCB at their office at 1100 North Last Chance Gulch in Helena, Montana, on June 7, 2012. Seven qualified bids were received. The bids ranged from \$1,745,023.00 (with an alternative bid for lime products of \$15,000.00) to \$3,414,864.32 (with an alternative bid for lime products of \$31,750.00). The apparent low bid was submitted by Mungas in the amount of \$1,745,023.00, with an alternative bid for lime products of \$15,000.00. The engineer's estimate was \$3,552,513.39, with an alternative bid for lime products of \$8,750.00. The bid tabulations are included in Appendix B-2.

4.3 CONTRACT AWARD

A Notice of Award was issued to the low bidder, Mungas on June 15, 2012. A pre-award meeting between DEQ MWCB, HEC, and Mungas was held on June 15, 2012, at the Wagon Wheel Café in Drummond. The purpose of the pre-award meeting was to discuss unbalanced portions of the Bid as determined by the Engineer and to assure the Bidder's understanding and interpretation of Contract Documents and Specifications. The pre-award meeting minutes are in Appendix D-2. The subcontractors Mungas proposed to use on the Project were approved on June 15, 2012. The Notice of Award and Approval of Subcontractors are provided in Appendix C-2.

4.4 CONTRACT AGREEMENT

An Agreement for Contract No. 412001 was issued June 15, 2012, between Mungas and DEQ MWCB and became effective on June 29, 2012. The Agreement required all work be completed within 120 consecutive calendar days with a completion date of October 27, 2012. DEQ MWCB issued the Notice to Proceed to Mungas on June 28, 2012.

A Temporary Suspension of Work was issued on November 7, 2012, until June 1, 2013, due to adverse weather conditions. Suitable site conditions led to an early lift of the temporary suspension. DEQ MWCB issued the 2013 Notice to Proceed on May 14, 2013.

The Agreement and Notices to Proceed are included in Appendix C-2. Meeting minutes associated with the temporary suspension are included in Appendix D-2, with the Temporary Suspension of Work included in Appendix F-2.

4.5 CONSTRUCTION START-UP

The pre-construction meeting between DEQ MWCB, HEC, and Mungas was held on June 29, 2012. The purpose of the 2012 pre-construction meeting was to establish a mutual understanding of construction activities and review the schedule.

Meeting attendees were:

- Devin Clary, DEQ MWCB
- Kevin Houck, P.E., HEC
- Christina Egger, HEC
- Ray Bennett, Mungas, Project Manager

The pre-construction meeting minutes are in Appendix D-2. The Contractor began mobilizing to the site on June 29, 2012.

4.6 WORD DIRECTIVES AND CHANGE ORDERS

One work directive and seven change orders were written for the mine reclamation phase of the Project. Copies of all work directives and change orders and related documentation are in Appendix E-2.

Work Directive No. 1 was issued on July 27, 2012. It directed the Contractor to proceed with the application of water beyond the contracted quantity at \$75 per 1,000 gallons.

Change Order No. 1, executed on September 5, 2012, compensated the Contractor for applying water for dust control during hauling and for compaction purposes during material placement as directed in Work Directive No. 1. Change Order No. 1 also added lime products into the total contract cost, as this was an optional bid item, and compensated the Contractor for applying additional lime in order to meet construction production rates. This change order increased the contract cost by \$677,100.00 and did not extend the contract time.

Change Order No. 2, executed on October 24, 2012, compensated the Contractor for weather days in October and for installing two culverts near the waste removal area in June to convey water from springs across USFS Road 707. This change order did not increase the contract cost but extended the contract time by 15 calendar days to November 11, 2012.

Change Order No. 3, executed on November 12, 2012, compensated the Contractor for the installation of two culverts along Dunkleberg Creek Road and for applying Gorilla Snot to all disturbed areas in the waste removal and repository areas prior to the winter shutdown. This change order increased the contract cost of the Project by \$137,976.35 and extended the contract time by 5 calendar days to November 16, 2012.

Change Order No. 4, executed on December 27, 2012, compensated the Contractor for additional handling and excavation of the repository, additional handling of saturated material from the waste removal area, installing drain pipe, and for winter shutdown activities. This change order increased the contract cost of the Project by \$148,860.64 and extended the contract time by 43 calendar days.

Change Order No. 5, executed on July 1, 2013, compensated the Contractor for weather days when no work could be done at the site. This change order did not increase the contract cost but extended the contract time by 16 calendar days to July 20, 2013.

Change Order No. 6, executed on September 6, 2013, was for reconciliation of quantities for the Contractor. This change order compensated the Contractor for half of the mobilization costs following the winter shutdown, blading Dunkleberg Creek Road and USFS Road 707, water management activities, repairing cattle guards in Granite County, spreading brush in the waste removal and repository areas, installing water bars, decking trees in the repository and disposing of the root wads, applying water above the contracted amount for dust control, and amending waste materials with lime above the contracted amount. In addition, this change order adjusted the contract price to account for a reduction in the contracted quantity in silt fence, grade control structures, and straw wattles. This change order increased the contract cost by \$351,206.05 and increased the contract time by 21 calendar days to August 20, 2013.

Change Order No. 7, executed on November 8, 2013, compensated the Contractor for fertilizing, seeding, and mulching additional areas and for installing fence around the repository beyond the original quantity in the contract based on the larger impacted area of the repository and embankment fill area. This change order increased the contract cost by \$12,501.00 and did not extend the contract time.

The seven change orders for the Project totaled \$1,327,644.04, an increase of approximately 76 percent of the original contract price. This increase in price was due mainly to the moisture content of the tailings. High snow pack and heavy rain in 2011 re-saturated the tailings and provided more run-on of water into the tailings impoundments. Also, numerous springs in the tailings impoundments were unearthed during excavation of the tailings. Although the tailings were spread in thin lifts at the repository, the low temperatures, in conjunction with the large quantity of saturated tailings excavated, did not provide sufficient conditions for the tailings to dry. Applying lime beyond the contracted quantity was the approach chosen to address the saturated waste while trying to maintain the project schedule. This was also selected as the preferred method of stabilizing the tailings due to the limited footprint available and the lack of area for drying both at the waste removal area and repository. The saturated tailings also led to a decrease in production because load sizes had to be cut in half to ensure that the tailings remained in the back of the haul trucks. A winter shutdown occurred, which also increased the contract price due to a second mobilization/demobilization cost and application of Gorilla Snot. Section 5.2 discusses geotechnical testing that was completed on the waste material and the corresponding results. The seven change orders added 100 days to the contract period, resulting in a total contract period of 220 days.

4.7 WEATHER DAYS AND WORK SUSPENSIONS

There were several weather days and work suspensions during construction in 2012 and 2013. A weather day was issued when work could not be conducted because of adverse site conditions. The weather and work suspensions are listed below.

