Jumbo Mine Road Corridor

Part D Operation and Reclamation Plan

Permit Renewal

May 2018

USIBELLI COAL MINE, INC.

MASTER TABLE OF CONTENTS
JUMBO DOME ROAD CORRIDOR

VOLUME 1

CHAPTER II: GEOLOGY

CHAPTER III: OVERBURDEN AND INTERBURDEN ASSESSMENT

CHAPTER IV: HYDROGEOLOGY

CHAPTER VIII: VEGETATION

CHAPTER IX: FISH AND WILDLIFE INFORMATION

CHAPTER X: SOIL RESOURCES

CHAPTER XI: LAND USE INFORMATION

PART D: OPERATION AND RECLAMATION PLAN

LIST OF TABLES

LIST OF PLATES

LIST OF EXHIBITS

LIST OF APPENDICES

LIST OF FIGURES

SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

UCM has maintained active ongoing coal mining and reclamation operations in the Hoseanna Creek Valley since the early 1970's, beginning with the Gold Run Pass mining area and progressing to the Poker Flats and Two Bull Ridge areas for additional reserves to support ongoing operations and meet contractual obligations. The Jumbo Dome Mine was permitted in 2012. The purpose of the Jumbo Road Corridor is to function as a haul road from the Jumbo Dome Mine Permit No. S-0606 to the Hoseanna Creek Haul Road to the UCM Coal Tipple and Train Load Out Facility.

Construction activities for the Jumbo Road Corridor will involve cut, fill and grading work. Reclamation of the associated side slope areas will be an integral part of and will occur contemporaneously with the construction activities.

Part D of this application addresses all requirements for road construction in support of coal mining activities of the Alaska Surface Coal Mining Control and Reclamation Act (AS 27.21) as implemented through the Regulations Governing Coal Mining in Alaska including Sections 11 AAC Parts 90.071 through 101 and 90.301 through 501, as applicable. This section is organized as follows:

1.0 Introduction
2.0 Life of Project Plan
3.0 Topsoil Handling
4.0 Blasting Plan
5.0 Pit Excavation – Not Used
6.0 Coal Removal and Storage – Not Used
7.0 Roads and Transportation Systems
8.0 Existing Structures and Mine Facilities
9.0 Drainage and Sediment Control
10.0 Reclamation Plan

11.0 Fish and Wildlife Protection Plan – Not Used

12.0 Protection of Hydrologic Balance and Water Quality – Not Used

13.0 Air Pollution Control Plan

14.0 Protection of Public Parks and Historic Places

15.0 Responsible Parties

The reclamation plans and environmental protection measures discussed in this Part of the permit application are based on and reflect consideration of the baseline environmental resource information presented in Part C. As appropriate, cross-references are provided to relevant environmental resource information.

LEGEND

- JUMBO DOME ROAD CORRIDOR (JDRC) PERMIT BOUNDARY
- JUMBO DOME MINE PERMIT BOUNDARY
- APPROXIMATE EXISTING CONTOUR AND ELEVATION, FT
- APPROXIMATE REGRADED CONTOUR
- PROPOSED JDRC CENTERLINE
- PROPOSED JDRC BREAKLINE
- EXISTING EXPLORATION TRAIL (SEE PERMIT XXXX)
- EXISTING CONSTRUCTION ACCESS
- TOPSOIL STOCKPILE (BRUSH BARRIERS NOT SHOWN)
- IMPACTED WETLAND
- EXISTING STREAM
- STREAM BUFFER ZONE
- EXISTING CULVERT
- ROCK UNDERDRAIN
- PROPOSED CLEAN WATER DIVERSION
- PROPOSED CONVEYANCE (DESIGNED; IF NEEDED WILL FIELD FIT)
- SEDIMENT SUMP
- GRP ROAD PERMIT BOUNDARY
- GRAVEL SOURCE A BOUNDARY
- EXISTING ROADS TO WIDEN-GRAVEL SOURCE A ACCESS
- EXTENT OF GRAVEL REMOVAL AREA

Sec.7 Sec.8 Sec.12 Sec.13 Sec.18 Sec.17 Sec.19 Sec.20 Sec.24 Sec.30 Sec.29 Sec.25

DESCENT TO SUBSURFACE CROSSING

SECOND WETLAND

FIRST WETLAND

BRUSH BARRIER (TOPSOIL) ALONG EDGES OF ACCESS TRAIL

BRUSH BARRIER - WADDLE CHECK DAMS AND SILT FENCE

Exploration Trail- Widen to 80' Roadway Currently a 40' Roadway

Access-G

Access-H

GRAVEL SOURCE A

PROPOSED TOPSOIL STOCKPILE

AN- 67555B

40 Acres

TOPSOIL SPREAD

TOPSOIL STOCKPILE

CUT 13

Access-C

Access-C1

Existing Exploration Trail

WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS

BRUSH BARRIER (TOPSOIL) ALONG TOE OF OUTSLOPE

Access-B

Access-B1

Existing Exploration Trail

WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS

Access-A

Access-E

BRUSH BARRIER (TOPSOIL) ALONG LENGTH OF ACCESS E

WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS

STREAM BUFFER IS ADDITIONAL VEGETATED BUFFER ZONE SEDIMENT CONTROL

Access-F

BRUSH BARRIER (TOPSOIL) ALONG LENGTH OF ACCESS E

CUT 1-2

SEDIMENT TRAP

WADDLE CHECK DAMS

SEDIMENT TRAP

WATER TANK

DRAWING NOTES:

- TOPOGRAPHY SHOWN IS FROM AERIAL SURVEY MAY 2013 – CONTOUR INTERVAL 10FT
- 25 FT CONTOURS FOR SURROUNDING AREA SHOWN FOR REFERENCE ONLY
- ALL DRAINAGE AND SEDIMENT CONTROL LOCATIONS SHOWN ARE APPROXIMATE
- REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS

N

0 500' 250' 500' 1000' 1500' 2000'

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
0	01/10	TSV	ORIGINAL SUBMITTAL
1	08/13	JTS	UPDATED FOR REVISION ORDER
2	02/14	JTS	UPDATED FOR REVISION ORDER
3	03/14	RCS	UPDATED FOR REVISION ORDER
4	06/15	DHR	UPDATED FOR REVISION ORDER
5	11/15	RCS	SBZ WIDTH, OTHER MINOR CHANGES
6	12/16	RCS	ADDED GRAVEL SOURCE A, MODIFIED PERMIT BOUNDARY
7	4/17	RCS	4PR REVISION FINAL DRAFT
8	2/18	RCS	CUT 13 REVISION

DESIGN BY:

DRAWN BY: JTS

CHECK BY:

DWG FILE:

DATE DRAWN: 1/1/13

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

JUMBO DOME ROAD CORRIDOR

PERMIT NUMBER S-0605

JUMBO DOME ROAD CORRIDOR FEATURE PLOT

JUMBO DOME ROAD CORRIDOR

PLATE No. D1-1 REV. 8

SHEET No. 1 OF 1

LEGEND

- JUMBO DOME ROAD CORRIDOR (JDRC) PERMIT BOUNDARY
- JUMBO DOME MINE PERMIT BOUNDARY
- APPROXIMATE EXISTING CONTOUR AND ELEVATION, FT (2000)
- APPROXIMATE REGRADED CONTOUR
- PROPOSED JDRC CENTERLINE (100+00)
- PROPOSED JDRC BREAKLINE
- EXISTING EXPLORATION TRAIL (SEE PERMIT XXXX)
- EXISTING CONSTRUCTION ACCESS
- TOPSOIL STOCKPILE (BRUSH BARRIERS NOT SHOWN)
- IMPACTED WETLAND
- EXISTING STREAM
- STREAM BUFFER ZONE
- EXISTING CULVERT
- ROCK UNDERDRAIN
- PROPOSED CLEAN WATER DIVERSION
- PROPOSED CONVEYANCE (DESIGNED; IF NEEDED WILL FIELD FIT)
- SEDIMENT SUMP
- GRP ROAD PERMIT BOUNDARY
- PROPOSED GRAVEL SOURCE A BOUNDARY
- PROPOSED JDRC PERMIT BOUNDARY
- EXISTING ROADS TO WIDEN-GRAVEL SOURCE A ACCESS
- EXTENT OF GRAVEL REMOVAL AREA

JUMBO DOME MINE PERMIT BOUNDARY

DESCENT TO MARGUERITE CREEK

MARGUERITE CREEK CROSSING

JDRC PERMIT BOUNDARY

SECOND WETLANDS

BRUSH BARRIER, WADDLE CHECK DAMS, AND SILT FENCE

BRUSH BARRIER (TOPSOIL) ALONG EDGES OF ACCESS TRAIL

FLATS

FIRST WETLANDS

Exploration Trail- Widen to 80' Roadway Currently a 40' Roadway

83 Acres

107 Acres

110 Acres

Access-D

Access-D

GRAVEL SOURCE A

421 Acres

PROPOSED TOPSOIL STOCKPILE

ADL 673538

BRUSH BARRIER (TOPSOIL) ALONG EDGES OF ACCESS TRAIL

TOPSOIL SPREAD

TOPSOIL STOCKPILE

CUT 13

CUT 12

Existing Exploration Trail

Access-C

Access-C

WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS

CUT 11

CUT 10

BRUSH BARRIER (TOPSOIL) ALONG TOE OF OUTSLOPE

Access-B

Access-B

Existing Exploration Trail

WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS

Access-A

Access-A

CUT 9

CUT 8

Access-E

BRUSH BARRIER (TOPSOIL) ALONG LENGTH OF ACCESS E

WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS

CUT 7

CUT 6

STREAM BUFFER IS ADDITIONAL VEGETATED BUFFER ZONE SEDIMENT CONTROL

Access-E

BRUSH BARRIER (TOPSOIL) ALONG LENGTH OF ACCESS E

CUT 5

CUT 4

CUT 1-2

JDRC PERMIT BOUNDARY

SEDIMENT TRAP

JDRC PERMIT BOUNDARY

GRP ROAD PERMIT BOUNDARY

WADDLE CHECK DAMS

SEDIMENT TRAP

WATER TANK

SEDIMENT TRAP

Sec.7 Sec.8 Sec.12 Sec.13 Sec.18 Sec.17 Sec.16 Sec.19 Sec.20 Sec.24 Sec.25 Sec.30 Sec.29 Sec.28

DRAWING NOTES

- TOPOGRAPHY SHOWN IS FROM AERIAL SURVEY MAY 2013 – CONTOUR INTERVAL 10FT
- 25 FT CONTOURS FOR SURROUNDING AREA SHOWN FOR REFERENCE ONLY
- ALL DRAINAGE AND SEDIMENT CONTROL LOCATIONS SHOWN ARE APPROXIMATE
- REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS

N W E S

500' 250' 0' 500' 1000' 1500' 2000'

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
0	01/10	TSV	ORIGINAL SUBMITTAL
1	08/13	JTS	UPDATED FOR REVISION ORDER
2	02/14	JTS	UPDATED FOR REVISION ORDER
3	07/14	RCS	UPDATED FOR REVISION ORDER
4	06/15	SHW	UPDATED FOR REVISION ORDER
5	11/15	RCS	SBZ WIDTH, OTHER MINOR CHANGES
6	12/15	RCS	ADDED GRAVEL SOURCE A, MODIFIED PERMIT BOUNDARY

DESIGN BY: JTS

DRAWN BY: JTS

CHECK BY:

DWG FILE:

DATE DRAWN: 11/13

JUMBO DOME ROAD CORRIDOR

USIBELLI COAL MINE INC.

PERMIT NUMBER S-0605

JUMBO DOME ROAD CORRIDOR FEATURE PLOT

JUMBO DOME ROAD CORRIDOR

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. D1-1

SHEET No. 1 OF 1

REV. 6

SECTION 2.0

LIFE OF MINE PLAN

TABLE OF CONTENTS

2.0 LIFE OF MINE PLAN

2.1 DESCRIPTION OF PROJECT

The Jumbo Dome Road Corridor area begins approximately 3 miles northeast of the current Two Bull Ridge Pit, on the north side of the Hoseanna Creek Valley.

The Jumbo Dome Mine is located approximately 7 miles northeast of the Two Bull Ridge Pit and the coal reserves are a geologic extension of the coal reserves in the Two Bull and Poker Flats Mine area, with minable reserves associated with the Upper Suntrana Formation as discussed in Part C, Chapter II, Geology. The Jumbo Dome Mine was permitted in 2012. The purpose of the Jumbo Dome Road Corridor is to function as a haul road from the Jumbo Dome Mine Permit No. S-0606 to the Hoseanna Creek Haul Road to the UCM Coal Tipple and Train Load Out Facility.

If coal is encountered, it will be recovered.

2.2 CONSTRUCTION METHODS AND EQUIPMENT

The proposed Jumbo Dome Road Corridor operations will involve the use of the following equipment:

Cut, Fill, Grading and Topsoil* Handling

- Caterpillar D9, D10, and D11 Tractors*
- Komatsu 475 Tractor
- Drilltech C60K21 Drill
- Ingersoll-Rand DMM2 Drill
- Explosives Prill Truck
- Caterpillar 992 Front-End Loader*
- O&K 120C Hydraulic Excavator*
- Caterpillar 785 150-Ton Trucks*
- Caterpillar 777 100-Ton Trucks*

Coal Removal

- Caterpillar 992 Front-End Loader
- O&K 120C Hydraulic Excavator
- Caterpillar 385 Excavator
- Caterpillar 785 150-Ton Trucks
- Caterpillar 777 100-Ton Trucks

Reclamation

- Caterpillar D6, D9, D10, and D11 Tractors
- Komatsu 475 Tractor
- Volvo EC210 Backhoe

In addition, a variety of ancillary equipment will be utilized for support and maintenance during mining and reclamation operations.

The project will be constructed using the standard practices for linear construction projects. As is typical of linear road projects, the road will not be completed with surfacing material until the entire project is up to final grade. The project will start with initial survey of plan and profile. Work will typically progress starting at station 0+00 and progress upstation. When accessible, initial sediment control BMP's will be installed prior to disturbance or with initiation of clearing in the case where brush barriers are used. Initial conveyance structures at the existing grades will be installed where necessary and as shown on Plate D1-1 and as described in Section D-9, Drainage and Sediment Control Plan. These will consist of a typical 3'x3' rock drain wrapped in geotextile filter fabric. In areas where salvage of topsoil is feasible, topsoil will be salvaged in accordance with Section D-3, Topsoil. Subgrade preparation will be completed as the appropriate cuts and fills balance along the road corridor. Interim ditches, BMPs, and vegetative cover will be installed to facilitate drainage control during the construction phase in accordance with Section D-9 and Section D-10, Reclamation Plan. Final conveyance structures will be installed in accordance with the design shown in Section D9. Once the subgrade is at the design plan and profile, then surfacing and final seeding of slopes will be completed.

2.3 PROJECT LAYOUT AND DISTURBANCE AREAS

The Jumbo Dome Road Corridor Project will generally start from the southern end, near the existing haul road and work north as depicted on Plate D1-1. The project has been design with balanced cut and fills over the entire length of the project. The majority of the fill is located within the first half of the project while the bulk of the cuts are located in the latter half of the project. The large fill depressions will be used as temporary sediment trap BMPs during the construction phase. As of August 2013, 75 percent of the road has been completed.
Road surfacing material for Jumbo Dome Mine Long Term Haul Road and Road Corridor will be extracted from Gravel Borrow Site A located west of Cut 13. This will be accessed via the existing exploration trail labeled Access D. Access D will be widened to accommodate haul

truck traffic to an 80’ wide haul road with ditches and berms as required by MSHA for 785 haul truck traffic. The gravel deposit lies above elevation 2750’ and test holes dug validated this location. A topsoil pile will be located east of the gravel deposit and topsoil stockpiled if encountered. Equipment will start at roughly 2750’ which is the gravel contact and remove gravel as it is encountered within the 42 acre site.

2.4 TOPSOIL HANDLING

Prior to disturbance, vegetation and the O soil horizon will be dozed into a brush barrier BMP for sediment control wherever the terrain is suitable. The suitability of terrain for topsoil salvage is discussed in Chapter CX Table CX-3. The brush barriers will be located at the edges of disturbance either at toes of slopes or tops of cuts. Topsoil, defined in 11 AAC 90.313 as the A horizon, will be recovered for use as a revegetation medium wherever the terrain is suitable. Topsoil material recovered from disturbance areas will either be stockpiled for future reclamation use or directly replaced on regraded areas. Dozers will remove the topsoil material and push it into temporary piles from which mobile loading units will load it into haul trucks. The haul trucks will transport the topsoil material to either temporary stockpiles or directly to regraded slopes. Topsoil stockpiles will be located along the road corridor, located in areas where they can be protected from storm runoff.

2.5 COAL REMOVAL

During construction of the road, coal may be encountered. If coal is encountered, construction activities will maximize utilization and conservation of the coal resource. If coal is encountered the following steps will take place:

Once the surface of the coal seam(s) is cleaned, the seam(s) may be drilled and blasted, to fragment the coal for loading. Dependent on operating conditions and equipment availability, a front-end loader, shovel, or backhoe may be used to load the coal into haulage trucks for transport to the coal handling facility.

The coal handling facility is an existing permitted facility, located at the mouth of Hoseanna Creek, consisting of a run-of-mine coal hopper; coal stockpiles; coal sizing, and conveying facilities and equipment; and a coal tipple and loadout facility. The coal stockpiles allow segregation of different quality coal for blending purposes to meet contract specifications. All coal handling facilities and operations are permitted under the Poker Flats Mining and Reclamation Permit (Permit No. 01-83-796) and are not considered as a component of this permit application.

2.6 RECLAMATION

As construction progresses, side slopes will be vegetated each season to prevent erosion. Drainage structure maintenance during construction will consist of regarding the road and ditches after rain events to ensure proper drainage. If ditch check dam BMPs are damaged they will be replaced as soon as practicable. At the completion of final sub grade an additional re-vegetation effort will be done on side slopes. After the life of the project is over, the road surface will be scarified and seeded.

2.7 PERMIT TERMS

The Permit Renewal Application for the Jumbo Dome Road Corridor is for an additional permit term of five years as discussed and referenced in Part B of this application. The requests for renewal will be filed at least 120 days prior to permit expiration and will follow the procedures outlined under 11 AAC90.129. A proposed schedule to complete the road construction within the permit term October 2012 to September 2017 is included in Figure D2-1.

SECTION 3.0

TOPSOIL HANDLING

TABLE OF CONTENTS

LIST OF TABLES

3.0 TOPSOIL HANDLING

3.1 INTRODUCTION

As discussed in the soil resource assessment report (Part C, Chapter X), the Jumbo Dome Road Corridor soils have some similarities to the Two Bull Ridge area soils due to the common bedrock, geology, and stratigraphy. Soil textures run from silt loam to extremely gravelly or cobbly sandy loam to sand. Table CX-3 lists the criteria established for the suitability of topsoil.

3.2 REMOVAL METHODS

Prior to disturbance, vegetation and the O soil horizon will be dozed into a brush barrier BMP for sediment control wherever the terrain is suitable. The suitability of terrain for topsoil salvage is discussed in Part C Chapter X Table CX-3. The brush barriers will be located at the edges of disturbance either at toes of slopes or tops of cuts. Topsoil, defined in 11 AAC 90.311 as the A horizon, will be recovered for use as a revegetation medium wherever the terrain is suitable. Where suitable A horizon is not available, the top 6 inches after vegetation removal will be salvaged.

Topsoil material recovered from disturbance areas will either be stockpiled for future reclamation use or directly replaced on regraded areas. Dozers will remove the topsoil material and push it into temporary piles from which mobile loading units will load it into haul trucks. The haul trucks will transport the topsoil material to either temporary stockpiles or directly to regraded slopes. Topsoil stockpiles will be located along the road corridor located in areas where they can be protected from storm runoff.

3.3 QUANTITIES AND CHARACTERISTICS.

The native soils within the Jumbo Dome Road Corridor permit area have been identified and characterized as outlined in the Soil Resources in Part C, Chapter X. Topsoil suitability criteria were

developed from the known morphological, physical, and chemical properties of each soil type. These suitability criteria were then used to estimate the depth of salvageable topsoil within each mapping unit. The areal extent of each soil mapping unit within the disturbance area was further adjusted based on certain limiting factors associated with salvageability (e.g. slope, wetness, permafrost, etc.).

Maximum Potential Salvage Depths for are presented in Table 4 of the Soil Resources Report found in Part C Chapter X. Table D3-1 shows Maximum Potential Salvage Depths Verses Actual Salvage Depth of Topsoil's in Jumbo Dome Road Corridor Permitting Area. The actual depth of topsoil found at the road cuts is significantly less than the maximum potential salvage depth anticipated based on the baseline surveys.

3.4 STOCKPILING AND REPLACEMENT

Topsoil removed during construction will be stockpiled for future replacement on road embankment fill slopes. Topsoil stock piles will be located in areas near summits to protect the stockpile from storm runoff. During active stockpiling efforts waddles or straw bales will be used for erosion protection. Once active stockpiling efforts are completed, a dirt berm will be used for erosion protection. "Topsoil Stockpile" signs will be installed to delineate topsoil stockpiles.

For diversion ditches outside of the disturbance area, topsoil will be removed and bermed for storage along the length of the structure. At the end of the useful life of these structures, this material will be respread on the regraded area for final reclamation. . If there are insufficient quantities of topsoil along these areas for final reclamation, the overburden will be used as substitute growth medium. These topsoil stockpiles will be seeded in a timely manner in order to control water and wind erosion. Waddles, ditches, or dirt berms will be utilized to ensure topsoil is contained. These areas will be signed and the locations mapped.

All topsoil stockpiled for longer than 12 months will be mapped, marked and protected. All topsoil stockpile construction will be monitored by a trained UCM employee, and changes made to applicable plates will be made on an as needed basis with maps being submitted to DMLW with the annual report.

All topsoil stockpiles will be located and constructed to ensure stability and to minimize wind and water erosion, unnecessary compaction or contamination with other materials

Long term stockpiled topsoil will be graded to maximum slopes of 3H:1V and seeded with a grass mixture to minimize erosion. Long term topsoil stockpiles are reseeded with the Seed Mix 1 as discussed in Section D-10 (Reclamation Plan). A temporary seed mixture, Seed Mix 2 as discussed in Section D-10 (Reclamation Plan) is used to control erosion on salvaged topsoil which is typically stockpiled for less than a year or two. Seed mix 2 will be applied at a rate of 43 pounds per acre. It will be the goal of the topsoil handling program to minimize topsoil stockpiling and haul topsoil directly to regraded areas for final placement.

Once final grading is accomplished, topsoil will be placed on the surface of the road embankment fill slope. On slopes less than 2.5:1 topsoil will be spread by truck dump and spread with dozers to a minimum depth of six inches. On slopes greater than 2.5:1 topsoil will be spread by bulldozers to a minimum depth of six inches. Depths will be monitored by qualified individual to ensure sufficient topsoil depth is achieved.

3.5 TOPSOIL MONITORING

Topsoil stripping operations will be monitored by field engineers to define appropriate salvage depths. The equipment operator will be given approximate depth criteria based on Part C Chapter CX Table CX-4 for determination of the topsoil horizons to be salvaged. Topsoil depths vary significantly within each mapped soil unit. Depths will be measured, either with shovel spade or tape measure, within topsoil salvage areas to estimate quantities actually salvaged with approximate topsoil depth visual markers. Topsoil stockpiles will be inspected periodically for erosion. Any erosion features that may cause substantial loss of the topsoil resource will be repaired.

Table D3-1

MAXIMUM POTENTIAL SALVAGE DEPTH
vs
ACTUAL SALVAGE DEPTH OF TOPSOILS
IN JUMBO DOME ROAD CORRIDOR

Table D3-1 Maximum Potential Salvage Depth verses Actual Salvage Depth of Topsoils in Jumbo Dome Road Corridor

Map Unit Symbol from Table CX-4	Salvage Depth (inches) from Table CX-4	Slope (%) from Table CX-4	Limiting Factors from Table CX-4	Location based on Road Centerline stationing	Estimated Topsoil based on actual survey at cuts
3	N/A	0	wetness	GRP Road	
4	N/A	>100	no topsoil	240+00-250+00	<6"
6	N/A	N/A	utility corridor		
13	40	0-15	seasonal wetness	250+00-252+00	< 6"
14	40	0-15	sand	GRP Road	
15	40	25-60	sand, steep slope	0+00-60+00	< 6"
16	40	0-12	sand	GRP Road	
17	40	25-50	sand, steep slope	182+00-191+00	3"-21"
18	N/A	45-90	steep slope	285+00-290+00	N/A
19	N/A	45-90	steep slope	60+00-170+00	4"-39"
20	40	0-12	wetness, sand	208+00-210+00	3"-21"
21	40	0-3	wetness	277+00-284+00	N/A
22	40	3-15	wetness	191+00-192+00 & 212+00-	6.5"
23	40	15-45	wetness, steep slope, stone	Does not intersect road	
24	40	0-8	wetness	192+00-195+00 & 265+00-	3"-21"
25	40	8-25	wetness, sand	221+00-240+00	<6"
30	40	0-15	ocassional gravelly	208+00-212+00 & 252+00-	6.5"
Substratum					
31	60	0-25	none	173+00-182+00 & 195+00-	3"-21"
32	40	0-25	sandy	221+00-240+00	<6"
33	40	0-15	none	Does not intersect road	
40	40	40-70	sand, steep slope	284+00-285+00	N/A
Gravel Site A Area					
15-1	N/A	0	Mixed Clay,Gravel,Sand	Exploration Trail	
15-2	N/A	3-15	Schist	Exploration Trail	
15-3	Less than 3"	15-45	Sandy Gravel	Exploration Trail	< 3"
15-4	N/A	0-12	Sandy Gravel	Exploration Trail	
15-5	Less than 3"	0-15	Sand	Exploration Trail	< 3"
15-6	N/A	0	Sandy Gravel	Exploration Trail	
15-7	N/A	15-45	Pebbly Gravel	Exploration Trail	
15-8	N/A	15-45	Sandy Gravel	Exploration Trail	
15-9	N/A	15-45	Pebbly Gravel	Exploration Trail	
15-10	N/A	15-45	Sandy Gravel	Exploration Trail	
15-11	N/A	15-45	Sandy Gravel	Exploration Trail	
15-12	N/A	45-90	Gravel	Exploration Trail	
15-13	N/A	45-90	Gravel	Exploration Trail	

SECTION 4.0

BLASTING PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF EXHIBITS

4.0 BLASTING PLAN

The following section describes the general blasting procedures and methods that will be used at the Jumbo Dome Mine. These procedures will be used throughout the mine life for the blasting associated with overburden, interburden and coal removal.

4.1 DESCRIPTION OF BLASTING OPERATION

There are several different variations of blasting which occur for different reasons at UCM. There is overburden blasting for the purpose of loosening the material to help facilitate excavation. There is overburden blasting where the desired intent of the blast is to move material by way of explosive energy into its final spoil location (Cast blasting). The coal must also be blasted in order for it to be loaded into haul trucks. In all cases the width and length of the blast will vary between 100 to 200 feet and several 100 to several 1000 feet respectively.

The truck and shovel pre-striping operations usually require a shallow blast, less than 40 feet deep, to fracture the material. The blasted material must be loaded and hauled; therefore the desired result from the blast is to maximize fragmentation in order to optimize production rates. The powder factor will range from 0.5 to 1.0 lb. per cubic yard depending on the material type, depth, available excavating equipment, and desired muck-pile profile.

The dragline pits have overburden or interburden depths of up to 150 feet. In the case where the majority of the blasted material can be horizontally displaced into its final spoil location a blasting technique called cast blasting is implemented. Cast blasting requires the highest powder factor and will range from 1.0 to 2.0 lb. per cubic yard depending on the type of material being blasted. If dragline pits cannot take advantage of cast blasting and the material must be mechanically striped after blasting occurs, then a much lower powder factor of 0.5 to 1.0 lb. per cubic yard is used.

The coal seams must be blasted in order to be efficiently extracted and loaded into haul trucks. The idea in coal blasting is to minimally blast the coal to create uniform chunks which are easily loaded,

while being careful not to over blast and create excessive coal fines. The coal is blasted at a powder factor of about 0.35 lb. per ton.

In all blasting scenarios the drill holes are loaded with ANFO or an ANFO/Emulsion blend (Heavy ANFO); the amount is dictated by hole depth, diameter, and the pattern size. The powder factor and pattern will vary due to differing fragmentation objectives, overburden material properties, and the varying thickness of overburden and parting. Both vertical and angle holes ranging from 15 to 30 degrees from vertical are designed into specific patterns. Presplitting is used to define highwall slopes in selected areas. Presplitting involves detonating limited size explosive charges within angle holes to create a defined fracture plane that is the future sandstone highwall. Air deck presplitting will work best and produce the safest highwalls for the material type that will be encountered at Jumbo.

Figure D4-1 shows a typical blast pattern for consolidated overburden, with holes of 12 1/4 inch diameter drilled to 100 feet of depth on centers of 27 feet with a burden of 31 feet between rows. ANFO will be the blasting agent, with a powder factor of around 0.75 pound per cubic yard of consolidated overburden. For this case, an ANFO with a specific gravity of 0.85 in a 12 1/4 inch diameter hole yields an approximate explosive weight per foot of borehole of 42 pounds. Blasts will be initiated by cast boosters, non-electric shock tube and blasting cap or detonating cord, and electric or electronic blasting caps. Shots will be designed and delayed as necessary to maximize breakage, control fly rock, minimize air blast, and regulate ground vibration.

For an average overburden blast hole depth of 100 feet, 80 feet of the hole would be charged with approximately 3360 pounds of ANFO. The remainder of the blast hole, approximately 20 feet, will be stemmed with drill hole cuttings. Past experience in this type of overburden material indicates that this amount of stemming will be adequate to control air blast.

Coal will be blasted in 10 to 30 foot thickness on 12 to 27 foot centers depending upon seam thickness. When required, a water repellent emulsion mixture may be substituted for ANFO.
A typical blast pattern for coal is shown on Figure D4-2. For an average coal blast hole depth of 25 feet approximately 4 1/2 feet of the hole would be charged with 189 pounds of ANFO. The remainder of the blast hole, approximately 21 1/2 feet will be stemmed with drill hole cuttings. Blast initiation will be the same as for overburden.

4.2 EXPLOSIVE STORAGE

The explosive storage area is shown on Plate D2-1, General Facility Arrangement. The storage area location meets all the State and Federal laws for distance considerations. The explosive storage area will consist of several powder magazines, a heated emulsion tank, and other explosive support storage housing. All powder magazines will be double locked as required by law.

4.3 BLASTING CONTROL

The maximum weight of explosives calculated will be based on the minimum distance to the nearest building from the permit boundary as defined in 11 AAC 90.375. If UCM exceeds the limits established by the formulas contained in 11 AAC 90.379, then a seismograph will be used to monitor the ground vibration and air blast at the nearest structure not owned by the company. The maximum peak particle velocity of the ground motion will not exceed three quarters inch per second at the immediate location of any dwelling, public building, or privately owned buildings in the vicinity of the blast.

Alaska Department of Fish and Game (ADF&G) blasting standards defined in 11 AAC 95.248 state that “Without prior written approval from ADF&G, no person may discharge an explosive that produces or is likely to produce an instantaneous pressure change greater than 2.7 pounds per square inch (psi) in the swim bladder of a fish or produces or is likely to produce a peak particle velocity greater than 0.5 inches per second (ips) in a spawning bed during the early stage of egg incubation.” ADF&G draft publication Blasting Standards for the Protection of Fish dated February 15, 1991 figures 5 through 7 show that setback requirements for the Office of Surface

Mining Standards (OSM) are more stringent in all cases than ADF&G setback requirements. UCM is required to meet OSM standards and therefore will exceed setback requirements of ADF&G and will therefore be protective of fish. See Exhibit D4-3 showing correspondence from ADF&G regarding this matter.

Flyrock will be minimized by proper blasting design and will not be cast beyond the permit boundary. All practical precautions will be taken to prevent injury to persons and adverse effects to the surrounding public and environment.

4.4 BLASTING SCHEDULE AND PUBLIC NOTICE

A blasting schedule will be developed that describes the dates, locations, access control features, and audible warning systems for the blasting areas. At least 30 days prior to the commencement of blasting, this schedule will be published in the Fairbanks Daily News Miner and copies distributed to the Denali Borough, and Golden Valley Electric Association. A prototype blasting schedule for the Jumbo Dome Road Corridor is presented as Exhibit D4-1 (the prototype is from UCM's Two Bull Ridge Mine). The schedule will be redistributed every 12 months. If revisions are required, they will be redistributed within 10 days prior to initiating blasting operations.

Blasting will be conducted only during the hours identified in the public notice except during situations where rain, lightning, other atmospheric conditions, or operator or public safety requirements dictate unscheduled detonations. The time set for blasting will be 6:00 a.m. until 9:00 p.m. or during daylight hours (whichever is greater). The proper officials of local governments and public utilities will be verbally notified of unscheduled blasts prior to executing the blasts.

In the future, a pre-blasting survey of any privately owned structure that may occur within a one-half mile radius of a blasting site may be conducted, if requested by the owner of the property or the Commissioner. A copy of the survey will be provided to the property owner and Commissioner.

4.5 BLASTING SIGNS, WARNING, AND ACCESS

Access to blast areas before, during and after shot firing will be controlled by signs and mine personnel. Access to blasting will be completely regulated ten minutes prior to detonation to prevent unauthorized entry and will remain guarded until the all-clear signal is given. At five minutes before the blast, two short audible signals will be sounded. At one minute before the shot, one long audible signal will be given. After the blast, one all-clear audible signal will be given. No one will be allowed back in the blasting area until the shot is inspected by a pit foreman or a certified blaster. The blasting signals will be audible in excess of a one-half mile range as required by AAC 90.377.

Blasting signs will be conspicuously placed at all mine entrances which state "Warning, Explosives In Use". The signs will clearly explain the pre-blast warnings and all-clear signals before and after the blast. Charged holes within the permit area will also be flagged or posted with signs that give clear warning of the blasting area.

4.6 RECORDS OF BLASTING

Records of all blasts will be kept for a minimum of three years following the date of any given blast. A sample blasting report is included as Exhibit D4-2. This report identifies all information required by 11 AAC 90.383. All blasting reports will be signed by the certified blaster who was in charge of the blast. These reports will be made available for inspection by the appropriate regulatory agencies and the public upon request.

FIGURE D4-1
OVERBURDEN BLAST PATTERN

FIGURE D4-1

OVERBURDEN BLAST PATTERN

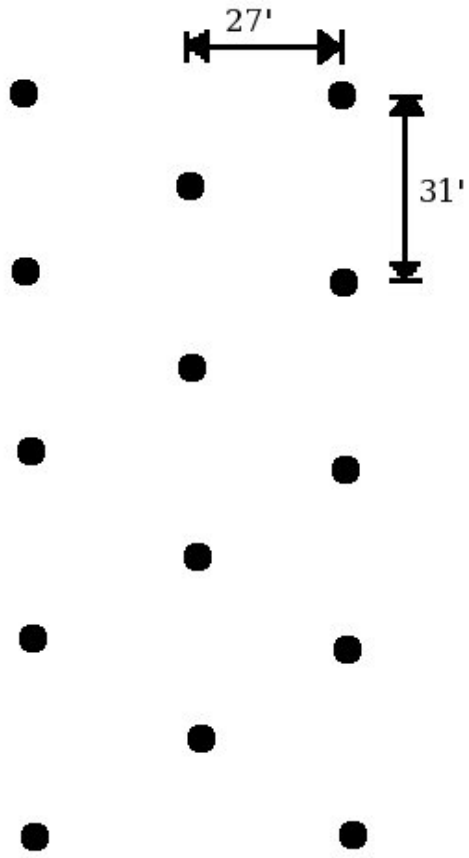


FIGURE D4-2
COAL BLAST PATTERN

FIGURE D4-2

COAL BLAST PATTERN

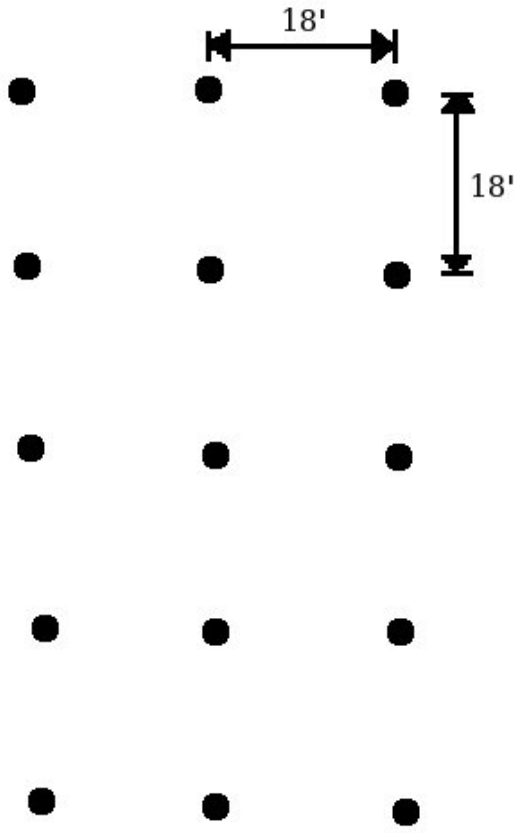


EXHIBIT D4-1
PUBLIC NOTICE OF BLASTING SCHEDULE

EXHIBIT D4-1

PUBLIC NOTICE OF BLASTING SCHEDULE (SAMPLE)

USIBELLI COAL MINE, INC
PO BOX 1000
HEALY, ALASKA 99743
(907) 683-2226
Updated Feb 2017

BLASTING SCHEDULE

I. AREAS OF OPERATION:
Gold Run Pass Mine (T11S R6W, Sections 34 &35 FM);
Poker Flats Mine (T12S R7W, Sections 3, 4, and 5 FM);
Two Bull Ridge Mine (T11S R7W, Portions of Sections 26, 27, and 35 and Sections 33 &34 FM);
Jumbo Dome Road Corridor (T11S R6W, Portions of Sections 4, 8, 9, 19, 20, 25, 29, 30 FM); and
Jumbo Dome Mine (T10S R6W, Sections 27,28,33,& 34 and T11S R6W Sections 3,4,5,8,&9 FM).
Rosalie Mine (T12S R7W, Sections 21-28 and T12S R6W Sections 17-20 FM).

II. BLASTING TIMES: The hours of 6:00 a.m. until 9:00 p. m. or during daylight hours, whichever is longer, on a Monday through Sunday basis will be used to detonate explosive blasts within overburden. Explosive blasts in coal may be conducted 24 hours a day year-around on a Monday through Sunday basis.

III. METHODS OF CONTROL: All roads providing access to the blasting are will be clearly marked with "Blasting Area" signs. Only authorized individuals should enter areas marked with these signs.

IV. AUDIBLE WARNING SIGNALS: The following are the signals used to warn individuals in or near a blasting area or the blast status. Signals will be produced by a siren, air horn or other audible warning signal device.
TWO SHORT BLASTS – 5 minutes until blast detonation
ONE LONG BLAST – 1 minute until blast detonation – KEEP OUT
ONE SHORT BLAST – all clear, blasting area safe to enter

V. EFFECTIVE DATES: This notice shall remain in effect from (date of publication for the next twelve (12) calendar months. If major changes are made are made to this schedule, a revised schedule will be published prior to the expiration date of (12 months from date of publication)

EXHIBIT D4-2
SAMPLE BLASTING REPORT

BLASTING REPORT

PO Box 1000, Healy Alaska 99743
Ph (907/683-2226) Fax (907/683-2253)

Date of blast:_____ Time of blast:_____ am/pm

Location of blast (Pit Name & Seam): _____

Number of people on blasting crew: _____

Blaster in charge:_____ License:_____

Direction and distance to nearest designated structure:
_____

Temperature:_____Wind Direction:_____Wind Velocity:_____

Type of Material blasted:_____ Dist to Dragline:_____

Number of holes:_____ Diameter of holes:_____

Burden:_____ Spacing:_____Type of explosive: _____

Weight of explosive/hole:_____

Total BCY/Tons shot:_____ Powder Factor: _____

Total explosive weight:_____ Total Det. Cord Used:_____

Total Boosters Used:_____ Initiator(ms & Length):_____

Total Downlines of each Length Used:_____
_____
_____

Total Surface Delays & Delay Times:_____
_____
_____

Max. weight of explosives detonated within any 8 millisecond period:_____

Section of typical blast hole:

120	
110	
100	
90	
80	
70	
60	
50	
40	
30	
20	
10	
0	

Initiation System (Check One): ☐ Foot Plunger ☐ Hand Starter ☐ Orange Box ☐ iKon II Box

Type of stemming:_____ Length of stemming:_____ Mats or flyrock protection?_____

Unscheduled blast? Y/N

*Note: A **scheduled** overburden blast is between 6 a.m. to 9 p.m., or during daylight hours, whichever is longer. Coal shots may occur at any time.*

Reason for unscheduled blast:
☐ Safety ☐ Road Construction ☐ Scheduling ☐ Maintenance ☐ Weather Delay ☐ Supply Delay ☐ Other:_____

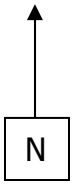
Drilled By:_____

Shot Walked By:_____

Signature of Blaster in Charge:_____

Signature of Chief/Senior Engineer:_____

NOTICE: Engineering can supply the numbers for the powder factor, the distance to the nearest designated structure, and distance to dragline. ALL OTHER INFORMATION MUST BE FILLED OUT BY THE BLASTER. Sections in grey will be filled out by the Blasting Engineer. This report is required by state law and these reports are reviewed by state regulators.



Report must include a sketch of the blast. Draw the blastholes, the tie-in pattern, surface delays used, and any other pertinent information. Sketch must be neat and Legible.

EXHIBIT D4-3
ADF&G Blasting Standards

Sean Wilson

From: Keith Clark
Sent: Monday, June 22, 2015 12:00 PM
To: Richard Sivils; Sean Wilson
Subject: FW: Applicability of Blasting Standards to UCM activity at Jumbo Dome

From: Durst, James D (DFG) [mailto:james.durst@alaska.gov]
Sent: Friday, February 21, 2014 4:35 PM
To: Tammy Scholten
Cc: Kirkham, Russell A (DNR); Fred Wallis; Keith Clark; Colin Webb; Morris, William A (DFG)
Subject: RE: Applicability of Blasting Standards to UCM activity at Jumbo Dome

Tammy:

Thank you for bringing your concerns to my attention. As shown in the updated publication, ADF&G recently changed the standards for protecting fish during blasting. This revision was based on modern monitoring methods and equipment, and on work done the past few years documenting various physical effects on fish of various blasting energies. Similar reviews and standards revisions have recently occurred in other states.

I sent the new standards to UCM in response to a request by Keith Clark, appended below your message. In the message string, I note that ADF&G has not identified any spawning areas in Marguerite Creek, so UCM would not need to meet the peak particle velocity standard in that water body. I did not propose issuing a Fish Habitat (Title 16) Permit for blasting near Marguerite Creek, and ADF&G has no plans at this time to do so. Although no Fish Habitat Permit is anticipated for blasting at the Jumbo Dome Mine, the ADF&G considers the new standards the best currently available guidance to minimize disturbances and effects on fish in water bodies.

ADF&G Division of Habitat's Douglas office has monitoring equipment and staff trained in its use. We would be interested in a cooperative monitoring arrangement with UCM that could provide UCM with verification that the blasting plan is performing as designed and could provide ADF&G with additional field confirmation of safe blasting methods. The monitoring work would be oriented towards data gathering and comparing predicted values versus actual values to help guide future blasting programs for Jumbo Dome and other operations.

I hope this addresses your concerns. Feel free to give me a call if you need additional information.

Jim Durst
ADF&G Habitat
907-459-7254

From: Tammy Scholten [mailto:tammy@usibelli.com]
Sent: Friday, February 07, 2014 9:48 AM
To: Durst, James D (DFG); Kirkham, Russell A (DNR)
Cc: Fred Wallis; Keith Clark; Colin Webb; Kirkham, Russell A (DNR)
Subject: Applicability of Blasting Standards to UCM activity at Jumbo Dome

Hello Jim and Russ,

UCM would like to thank Jim for sharing the November 2013 ADF&G Blasting Standard; *Habitat Publication No. 13-03 Alaska Blasting Standard for the Proper Protection of Fish* (blasting standard), with Keith Clark. We would like a clarification from ADF&G on how this standard is applicable to UCM's blasting efforts at Jumbo Dome Mine.

In the Background section of the blasting standard it references two Alaska statues as the regulatory framework authorizing the review and permit process. *"The State of Alaska Department of Fish and Game (ADF&G) Division of Habitat reviews and permits, when appropriate, blasting activities in or near anadromous water bodies per AS 16.05.817(b), and in or near resident fish water bodies per AS 16.05.841."*

Sec. 16.05.871. Protection of fish and game. *(a) The commissioner shall, in accordance with AS 44.62 (Administrative Procedure Act), specify the various rivers, lakes, and streams or parts of them that are important for the spawning, rearing, or migration of anadromous fish.*

(b) If a person or governmental agency desires to construct a hydraulic project, or use, divert, obstruct, pollute, or change the natural flow or bed of a specified river, lake, or stream, or to use wheeled, tracked, or excavating equipment or log-dragging equipment in the bed of a specified river, lake, or stream, the person or governmental agency shall notify the commissioner of this intention before the beginning of the construction or use.

(c) The commissioner shall acknowledge receiving the notice by return first class mail. If the commissioner determines that the following information is required, the letter of acknowledgement shall require the person or governmental agency to submit to the commissioner:

(1) full plans and specifications of the proposed construction or work;

(2) complete plans and specifications for the proper protection of fish and game in connection with the construction or work, or in connection with the use; and

(3) the approximate date the construction, work, or use will begin.