- Work was halted on October 3 and 4, 2012, due to snow at the site.
- Work was halted on October 13, 15, and 16, 2012, due to rain and mud at the site.
- Work was halted for 6 days from October 23 through 28, 2012, due to snow and ice at the site.
- Work was halted on May 19, 20, 26, 27, 28, 29, and 30, 2013, and June 2, 3, 4, 13, 14, 20, 25, and 26, 2013, due to rain and mud at the site.
- Work was halted on May 23 and 24, 2013, due to snow and ice at the site.

In addition to the weather days, work was stopped at the Contractor's discretion for weekends in July and August 2012, and on two holidays:

- Work was halted on the following days: July 14, 15, 21, 22, 28, and 29, 2012, and on August 4, 5, 11, and 12, 2012.
- Work was halted on September 3 and 4, 2012, at the discretion of the Contractor for the Labor Day holiday.
- Work was halted on July 4, 2013, at the discretion of the Contractor in observance of Independence Day.

4.8 REQUESTS FOR PAYMENT

Mungas made 12 requests for payment during the Project. The total amount paid for each pay request is the net payment after a 5 percent retainage fee plus \$1,000 and 1 percent state withholding tax. Copies of these payment requests are in Appendix G-2.

- Payment Request No. 1 was for the period June 29 through July 29, 2012. The total amount paid, less retainage and 1 percent tax, was \$57,321.00. This pay request accounted for one-half of the mobilization/demobilization costs. Payment Request No. 1 was approved on June 29, 2012.
- Payment Request No. 2 was for the period June 29 through July 31, 2012. The total amount paid, less retainage and 1 percent tax, was \$320,048.41. Payment Request No. 2 was approved on August 8, 2012.
- Payment Request No. 3 was for the period August 1 through August 31, 2012. The total amount paid, less retainage and 1 percent tax, was \$258,621.76. Pay Request No. 3 was approved on September 21, 2012.

- Payment Request No. 4 was for the period September 1 through September 30, 2012. The total amount paid, less retainage and 1 percent tax, was \$431,765.33. Pay Request No. 4 was approved on October 4, 2012.
- Payment Request No. 5 was for the period October 1 through October 31, 2012. The total amount paid, less retainage and 1 percent tax, was \$387,950.85. Pay Request No. 5 was approved on November 12, 2012.
- Payment Request No. 6 was for the period November 1 through November 7, 2012. The total amount paid, less retainage and 1 percent tax, was \$236,379.29. Pay Request No. 6 was approved on January 11, 2013.
- Payment Request No. 7 was for the period March 1 through March 31, 2013. The total amount paid, less retainage and 1 percent tax, was \$98,821.34. Pay Request No. 7 was approved on May 2, 2013.
- Payment Request No. 8 was for the period May 1 through May 31, 2013. The total amount paid, less retainage and 1 percent tax, was \$73,884.36. Pay Request No. 8 was approved on July 2, 2013.
- Payment Request No. 9 was for the period June 1 through June 30, 2013. The total amount paid, less retainage and 1 percent tax, was \$338,626.93. Pay Request No. 9 was approved on July 2, 2013.
- Payment Request No. 10 was for the period July 1 through July 31, 2013. The total amount paid, less retainage and 1 percent tax, was \$334,006.72. Pay Request No. 10 was approved on August 2, 2013.
- Payment Request No. 11 was for the period August 1 through August 31, 2013. The total amount paid, less retainage and 1 percent tax, was \$225,728.58. Pay Request No. 11 was approved on September 6, 2013.
- Pay Request No. 12, the final pay request, was for the period September 1 through October 31, 2013. The total amount paid, less 1 percent tax, was \$278,785.78. Pay Request No. 12 was approved on November 8, 2013.

4.9 SUBSTANTIAL COMPLETION

Mungas reached substantial completion on July 30, 2013, after Ms. Clary and Mr. Houck conducted a site inspection on July 31, 2013. Attendees at the inspection included:

- Devin Clary, DEQ MWCB
- Kevin Houck, P.E., HEC
- Christina Egger, HEC
- Ray Bennett, Mungas

The four outstanding items listed below were agreed to be completed in August and September, 2013:

- Bid Item No. 10 - Fertilize, Seed and Mulch
- Bid Item No. 11 - Dunkleberg Creek Bank Plantings - Willow Stakes
- Bid Item No. 12 - Tree Protectors
- Bid Item No. 16 - Farm Fence

A copy of the Certificate of Substantial Completion is provided in Appendix F-2.

4.10 CLOSEOUT DOCUMENTATION

Mungas completed the outstanding work items on October 7, 2013. A final site inspection was conducted on October 9, 2013, by Ms. Clary to ensure the outstanding work items were complete.

The following construction closeout forms were executed on the dates outlined below:

- Certificate of Completion, October 9, 2013
- Certificate of Acceptance, November 14, 2013
- Affidavit on Behalf of Contractor, October 24, 2013
- Consent of Surety Company to Final Payment, October 23, 2013

Copies of these executed forms are in Appendix F-2.

4.11 FINAL PAYMENT

Mungas' final payment request, Pay Request No. 12, was approved on November 8, 2013. This included payment for demobilization, Bid Items 10, 11, 12, and 16, and Change Order No. 7.

5.0 CONSTRUCTION

The following section summarizes reclamation construction and describes the major equipment used at the site, construction activities, and bid quantities completed.

5.1 MAJOR EQUIPMENT LIST

An abbreviated list of equipment used on the Project is presented in Table 5.1.

Table 5.1. Major Equipment List.	
Description	Number
DS Jr. Trucking	
CAT Grader	2
Water Truck	2
Roller	1
Backhoe	1
Belly-Dump Truck	6
Excavator/Dozer Combo	1
Mungas	
CAT 330L Excavator	1
CAT 330B Excavator	1
Komatsu 400 Excavator	2
CAT D8 Dozer	1
CAT D5 Dozer	1
CAT Front-End Loader	2
CAT Grader	1
John Deere Grader	1
Roller	1
40-Ton Articulating Haul Truck	6
40-Ton Articulating Haul Truck (Rental)	4
Fuel Truck	2
Water Truck	1
Wash Truck	1
Wacker Neuson Generator	2
Side-Dump Truck	1

5.2 COMPACTION AND MOISTURE CONTENT TESTING

Compaction testing was performed on four occasions from August through October 2012 and on five occasions from June through July 2013. Five samples of material in the waste removal area were tested for moisture content on two occasions in 2012. Compaction testing on waste material and on cover material on the repository was done by SK Geotechnical and Holman Consulting Engineers from Missoula, Montana. Moisture content was conducted by SK Geotechnical.

Copies of compaction and moisture content are in Appendix H-1.