(d) The commissioner shall approve the proposed construction, work, or use in writing unless the commissioner finds the plans and specifications insufficient for the proper protection of fish and game. Upon a finding that the plans and specifications are insufficient for the proper protection of fish and game, the commissioner shall notify the person or governmental agency that submitted the plans and specifications of that finding by first class mail. The person or governmental agency may, within 90 days of receiving the notice, initiate a hearing under AS 44.62.370. The hearing is subject to AS 44.62.330 - 44.62.630.

ADF&G has specified rivers, lakes and streams in Alaska that are important for the spawning, rearing, and migration of anadromous fish and according to ADF&G's Regulatory Maps HEA250 and FAI250 there is no reach of Marguerite Creek which is considered a "specified" river or stream. Therefore, AS 16.05.817 should not be considered applicable to the Jumbo Dome Mine project.

Sec. 16.05.841. Fishway required. *If the commissioner considers it necessary, every dam or other obstruction built by any person across a stream frequented by salmon or other fish shall be provided by that person with a durable and efficient fishway and a device for efficient passage for downstream migrants. The fishway or device or both shall be maintained in a practical and effective manner in the place, form, and capacity the commissioner approves for which plans and specifications shall be approved by the department upon application. The fishway or device shall be kept open, unobstructed, and supplied with a sufficient quantity of water to admit freely the passage of fish through it.*

AS 16.05.841 addresses obstructions across a stream for salmon and or other fish. UCM applied for the requisite permits for the culvert installation and stream crossings for Marguerite Creek. UCM does not understand how this regulation encompasses blasting activities adjacent to the creek related to the mine activity.

Based on UCM's understanding of the referenced Alaska Statues, the ADF&G blasting standard does not apply to blasting activity for the Jumbo Dome Mine project. We would like ADF&G's clarification of how this project would fall under those standards.

If ADF&G cannot determine that the blasting activity for Jumbo Dome Mine is regulated under the referenced Statues, than UCM will submit a minor revision request to DNR that removes any reference to meeting the States blasting standards. UCM will continue operate in accordance with the SMCRA blasting standards.

Please get back to us at your earliest convenience.

Tammy

Tamara A. Scholten P.E., P.M.P.
Senior Environmental Engineer
phone: 907-683-9734
cell: 907-750-9580
Usibelli Coal Mine, Inc.
PO Box 1000
Healy, AK 99743

From: Durst, James D (DFG)
Sent: Wednesday, January 22, 2014 4:28 PM
To: 'Keith Clark'
Cc: Colin Webb; Morris, William A (DFG); Kirkham, Russell A (DNR)
Subject: RE: Questions regarding blasting standards for fish

Keith:

Thanks for the follow up. The Alaska Blasting Standard for the Proper Protection of Fish was released in November. I've attached a PDF copy. For general information on use of explosive in or near streams, see http://www.adfg.alaska.gov/index.cfm?adfg=uselicense.explosives.

Jim Durst, Habitat Biologist
Alaska Department of Fish & Game
Division of Habitat
1300 College Road
Fairbanks, AK 99701
Phone: (907) 459-7254
FAX: (907) 459-7303

From: Keith Clark [mailto:keithc@usibelli.com]
Sent: Wednesday, January 22, 2014 2:09 PM
To: Durst, James D (DFG)
Cc: Colin Webb
Subject: RE: Questions regarding blasting standards for fish

Hello Jim,
My name is Keith Clark and I had corresponded with you briefly last spring on blasting standards for the protection of fish. You had mentioned a review of the standards was underway at the time. I am writing to ask if those standards are finalized and if so, where could I find a copy? Our current mine plan will have us in an area where those standards would apply this spring.

I have CC'd Colin Webb, a mining engineer here who will be taking over the blasting program here at Usibelli. Thanks so much,

Keith Clark, PE
Mining Engineer
Usibelli Coal Mine
907-687-6629

From: Keith Clark
Sent: Tuesday, May 21, 2013 4:26 PM
To: Durst, James D (DFG)
Subject: RE: Questions regarding blasting standards for fish

Thanks much. The standard revision sounds like an interesting project!
Cheers
Keith

From: Durst, James D (DFG) [mailto:james.durst@alaska.gov]
Sent: Tuesday, May 21, 2013 2:15 PM
To: Keith Clark
Cc: Morris, William A (DFG); Kirkham, Russell A (DNR); Tammy Scholten
Subject: RE: Questions regarding blasting standards for fish

Keith:

Thanks for the contact and good questions. At this time, we have not identified any spawning areas in Marguerite Creek, so you would not be required to meet the peak particle velocity standard in that water body. If one or more spawning areas are identified in the future in Marguerite Creek, the highest egg sensitivity is between spawning and the "eyed up" stage. For Arctic grayling, spawning generally occurs at or just after breakup, and the sensitive period lasts about three weeks. Grayling spawning areas are typically found in the upper reaches of streams. As you note, frequency does play a role in effects and total energy transmitted. At present, the variability in our tables is dependent on substrate rather than frequency for explosives. For pile driving, we work with both peak pressures and total impulse.

FYI, ADF&G is currently doing an internal review on a revision to our blasting standards. The new values for blasting will be somewhat relaxed from the current ones, and rely heavily on the past 20 years' monitoring work with fish, blasting, and pile driving using more modern sensors. We hope to have the new standards out by the end of the summer.

-Jim

Jim Durst, Habitat Biologist
Alaska Department of Fish & Game
Division of Habitat
1300 College Road
Fairbanks, AK 99701
Phone: (907) 459-7254
FAX: (907) 459-7303
james.durst@alaska.gov
http://www.adfg.alaska.gov

From: Keith Clark [mailto:keithc@usibelli.com]
Sent: Tuesday, May 21, 2013 12:20 PM
To: Durst, James D (DFG)
Subject: Questions regarding blasting standards for fish

Hello Mr. Durst,

My name is Keith and I am a mining engineer at Usibelli Coal Mine. I direct our drilling and blasting program and am formulating a plan for blasting at our new mining area near Jumbo Dome. I have been reading the ADF&G publication "Blasting Standards for the Protection of Fish" and I have some questions.

My question is regarding the requirement on page 1, "...no person may discharge an explosive that produces or is likely to produce an instantaneous pressure change greater than 2.7 pounds per square inch (psi) in the swim bladder of a fish or produces or is likely to produce a peak particle velocity greater than 0.5 inches per second (ips) in a spawning bed during the early stage of incubation."

I understand the first requirement, 2.7 psi pressure change in the swim bladder, but have questions regarding the second requirement. Specifically in regard to Marguerite Creek adjacent to our permitted mining areas, which areas of that drainage could be considered spawning beds? Also, can you please provide a timeframe during which I could expect fish eggs in the early stage of incubation to be present?

Lastly, the USBM developed a chart used by OSM where the maximum peak particle velocity varied according the frequency of those waves. They proved that structures were more resilient to higher frequency vibrations. Are there any similar provisions for vibrations affecting fish?

Thanks much,

Keith Clark
Mining Engineer
Usibelli Coal Mine
907-687-6629
keithc@usibelli.com

SECTION 6.0

COAL REMOVAL AND STORAGE

TABLE OF CONTENTS

6.0 COAL REMOVAL AND STORAGE

6.1 REMOVAL PROCESS

During construction of the road incidental coal may be encountered. If coal is encountered the resource will be recovered to the extent possible. Dozers will be used to clean the top of the coal seam. Once the coal seam has been cleaned, it will be drilled and blasted to fragment the coal for loading. Dependent upon operating conditions and equipment availability, a front end loader, shovel, or backhoe may be used to load the coal into haulage trucks.

6.2 COAL HANDLING AND STORAGE

Coal from the Jumbo Dome Road Corridor will be hauled by truck to either UCM's existing coal handling facilities or the Golden Valley Electric Association power plant. The existing coal handling facilities are addressed under UCM's Poker Flats mine permit (No. 01_83_796) and are not considered a component of this permit application. No coal stockpiling, crushing, or screening will be conducted on the Jumbo Dome Road Corridor permit area.

SECTION 7.0

ROADS AND COAL TRANSPORT SYSTEMS

TABLE OF CONTENTS

LIST OF PLATES

APPENDICES

7.0 ROADS AND COAL TRANSPORT SYSTEMS

7.1 ROADS

The road for the proposed Jumbo Dome Road Corridor (JDRC) mine is shown on Plates A-1 and D1-1. The road is intended to be a long-term haul road for future mining while providing reliable access to the permitted riprap material site as well as for exploration and data gathering for permit preparation in the near term.

Long-Term Haul Roads

Long-term haul roads are roads which will undergo heavy duty usage throughout the life of the permit or longer. They are designed for 80 feet of driving surface and grades are limited to ten percent maximum. Long-term haul roads are designed to meet all required MSHA regulations as they pertain to UCM operations. Cut slopes are determined by the type of material in the cut. Competent materials such as undisturbed sandstone, may be cut at grades as steep as 0.5H to 1V. The fill section of roads are designed to have shoulder slopes ranging from 1.3H to 1V or flatter depending on fill depth. Roads are surfaced with a veneer of fine gravel to provide a good traveling surface. All fill slopes will be revegetated to reduce erosion and siltation from surface waters. Cut slopes are to steep to be revegetated. Typical long-term haul road cross sections are shown on Plate D7-1.

Small, 18 to 24 inch culverts or burrito drains are installed at obvious small drainage channels. Burrito Drains are placed at the main drainages. Culverts burrito drain pipes are equipped with thaw pipes in drainages where winter flow causes ice build-up. Drainage and Sediment Control Plan are described in more detail in Section D-9.

The road starts near bridge 5 of the Hoseanna Creek haul road and heads north toward Jumbo Dome. The actual centerline of the road may vary slightly from that shown on Plate D1-1 to accommodate the optimum profile. The road will be constructed in two efforts. The initial effort

is along centerline and may be less than full width in places. The second phase will complete full width and finalize the out slopes. Where applicable, vegetation and the O soil horizon will be windrowed along the toe of the fill area as a brush barrier BMP. The windrows will act as vegetative berms (brush barriers), a best management practice for sediment control. The topsoil will be salvaged into piles or windrows strategically placed along the road corridor and will be replaced on the finished fill slopes and then revegetated.

The road cut material is designed to balance with the quantity needed for the fill section. Where quality is acceptable, coal encountered during road construction will be salvaged. An as built in the form of a topographic map will be submitted when the main haul road is finished.

During the construction of the main haul road, the drainage and sediment control plan will consist of best management practices in the Hoseanna Creek drainage. Best management practices will consist of seeding, down drains, and waddles for erosion control and vegetative berms, brush barriers, waddles, haybales, and silt fences for sediment control. Drainage and sediment control in the Marguerite Creek drainage will be governed by Alaska Department of Environmental Conservations Construction General Permit and UCM's site specific Stormwater Pollution Prevention Plan.

7.2 ROAD MAINTENANCE

Several activities will occur to maintain and groom roads for both safety and equipment longevity reasons. During summer months water will be spread on roads with a 14,000 – to 30,000 gallon watering trucks to minimize dust potentially generated by mine traffic. The water for the watering truck will come from Popovitch Creek which has an existing water use permit issued by DNR or from the future sediment control ponds at the Jumbo Dome Mine. Graders will be used year round to smooth and maintain road surfaces. On the main roads, a crown will be graded into the center to promote drainage during rain events. During the winter months, snow will be cleared with graders and occasional help from a front end loader. Gravel may also be spread on roads after snow clearing to promote safety.

On an as needed basis, brushing will be done to clear road edges of vegetation that impairs visibility. The typical clearing width will be 30 feet from road edges and will involve cutting and shearing trees and brush with only incidental disturbance to the ground surface. Greater clearing widths may sometimes be needed on the inside of corners and at intersections.

7.3 EXISTING MINE AREA HAUL ROAD SYSTEM

The following existing transportation facilities will be used for access and transportation of coal from the Jumbo Road Corridor.

Hoseanna Creek Haul Road (HCHR)

The eastern portion of HCHR was permitted as part of the approved Gold Run Pass (GRP) permit (#02-83-796). The HCHR connects the TBR mine with the GRP and the Poker Flats mines. The HCHR runs from the eastern part of Poker Flats (where the ADL widens) to GRP. The western part of HCHR is part of the Poker Flats permit (#01-83-796).

UCM Tipple

Incidental coal from Jumbo Dome Road Corridor construction will be delivered to the UCM crusher near the mouth of Hoseanna Creek or the Golden Valley Electric Association power plant. When coal is delivered to UCM's Tipple it is crushed, and then transported across the Nenana River by an elevated conveyer belt to the load-out stockpile. The UCM tipple facility and the connecting road is permitted as part of the Poker Flats Mine permit (#01-83-796).

APPENDICES

D7-1 Geotechnical Evaluation for the Jumbo Dome Road Corridor Final Design

AJAX Mountain Enterprises, LLC
Engineering, Geology, Surveying
Project and Construction Management

October 28, 2013

Usibelli Coal Mine, Inc. (via e-mail)
P.O. Box 1000
Healy, Alaska 99743
Tel: (907) 683-2226

ATTN: Mr. Fred Wallis, PE

SUBJECT: Geotechnical Evaluation for the Jumbo Dome Road Corridor Final Design

This letter presents the results of a geotechnical slope stability evaluation of the final design configurations at select locations along the alignment of the partially constructed Jumbo Dome Road. The work has involved slope stability analyses using design cross-sections and historic values for materials properties obtained from similar UCM construction projects over the past 20 years. Stability results were obtained using the geotechnical design software, *Slide 6.0* (Rocscience 2010), a two-dimensional limit equilibrium slope stability computer code.

The sections analyzed included worst-case scenarios (having the most fill and the steepest underlying natural slopes) from Cuts 4 through 12, as well as in the "Flats" and "Descent into Marguerite Creek" areas. A total of 11 sections were evaluated.

MATERIAL TYPES AND STRENGTHS

Based on information gathered from previous geotechnical investigations on other UCM projects (including Golder 1992), the following material types were used in the analyses:

- Sandstone: This material was assumed to underly the road sections and represents *in-situ* native material. $\phi = 37^{o}$, c = 0 psf, $\gamma = 125$ pcf.
- Compacted Road Fill: Moist silty sands with little to no coal and gravel present, placed in controlled lift thicknesses under various degrees of haul truck compaction. $\phi = 35^{o}$, c = 0 psf, $\gamma = 125$ pcf.

Additionally, it has been our understanding that all organic material (vegetation and peaty soils) is being pre-stripped prior to each excavation and placement operation.

ϕ is the internal friction angle in degrees; c is the cohesion in pounds per square foot; and, γ is the moist unit weight in pounds per cubic foot.

SLOPE STABILITY ANALYSES (static only)

Shallow failure surfaces of less than about 20 feet thick and of varying lengths were not considered as 'critical' in these analyses. Therefore, a critical failure was defined to be one where the failure surface was both deep-seated (minimum 15-20 feet) and where it covered a large portion of the fill slope. The underlying material was defined as undisturbed sandstone, and the road fill was defined as compacted silty sand, end-dumped from the mine haul trucks, and further leveled by a dozer.

Analyses were conducted for the 11 sections mentioned above, the results of which are presented in the table below.

Table 1: Final Road Fill Configuration

Cut	Station	Slope (H:V)	Static FS
4	73+00	2:1	1.4
5	83+00	2:1	1.5
6	91+00	2:1	1.5
7	97+00	1.75:1	1.3
8	108+00	1.75:1	1.4
9	117+00	1.75:1	1.3
10	137+00	2:1	1.5
11	143+00	1.5:1	1.4
12	160+00	1.5:1	1.3
Flats	187+00	1.5:1	1.4
Marg. Crk.	249+00	1.5:1	1.5

SUMMARY AND RECOMMENDATIONS

Assuming that the material properties utilized in this evaluation reflect realistic, final as-built conditions, all slopes analyzed will meet the required FS for static stability. In addition, the following one or a combination of the following recommendations should therefore ensure the long-term stability requirement.

- Pre-stripping of all vegetation and organic soils.
- Import of fill in a dry or moist state, not wet or saturated; elimination of free standing water, snow, or ice at the point of fill.
- Loaded haul truck compaction of placed fill, several passes, prior to dumping.
- Installation of culverts, burrito rock drains, and ditches, where appropriate.

As always, please call us with any comments or questions.

Sincerely,

AJAX Mountain Enterprises LLC (dba AJAX Ltd)

Andrew J. Hardy, PE

References:

DNR. 2009. Regulations Governing Coal Mining in Alaska. State of Alaska, Department of Natural Resources, Anchorage, Alaska. Article 11, Section 491, Part (f) (2) (A) Embankment Static Factor of Safety Requirement = 1.3. Dated April 24. 224 pp.

DNR. 2013. Letter to UCM re: Revision Order, Jumbo Dome Road Corridor Permit # S-0605. State of Alaska, Department of Natural Resources, Anchorage, Alaska. By Russell Kirkham, CPG. Dated July 17.

Golder Associates, Inc. 1992. *Re-Evaluation of In-Pit Spoil Pile Stability, Poker Flats Mining Area*. A report prepared for Usibelli Coal Mine, Inc., Healy, Alaska. Anchorage, Alaska. Dated February.

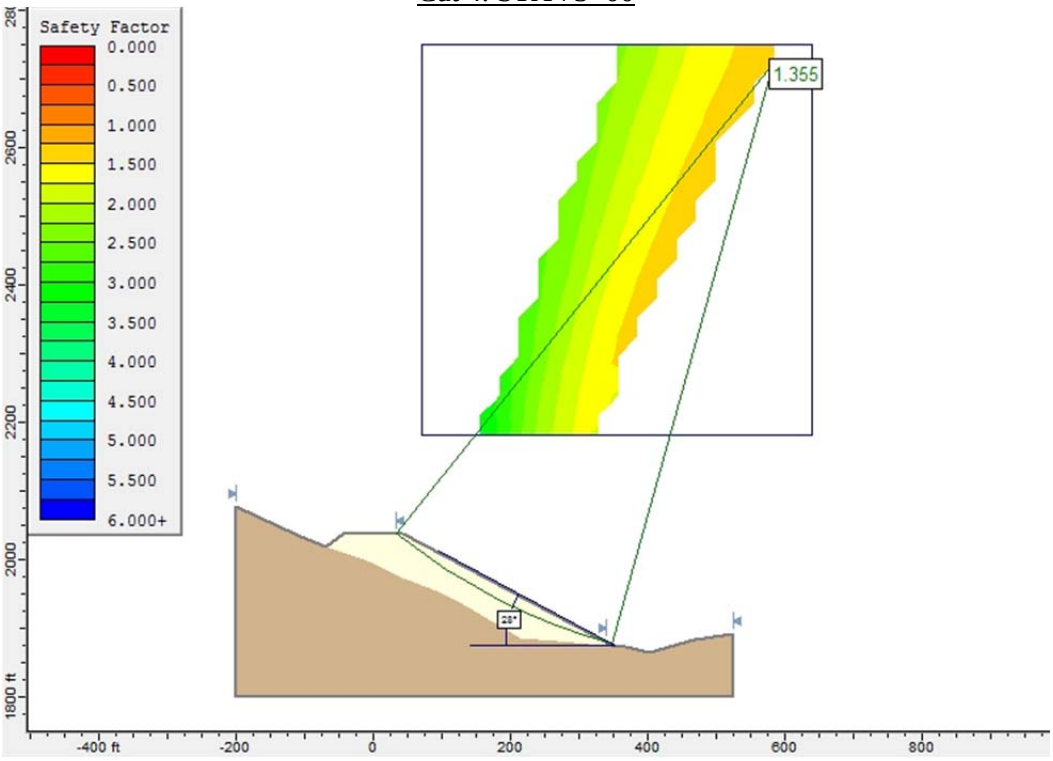
Rocscience. 2010. "Slide" Limit Equilibrium Computer Program, Version 6.0, Alberta, Canada.

Usibelli Coal Mine, Inc., unpublished and proprietary in-house data.

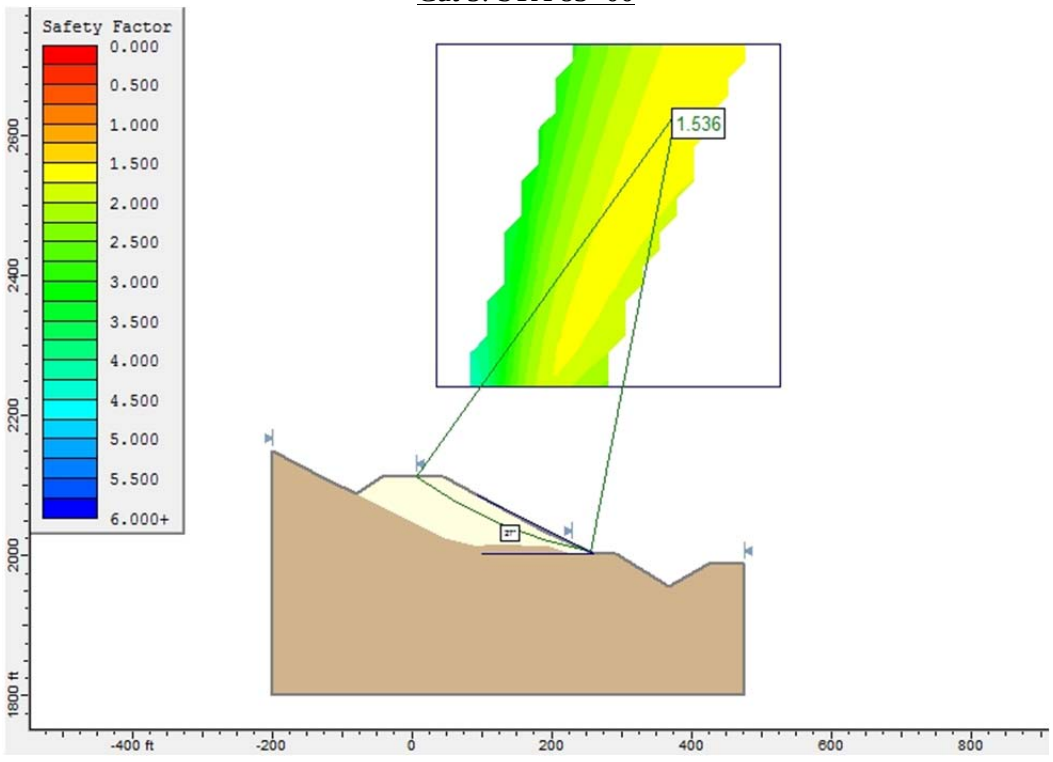
Limitations:

AJAX staff visited the site in 2011 and again on August 1 and 2, 2013. Professional judgments on subsurface conditions and engineering properties of geologic materials are presented in this report. They are based partially on the evaluation of the technical information gathered from this study, partially on our understanding of the characteristics of the site, and partially on our experience with material performance and subsurface conditions in the surrounding area. We do not guarantee the performance of the project in any respect; only that our engineering work and judgments rendered meet the standard of care for our profession. Variations from the conditions portrayed, which are not indicated by the historical data collected at other areas of the site, may occur. Judgments made should consider this potential variability. If different conditions or construction practices have occurred during past or future road construction, it may be necessary that we be contacted so that our recommendations can be reviewed or that site-specific material properties can be investigated. We represent that our services are performed within the limits set forth by UCM, in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation to UCM, expressed or implied, and no warranty or guarantee is included or intended.

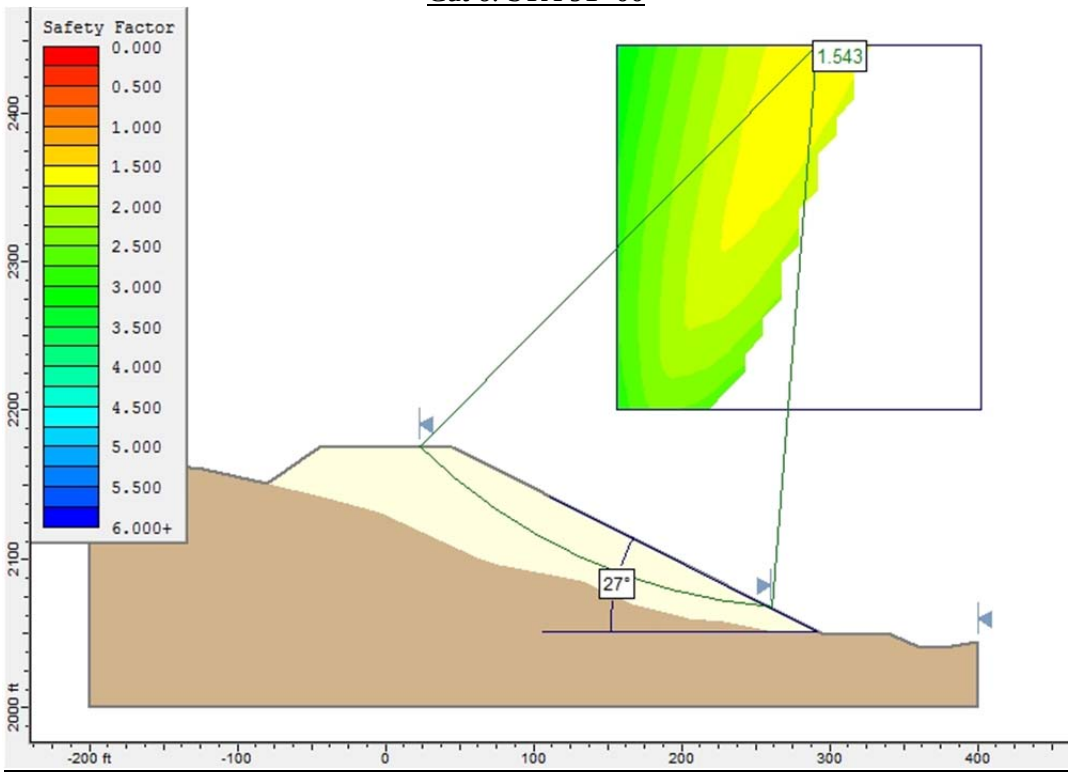
Cut 4: STA 73+00



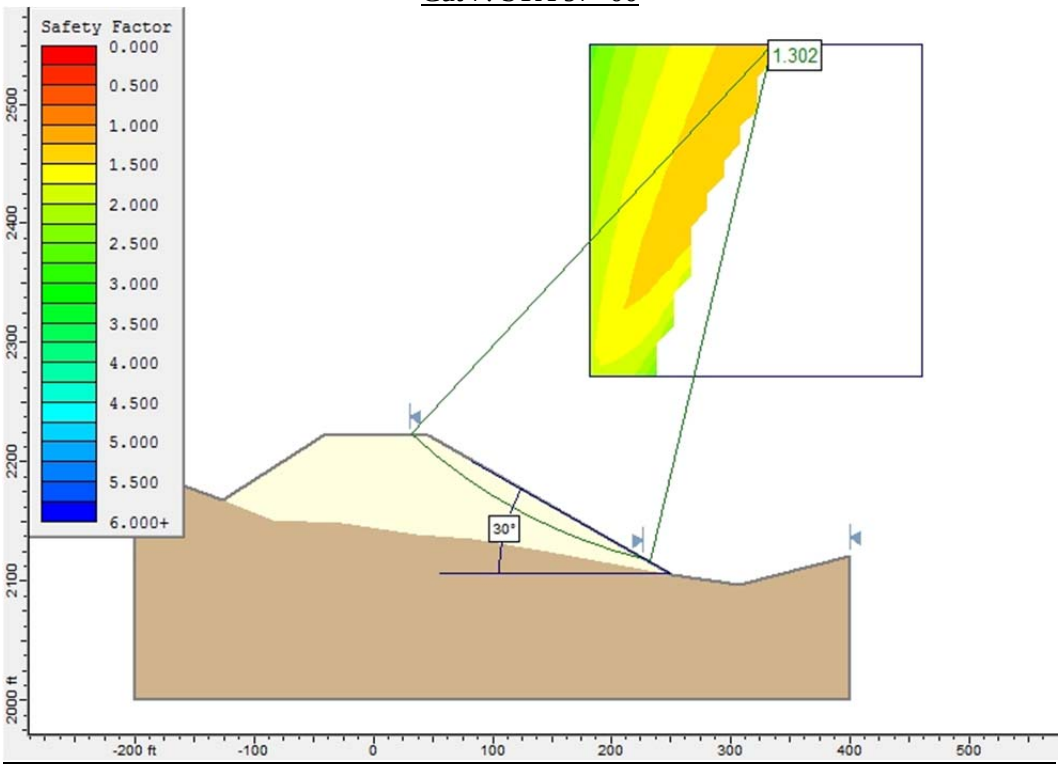
Cut 5: STA 83+00



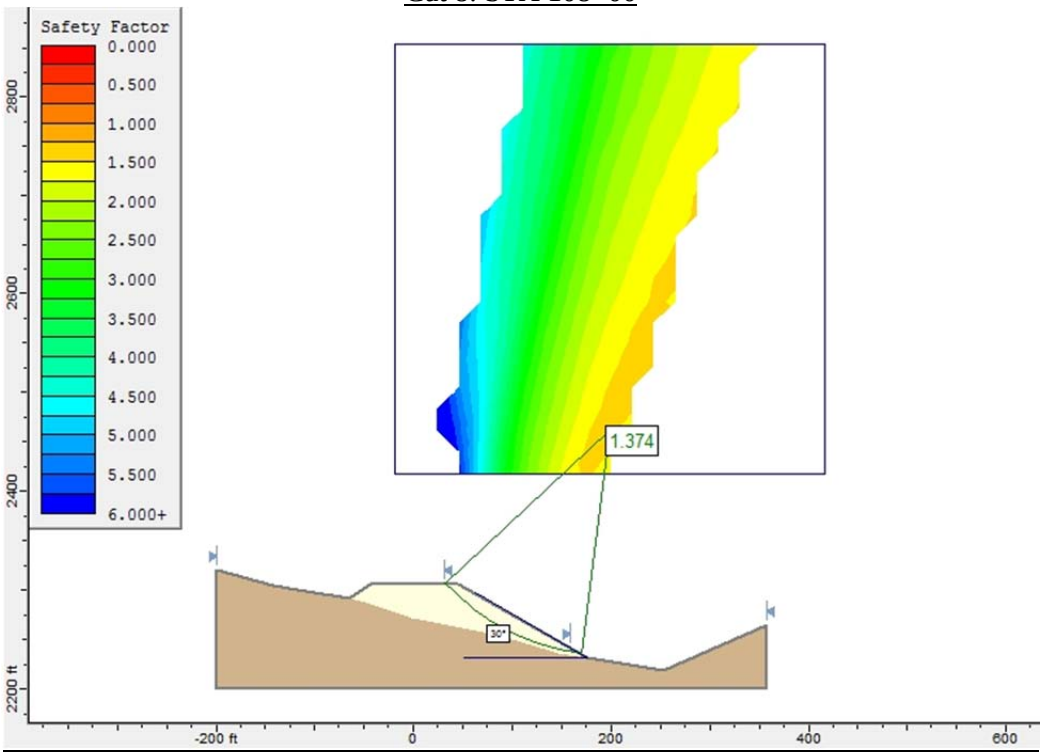
Cut 6: STA 91+00



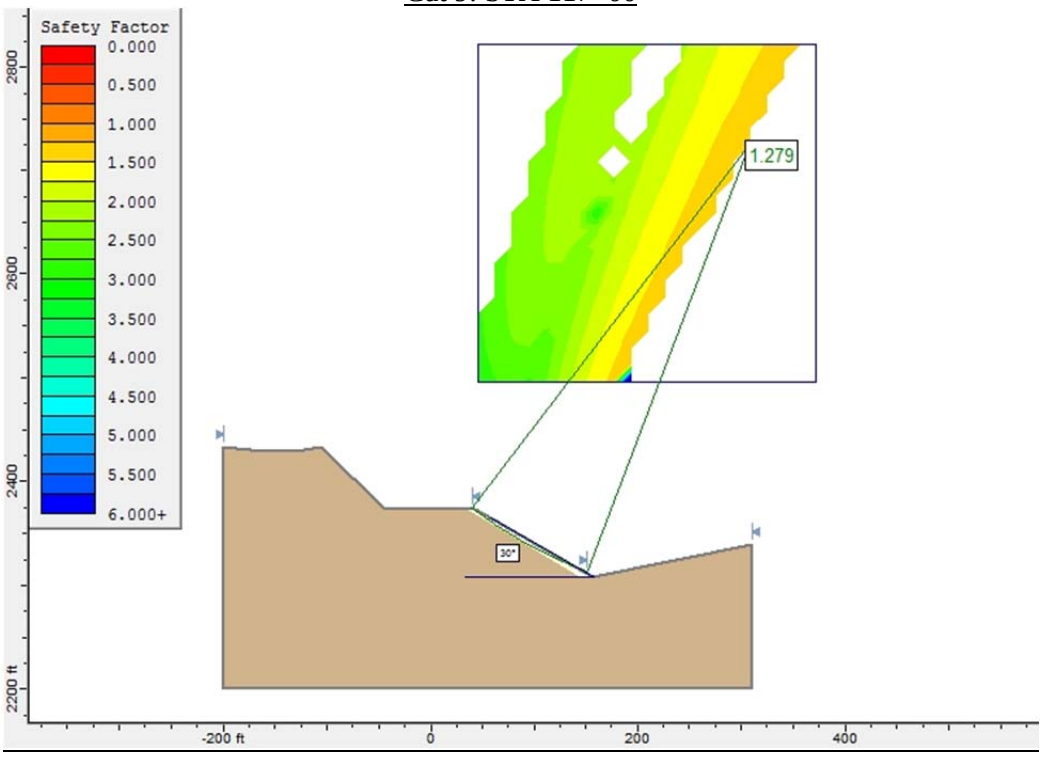
Cut 7: STA 97+00



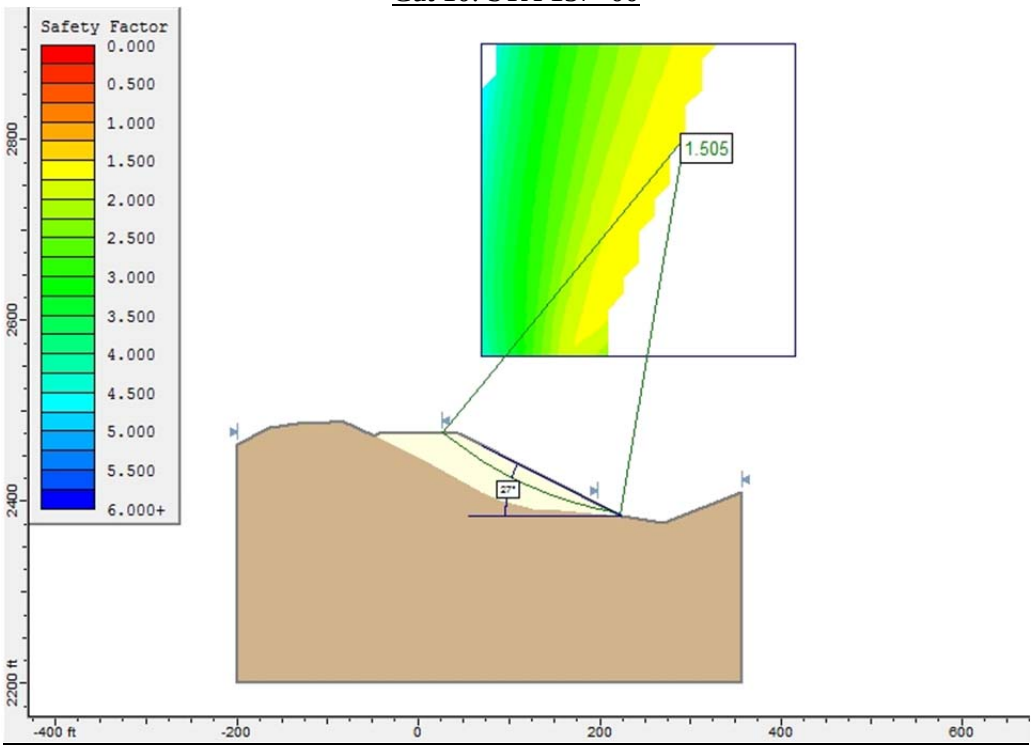
Cut 8: STA 108+00



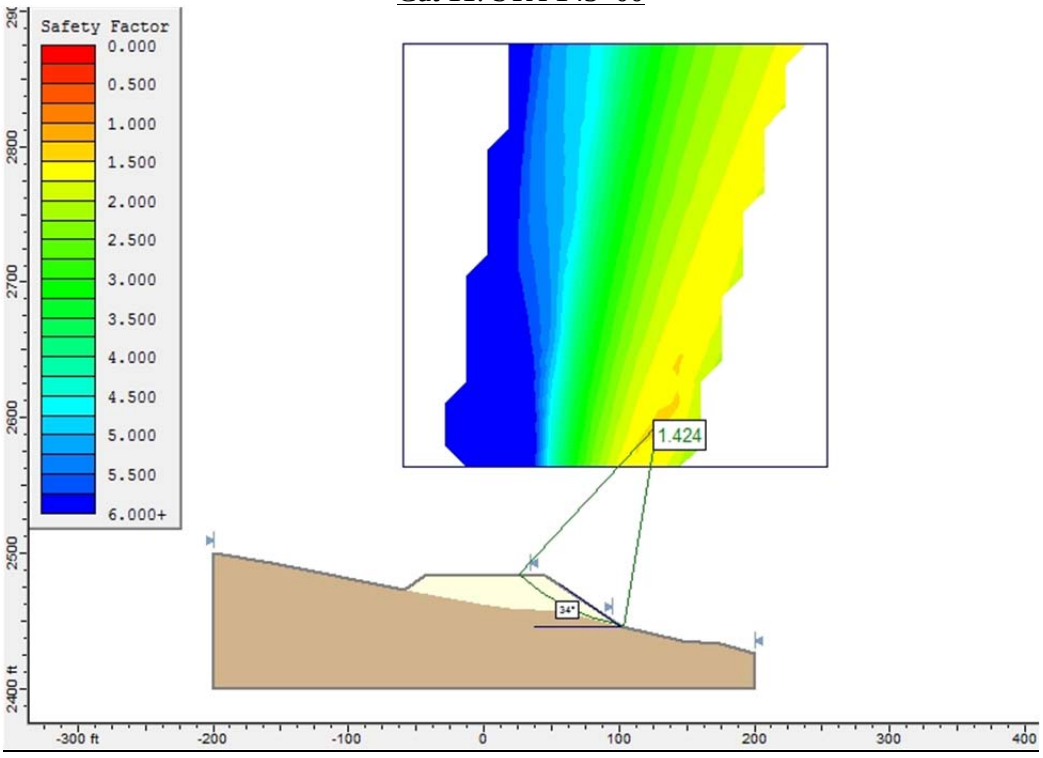
Cut 9: STA 117+00



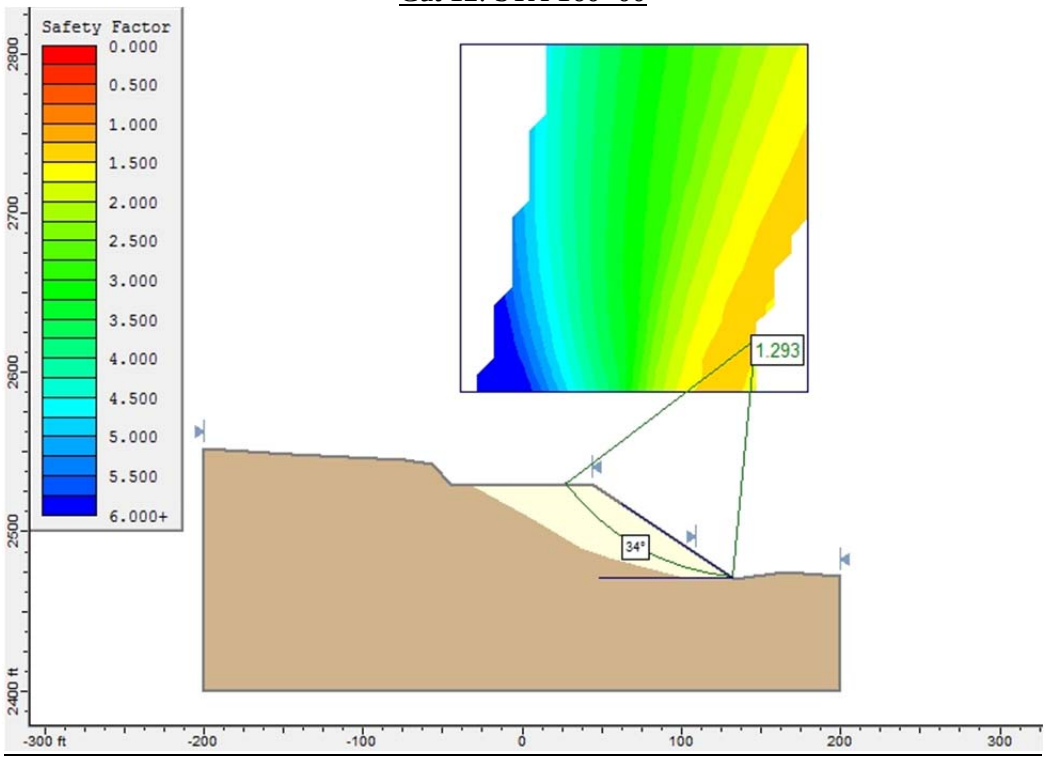
Cut 10: STA 137+00



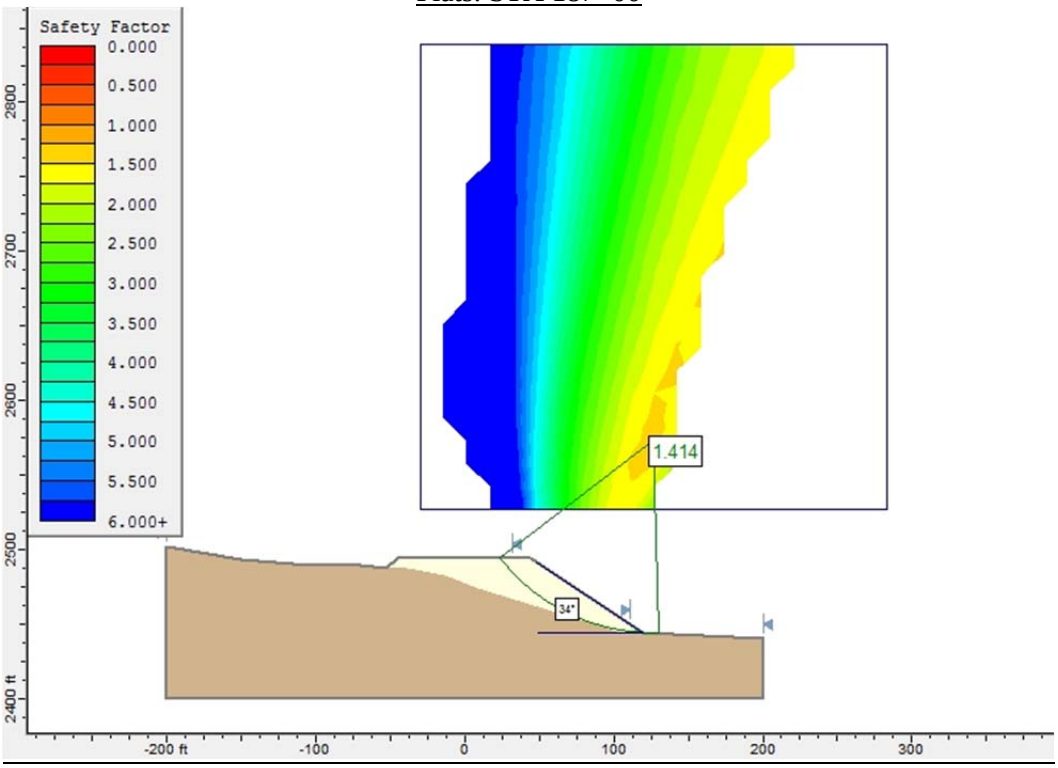
Cut 11: STA 143+00



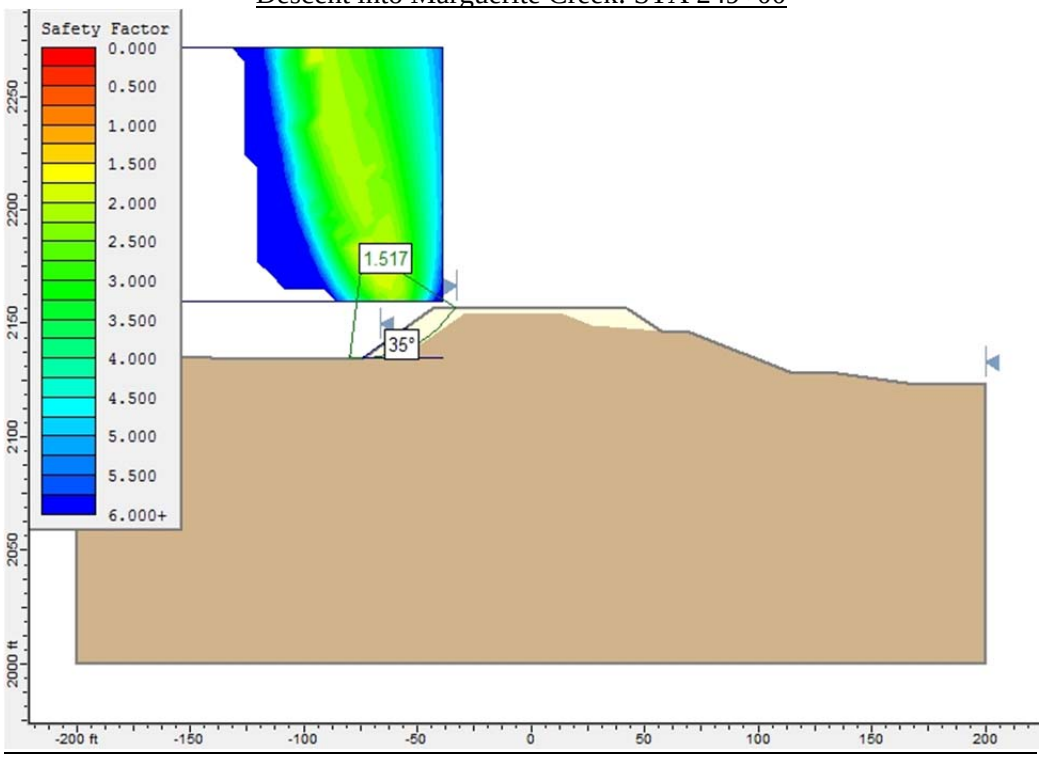
Cut 12: STA 160+00



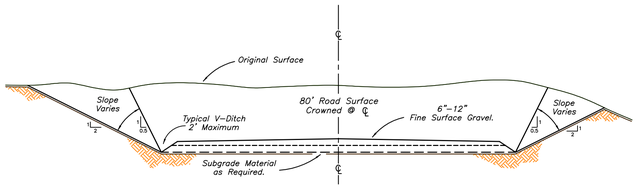
Flats: STA 187+00



Descent into Marguerite Creek: STA 249+00

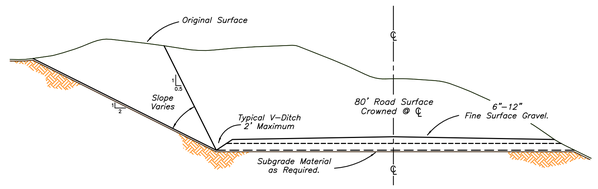


TYPICAL HAUL ROAD CROSS SECTIONS



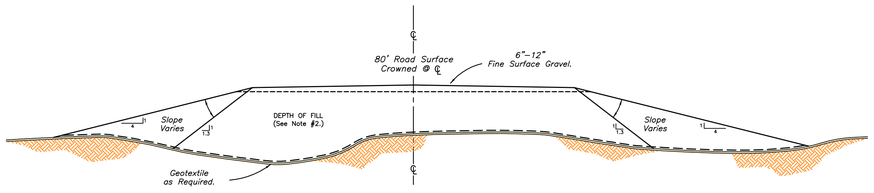
TYPICAL HAUL ROAD CUT

NOT TO SCALE



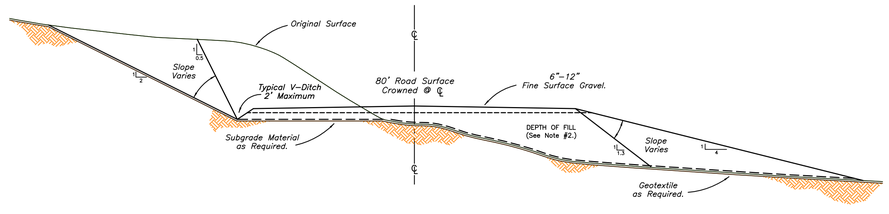
TYPICAL HAUL ROAD, HILLSIDE CUT

NOT TO SCALE
(See Note #1.)