5.3 QUANTITIES COMPLETED

Work items were bid on a lump sum, actual quantity, and unit price basis. All materials submitted were approved by the Engineer before they were used at the site. Material submittals and substitution requests are included in Appendix I. Tables 5.2 and 5.3 list each bid item, the estimated bid quantity, the actual bid quantity, the actual bid quantity as a percentage of the estimated bid quantity, and illustrates the differences between the estimated quantity and the actual quantity for the road improvements and mine reclamation phases of the Project, respectively. Actual quantities were verified by HEC's onsite project representative, surveys conducted by DJ&A, and by weigh tickets.

Tables 5.4 and 5.5 show a cost comparison between the estimated bid item price and the actual bid item price for the road improvements and mine reclamation phases of the Project, respectively. Bid Items that varied significantly from the estimated bid quantity are:

5.3.1 ROAD IMPROVEMENTS PHASE

- **Bid Item 3, Provide Water** - Additional water was applied beyond the contracted quantity to aid in compaction of the surfacing material and to provide adequate dust control. The dry weather encountered during this phase of the Project necessitated a significant increase of roughly 129 times the anticipated quantity of this bid item.
- **Bid Item 4c-2, USFS Road Improvements - Surfacing Material** - The initial 0.7-mile segment of USFS Road 707, directly south of the Granite County portion of Dunkleberg Creek Road, required surfacing material. This increased the quantity of surfacing material by nearly two times the anticipated quantity.
- **Bid Item 4c-c, USFS Road Improvements - Select Borrow** - No borrow was used as embankment on USFS Road 707; therefore, a 100 percent decrease in this bid item was encountered.

5.3.2 MINE RECLAMATION PHASE

- **Bid Item 3a, Install Silt Fence** - It was deemed unnecessary to install silt fence along the eastern and western sides of the waste removal area; therefore, the quantity of silt fence used was decreased by approximately 37 percent.

- **Bid Item 3b, Install Straw Wattles** - Slash was available from clearing and grubbing in the waste removal area and from cutting and decking trees in the repository area. Slash was therefore substituted for straw wattles in the waste removal and repository areas and the quantity of straw wattles was decreased by approximately 34 percent.
- **Bid Item 5, Excavation and Embankment** - Additional material was excavated from the repository than originally planned to ensure that there would be adequate volume for waste material. Additional material was also placed in the repository area for contouring following the placement of the repository liner. These two activities led to an increase of roughly 30 percent of the bid quantity.
- **Bid Item 6a, 0 to 25 Percent Non-Saturated Waste Materials** - The majority of material with this level of saturation was excavated near the surface of the tailings impoundments. A reduction of approximately 43 percent of the anticipated volume was encountered.
- **Bid Item 6b, 26 to 35 Percent Saturated Waste Materials** - The majority of material excavated below the surface in the waste removal area had moisture contents within this range. The material within this saturation range required additional time and resources when handling due to its consistency and higher water content. An increase of roughly 3.5 times the anticipated volume of this material was encountered due to high snow pack and heavy rains in 2011.
- **Bid Item 6c, 36 to 100 Percent Saturated Waste Materials** - There was no material excavated that had this level of saturation; therefore, a 100 percent decrease in the quantity of this bid item was encountered.
- **Bid Item 10, Fertilize, Seed, and Mulch** - Turnouts along USFS Road 707 attributed to additional area needing to be revegetated, in addition to a larger repository area footprint. An increase in roughly 30 percent of the anticipated area was encountered.
- **Bid Item 17, Provide Water** - Dust control activities required significantly more application of water than estimated. The dry weather encountered during the course of the Project necessitated an increase of roughly 14 times the anticipated quantity of this bid item.
- **Alternative Bid Item A1, Lime Products** - The waste material hauled and placed in the repository did not dry as quickly as anticipated. This was in part due to the large quantity of saturated material excavated and the lack of drying area due to the limited footprint available for drying activities. As discussed in Bid Item 6b, there was an increase of roughly 3.5 times the anticipated volume of material within the 26 to 35 percent saturation range due to high snow pack and heavy rains in 2011. It was not possible to continually place this large volume of saturated material within the confines of the repository footprint without utilizing a lime amendment. In order to meet the daily construction production rates, there was a significant increase of roughly 53 times the anticipated quantity of lime. Lime weigh tickets are included in Appendix J-2.

Table 5.2. Road Improvements Estimated and Actual Bid Quantity Comparison.

Bid Item	Description	Estimated Bid Quantity		Actual Bid Quantity		Actual Bid Quantity as Percentage of Estimated Bid Quantity	Difference Between Estimated Bid Quantity and Actual Bid Quantity
1	Mobilization, Demobilization, Bonding, and Insurance	1	LS	1	LS	100%	0
2	Traffic Control	1	LS	1	LS	100%	0
3	Provide Water	10	kGAL	1,285	kGAL	12,850%	+ 1,275
4a	Powell County Road Improvements – Surfacing Material	2,816	CY	2,816	CY	100%	0
4b	Granite County Road Improvements – Surfacing Material	8,292	CY	8,292	CY	100%	0
4c-1	USFS Road Improvements – Clearing, Grubbing, and Cutting	1	LS	1	LS	100%	0
4c-2	USFS Road Improvements – Surfacing Material	1,643	CY	2,923	CY	178%	+ 1,280
4c-3	USFS Road Improvements – Base Course	40	CY	40	CY	100%	0
4c-4	USFS Road Improvements – Select Borrow	120	CY	0	CY	0%	- 120
5	Culvert Installation	1	LS	1	LS	100%	0
6	Seed and Mulch	1.3	AC	1	AC	77%	- 0.3
7	Construction BMPs – Straw Wattles	700	LF	700	LF	100%	0

Notes:

- LS Lump Sum
- LF Linear Foot
- CY Cubic Yard
- kGAL 1,000 Gallons
- AC Acre

Table 5.3. Mine Reclamation Estimated and Actual Bid Quantity Comparison.

Bid Item	Description	Estimated Bid Quantity		Actual Bid Quantity		Actual Bid Quantity as Percentage of Estimated Bid Quantity	Difference Between Estimated Bid Quantity and Actual Bid Quantity
1	Mobilization, Demobilization, Bonds, and Insurance	1	LS	1	LS	100%	0
2	Clearing and Grubbing	1	LS	1	LS	100%	0
3	Install Construction BMPs	-	-	-	-	-	-
3a	Install Silt Fence	2,150	LF	1,344	LF	63%	- 806
3b	Install Straw Wattles	7,700	LF	5,080	LF	66%	- 2,620
3c	Install Stabilized Construction Entrance	2	EA	2	EA	100%	0
4	Water Management	1	LS	1	LS	100%	0
5	Excavation and Embankment	69,700	CY	89,114	CY	128%	+ 19,414
6	Excavate, Haul, Place, and Compact Waste in Waste Disposal Area	-	-	-	-	-	-
6a	0-25% Non-Saturated Waste Material	70,800	CY	40,211	CY	57%	- 30,589
6b	26-35% Saturated Waste Material	18,880	CY	68,711	CY	364%	+ 49,831
6c	36-100% Saturated Waste Material	4,720	CY	0	CY	0%	- 4,720
7	Repository Cover	20,700	SY	21,447	SY	104%	+ 747
8	Dunkleberg Creek Channel Construction	1,300	LF	1,300	LF	100%	0
9	Cover Soil	41,600	CY	51,044	CY	123%	+ 9,444
10	Fertilize, Seed, and Mulch	12	AC	16	AC	133%	+ 4
11	Dunkleberg Creek Bank Plantings - Willow Stakes	1,300	EA	1,300	EA	100%	0
12	Tree Protectors	1,300	EA	1,300	EA	100%	0
13	Log Salvage and Stockpile	176	EA	176	EA	100%	0
14	Road Improvement	10,000	LF	9,064	LF	91%	- 937
15	Debris and Structure Removal	1	LS	1	LS	100%	0

Table 5.3 (continued). Mine Reclamation Estimated and Actual Bid Quantity Comparison.