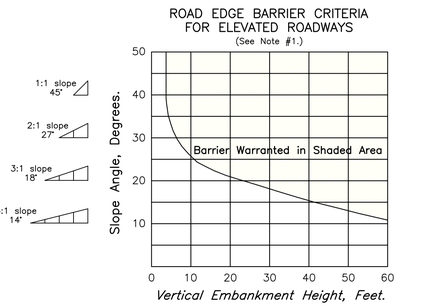
TYPICAL HAUL ROAD FILL

NOT TO SCALE
(See Note #1.)



TYPICAL HAUL ROAD, HILLSIDE CUT & FILL

NOT TO SCALE



Barriers are warranted when Slope Angle and Slope Height exceed those listed on chart.

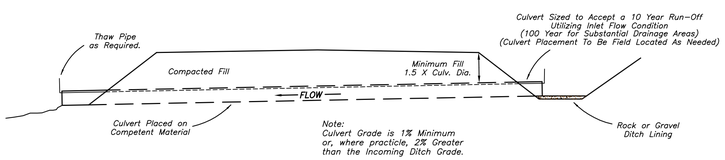
Slope Angle (°)	Gradient	Slope Height	Approx. Slope Length
45.0	1:1	4 ft	6 ft
33.7	1.5:1	4 ft	7 ft
26.6	2:1	10 ft	22 ft
21.8	2.5:1	19 ft	51 ft
18.4	3:1	31 ft	98 ft
16.0	3.5:1	39 ft	142 ft
14.0	4:1	47 ft	194 ft
12.5	4.5:1	55 ft	253 ft
11.3	5:1	66 ft	336 ft
10.2	5.5:1	83 ft	468 ft
9.4	6:1	100 ft	608 ft

(From MSHA Program Information Bulletin No. P93-8, 4/01/93)

NOTES:

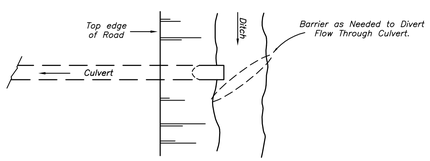
1. *Elevated roadways have at least one embankment not protected by a natural topographic barrier, where a drop in grade or height can endanger an uncontrolled or sliding vehicle. The graph above is intended for use on permanent out of pit haul roads. The term, "barrier", may be a curb, fence, berm, road edge marker and/or a reduced speed limit. Exact road edge configuration is determined by a site specific evaluation.*
2. *The depth of road fill is dependent on soil conditions of the original ground and final haul road grade design.*

CULVERT DESIGN CRITERIA



TYPICAL CROSS SECTION

NOT TO SCALE



TYPICAL PLAN VIEW

NOT TO SCALE

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
0	03/06	AER	ORIGINAL SUBMITTAL

DESIGN BY: A.E Renshaw PE
DRAWN BY: T.S. Venechuk PLS
CHECK BY: R.E. Renshaw PE
DWG FILE: XX-X.DWG
DATE DRAWN: Mar. 02, 2006

JUMBO DOME MINE — PERMIT NUMBER

ROAD DESIGN TYPICAL SECTIONS

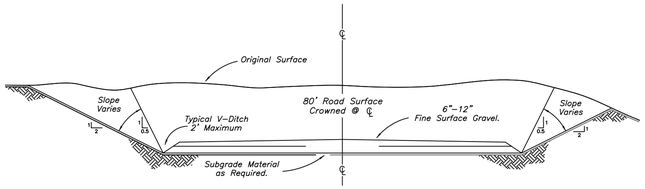
JUMBO DOME MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

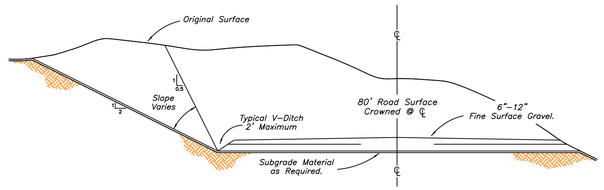
PLATE No. D7-1
SHEET No. 1 OF 1
REV. 0

U:\Ucm-data2\Jumbo Dome Road Corridor\All PERMITS\DRC SMCRA\2011 Renewal\2012 Nov\D7-1 Road Design Typical Sections.dwg

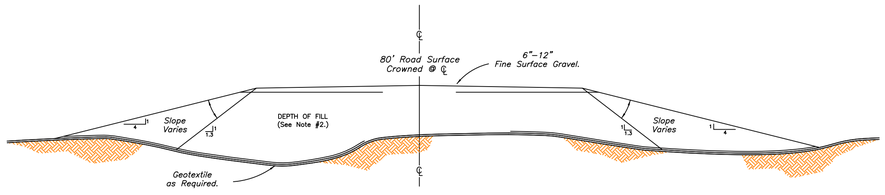
TYPICAL HAUL ROAD CROSS SECTIONS



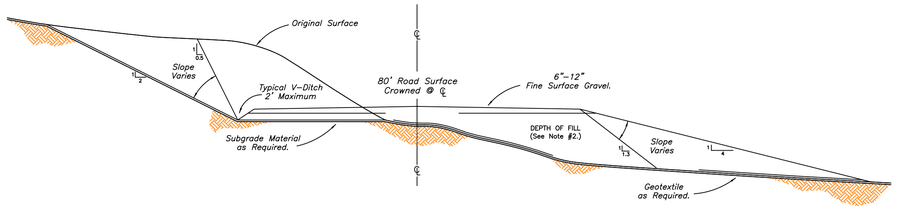
TYPICAL HAUL ROAD CUT
NOT TO SCALE



TYPICAL HAUL ROAD, HILLSIDE CUT
NOT TO SCALE
(See Note #1.)

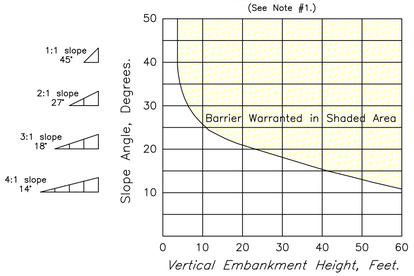


TYPICAL HAUL ROAD FILL
NOT TO SCALE
(See Note #1.)



TYPICAL HAUL ROAD, HILLSIDE CUT & FILL
NOT TO SCALE

ROAD EDGE BARRIER CRITERIA FOR ELEVATED ROADWAYS
(See Note #1.)



Barriers are warranted when Slope Angle and Slope Height exceed those listed on chart.

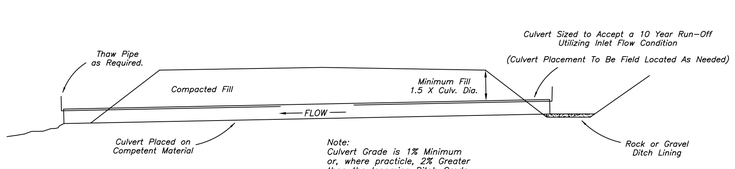
Slope Angle (°)	Gradient	Slope Height	Approx. Slope Length
45.0	1:1	4 ft	6 ft
33.7	1.5:1	4 ft	7 ft
26.6	2:1	10 ft	22 ft
21.8	2.5:1	19 ft	51 ft
18.4	3:1	31 ft	98 ft
16.0	3.5:1	39 ft	142 ft
14.0	4:1	47 ft	194 ft
12.5	4.5:1	55 ft	253 ft
11.3	5:1	66 ft	336 ft
10.2	5.5:1	83 ft	468 ft
9.4	6:1	100 ft	608 ft

(From MSHA Program Information Bulletin No. P93-8, 4/01/93)

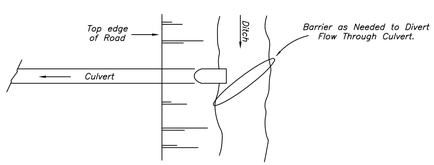
NOTES:

1. *Elevated roadways have at least one embankment not protected by a natural topographic barrier, where a drop in grade or height can endanger an uncontrolled or sliding vehicle. The graph above is intended for use on permanent out of pit haul roads. The term, "barrier", may be a curb, fence, berm, road edge marker and/or a reduced speed limit. Exact road edge configuration is determined by a site specific evaluation.*
2. *The depth of road fill is dependent on soil conditions of the original ground and final haul road grade design.*

CULVERT DESIGN CRITERIA



TYPICAL CROSS SECTION
NOT TO SCALE



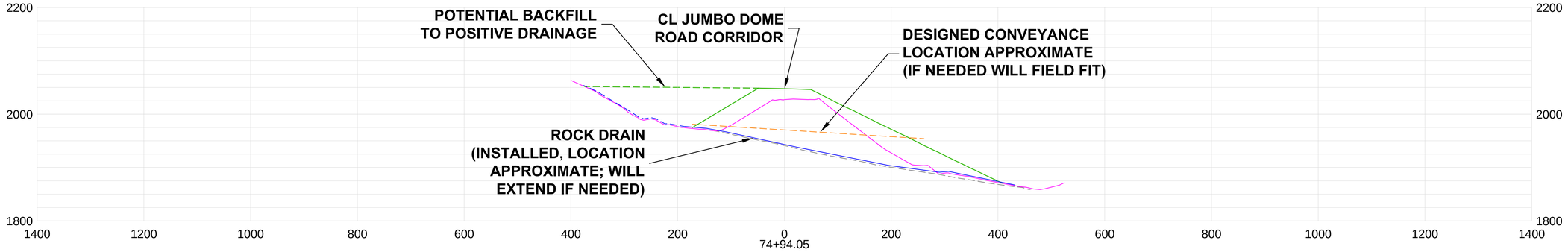
TYPICAL PLAN VIEW
NOT TO SCALE

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
0	03/06	AER	ORIGINAL SUBMITTAL
1	11/16	RCS	REMOVED SUBSTANTIAL DRAINAGE STATEMENT, CORRECTED PERMIT INFO

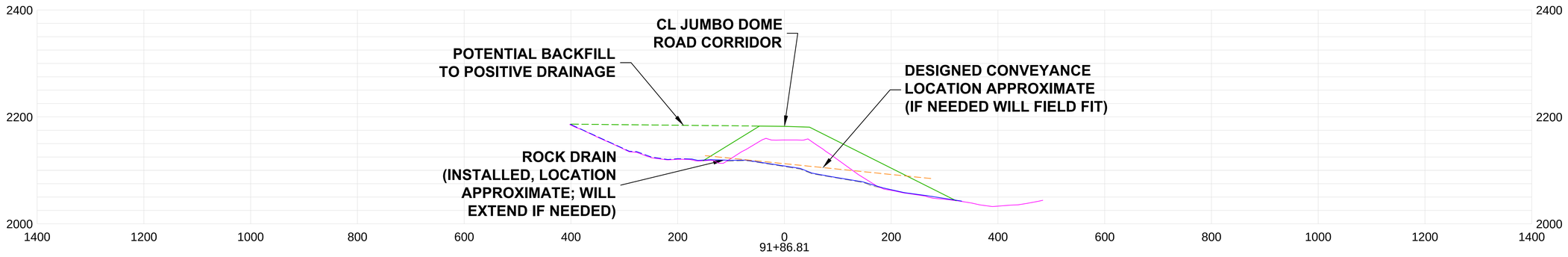
DESIGN BY: A.E Renshaw PE	JUMBO DOME ROAD CORRIDOR — USIBELLI COAL MINE, INC. — PERMIT NUMBER S-0605
DRAWN BY: T.S. Venechuk PLS	ROAD DESIGN
CHECK BY: R.E. Renshaw PE	TYPICAL SECTIONS
DWG FILE: XX-X.DWG	JUMBO DOME ROAD CORRIDOR
DATE DRAWN: Mar. 02, 2006	

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. D7-1 | SHEET No. 1 OF 1 | REV. 1



JUMBO DOME ROAD CORRIDOR CUT 4 / CUT 5 FILL



JUMBO DOME ROAD CORRIDOR CUT 6 / CUT 7 FILL

LEGEND

- PRE-CONSTRUCTION TOPO PROFILE
- EXISTING TOPO 05/13 PROFILE
- DESIGNED ROAD PROFILE
- INSTALLED ROCK DRAIN

DRAWING NOTES

- **PRECONSTRUCTION TOPO FROM AERIAL PHOTOGRAPHY MAY 1989 AND MAY 2009**
- **EXISTING TOPO FROM AERIAL SURVEY MAY 2013**
- **LOCATIONS AND SCALE OF DRAINAGE CONTROLS SHOWN ARE APPROXIMATE AND ALTERED TO SHOW DETAIL**
- **REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS**

N
W E
S

200' 100' 0' 200' 400' 600'

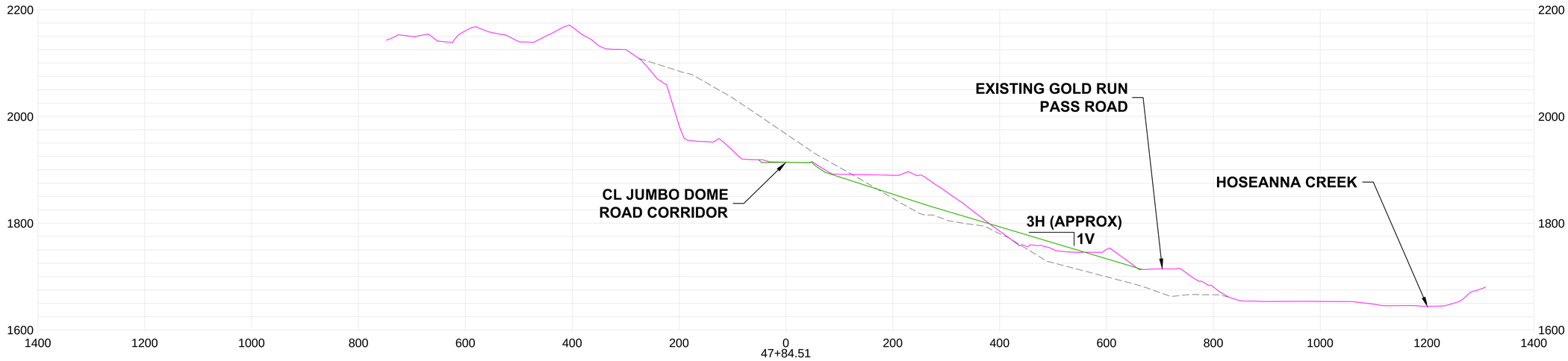
SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
0	06/15	SHW	ORIGINAL SUBMITTAL TO REPLACE PREVIOUS CROSS SECTION PLATES
1	11/15	RCS	UPDATED LEGEND

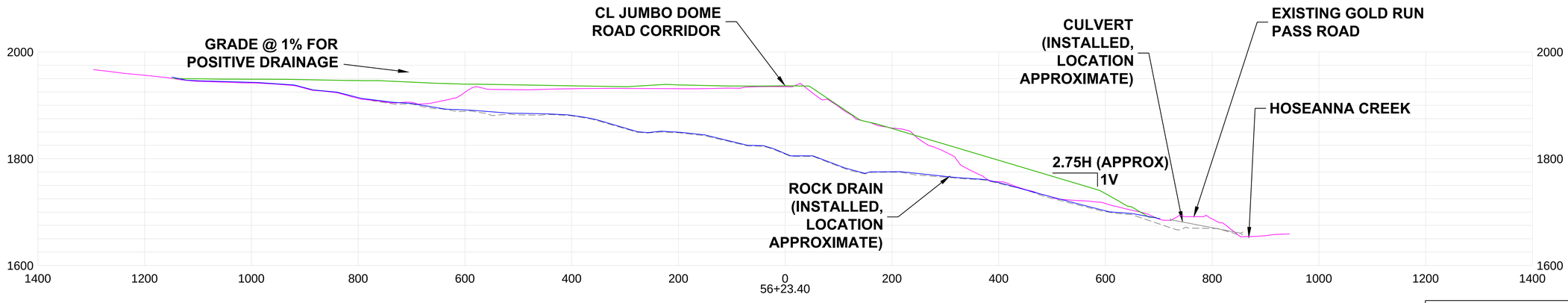
DESIGN BY: JTS	JUMBO DOME ROAD CORRIDOR — PERMIT NUMBER S-0605
DRAWN BY: SHW	
CHECK BY:	CUT 4/CUT 5 FILL
DWG FILE:	CUT 6/CUT 7 FILL
DATE DRAWN: 06/15	JDRC CROSS-SECTIONS

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. D7-3 | SHEET No. 3 OF 3 | REV. 1



JUMBO DOME ROAD CORRIDOR CUT 2



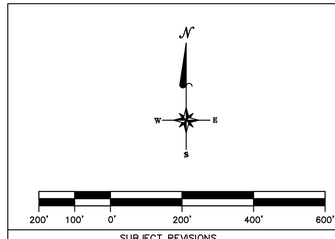
JUMBO DOME ROAD CORRIDOR CUT 2 / CUT 3 FILL

LEGEND

- PRE-CONSTRUCTION TOPO PROFILE
- EXISTING TOPO 05/13 PROFILE
- DESIGNED ROAD PROFILE
- INSTALLED ROCK DRAIN

DRAWING NOTES

- **PRECONSTRUCTION TOPO FROM AERIAL PHOTOGRAPHY MAY 1989 AND MAY 2009**
- **EXISTING TOPO FROM AERIAL SURVEY MAY 2013**
- **LOCATIONS AND SCALE OF DRAINAGE CONTROLS SHOWN ARE APPROXIMATE AND ALTERED TO SHOW DETAIL**
- **REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS**



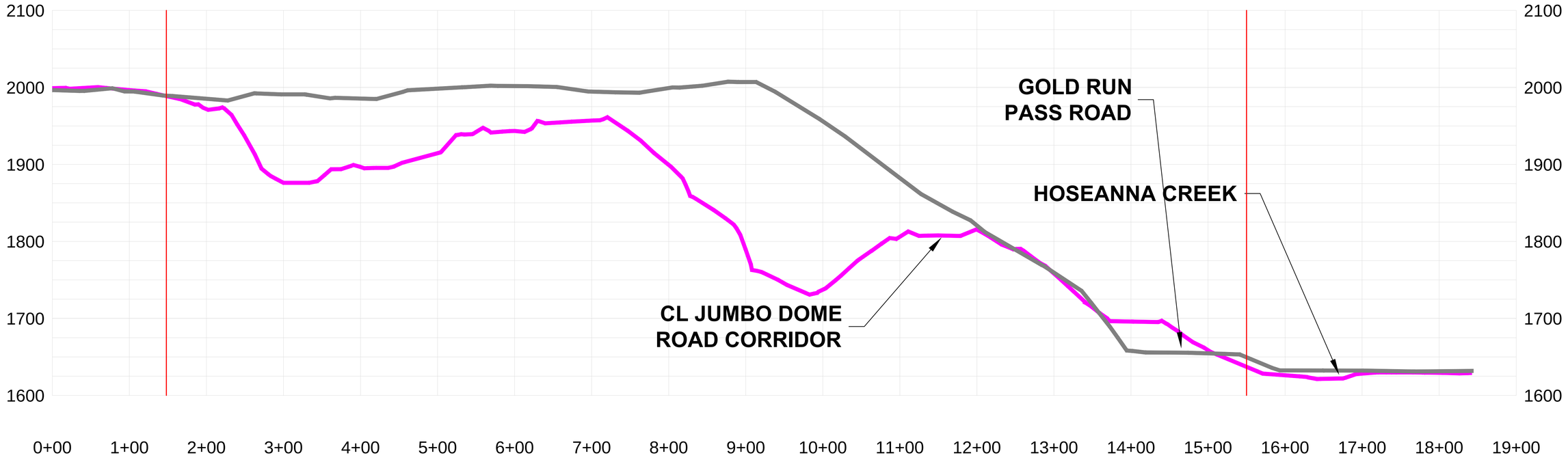
SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
0	06/15	SHW	ORIGINAL SUBMITTAL TO REPLACE PREVIOUS CROSS SECTION PLATES
1	11/15	RCS	UPDATED LEGEND