Bid Item	Description	Estimated Bid Quantity	Actual Bid Quantity	Actual Bid Quantity as Percentage of Estimated Bid Quantity	Difference Between Estimated Bid Quantity and Actual Bid Quantity
16	Farm Fence	2,400 LF	2,578 LF	107%	+ 178
17	Provide Water	90 kGAL	1,280 kGAL	1,422%	+ 1,190
A1	Lime Products	50 TN	2,632 TN	5,264%	+ 2,582

Notes:

- LS Lump Sum
- LF Linear Foot
- EA Each
- CY Cubic Yard
- SY Square Yard
- kGAL 1,000 Gallons
- TN Ton
- AC Acre

Bid Item	Description	Estimated Bid Price	Actual Bid Price	Difference Between Estimated Bid Price and Actual Bid Price
1	Mobilization, Demobilization, Bonding, and Insurance	\$2,950.00	\$2,950.00	\$0.00
2	Traffic Control	\$3,470.00	\$3,470.00	\$0.00
3	Provide Water	\$10,795.00	\$57,384.00	+ \$46,589.00
4a	Powell County Road Improvements – Surfacing Material	\$22,871.44	\$22,871.44	\$0.00
4b	Granite County Road Improvements – Surfacing Material	\$147,431.76	\$147,431.76	\$0.00
4c-1	USFS Road Improvements – Clearing, Grubbing, and Cutting	\$5,850.00	\$3,600.00	- \$2,250.00
4c-2	USFS Road Improvements – Surfacing Material	\$48,928.54	\$38,118.40	- \$10,810.14
4c-3	USFS Road Improvements – Base Course	\$14,363.20	\$14,363.20	\$0.00
4c-4	USFS Road Improvements – Select Borrow	\$3,500.40	\$0.00	- \$3,500.40
5	Culvert Installation	\$10,000.00	\$8,000.00	- \$2,000.00
6	Seed and Mulch	\$4,160.00	\$4,160.00	\$0.00
7	Construction BMPs – Straw Wattles	\$3,402.00	\$3,402.00	\$0.00

Table 5.5. Mine Reclamation Estimated and Actual Bid Price Comparison.

Bid Item	Description	Estimated Bid Price	Actual Bid Price	Difference Between Estimated Bid Price and Actual Bid Price
1	Mobilization, Demobilization, Bonds, and Insurance	\$124,000.00	\$124,000.00	\$0.00
2	Clearing and Grubbing	\$33,600.00	\$33,600.00	\$0.00
3	Install Construction BMPs	-	-	-
3a	Install Silt Fence	\$7,525.00	\$4,704.67	- \$2,820.33
3b	Install Straw Wattles	\$30,030.00	\$19,810.44	- \$10,219.56
3c	Install Stabilized Construction Entrance	\$6,900.00	\$6,900.00	\$0.00
4	Water Management	\$90,550.00	\$90,550.00	\$0.00
5	Excavation and Embankment	\$138,006.00	\$176,445.72	+ \$38,439.72
6	Excavate, Haul, Place, and Compact Waste in Waste Disposal Area	-	-	-
6a	0-25% Non-Saturated Waste Material	\$330,636.00	\$187,785.37	- \$142,850.63
6b	26-35% Saturated Waste Material	\$99,120.00	\$510,225.75	+ \$411,105.75
6c	36-100% Saturated Waste Material	\$42,480.00	\$0.00	- \$42,480.00
7	Repository Cover	\$389,160.00	\$403,203.60	+ \$14,043.60
8	Dunkleberg Creek Channel Construction	\$120,250.00	\$52,507.00	- \$67,743.00
9	Cover Soil	\$114,816.00	\$140,881.44	+ \$26,065.44
10	Fertilize, Seed, and Mulch	\$36,000.00	\$47,701.00	+ \$11,701.00
11	Dunkleberg Creek Bank Plantings - Willow Stakes	\$8,450.00	\$8,450.00	\$0.00
12	Tree Protectors	\$3,900.00	\$3,900.00	\$0.00
13	Log Salvage and Stockpile	\$26,400.00	\$26,400.00	\$0.00
14	Road Improvement	\$94,600.00	\$85,745.44	- \$8,854.56
15	Debris and Structure Removal	\$15,300.00	\$15,300.00	\$0.00
16	Farm Fence	\$10,800.00	\$11,601.00	+ \$801.00
17	Provide Water	\$22,500.00	\$111,750.00	+ \$89,250.00
A1	Lime Products	\$15,000.00	\$789,531.00	+ \$774,531.00

5.4 DESIGN AND AS-BUILT DRAWINGS

The Forest Rose Mine design and as-built drawings are included in Appendix K.

5.5 CONSTRUCTION ACTIVITIES

Copies of the onsite project representative's daily reports are in Appendix L. These daily logs detail site conditions and road improvement activities from June 12, 2012, through July 1, 2012, and reclamation activities from July 9, 2012, through November 7, 2012, and from May 13, 2013, through October 7, 2013. Weekly summaries of construction and oversight activities are provided below.

5.5.1 JUNE 9-15, 2012

DS Jr. Trucking mobilized equipment at the site. Grading and resurfacing of Powell and Granite County roads began. Clearing and grubbing along and widening of USFS Road 707 began. Straw wattles were placed around the staging area on USFS-administered lands. One weather day (June 13) was granted due to rain creating muddy conditions at the site.

5.5.2 JUNE 16-22, 2012

Tree felling along and widening of USFS Road 707 was completed. Two additional culverts were agreed to be replaced in Granite County. Base course was placed in a section of USFS Road 707 to prevent dump trucks from sinking where the road was soft. One culvert was installed on USFS Road 707 where a spring was located. Resurfacing of USFS Road 707 was completed. The majority of gravel was placed on Dunkleberg Creek Road. Straw wattles were placed along sections of Dunkleberg Creek and along the sides of the three bridges on USFS Road 707. One of the culverts in Powell County was replaced.

5.5.3 JUNE 23-29, 2012

DS Jr. Trucking: Three culverts were installed in Powell County and two culverts were installed in Granite County. Finish grading and compaction via roller began on Powell and Granite County roads and USFS Road 707. Cattle guards in Powell and Granite counties were cleared of gravel. Punch-list items were addressed. Mulch and seed were placed on disturbed areas in Granite County and on USFS-administered lands.

Mungas: Equipment was mobilized to the site (June 29).

5.5.4 JUNE 30-JULY 6, 2012

DS Jr.: Finish grading and compaction via roller were completed on Powell and Granite County roads and USFS Road 707. The remaining disturbed areas in Powell and Granite Counties and on USFS-administered lands were mulched and seeded. Punch-list items were completed and DS Jr. Trucking demobilized July 1, 2012.

Mungas: Equipment continued to be mobilized to the site throughout the week. A CMP culvert was installed (July 6) under USFS Road 707 near the waste removal area to prevent saturation of the road as equipment traveled overtop it.

5.5.5 JULY 7-13, 2012

Clearing, grubbing, and widening of USFS Road 707 began on July 9. Trees were felled in the repository area and stockpiled to the east of the repository. Topsoil was stripped from the repository area and stockpiled on the east and west sides. A corrugated pipe (plastic) was installed above the mine to convey a spring located on the adjacent side slope away from the road. Piping was placed in various sections of the waste removal area to divert water from springs near the tailings impoundments. Clearing and grubbing began in the waste removal area and a ledge was excavated along the eastern slope to support the HDPE diversion pipe. Structures in the waste removal area were removed and material was stockpiled to be transported to a RCRA-licensed facility. Magnesium Chloride was applied to roughly 6 miles of road in Powell and Granite counties to provide dust suppression while belly dumps delivered gravel to the site for the road improvements from the waste removal area to the repository.

5.5.6 JULY 14-20, 2012

Clearing and grubbing in the waste removal area continued. Fusing of the HDPE diversion pipe was done, taking three days to complete. Final clearing, grubbing, and widening of USFS Road 707 was completed in preparation for the delivery of gravel. Gravel was placed and graded along USFS Road 707 from the waste removal area to the repository. The northwest corner and the southern ridge of the repository were excavated and found to be unrippable. The design of a new excavation grading plan for the repository was discussed to take advantage of the midsection and the northeast area of the repository, where material was easier to excavate. Water from the adit and Dunkleberg Creek was diverted to the inlet of the HDPE diversion pipe.

5.5.7 JULY 21-27, 2012

Delivery and grading of gravel along USFS Road 707 from the waste removal area to the repository was completed. Due to the material in the northwest corner and southern ridge being unrippable, a revised excavation grading plan was proposed (included in Appendix K-1). Mungas proceeded with the repository excavation following the elevations of the new grading plan, excavating to greater depths in areas with more rippable material. Silt fence was installed downgradient of the embankment fill area. The inlet and outlet of the HDPE diversion pipe were constructed and the access road on the east side of the tailings impoundments was widened for equipment to access T1. Trees of the appropriate diameter were felled and cut to length for the Dunkleberg Creek weirs. The construction entrance near T3 was constructed and debris from the removal of mine structures was transported to a RCRA-licensed facility in Butte. The weigh tickets for the mine structure debris are included in Appendix J-1.

5.5.8 JULY 28-AUGUST 3, 2012

Clearing and grubbing was done along the north side of T1, on the east and west sides of T2, and in the vegetated embankment between T1 and T2. Additional debris from the removal of the mine structures was transported to a RCRA-licensed facility in Butte (weigh tickets are included in Appendix J-1). Excavation continued in the repository. Water was diverted around the tailings impoundments from the toe of the south side of T3 by excavating a trench in T3

and T2 and placing plastic corrugated piping in the trench to transport the water. The construction entrance leading to the waste rock pile was constructed.

5.5.9 AUGUST 4-10, 2012

Clearing and grubbing in the embankment fill area was completed. Felled trees of the appropriate diameter were cut to length for the Dunkleberg Creek weirs. DJ&A conducted the initial final-grade survey of the repository, showing approximately 55,000 CY of material having been excavated. Further excavation of the repository was done to meet the specified volume. A limited quantity of tailings from T3 were transported to the repository in order to free a stuck excavator from the material. Water diversion continued in the waste removal area. Water flowing through the culvert above the mine and across T2 and T3 was diverted to a central area and piped on the west side of T1. Silt fence was installed across Dunkleberg Creek.

5.5.10 AUGUST 11-17, 2012

Seeps and springs were located on the west side of T1 and a trench was excavated to eliminate ponding of the water. Excavation in the repository was completed and DJ&A conducted the second final-grade survey of the repository. In total, approximately 76,000 CY of material had been excavated from the repository. Hauling of tailings from T2 to the repository began and material was segregated in different sections depending on its level of saturation.

5.5.11 AUGUST 18-24, 2012

Material from T1, T2, and T3 was transported to the repository. Three samples of material were collected and taken to a lab to determine the moisture content. Additional springs were located in T1 once excavation began; another trench was excavated to divert the water and prevent pooling. Lime started being delivered to the site to aid in decreasing the wetness of the tailings. Additional time was spent freeing a stuck excavator from T2 due to material instability.

5.5.12 AUGUST 25-31, 2012

Compaction testing of material in the repository was done by SK Geotechnical. Excavation continued in T2, with blending of lime occurring in the waste removal area and to piles of material in the repository. Lining for the repository cover was delivered and staged east of the repository area. Due to the wet nature of the tailings, the Contractor used two excavators in tandem to remove waste in T2 more effectively and efficiently.

5.5.13 SEPTEMBER 1-7, 2012

Due to material saturation and instability, less material was hauled per truck load and a dam of dry material was placed in the rear of the truck to prevent spillage. Material in the repository became difficult to spread due to its moisture content. The Contractor applied lime to the waste material and to the surface of the waste lift once the material was spread to address the high moisture content. Excavation continued in T2. Tree debris and rotted lumber were excavated, hauled, and placed in the repository, and continued to be excavated

and hauled to the repository until the end of October. Work did not occur for 2 days (September 3 and 4) in observance of Labor Day, at the Contractor's discretion.

5.5.14 SEPTEMBER 8-14, 2012

Excavation continued in T1 and T2. The plastic corrugated pipe that had been placed as a culvert above the mine failed and was fixed prior to hauling material to the repository. Samples of tailings were taken to determine moisture content values (values from SK Geotechnical are included in Appendix H-2). SK Geotechnical conducted compaction testing in the repository.

5.5.15 SEPTEMBER 15-21, 2012

Excavation continued in T2. Excavation was done in tandem at various times to more efficiently and effectively reach saturated material.