DESIGN BY: JTS	JUMBO DOME ROAD CORRIDOR — PERMIT NUMBER S-0605
DRAWN BY: SHW	CUT 2 AND CUT 2 / CUT 3 FILL
CHECK BY:	
DWG FILE:	JDRC CROSS-SECTIONS
DATE DRAWN: 06/15	

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. D7-3 | SHEET No. 2 OF 3 | REV. 1



JUMBO DOME ROAD CORRIDOR CUT 1-2

LEGEND
PRE-CONSTRUCTION TOPO PROFILE
EXISTING TOPO 05/13 PROFILE
PERMIT BOUNDARY

DRAWING NOTES
- PRECONSTRUCTION TOPO FROM AERIAL PHOTOGRAPHY MAY 1989 AND MAY 2009
- EXISTING TOPO FROM AERIAL SURVEY MAY 2013
- LOCATIONS AND SCALE OF DRAINAGE CONTROLS SHOWN ARE APPROXIMATE AND ALTERED TO SHOW DETAIL
- REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS

N
W E
S

200' 100' 0' 200' 400' 600'

SUBJECT REVISIONS

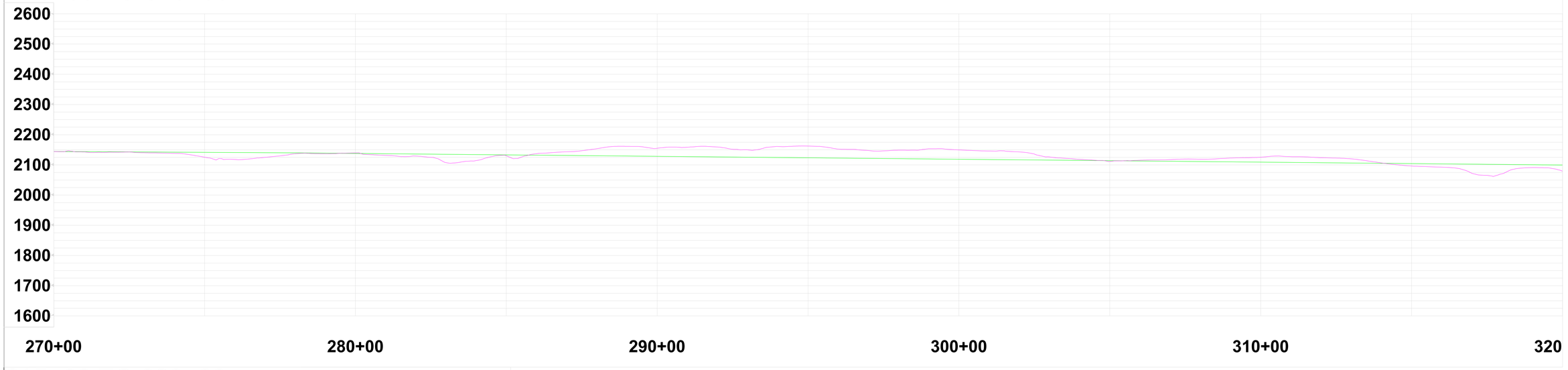
REV.	DATE:	BY:	DESCRIPTION
0	06/15	SHW	ORIGINAL SUBMITTAL TO REPLACE PREVIOUS CROSS SECTION PLATES
1	11/15	RCS	UPDATED LEGEND

DESIGN BY: JTS	JUMBO DOME ROAD CORRIDOR — PERMIT NUMBER S-0605
DRAWN BY: SHW	
CHECK BY:	CUT 1 – 2
DWG FILE:	
DATE DRAWN: 06/15	JDRC CROSS-SECTIONS

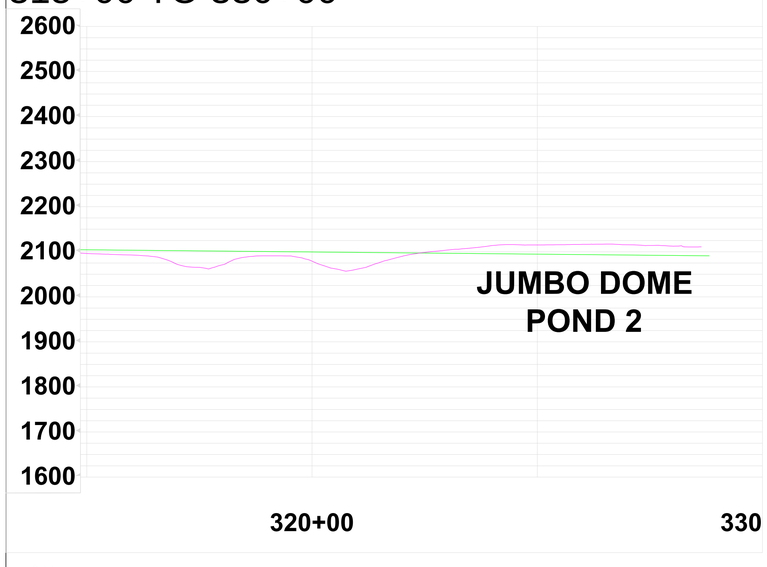
USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. D7-3 | REV. 1
SHEET No. 1 OF 3

270+00 TO 315+00



315+00 TO 330+00



LEGEND
PRE-CONSTRUCTION TOPO PROFILE
EXISTING TOPO 05/13 PROFILE
DESIGNED ROAD PROFILE

DRAWING NOTES
- PRECONSTRUCTION TOPO FROM AERIAL PHOTOGRAPHY MAY 1969 AND MAY 2009
- EXISTING TOPO FROM AERIAL SURVEY MAY 2013
- LOCATIONS AND SCALE OF DRAINAGE CONTROLS SHOWN ARE APPROXIMATE
- REFER TO PLATE 07-1 FOR KEY MAP
- REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS

N

500' 250' 0' 500' 1000' 1500'

SUBJECT REVISIONS

NO.	DATE	BY	DESCRIPTION
0	06/13	SWP	ORIGINAL SUBMITTAL TO REPLACE PREVIOUS ROAD PROFILE PLATES

DESIGN BY: JTS
DRAWN BY: SWP
CHECK BY:
DWG FILE:
DATE DRAWN: 06/15

JUMBO DOME ROAD CORRIDOR

PERMIT NUMBER S-5005

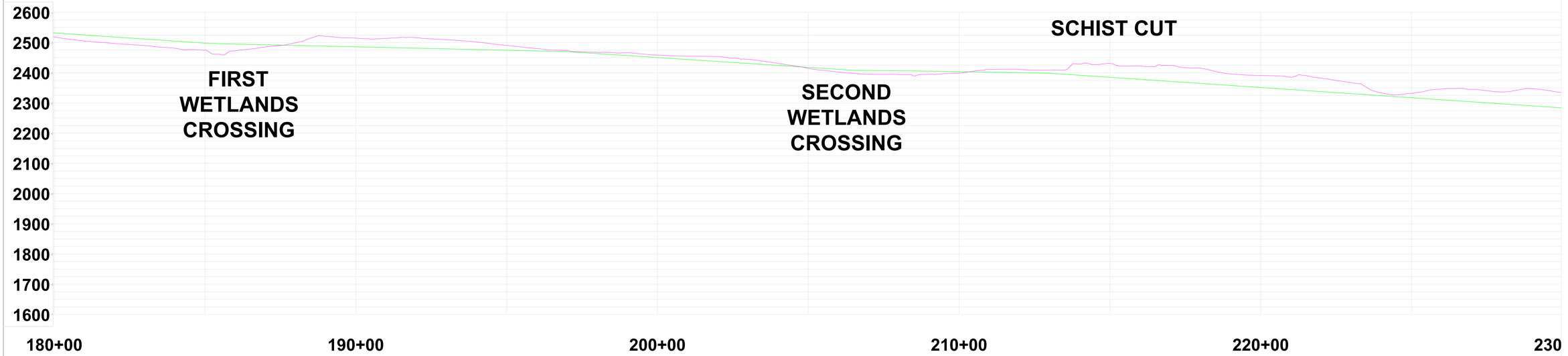
PROFILE ALONG ROAD

JUMBO DOME ROAD CORRIDOR

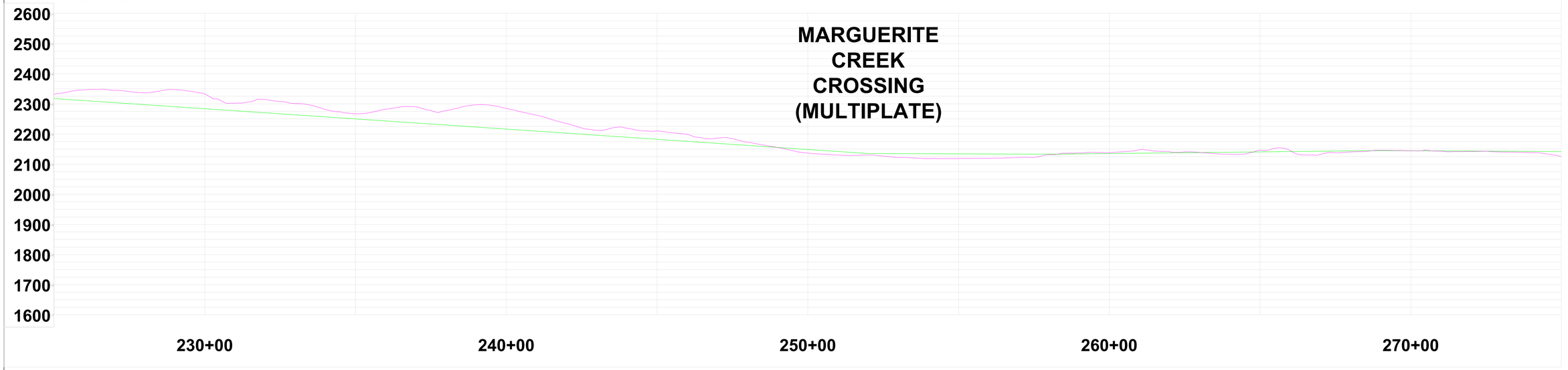
USIBELLI COAL MINE, INC.
P.O. BOX 1500, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 07-2
SHEET No. 4 OF 4
REV. 0

180+00 TO 225+00



225+00 TO 270+00



LEGEND
PRE-CONSTRUCTION TOPO PROFILE
EXISTING TOPO 05/13 PROFILE
DESIGNED ROAD PROFILE

DRAWING NOTES
- PRECONSTRUCTION TOPO FROM AERIAL PHOTOGRAPHY MAY 1969 AND MAY 2009
- EXISTING TOPO FROM AERIAL SURVEY MAY 2013
- LOCATIONS AND SCALE OF DRAINAGE CONTROLS SHOWN ARE APPROXIMATE
- REFER TO PLATE 07-1 FOR KEY MAP
- REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS

500' 250' 0' 500' 1000' 1500'

NO.	DATE	BY	DESCRIPTION
2	06/13	SWP	ORIGINAL SUBMITTAL TO REPLACE PREVIOUS ROAD PROFILE PLATES

SUBJECT REVISIONS

DESIGN BY:	JTS
DRAWN BY:	SWP
CHECK BY:	
DWG FILE:	
DATE DRAWN:	06/13

JUMBO DOME ROAD CORRIDOR — PERMIT NUMBER S-1605

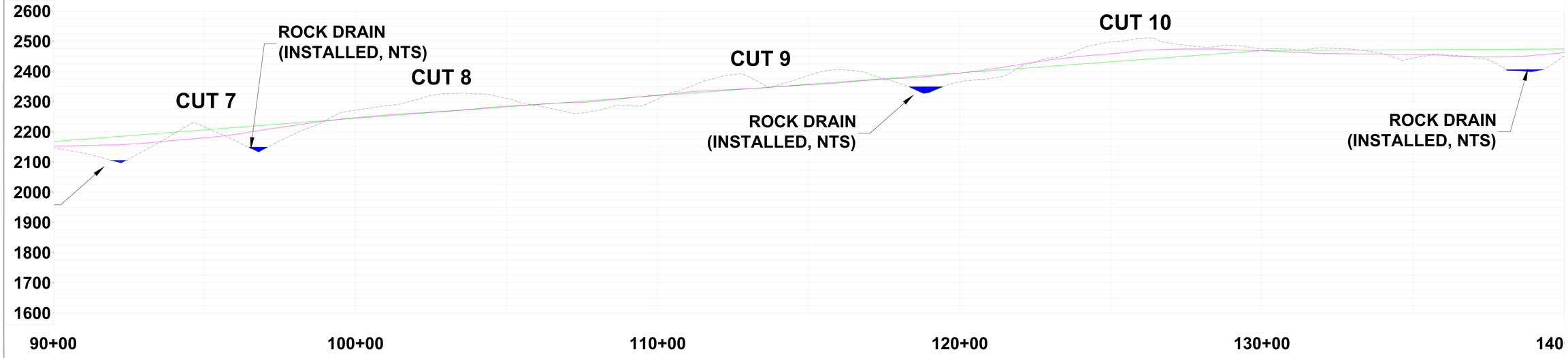
PROFILE ALONG ROAD

JUMBO DOME ROAD CORRIDOR

USIBELLI COAL MINE, INC.
P.O. BOX 1500, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 07-2 — REV. 0
SHEET No. 3 OF 4

90+00 TO 135+00



135+00 TO 180+00

LEGEND
PRE-CONSTRUCTION TOPO PROFILE
EXISTING TOPO 05/13 PROFILE
DESIGNED ROAD PROFILE

DRAWING NOTES
- PRECONSTRUCTION TOPO FROM AERIAL PHOTOGRAPHY MAY 1989 AND MAY 1990
- EXISTING TOPO FROM AERIAL SURVEY MAY 2013
- LOCATIONS AND SCALE OF DRAINAGE CONTROLS SHOWN ARE APPROXIMATE AND ALTERED TO SHOW DETAIL.
- REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS.

500' 250' 0' 500' 1000' 1500'

REV.	DATE	BY	SUBJECT REVISIONS DESCRIPTION
0	06/13	SW	ORIGINAL SUBMITTAL TO REPLACE PREVIOUS ROAD PROFILE PLATES

DESIGN BY: JTS
DRAWN BY: SW
CHECK BY:
DWG FILE:
DATE DRAWN: 06/13

JUMBO DOME ROAD CORRIDOR

PERMIT NUMBER S-0605

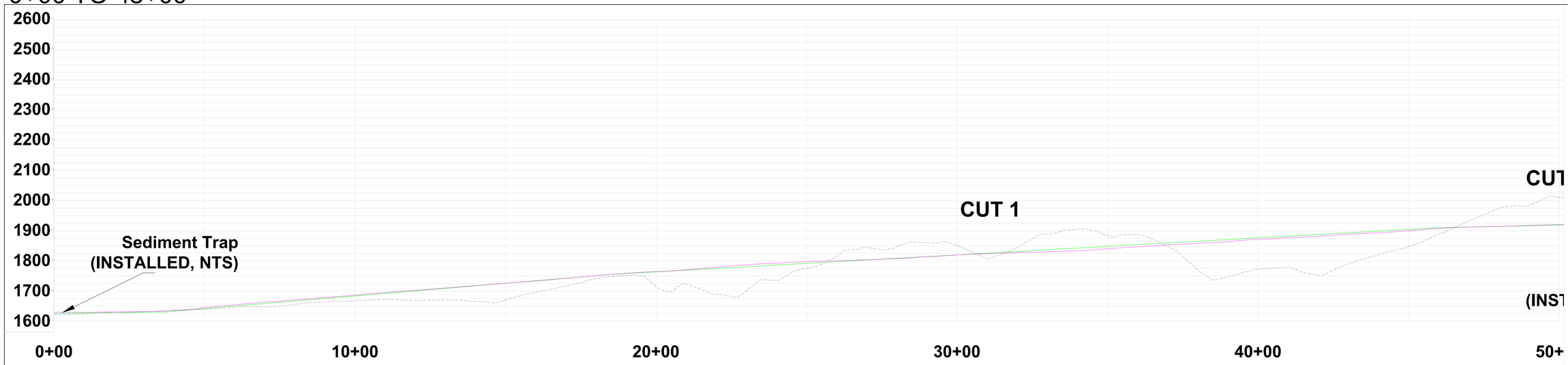
PROFILE ALONG ROAD

USIBELLI COAL MINE, INC.
P.O. BOX 1500 HEALY, ALASKA 99743
(907) 683-2226

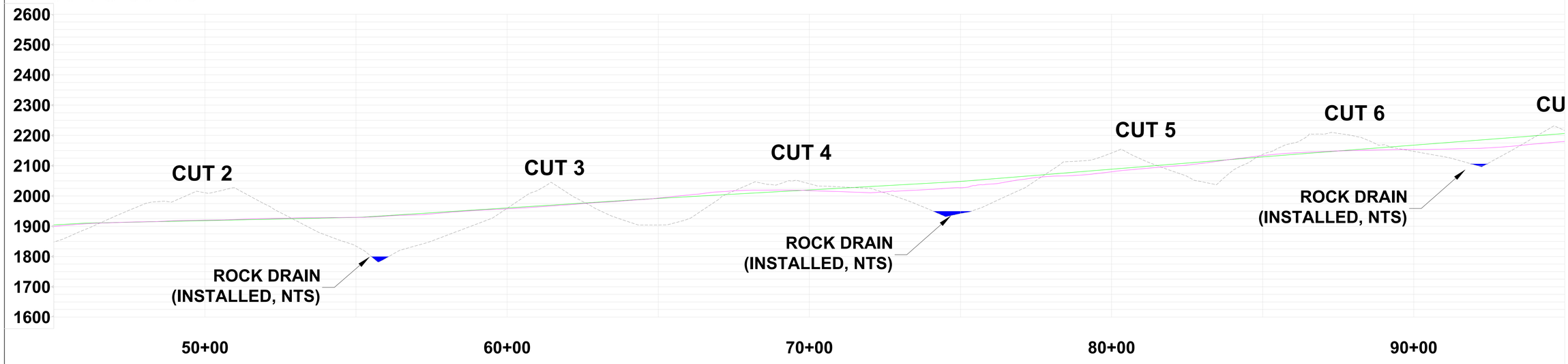
JUMBO DOME ROAD CORRIDOR

PLATE No. D7-2 | REV. 0
SHEET No. 2 OF 4

0+00 TO 45+00



45+00 TO 90+00



LEGEND
PRE-CONSTRUCTION TOPO PROFILE
EXISTING TOPO 05/13 PROFILE
DESIGNED ROAD PROFILE

DRAWING NOTES
- PRECONSTRUCTION TOPO FROM AERIAL PHOTOGRAPHY MAY 1989 AND MAY 2009
- EXISTING TOPO FROM AERIAL SURVEY MAY 2013
- LOCATIONS AND SCALE OF DRAINAGE CONTROLS SHOWN ARE APPROXIMATE AND ALTERED TO SHOW DETAIL
- REFER TO PERMIT TEXT FOR DRAINAGE AND SEDIMENT CONTROL DETAILS

500' 250' 0' 500' 1000' 1500'

REV	DATE	BY	SUBJECT REVISIONS DESCRIPTION
2	06/13	JDW	DRAWING SUBMITTAL TO REPLACE PREVIOUS ROAD PROFILE PLATES

DESIGN BY: JTL
DRAWN BY: SW
CHECK BY:
DWG FILE:
DATE DRAWN: 06/15

JUMBO DOME ROAD CORRIDOR
PERMIT NUMBER S-5605
PROFILE ALONG ROAD
JUMBO DOME ROAD CORRIDOR

USIBELLI COAL MINE, INC.
P.O. BOX 1909, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. D7-2
REV. 2
SHEET No. 1 OF 1

SECTION 8.0

EXISTING STRUCTURES AND MINE FACILITIES

TABLE OF CONTENTS

8.0 MINE FACILITIES

8.1 SIGNS AND MARKERS

Usibelli Coal Mine will place signs that are easily seen and constructed of durable material. Permit signs and markers will be posted to mark the perimeter of areas affected by surface operations. Markers will also be placed where appropriate at stream buffer zones and disturbance boundaries. Markers will also be used where topsoil has been segregated in stockpiles.

Identification signs are currently posted on the Nenana River Road, Gold Run Pass south access road, Poker Flats south access road, and the West Side Tipple Road. The existing signs have been modified to include the Jumbo Dome Road Corridor.

8.2 ACCESS CONTROL FEATURES

The primary entrance from public roads to UCM operations is controlled by a gate constructed to deny access to anyone not authorized to enter the mine area. Employees of Usibelli Coal Mine gain access by using an electronic key to open the gate. Non-employees are required to call the main mine office using a phone provided at the main entry gate to gain access. All gates have the mine permit numbers, MSHA I.D. numbers, and blast warning signals posted on a sign.

Secondary access gates may not have phone contact with the mine office or electronic key entry.

There are no public roads which provide access to the permit area. Access is already existing to the permit area is via roads permitted under the Poker Flats Permit #01-83-796 and the Gold Run Pass Permit #02-83-796; S-0602-A.

8.3 EXISTING STRUCTURES

There are no structures in the Jumbo Dome Road Corridor permit area associated with exploration activities either pre or post SMCRA.

SECTION 9.0

DRAINAGE AND SEDIMENT CONTROL PLAN

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF PLATES

9.0 DRAINAGE AND SEDIMENT CONTROL PLAN

9.1 GENERAL

The surface water control system proposed to protect the hydrologic system consists of road side ditches, road side berms and side drains, vegetative berms, brush barriers, silt fencing, hay bales, slash piles and seeding or other best management practices (BMPs). In areas where incidental coal is encountered during road construction UCM will mine the coal. Surface water will be diverted around the pit to the maximum extent practicable. There will be no surface discharge of in-pit water. In-pit water will be controlled using in-pit sumps that infiltrate into coal seams that dip away from surface water.

If necessary, roadway stream crossings will utilize conveyances such as pipes, culverts or burrito drains located within the natural channel confines. Minor drainage, internal to developed or disturbed areas within the permit boundary and of a "housekeeping" nature, will be controlled by drainage ditches as appropriate.

Sediment control BMPs will be in place prior to disturbance of their tributary area(s). They will remain in place until no longer required because of operational requirements and/or successful vegetation reestablishment of affected tributary areas, as appropriate. Storm water along the Jumbo Dome Road Corridor (JDRC) is governed by two Alaska Department of Environmental Conservation permits based upon whether the drainage is part of Hoseanna Creek or Marguerite Creek. Detailed sediment control and erosion control measures for storm water are covered in the required BMP Plan for the Alaska Pollution Discharge Elimination Permit (APDES) point source discharge permit number AK-004038-0 for all drainages along JDRC that flow into Hoseanna Creek. Storm water that flows into Marguerite Creek is regulated under the Alaska Construction General Permit (CGP). Detailed sediment control and erosion control measures are covered in the Storm Water Pollution Prevention Plan (SWPPP) required for the CGP.