5.5.16 SEPTEMBER 22-28, 2012

Excavation continued in T1 and T2. Tandem excavation was done in T1 at various times. SK Geotechnical conducted compaction testing on material in the repository. DJ&A surveyed the repository to estimate the volume of waste material that had been placed in the repository.

5.5.17 SEPTEMBER 29-OCTOBER 5, 2012

Excavation continued in T1 and T2. Native material excavated from the repository was used to fill sections of USFS Road 707 from the waste removal area to the repository where it was rutted and rough. The hauling of waste rock began in response to the wetness of the material placed in the repository due to snow that had accumulated on it and melted. Two weather days (October 3 and October 4) were granted due to snow and ice.

5.5.18 OCTOBER 6-12, 2012

Excavation continued in T1 and T2. Waste rock was hauled when the surface of the repository became slick. A trench was excavated on the western side of T1 to drain water that had accumulated from springs. Water that had pooled between T1 and T2 was pumped in to the side slope northwest of T1.

5.5.19 OCTOBER 13-19, 2012

Excavation continued in T1 and T3. Hauling of waste rock continued due to difficulties with trucks maneuvering in the repository due to wetness. Water continued to be pumped from the sump between T1 and T2. Silt fence was installed around the northeast corner of the repository. Three weather days (October 13, October 15, and October 16) were granted due to rain causing slick and muddy conditions at the site.

5.5.20 OCTOBER 20-26, 2012

Excavation continued in T1 and T3. Water continued to be pumped from the sump between T1 and T2. Silt fence was installed around the southwest corner of the repository. Three

weather days (October 24, October 25, and October 26) were granted due to snow and ice at the site.

5.5.21 OCTOBER 27-NOVEMBER 2, 2012

Winter shutdown activities began in the waste removal and repository areas. Demobilization of equipment from the site began. Three weather days (October 27, October 28, and October 29) were granted due to snow and ice at the site.

5.5.22 NOVEMBER 3-9, 2012

Gorilla Snot was applied in the waste removal area, the repository area, the two topsoil stockpiles, and the embankment fill area. Equipment continued to be demobilized from the site for the winter shutdown. Winter shutdown activities were concluded on November 7.

5.5.23 MAY 11-17, 2013

Equipment was mobilized at the site and preparatory work commenced. USFS Road 707 from the waste removal area to the repository was bladed in preparation for hauling. The hauling of waste rock and tailings from the waste removal area began. Water management tasks were completed to divert water from flowing through the tailings impoundments. Two generators were brought to the site and used to divert water from entering the work area. One generator was placed near T3 and the other was placed near T1. Both generators operated each day for 24 hours a day to divert water from the tailings impoundments. Hydroseeding was done on the cut slopes from the lower staging area to the repository.

5.5.24 MAY 18-24, 2013

Waste rock and tailings continued to be hauled from the waste removal area. Additional springs were located in T1 while excavating the tailings. Perforated pipe was placed in T1 to divert the water and allow haul trucks to travel over the surface without sinking in the wet material. Road work was done on USFS Road 707 where excess moisture from rain had caused ruts and dips, causing issues for the haul trucks. Sumps were excavated at the northeast and southeast corners of the repository to prevent repository runoff from being transported offsite due to heavy rains. Both generators operated for 24 hours a day, 7 days a week, to divert water from the tailings impoundments. Rain and hail caused USFS Road 707 to become slick, thereby preventing haul trucks from operating due to hazardous conditions. Heavy snow broke numerous limbs off of trees, which fell across USFS Road 707. Clearing of the trees accounted for 1 weather day. Due to rain and snow, 4 weather days were granted (May 19, 20, 23, 24).

5.5.25 MAY 25-31, 2013

Waste rock and tailings continued to be hauled from the waste removal area. Road work was done to lessen the ruts and dips in the haul road caused from rain and snow from the previous week. Rain continued to lead to slick and wet conditions of USFS Road 707, resulting in short work days on May 25 and 29. Water management tasks were done on May 28 to address a large volume of water flowing through the waste removal area due to heavy rains. The following tasks were performed: perforated pipe was placed upgradient of the site, south of the waste rock pile, to divert Dunkleberg Creek to the 18-inch HDPE pipe, a sump was

excavated in T2, and two rock check dams were placed in a narrow section of T1 to prevent contaminated water from flowing offsite. The grade control structures design was modified for larger structures to be installed at less frequent intervals. The design was modified to more closely imitate the reference reach and because there is limited spawning ground upstream of the structures. The design modification was prepared in conjunction with DEQ and USFS personnel (revised drawings are included in Appendix K-1). Due to heavy rains, 5 weather days were granted (May 26, 27, 28, 29, and 30). Both generators operated for 24 hours a day, 7 days a week, to divert water from the tailings impoundments.

5.5.26 JUNE 1-7, 2013

Waste rock and tailings continued to be hauled from the waste removal area. Tailings in T3 were deeper than the Contractor anticipated, which created issues for the Contractor in determining how to access the material. A road was constructed through T2 in order to access tailings on the north side of T3. A substantial slide of material in T3 occurred on June 7, which transported tailings approximately 700 feet north, near the north end of T1. The slide displaced tailings into areas of T2 that had previously been excavated to native material. A portion of the switchback in USFS Road 707 had also been removed by the slide, decreasing the turning radius for haul trucks. Wet conditions caused haul trucks to have difficulty accessing loading areas in T1. Rain continued to lead to slick and wet conditions of USFS Road 707, resulting in a weather day on June 2. Ruts and dips in USFS Road 707 continued to be an issue for the haul trucks. Road work was done to address the adverse road conditions. Due to heavy rains, 3 weather days were granted (June 2, 3, and 4). Both generators operated for 24 hours a day, 7 days a week, to divert water from the tailings impoundments.

5.5.27 JUNE 8-14, 2013

Waste rock and tailings continued to be hauled from the waste removal area. Compaction testing of material in the repository was done by Holman Consulting Engineers. The following water management tasks were done: the sump in T3 was relocated to allow for excavation in that area and perforated pipe was placed in T1 to divert water and allow haul trucks to travel over wet areas. Trees that had been felled in the repository area were processed according to the Forest Service Road Maintenance Specifications (T-506 and T-507). The root wads were discarded over Turnout 4 and the logs were stockpiled on the east side of the repository. Ruts and dips in USFS Road 707 continued to be an issue for the haul trucks. Road work was done to address the adverse road conditions. Due to heavy rains, 2 weather days were granted (June 13 and 14). Both generators operated for 24 hours a day, 7 days a week, to divert water from the tailings impoundments.

5.5.28 JUNE 15-21, 2013

Waste rock and tailings continued to be hauled from the waste removal area. Compaction testing of material in the repository was done by Holman Consulting Engineers. The following water management task was done: additional perforated pipe was placed in T1 to divert water and allow haul trucks to travel over wet areas. Excavating in T1 became increasingly difficult due additional springs that were exposed, leading to ponding in various areas. A landowner issued complaints to a Granite County commissioner regarding two cattle guards along Dunkleberg Creek Road that were damaged and allowing cattle to cross into

unpermitted grazing lands and insisted the cattle guards be fixed or replaced. DEQ and Granite County discussed cattle guard replacement. A portion of the CDN from Northwest Linings was delivered to the site for the repository cover. Rain continued to make access into the tailings impoundments difficult for haul trucks. Due to heavy rains, 1 weather day was granted (June 20). Both generators operated for 24 hours a day, 7 days a week, to divert water from the tailings impoundments.

5.5.29 JUNE 22-28, 2013

Waste rock and tailings continued to be hauled from the waste removal area. Additional springs were located in T1 upon excavation. Tailings were excavated from behind the silt fence north of T1. Water management in T1 continued to be done as various springs led to large pools of water. The following tasks were done: additional perforated pipe was placed in T1 and the sump was relocated to allow for the continual excavation of material. Fill material stockpiled from the repository excavation was hauled to T1 to construct a road to access the tailings. Due to heavy rains, 2 weather days were granted (June 25 and 26). Both generators operated for 24 hours a day, 7 days a week, to divert water from the tailings impoundments.

5.5.30 JUNE 29-JULY 5, 2013

Waste rock and tailings continued to be hauled from the waste removal area. Fill material stockpiled from the repository excavation was hauled to T1 to construct a road for access to the tailings. The fill material was also unloaded over the west slope in T3 to reduce the grade of the slope and provide stabilization for the USFS Road 707 switchback. Tailings were removed in full from T1 (July 1) and T2 (June 29). Finish grading of the slopes began in T1 and T2. Dunkleberg Creek diversion was no longer required and the 18-inch HDPE pipe was removed from the waste removal area. The generator located near T1 was stopped; the generator near T3 continued to operate for 24 hours a day, 7 days a week, to divert water. The remaining CDN from Northwest Linings was delivered to the site. DJ&A conducted a final-grade survey of the repository; however, the Contractor hauled for 2 additional days (July 5 and 6) following the final-grade survey in order to complete the hauling of waste material. Work did not occur for 1 day (July 4) in observance of Independence Day, at the Contractor's discretion.

5.5.31 JULY 6-12, 2013

Tailings were removed in full from T3 and the area between the waste rock pile and T3 (July 6). Finish grading of the T1 slopes continued. The placement of 2 feet of embankment fill over the tailings and waste rock began (July 6) in 1-foot lifts, and was completed on July 10. Compaction testing of the 2-foot cover over the waste material was done by Holman Consulting Engineers. The anchor trenches were excavated along the repository perimeter. Silt fence was removed downgradient of the topsoil piles and in the northeast and southwest corners of the repository. Boulders excavated during the placement of the fill over the tailings and waste rock were hauled to the waste removal area to be used for weir construction. The installation of weirs in the Dunkelberg Creek channel began (July 11), in accordance with the modified design. The generator near T3 continued to operate for

24 hours a day, 7 days a week, to divert water. Northwest Linings began installing the 80-mil HDPE liner.

5.5.32 JULY 13-19, 2013

Northwest Linings continued installing the 80-mil HDPE liner. Northwest Linings ordered two rolls of HDPE liner and CDN, as it was determined that additional roles were necessary to complete the liner installation due to not accounting for material placed in anchor trenches. The two additional roles of CDN were delivered to the site. The south side of the repository remained open until the liner arrived. Pressure testing, destructive testing, and vacuum testing of the liner seams were completed. Destructive testing was conducted on seven seams. The seams were removed by Northwest Linings and then sent to Tri Environmental to confirm work done; results are included in Appendix H-2. The installation of CDN was completed, except for the south side of the repository that needed HDPE liner installed. Finish grading of the slopes between T3 and the south side of the waste rock pile was completed. Brush from the slash stockpile east of T1 was scattered over the east slopes of T1, T2, and T3. The ledge that the 18-inch HDPE pipe had been placed on was graded to blend in with the existing slope. The access road along the east side of the impoundments was also blended in with the existing slopes. Site-wide punch-list items were worked on. Installation of weirs in the Dunkleberg Creek channel continued. Straw wattles were delivered to the site. The generator near T3 continued to operate for 24 hours a day, 7 days a week, to divert water.

5.5.33 JULY 20-26, 2013

The two additional rolls of 80-mil HDPE liner were delivered to the site. The installation of 80-mil HDPE liner and CDN was completed by Northwest Linings. Pressure testing, destructive testing, and vacuum testing of the liner seams were completed. Five seams were sent to Tri Environmental to confirm work done by Northwest Linings; results are included in Appendix H-2. Diversion of water into the waste removal area was no longer required and the generator near T3 was stopped. The 2.5-foot cover of embankment fill was placed over the repository. Compaction testing of the 2.5-foot cover over the 80-mil HDPE liner and CDN was done by Holman Consulting Engineers. Once the 2.5-foot cover was placed, fill was used to contour the repository to blend in with the surrounding area. The placement of at least 0.5 feet of topsoil over the contoured repository began (July 26). Trees on the southwest side of the repository were de-limbed and decked according to Forest Service Road Maintenance Specifications (T-506 and T-507). The placement of straw wattles on the slopes in the waste removal area was completed. Turnout 2 along USFS Road 707 was scarified and scattered with brush to make it impassable.

5.5.34 JULY 27-AUGUST 2, 2013

The road above the waste removal area leading to the waste rock pile was scarified and scattered with brush to make it impassable. The run-on ditches on the west and north sides of the repository were excavated and rock lined. The contouring of embankment fill over the repository area, the placement of topsoil over the repository area, and the placement of straw wattles and slash over the repository area was completed. The installation of fencing around the repository and the planting, seeding, and mulching of the

waste removal and repository areas was postponed until mid-August and mid-September, respectively. Substantial completion was granted (July 30).

5.5.35 AUGUST 10-16, 2013

Nine water bars were installed between the lower staging area and the repository, under USFS guidance. Turnouts were roughened to prepare for hydroseeding. All equipment was demobilized from the site.

5.5.36 AUGUST 31-SEPTEMBER 6, 2013

Hillshire began installing the fence around the repository area.

5.5.37 SEPTEMBER 7-13, 2013

Hillshire finished installing the fencing around the repository area; 2,578 feet of fence were installed.

5.5.38 SEPTEMBER 14-20, 2013

Hydroseeding and willow planting in the waste removal area was completed by Valley Landscape. Drier areas of the creek channel were planted less densely with willows than specified and areas that were wetter from springs and seeps were planted more densely. Tree protectors were placed on all of the willows.

5.5.39 OCTOBER 5-11, 2013

Hydroseeding in the repository area, on the turnouts from the waste removal area to the repository, and at the lower staging area was completed by Valley Landscape.