9.2 CONVEYANCES

The only stream the road crosses that flows year round and supports a fish population is Marguerite Creek. Ephemeral streams or wetlands will also be crossed by the Jumbo Dome Road Corridor (JDRC) project. The locations of these drainages are shown on D1-1. Marguerite Creek crossing was designed to safely pass the peak discharge from the 100-year, 24-hour event. Conveyances for ephemeral streams or wetland drainages are designed to safely pass the discharge from the 10-year, 6-hour precipitation event. The conveyances were designed using SEDCAD+ computer program.

The methodology, assumptions and input parameters utilized in the design of Marguerite Creek Culvert, including the fish passage requirements are discussed Appendix D9-1 Technical Memorandum – Culvert Design for Marguerite Creek Haul Road Crossing. The methodology, assumptions and input parameters utilized in the design of the ephemeral stream and wetland crossings are discussed in Appendix D9-2 Technical Memorandum JDRC Culverts. The technical memorandum assumes the conveyances are typical CMP culverts and are designed to handle not only the adjacent drainage area but also upgradient road water not accounted for with upgradient conveyance. At the ephemeral streams burrito (rock) underdrains will be installed which have the equivalent flow carrying capacity as the culvert size specified in the Appendix D9-4, Technical Memorandum JDRC Rock Drains. The ephemeral streams are labeled as HR-7, HR-9, HR-11, HR-12, HR-15, and HR-16 in Appendix D9-2. Appendix D9-4, Technical Memorandum for Jumbo Dome Road Corridor Rock Drains, includes the assumptions and input parameters utilized to document that the burrito drains have the same flow capacity as the design culvert. The burrito drains have a cross sectional area of 3 foot by 3 foot and are comprised of 3-6 inch washed drain rock wrapped in geotextile fabric. Additionally, in an effort to minimize erosion and sediment transport, intermediate conveyance structures may be installed to remove road water in between the conveyance structures shown on Plate D1-1, thus reducing the required size of specified conveyance.

To facilitate construction at the wetland crossings, 8-inch HDPE pipes were installed to supplement the designed conveyances during construction. At the south wetland, HR-20, the

drisco pipes have been abandoned and a 36-inch diameter culvert was installed. The size of culvert required to meet the 10–year 6-hr design storm event was 18-inch. A 36-inch was installed to provide a safety factor. At the north wetland, HR-21, the five 8-inch HDPE pipes have equivalent cross sectional flow area as the size of culvert required to meet the 10–year 6-hr design storm event which was 18-inch. Additionally, a 24-inch and a 36-inch aufies overflow culverts were installed to deal with spring melts when normal flow is frozen.

9.3 DRAINAGE DITCHES

The drainage ditches are designed to convey the road water that falls on the road and in some cases, water from up gradient drainage areas, into the closest conveyance structure. The ditches are design to safely pass the peak flow from a 10 year 6 hour precipitation event. The ditches are also designed for ease of cleaning between storms. Check dam structures will be constructed of disposable materials such as straw bales and/or wood chip waddles. The methodology, assumptions and input parameters utilized in the design of the drainage ditches are discussed in Appendix D9-3 Technical Memorandum JDRC Channel Design. The technical memorandum assumes that the inside side slope of the ditch will be 20H:1V for road gradients less than 10%. UCM anticipates using steeper ditch side slopes therefore the submitted design is conservative.

9.4 IN-PIT SUMPS

In-pit sumps will be utilized for drainage control during removal of incidental coal encountered during the construction of the road. In-pit sumps will ensure there is no surface discharge of groundwater or of any surface water that flows into the pit. In-pit sumps are depressions in the coal were water infiltrates into the coal seam away from the mining activity and surface waters. The dry coal seams of Cut 1 will act as the in-pit sump for the wet coal seams of Cut 2.

APPENDIX D9-1

TECHNICAL MEMORANDUM

CULVERT DESIGN FOR MARGUERITE CREEK HAUL ROAD CROSSING

MWH

BUILDING A BETTER WORLD

TECHNICAL MEMORANDUM

TO:	*Tammy Scholten, Usibelli*	DATE:	*November 18, 2011*
FROM:	*Thomas Leidich, MWH* *Brandon Coleman, MWH*	REFERENCE:	*1009161*
SUBJECT:	*Culvert Design for Marguerite Creek Haul Road Crossing, Jumbo Dome Mine Area*		

At the request of Usibelli Coal Mine, Inc., MWH investigated the installation of a culvert for use in the Jumbo Dome Mining Area near Healy, AK, on Marguerite Creek, at its intersection with the proposed haul road. This culvert will be designed to maintain compliance with the requirements set by the Alaska Department of Fish and Game (ADFG) and the Alaska Department of Transportation and Public Facilities (ADOT) regarding Design, Permitting, and Construction of Culverts for Fish Passage.

Completion of this analysis has included the following:

- Fish species and size were reported in a WHPacific report, "Fisheries Assessment for Marguerite Creek". The design fish species and size was recommended by ADFG, and the minimum stream depth in the culvert needed for fish of this size was obtained using the FISHPASS program from the ADFG.
- Flow analysis for the 2-year fish passage design flow (Q_2), based on USGS statistical flow estimation methods by Curran, et. al (2003).
- Flow analysis for the 50-year peak design flow (Q_{50}), and 100-year peak design flow (Q_{100}) was performed using a regression equation provided by Curran, et. al (2003).
- Determination of the size and style of culvert to be used for the haul road crossing using HY8.
- Riprap sizing and shear analysis on bedding material for the Q_{50} design flow

EXISTING STREAM CONDITIONS

The existing stream conditions were estimated based on a LIDAR survey conducted for the area and field observations by Usibelli Coal and MWH at the site. The existing stream profile average longitudinal slope was approximately 1.4 %. The ordinary highwater mark (OHW) is commonly defined in streams as a break in vegetation on the banks. Based on field measurements of Marguerite Creek in the area that culvert will be installed, the stream width at the OHW is approximately 15 ft. Photographs of Marguerite Creek are shown in **Attachment A**.

From the WHPacific assessment of fish habitat on Marguerite Creek, it was determined that the species of concern were the Arctic Grayling and Slimy Sculpin. Of the 105 grayling collected, the sizes ranged from 64 to 220 mm in length. The Slimy Sculpin lengths were not reported in the WHPacific report, but ADFG recommended a length of 50 mm be used for Slimy Sculpin. Therfore, fish Passage flows were checked for a 120 mm Arctic Grayling and a 50 mm Slimy Sculpin, as recommended by ADFG.

DESIGN FLOW

Marguerite Creek is an ungaged stream; the design fish passage flow was approximated using a statistical analysis for Alaska Region 6, where Marguerite Creek is located. It was recommended by ADFG to use the 2% exceedance flow (Q_2) for anadormous and resident fish spawning systems.

The following equations applied for the 2% exceedance flow on Marguerite Creek and the haul road culvert location:

$$Q_2 = 9.204 \times 10^{-2} A^{0.9782} p^{1.342}$$

Where:
A is the drainage area in square miles,
p is the mean annual precipitation in inches

The drainage area above the culvert area on Marguerite Creek is 10.05 mi^2. A mean annual precipitation of 30 in. was used based reported values for Alaska by Jones (1994).

As identified by ADFG, the design flow for the shear stress analysis on the bed material to be used in the culvert is based on the 50-yr peak streamflow (Q_{50}). As identified by MWH, the design flow for capacity in the culvert is the 100-yr peak streamflow (Q_{100}). These design flows were approximated using a regression analysis for Alaska Region 6.

The following equations applied for the 50-year peak streamflow (Q_{50}) and 100-year peak streamflow (Q_{100}), respectively:

$$Q_{50} = 186.7A^{0.8929} (ST+1)^{-0.2599}(F+1)^{-0.2124}$$
$$Q_{100} = 220.6A^{0.7764}(ST+1)^{-0.2616}(F+1)^{-0.2023}$$

Where:
A is the drainage area in square miles,
ST is the area of lakes and ponds (storage) in percent, and
F is the area of forest in percent.

A drainage area of 10.05 mi^2 for Marguerite Creek above the culvert area, zero storage, and a forested area of 70% were determined using aerial photography and Carlson Software for AutoCAD. Based on the equations presented above, the 2% exceedance flow (Q_2), the 50-year peak (Q_{50}) and 100-year peak (Q_{100}) streamflows were determined to be 84.5 cfs, 465.7 cfs, and 558.7 cfs, respectively. These calculations are shown in **Attachment B**.

CULVERT SIZING AND ALIGNMENT

The culvert was sized to provide hydraulic conditions suitable for fish passage during the 2% exceedance streamflow, and safely pass the 100-year peak streamflow without overtopping the Jumbo Dome haul road.

ADFG and ADOT guidelines require the following criteria for culvert fish passages:

- Culvert width is greater than 0.9 * OHW
- Culvert grade should approximate the channel slope, but in no instance should it deviate more than 1% for the natural grade

- Invert burial depths for circular culverts should be at least 40% of the culvert diameter

Based on the above criteria the following culvert design parameters were assumed for modeling:

- 15 ft diameter
- 6 ft burial depth
- 2% longitudinal slope
- Corrugated metal steel
- 2" x 6" corrugations

HY8, a program developed by the Federal Highway Administration was used to model the hydraulic parameters in the culvert for the 100-yr, 50-yr and 2-yr peak streamflow.

The outlet channel is designed to convey flow from the outlet of the culvert to the existing stream channel. The outlet channel assumed normal depth for the design flows, and no backwater effects from downstream structures. Channel dimensions that were assumed are shown in **Attachment C**.

Based upon the fish passage design discharge of 84.5 cfs, HY8 determined that the culvert would be outlet controlled (Type 3 Flow). This is a preferable energy grade profile for fish passage because the energy through the culvert is relatively constant. The minimum depth in the culvert for the fish passage design flow is 1.87 ft, which is the headwater depth at the culvert inlet. This depth is based on HY8 modeling results shown in **Attachment C**.

The road location was based on the most perpendicular alignment possible to Marguerite Creek while still maintaining a safe haul road route, within the permitted road corridor. The location of the road was selected to have the least amount of impact on Marguerite Creek and its tributaries. The inlet location was chosen reduce the angle between the existing channel and the culvert inlet to create a smooth transition into the culvert.

RIPRAP ANALYSIS

The riprap that will be used to backfill the culvert and line the downstream channel is an important design component. As per ADFG the substrate material should remain dynamically stable up to and including the 50-yr peak streamflow. The riprap calculations are shown in **Attachment D**.

Federal Highway Administration methodology for calculating permissible shear stress for the culvert substrate material was used for this analysis. The permissible shear stress for material with a D_{50} = 12 in. was found to be 15.92 lb/ft^2. Based on the maximum depth expected in the culvert for the Q_{50} design flow the maximum shear stress was estimated to be 8.51 lb/ft^2.

The gradation of the material is recommended to be a mix of ADOT Class 1 and Class 2 riprap. It was also important to include a percentage of fines and sands in the riprap to seal and voids and promote interlocking between the stones. The gradation of the material is shown in **Table 1**.

Table 1. MCHR Culvert Substrate and Channel Lining Gradation

Rock Size (in)	% Passing
36	-
24	90-95
12	25-75

Rock Size (in)	% Passing
8	5-30
No. 4 Sieve	10-20

Due to the length of the culvert it is important to create fish resting points utilizing the substrate material within the culvert. For the purpose of creating fish resting points, riprap ranging from 24-36 in. should be placed within the culvert every 4-6 ft with 40% of the stone protruding from the embedded material.

CULVERT SPECIFICATIONS

In compliance with the ADFG and ADOT regulations, a 15 ft diameter, corrugated circular galvanized, multiplate culvert was selected. This is a galvanized steel, multi-plate structure. Specific burial depths (substrate within the culvert) for circular culverts are provided by ADFG and ADOT, a minimum burial of 40% of the diameter is required for circular culverts. A burial depth of 6 ft is planned for the Marguerite Creek culvert, 40% of the culvert height. Based on design specifications for a culvert of this type a minimum of 6 ft of material will be placed between the top of the culvert and the road surface to provide adequate support for the loads expected on the haul road. See **Figures 1** and **2** in **Attachment E**.

Ice flows and plugging of the culvert are a concern due to location of the installation and the climatic conditions in Alaska. To protect the road and to keep the culvert free of ice during the spring and winter seasons an overflow culvert will be installed in the floodplain of Marguerite Creek. A 1 in. pipe will be installed through the culvert that can be filled with steam to remove ice from the culvert. This device is commonly referred to as an “ice worm”. These devices have been installed at other culverts at the Usibelli mine site with successful results.

In addition to the ice worm, an overflow culvert will be installed in the historic stream flow path with the invert elevation of the culvert parallel or above the top of the MCHR fish passage culvert. This culvert will be 3 ft. in diameter or larger, and will pass approximately 60 cfs.

CONCLUSIONS AND RECOMMENDATIONS

The recommended culvert is a 15 ft diameter multiplate corrugated metal circular structure, approximately 220’ long with a longitudinal slope of 2%. The culvert will be backfilled to a depth of 6’ with suitable substrate material.

The recommended culvert design specifications will sufficiently meet each of the required fish passage criteria for the Arctic Grayling and Slimy Sculpin found in Marguerite Creek and will also be able to accommodate the design storm events.

Based upon the HY8 results, the peak design flow of 559 cfs the culvert will generate a hydraulic jump at the outlet. The exact location of this hydraulic jump is not known at this time, and erosion protection is recommended at the outlet of the culvert in the form of the specified riprap, to prevent potential scour.

The substrate material will be a mix of ADOT Class I and Class II riprap combined with finer material to seal voids in the riprap. This material will be dynamically stable up to the 50-yr design peak streamflow. Large stones (24”-36”) will be placed every 4-6 ft within the culvert with 40% of the stone protruding from the embedded material. This will create fish resting areas within the culvert.

Due to the project location and the potential for large ice flows during the winter season, a smaller relief culvert will be installed to help pass flow under the Jumbo Dome haul road if the MCHR culvert becomes obstructed by ice.

REFERENCES

Alaska Department of Fish and Game. 2001. Memorandum of Agreement Between Alaska Department of Fish and Game and Alaska Department of Transportation and Public Facilities for the Design, Permitting, and Construction of Culverts for Fish Passage. Juneau, AK.

Alaska Department of Transportation and Public Facilities. 2004. Standard Specifications for Highway Construction.

Curran, J.H., Meyer, D.F., and Tasker, G.D., 2003. Estimating the magnitude and frequency of peak streamflows for ungaged sites on streams in Alaska and conterminous basins in Canada: U.S. Geological Survey Water-Resources Investigations Report 03-4188.

Curran, J.H., Wiley, J.B., 2003. Estimating Annual High-Flow Statistics and Monthly and Seasonal Low-Flow Statistics for Ungaged Site on Streams in Alaska and Conterminous Basins in Canada: U.S. Geological Survey Water-Resources Investigations Report 03-4114.

Jones, S.H., and Fahl, C.B., 1994. Magnitude and Frequency of Floods in Alaska and Conterminous Basins of Canada, U.S. Geological Survey Water-Resources Investigations Report 93-4179, Plate 2.

United States Department of Commerce, Weather Bureau. 1965. Two-to-Ten-Day Precipitation for Return Periods of 2 to 100 Years in Alaska. http://www.weather.gov/oh/hdsc/PF_documents/TechnicalPaper_No52.pdf

United States Department of Transportation, Federal Highway Administration. 2011. HY-8 Version 7.2.

United States Department of Transportation, Federal Highway Administration. 2005. Design of Roadside Channels with Flexible Linings Hydraulic Engineering Circular Number 15, Third Edition.

WHPacific, Inc. 2008. Fisheries Assessment for Marguerite Creek. Portland, OR. 30 p.

WHPacific, Inc. 2008. Stream Morphology Report, Marguerite Creek, Jumbo Dome Area. Portland, OR. 13 p.

ATTACHMENTS

Attachment A: Photographs
Attachment B: Streamflow Calculations
Attachment C: HY8 Model
Attachment D: Riprap Calculations
Attachment E: Figures

Attachment A:
Photographs

Approximate Inlet Location looking Upstream in Marguerite Creek

Approximate Outlet Location looking Downstream in Marguerite Creek

Attachment B:
Streamflow Calculations

Table 2. Estimating equations for annual high-duration flows in Regions 1-7, Alaska and conterminous basins in Canada

[Estimating equation: *O-Sn* , daily mean discharge for the water year October-September having an *n* -percent exceedance probability, in cubic feet per second; *A* , drainage area, in square miles; *P* , mean annual precipitation, in inches]

	Estimating equation					
	Constant	**Exponent for A**	**Exponent for P**	**Coefficient of determination**	**Standard error of estimate, in percent**	**Estimate of discharge using user-supplied basin characteristics**
	Region 6 (34 streamflow gaging stations)					User: Enter values in shaded area for this region (9999 indicates a dummy value that must be replaced) **A** = 10.05 **P** = 30
O-S 15	3.93E-03	1.075	1.87	0.99	29	27.13977007
O-S 10	8.14E-03	1.05	1.765	0.99	27	37.15960888
O-S 9	9.74E-03	1.045	1.736	0.99	27	39.83260735
O-S 8	1.20E-02	1.038	1.703	0.99	28	43.14864032
O-S 7	1.52E-02	1.031	1.664	0.99	28	46.94351555
O-S 6	1.95E-02	1.023	1.618	0.99	29	50.8042816
O-S 5	2.55E-02	1.015	1.577	0.99	29	56.55580269
O-S 4	3.60E-02	1.005	1.514	0.99	29	63.09015481
O-S 3	5.28E-02	0.994	1.445	0.99	29	71.33611372
O-S 2	9.20E-02	0.9783	1.342	0.99	31	84.46803516
O-S 1	0.2144	0.9512	1.193	0.99	33	111.3501473

MWH

By BAC Date 10/3/11 Client Usibelli Sheet 1 of 1

Chkd. By Description Fish Passage Flow Estimation Job No. 100916

AK Region 6 Annual High Duration Flow Estimation

$$Q\text{-}S2 = 9.204 \times 10^{-2} A^{0.9783} P^{1.342}$$

2% exceedance probablity

A = drainage area, mi^2 = 10.05 mi^2

P = mean annual precipitation, in = 30 in (WRI 93-4179, Plate 2)

$$Q\text{-}S2 = 9.204 \times 10^{-2} (10.05)^{0.9783} (30)^{1.342}$$

$$Q\text{-}S2 = 84.468 \cong 84.5 \text{ cfs}$$

Table 3. Regression equations for estimating 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year peak streamflows for unregulated streams in Regions 1-7, Alaska and conterminous basins in Canada

[Q_T, T-year peak streamflow, in cubic feet per second; A, drainage area, in square miles; ST, area of lakes and ponds (storage), in percent; P, mean annual precipitation, in inches; J, mean minimum January temperature, in degrees Fahrenheit; E, elevation, in feet; F, area of forest, in percent]

	Constant	Exponent for A	Exponent for ST	Exponent for P	Exponent for J	Average standard error of prediction (log units)	Average standard error of prediction (percent)	Average equivalent years of record	Estimate of recurrence interval Q_T using user-supplied characteristics	
	Region 6 (97 gaging stations)								**User:** Enter values in shaded area for this region (9999 indicates a dummy value that must be replaced)	
	Applicable range of variables:								**A=**	10.05
	A: 1.29-321,000; ST: 0-15; F: 0-100								**ST=**	0
									F=	70
Q2	52.87	0.8929	-0.2676		-0.3076	0.172	41	1.8	111.840	
Q5	88.08	0.8479	-0.2596		-0.2648	0.176	42	2.5	201.558	
Q10	115.7	0.8253	-0.2579		-0.2443	0.185	45	3.2	274.258	
Q25	154.8	0.8026	-0.2585		-0.2243	0.199	48	3.9	379.203	
Q50	186.7	0.7885	-0.2599		-0.2124	0.211	52	4.3	465.742	
Q100	220.6	0.7764	-0.2616		-0.2023	0.223	55	4.6	558.699	
Q200	256.6	0.7656	-0.2636		-0.1935	0.235	58	4.8	658.107	
Q500	307.7	0.7530	-0.2662		-0.1833	0.252	63	5.0	800.613	

MWH

By BAC Date 10/3/11 Client Usibelli Sheet 1 of 1

Chkd. By _____ Description Magureite Creek Streamflow Analysis Job No. 100916

AK Region 6 Streamflow Regression Analysis

2-year

$$Q_2 = 52.87 A^{0.8929} (ST+1)^{-0.2676} (F+1)^{-0.3076}$$

A = drainage area, mi^2 = 10.05 mi^2

ST = storage, % = 0 %

F = forest area, % = 70 %

$$Q_2 = 52.87 (10.05)^{0.8929} (0+1)^{-0.2676} (70+1)^{-0.3076}$$

$$Q_2 = 111.8398 \text{ cfs} \cong 111.8 \text{ cfs}$$

50-year

$$Q_{50} = 186.7 A^{0.7885} (ST+1)^{-0.2599} (F+1)^{-0.2124}$$

$$Q_{50} = 186.7 (10.05)^{0.7885} (0+1)^{-0.2599} (70+1)^{-0.2124}$$

$$Q_{50} = 465.742 \text{ cfs} \cong 465.7 \text{ cfs}$$

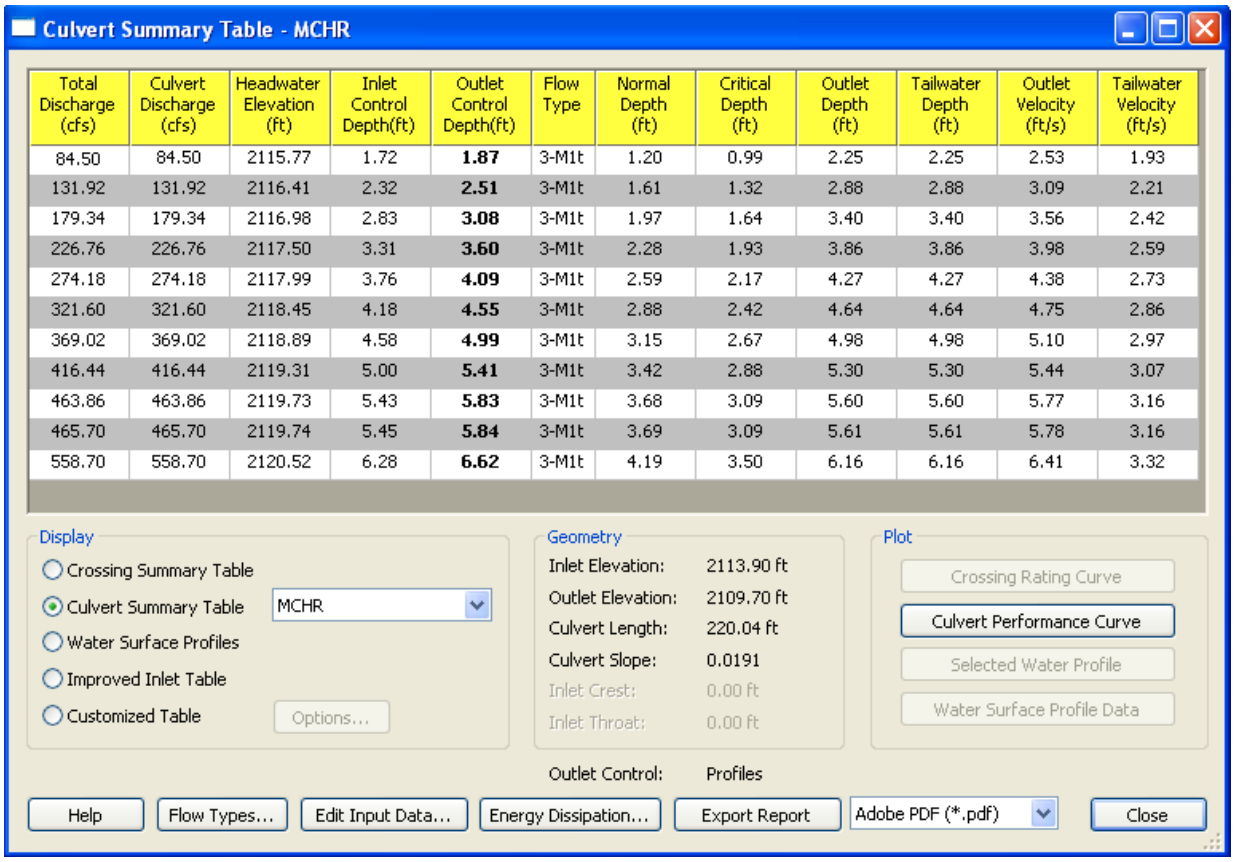
100-year

$$Q_{100} = 220.6 A^{0.7764} (ST+1)^{-0.2616} (F+1)^{-0.2023}$$

$$Q_{100} = 220.6 (10.05)^{0.7764} (0+1)^{-0.2616} (70+1)^{-0.2023}$$

$$Q_{100} = 558.699 \cong 558.7 \text{ cfs}$$

Attachment C:
HY8 Model



HY8 Model Results

Attachment D:
Riprap Calculations

Client: *Usibelli*
Project: *MCHR Culvert Shear Stress Analysis*
Description: *The shear stress on the selected lining for the MCHR bed material*