5.6 CONSTRUCTION PHOTOS

Daily photos documenting construction progress are included in Appendix M.

5.7 CONSTRUCTION SITE VISITATION

Visitors frequented the Forest Rose Mine during construction, including the USFS, Clark Fork Coalition, county commissioners, and television and newspaper crews. Construction site visitor logs are included in Appendix N.

6.0 PROJECT COSTS

The following sections outline and summarize all engineering and construction costs for the Forest Rose Mine Reclamation Project.

6.1 TOTAL PROJECT COSTS

Engineering services provided during the Project included site investigation activities, engineering design and evaluation, construction oversight, and report preparation and totaled \$465,838.41. The total cost for engineering services is summarized in Table 6.1.

Engineering Service	Year	Cost
RWP, RI	2010/2011	\$38,603.92
EEE/CA	2011	\$36,634.54
Engineering Services and Bid Document Preparation	2011	\$50,851.55
Engineering Services, Technical Support, and Update of Bid Documents	2012	\$12,183.26
Engineering Services, Construction Evaluation, Management, and Oversight and Report Preparation	2012/2013	\$327,565.14
Total Engineering Services		\$465,838.41

DS Jr. Trucking's original bid to complete the road improvements work was \$288,252.34 with one change order that increased the cost by \$114,102.00. Mungas' original bid for the mine reclamation was \$1,745,023.00 with seven change orders that increased the cost by \$1,327,644.04. Additional costs for the Project included the application of magnesium chloride by WE Dust Control on approximately 6 miles of road in Granite and Powell counties and the replacement of 1.5 cattle guards in Granite County by the Granite County Road Maintenance Division. The application of magnesium chloride increased the cost by \$20,788.90 and the cattle guard replacements increased the cost by \$4,181.50. The total construction cost for the Project, including road improvements, mine reclamation, magnesium chloride application, and cattle guard replacement, was \$3,499,991.78. The total construction costs are summarized in Table 6.2. Invoices for the magnesium chloride application and cattle guard replacement are in Appendix O.

An analysis of engineering and construction costs for the Project is summarized in Table 6.3.

Table 6.2. Construction Cost Summary.	
Road Improvements - DEQ CONTRACT NO. 412021	
DS Jr. Trucking Original Contract	\$288,252.34
Change Orders	
Change Order No. 1	\$114,102.00
Total Change Order	\$114,102.00
Mine Reclamation - DEQ CONTRACT NO. 412001	
Mungas Original Contract	\$1,745,023.00
Change Orders	
Change Order No. 1	\$677,100.00
Change Order No. 2	N/A
Change Order No. 3	\$137,976.35
Change Order No. 4	\$148,860.64
Change Order No. 5	N/A
Change Order No. 6	\$351,206.05
Change Order No. 7	\$12,501.00
Total Changer Order	\$1,327,644.04
Additional Costs	
Magnesium Chloride Application	\$20,788.90
Granite County Cattle Guard Replacement	\$4,181.50
Total Construction Cost	
DS Jr. Trucking: Road Improvements	\$402,354.34
Mungas: Mine Reclamation	\$3,072,667.04
Additional Costs (Magnesium Chloride Application and Cattle Guard Replacement)	\$24,970.40
Total Construction Cost	\$3,499,991.78

Table 6.3. Analysis of Engineering and Construction Costs Incurred.

	Amount	Percentage of Total Construction Costs	Percentage of Total Eng. & Const. Project Costs
Engineering Services			
RWP, RI	\$38,603.92	1.10%	0.97%
EEE/CA	\$36,634.54	1.05%	0.92%
Engineering Services and Bid Document Preparation	\$50,851.55	1.45%	1.28%
Engineering Services, Technical Support, and Update of Bid Document	\$12,183.26	0.35%	0.31%
Engineering Services, Construction Evaluation, Management, and Oversight and Report Preparation	\$327,565.14	9.36%	8.26%
Total Engineering Costs	\$465,838.41	13.31%	11.75%
Construction Services			
DS Jr. Trucking, Contract No. 412021	\$288,252.34	8.24%	7.27%
DS Jr. Trucking Change Orders	\$114,102.00	3.26%	2.88%
Mungas, Contract No. 412001	\$1,745,023.00	49.86%	44.00%
Mungas, Change Orders	\$1,327,644.04	37.93%	33.48%
Additional Costs: Magnesium Chloride Application and Granite County Cattle Guard Replacements	\$24,970.40	0.71%	0.63%
Total Construction Costs	\$3,499,991.78	100.00%	88.25%
Total Engineering & Construction Costs	\$3,965,830.19	-	100.00%

7.0 PROJECT SUMMARY

Reclamation activities at the Forest Rose Mine included two separate construction contracts. One contract was for performing road improvements on Dunkleberg Creek Road in Powell and Granite counties and along USFS Road 707 to provide access to the site. The second contract was for the reclamation of the Forest Rose Mine. Road improvement construction commenced on June 12, 2012, and was completed on July 1, 2012. Mine reclamation construction commenced on June 29, 2012. Reclamation activities were shut down from November 7, 2012, through May 14, 2013. Substantial completion for the mine reclamation phase of the Project was achieved on June 30, 2013, with final completion obtained on October 9, 2013. Reclamation construction consisted of excavating and placing approximately 109,000 CY of mine waste in an onsite repository on USFS-administered lands and reconstructing 1,300 feet of the Dunkleberg Creek channel.

The successful bidder for the road improvements contract was DS Jr. Trucking of Drummond, Montana. The original contract bid for DS Jr. Trucking was \$288,252.34 with one change order resulting in an increase of \$114,102.00. The successful bidder for the mine reclamation contract was Mungas Company, Inc. of Philipsburg, Montana. The original contract bid for Mungas Company, Inc. was \$1,745,023.00 with seven change orders resulting in an increase of \$1,327,644.04. Construction costs for the road improvements and mine reclamation contracts were \$3,360,919.38.

Additional costs for the Project included the application of magnesium chloride on approximately 6 miles of road in Granite and Powell counties (\$20,788.90) by WE Dust Control and the replacement of 1.5 cattle guards in Granite County (\$4,181.50) by the Granite County Road Maintenance Division. The total construction costs, including the road improvements and mine reclamation contracts, along with the additional costs of the magnesium chloride application and cattle guard replacements, were \$3,499,991.78. Total engineering costs were \$465,838.41. The total cost of the Project, including construction and engineering costs, was \$3,965,830.19. Tables 6.1 and 6.2 give a breakdown of the engineering and construction costs that were incurred through the duration of the Project.

8.0 REFERENCES

DEQ. 2002. Abandoned Mines Historic Narratives. Montana Department of Environmental Quality Remediation Division. <http://deq.mt.gov/abandonedmines/linkdocs/60tech.mcp.x>.