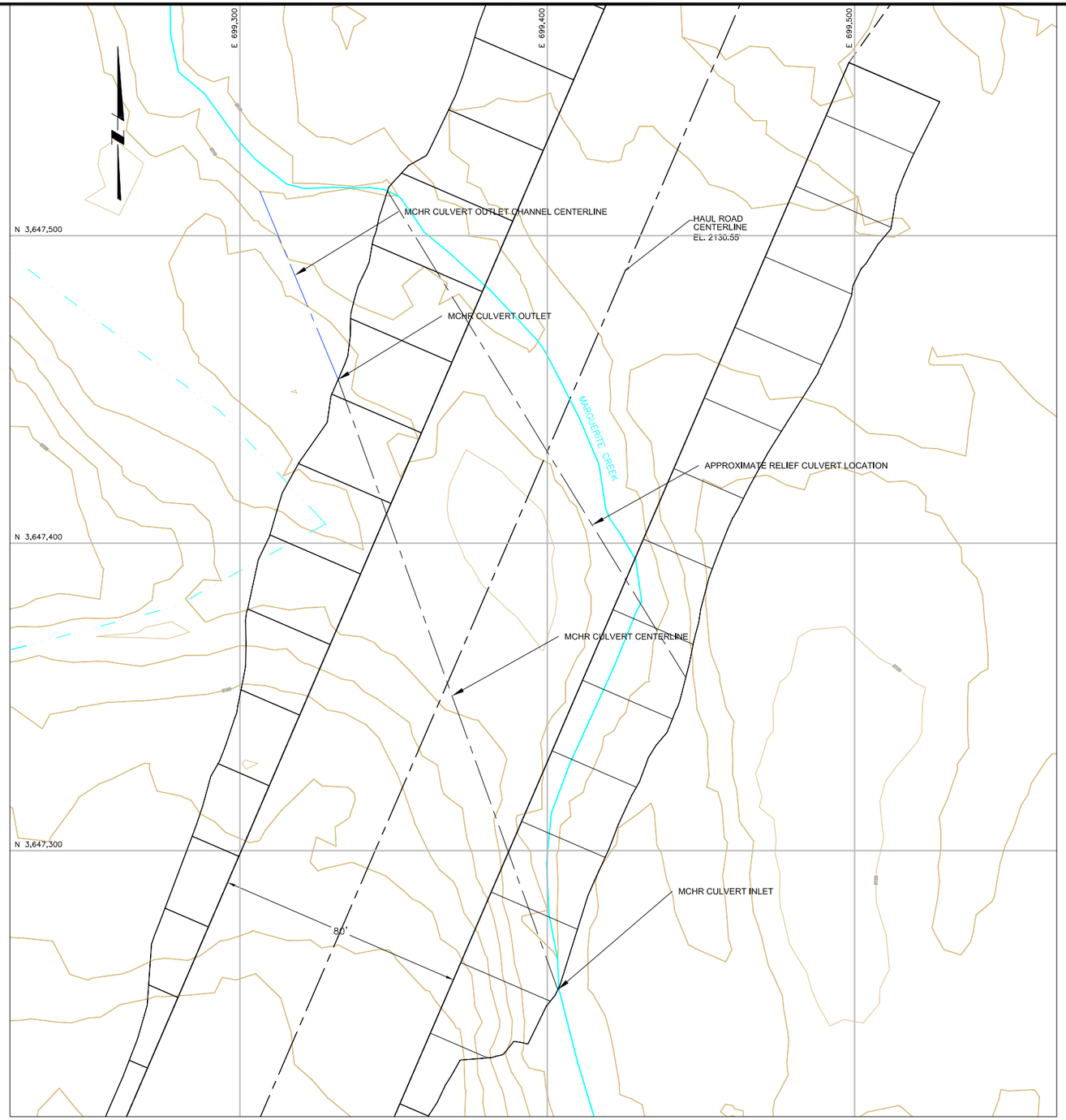
Sheet: 1 **of** 1
Date: *10/17/2011*
Job No: *1009161*
By: *Brandon Coleman* **Chkd**

MCHR Bed Material Shear Stress Analysis

INPUT DATA		
Depth of Flow	**6.82**	ft
Specific Weight of Water	**62.4**	lb/ft^2
Specific Weight of Rock	**155**	lb/ft^2
Slope of Channel	**0.02**	ft/ft
Assumed D50 of Rock	**1**	ft

$\tau_d = \gamma d S_o$	8.51136	lb/ft^2	Maximum shear stress	
$V_x =$	4.39208	ft/s	Maximum Velocity	
$F^* = \tau_d/(\gamma_s-\gamma_w)d_s$	0.091915		Shield parameter, unitless	0.15
$Re = V_x D_{50}/\nu$	3.61E+05		Reynolds Number, unitless	
$\tau_p = \tau^* (\gamma_s-\gamma_w)D_{50}$	13.89	lb/ft^2	Permissible shear stress	

Attachment E:
Figures



PLAN

SCALE
20' 0 20' 40'
CONTOUR INTERVAL = 2'

LEGEND:

- 2000 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- MCHR CULVERT CENTERLINE

NOTES:

1. The existing slope of Marguerite Creek is approximately 1.4%.
2. The design slope of the culverts is 2.0%.
3. The culvert is 15 ft diameter with the bottom 6 ft backfilled with suitable streambed material.
4. The outlet channel will have a 15 ft bottom width, 2H:1V sideslopes, and 0.20% slope.
5. A 3 ft diameter or larger culvert will be placed in the the historic stream flow path.
6. For a design profile of the culverts and outlet channel see Figure 2.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
0	ISSUED FOR FINAL REPORT	CHF	BC	11/18/11

DRAWING REFERENCE(S):

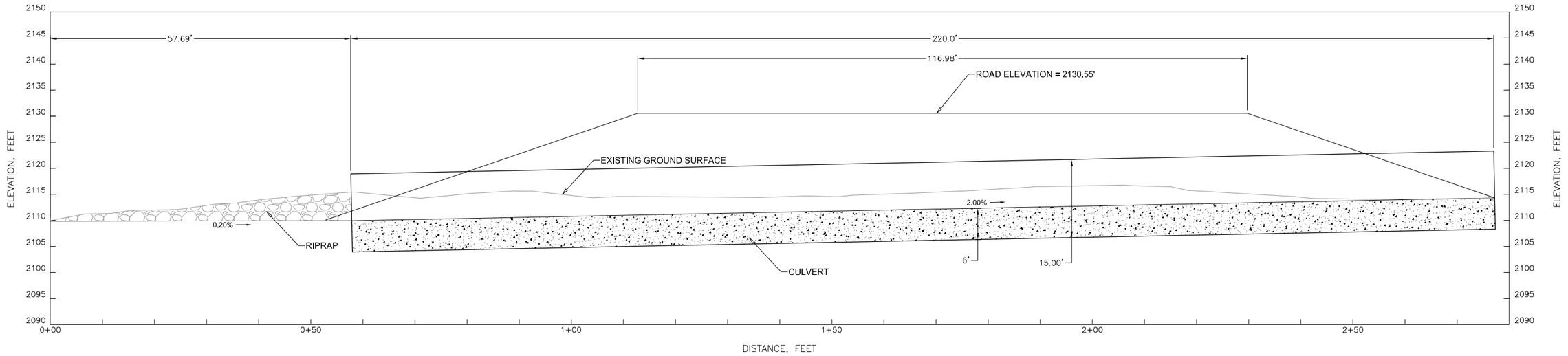
DESIGNED BY	B. COLEMAN	01/03/11
DRAWN BY	C. FOWLER	01/03/11
CHECKED BY	T. LEIDICH	01/03/11
APPROVED BY		
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

CLIENT LOGO

PROJECT LOCATION: USIBELLI COAL MINING CO.
PROJECT: MARGUERITE CREEK HAUL ROAD CROSSING
TITLE: CULVERT ALIGNMENT
FIGURE: 1
REVISION: 0
FILE NAME: 1009161D001

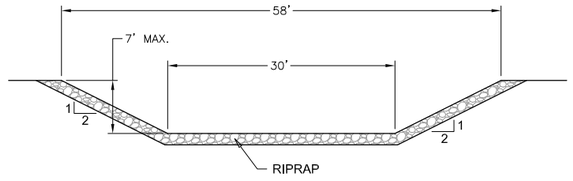
MWH

J:\Clients_Q-Z\Usibelli Coal\1009161 Usibelli Coal Healy\Technical\New Drainage Control\Marguerite Creek Culvert Design\FIGURES\015-Sheet Set\1009161D001



A
-
CULVERT PROFILE

SCALE
10' 0 10' 20'



LEGEND:

EXISTING GROUND SURFACE

SUBSTRATE FOR CULVERT BURIAL

B
-
TYPICAL OUTLET CHANNEL CROSS-SECTION

SCALE
10' 0 10' 20'

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
0	ISSUED FOR FINAL REPORT	CHF	BC	11/18/11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES, AND KNOW HOW OF MWH AS AUTHOR, ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):

DESIGNED BY	B. COLEMAN	01/03/11	
DRAWN BY	C. FOWLER	01/03/11	
CHECKED BY	T. LEIDICH	08/18/11	
APPROVED BY			
PROJECT MANAGER			
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

CLIENT LOGO

PROJECT LOCATION
USIBELLI COAL MINING CO.

PROJECT
MARGUERITE CREEK HAUL ROAD CROSSING

TITLE
CULVERT DETAILS

MWH

FIGURE 2
REVISION 0
FILE NAME 1009161D002

J:\Clients_Q-Z\Usibelli Coal\1009161 Usibelli Coal Healy\Technical\View Drainage Control\Marguerite Creek Culvert Design\FIGURES\03-Sheet Set\1009161D002

APPENDIX D9-2
TECHNICAL MEMORANDUM
JDRC CULVERTS

MWH

BUILDING A BETTER WORLD

TECHNICAL MEMORANDUM

TO: *Tammy Scholten PE*
Senior Environmental Engineer
Usibelli Coal Mine, Inc

DATE: *August 2013*

FROM: *Thomas Leidich PE, MWH*

REFERENCE: *1009161*

SUBJECT: *JDHR Culverts*

MWH was retained by Usibelli Coal Mine to design the culverts for the Jumbo Dome Haul Road Corridor (JDHR). The Culverts were designed to safely pass the peak flows for the 10-year, 6 hour event

METHODOLOGY

Calculations for all culverts were performed utilizing the SEDCAD4 Computer Model developed by Civil Software Design.

SEDCAD4 is a hydrologic, hydraulic and sediment calculation model designed for use on computer systems. The SEDCAD4 hydrologic model calculates runoff volume, and peak flow via a numerical modeling technique based on user inputs of a design storm event, (i.e., precipitation frequency data, selection of rainfall distribution, and convolution increment). Hydrographs are developed on a subwatershed basis with the input of area, time of concentration, SCS Curve Number, and the selection of a hydrograph shape. Routing of hydrographs is accomplished by the Muskingum Method.

Inputs to the hydrology component of the SEDCAD4 Computer Model include:

- Precipitation Distribution
- Storm Duration
- Return Period/Precipitation
- Hydrograph Response Shape
- Drainage Basin Area
- Time of Concentration
- Muskingum Routing Parameters
- Curve Number

Input values used in this model, are shown on the SEDCAD4 printouts and are explained in the following text of this exhibit.

<u>Precipitation Distribution</u>

A precipitation distribution is input to model the run-off hydrograph. SEDCAD4 allows the user to choose between the SCS Type I and Type II Storms. The SCS Type I Storm was used for the Jumbo Dome Road Corridor area.

<u>Storm Duration</u>

A storm duration of 6 hours was used to model the watershed for the Jumbo Dome Road Corridor area.

Return Period/Precipitation

A precipitation amount is required for the appropriate return period. The following precipitation amounts were used for Jumbo Dome Road Corridor Area:

10-year, 6-hour event	1.3 inches

The precipitation amounts were obtained from the TP-47, "Probable Maximum Precipitation and Rainfall - Frequency Data for Alaska" (U.S. Department of Commerce, 1963).

Hydrograph Response Shape

A unit hydrograph is chosen for each drainage area or sub-area model to predict the run-off response. The hydrograph responses available in the SEDCAD4 model are slow, medium, and fast. A slow response corresponds to a forested area or an area with a number of obstructions. A fast response corresponds to an unvegetated or poorly protected area. Fast and medium hydrograph responses were chosen for disturbed and undisturbed areas, respectively. The internal convolution increment is 0.05 hours and values are saved at the user specified interval of 0.1 hours or greater. A convolution increment of 0.1 was specified for the Poker Flats area.

Drainage Basin Area

The drainage areas were determined by direct measurement from digital contour maps.

Time of Concentration, Tc

The time of concentration was calculated using the SCS upland method (a utility of SEDCAD4). All hydraulic lengths, drainage heights and slopes were measured directly from a digital contour map. The calculated values for each structure are shown on the SEDCAD4 printouts.

Muskingum Routing Parameters, K, X

The Muskingum Routing Parameters were also calculated using the SCS upland method. All hydraulic lengths, drainage heights and slopes were measured directly from a digital contour map provided by UCM. The values calculated between each junction and/or subwatershed are shown on the SEDCAD4 printouts.

Curve Number, CN

Curve numbers (CN) were approximated based on hydrologic soil type, which was determined from the soil descriptions in the base line soils report, as well as type and amount of ground cover. Curve numbers were obtained from Technical Release No. 55 (USDA-SCS, 1986). Based on hydrologic soil type and vegetative cover the following curve numbers were determined:

Haul Road

Soil Type:	C
Ground Cover Type:	NA
Ground Cover:	NA
Curve Number:	90

Undisturbed

Soil Type:	B
Ground Cover Type:	Brush
Ground Cover:	Poor
Curve Number:	75

All inputs and results are shown on the attached SEDCAD printouts

CULVERT DESIGN

The culverts were determined using SEDCAD. The SEDCAD model provides you with the ability to size a culvert based length, type, slope, headwater and design. All culvert inputs and results are shown on the attached SEDCAD computer printouts.

REFERENCES

Barfield, B.J., Warner, R.C., Haan, C.T., 1981, Applied Hydrology and Sedimentology for Disturbed Areas.

Robinson, K.M., Rice, C.E., Kadavy, K.C., 1998, Design of Rock Chutes. American Society of Agricultural Engineers.

U.S. Department of Transportation, Federal Highway Administration, March 1989, Design of Riprap Revetment. Publication No. FHWA A-IP-89-016.

Usibelli Coal Company, 1996, Two Bull Ridge Permit Application.

Warner, R.C., Schwab, P.J, 1992, SEDCAD + Version 3.

Attachment A:

Culvert Runs

Table 1. Jumbo Dome Haul Road Culverts

Culvert	Drainage Area (ac)	10-yr 6-hr Peak Flow (cfs)	10-yr 6-hr Volume (ac-ft)	Head Water (ft)	Minimum Culvert Size (in)	Design Culvert Size (in)	HW/D
HR-7	246.3	7.75	1.9	2	18	24	1
HR-9	42.9	5.94	0.5	2	15	18	1.3
HR-11	79.3	2.75	0.6	1.5	12	12	1.5
HR-12	70	4.62	0.7	1.5	15	18	1
HR-15	42.4	5.82	0.5	2	15	18	1.3
HR-16	142.2	6.2	1.3	2	15	18	1.3
HR-20	227.4	6.63	1.7	2	18	18	1.3
HR-21	231.2	6.97	1.8	2	18	18	1.3
HR-22	42.6	3.14	0.5	1.5	12	12	1.5

HR-7 Culvert

This is the design for the culvert HR-7 that passes under the haul road the jumob dome area

Bandon Coleman

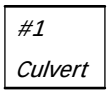
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	246.300	246.300	7.75	1.84

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	2.00	0.00	0.90

Culvert Results:

Design Discharge = 7.75 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	226.300	0.307	0.000	0.000	75.000	M	6.43	1.525
	2	15.700	0.067	0.032	0.412	75.000	M	1.30	0.130
	3	4.300	0.065		0.000	90.000	F	3.56	0.189
	Σ	**246.300**						**7.75**	**1.844**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	14.38	850.00	5,910.00	5.680	0.289
#1	**1**	**Time of Concentration:**					**0.307**
#1	2	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	27.17	375.00	1,380.00	7.810	0.049
#1	**2**	**Time of Concentration:**					**0.067**
#1	3	8. Large gullies, diversions, and low flowing streams	7.00	131.60	1,880.00	7.930	0.065
#1	**3**	**Time of Concentration:**					**0.065**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	64.05	915.00	7.930	0.032
#1	**2**	**Muskingum K:**					**0.032**

HR-9 Culvert

This is the design for the culvert HR-9 that passes under the haul road the jumob dome area

Bandon Coleman

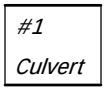
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	42.900	42.900	5.94	0.50

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	2.00	0.00	0.90

Culvert Results:

Design Discharge = 5.94 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	28.600	0.072	0.000	0.000	75.000	M	2.37	0.237
	2	10.200	0.041	0.029	0.412	75.000	M	0.84	0.085
	3	4.100	0.062	0.000	0.000	90.000	F	3.39	0.180
	Σ	**42.900**						**5.94**	**0.501**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	27.51	425.00	1,545.00	7.860	0.054
#1	**1**	**Time of Concentration:**					**0.072**
#1	2	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	37.97	300.00	790.00	9.240	0.023
#1	**2**	**Time of Concentration:**					**0.041**
#1	3	8. Large gullies, diversions, and low flowing streams	7.00	124.60	1,780.00	7.930	0.062
#1	**3**	**Time of Concentration:**					**0.062**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	59.57	851.00	7.930	0.029
#1	**2**	**Muskingum K:**					**0.029**

HR-11 Culvert

This is the design for the culvert HR-11 that passes under the haul road the jumob dome area

Bandon Coleman

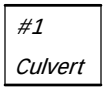
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	79.300	79.300	2.75	0.59

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	1.50	0.00	0.90

Culvert Results:

Design Discharge = 2.75 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	77.900	0.170	0.000	0.000	75.000	M	2.44	0.533
	2	1.400	0.021	0.000	0.000	90.000	F	1.16	0.061
	Σ	**79.300**						**2.75**	**0.594**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	16.99	575.00	3,385.00	6.180	0.152
#1	**1**	**Time of Concentration:**					**0.170**
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	43.40	620.00	7.930	0.021
#1	**2**	**Time of Concentration:**					**0.021**

HR-12 Culvert

This is the design for the culvert HR-12 that passes under the haul road the jumob dome area

Bandon Coleman

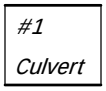
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	70.000	70.000	4.62	0.68

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	1.50	0.00	0.90

Culvert Results:

Design Discharge = 4.62 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	46.000	0.126	0.000	0.000	75.000	M	1.45	0.315
	2	12.600	0.077	0.038	0.412	75.000	M	1.04	0.104
	3	6.600	0.045	0.058	0.412	75.000	M	0.55	0.055
	4	4.800	0.073	0.000	0.000	90.000	F	3.97	0.211
	Σ	**70.000**						**4.62**	**0.685**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	20.68	550.00	2,660.00	6.820	0.108
#1	**1**	**Time of Concentration:**					**0.126**
#1	2	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	22.88	350.00	1,530.00	7.170	0.059
#1	**2**	**Time of Concentration:**					**0.077**
#1	3	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	26.49	200.00	755.00	7.720	0.027
#1	**3**	**Time of Concentration:**					**0.045**
#1	4	8. Large gullies, diversions, and low flowing streams	7.00	147.00	2,100.00	7.930	0.073
#1	**4**	**Time of Concentration:**					**0.073**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	76.23	1,089.00	7.930	0.038
#1	**2**	**Muskingum K:**					**0.038**
#1	3	8. Large gullies, diversions, and low flowing streams	7.00	116.90	1,670.00	7.930	0.058
#1	**3**	**Muskingum K:**					**0.058**

HR-15 Culvert

This is the design for the culvert HR-15 that passes under the haul road the jumob dome area

Bandon Coleman

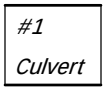
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	42.400	42.400	5.82	0.50

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	2.00	0.00	0.90

Culvert Results:

Design Discharge = 5.82 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	33.400	0.091	0.000	0.000	75.000	M	2.77	0.277
	2	4.700	0.028	0.054	0.412	75.000	M	0.39	0.039
	3	4.300	0.065		0.000	90.000	F	3.56	0.189
	Σ	**42.400**						**5.82**	**0.504**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	15.87	250.00	1,575.00	5.970	0.073
#1	**1**	**Time of Concentration:**					**0.091**
#1	2	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	46.05	175.00	380.00	10.170	0.010
#1	**2**	**Time of Concentration:**					**0.028**
#1	3	8. Large gullies, diversions, and low flowing streams	7.00	130.89	1,870.00	7.930	0.065
#1	**3**	**Time of Concentration:**					**0.065**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	108.36	1,548.00	7.930	0.054
#1	**2**	**Muskingum K:**					**0.054**

HR-16 Culvert

This is the design for the culvert HR-16 that passes under the haul road the jumob dome area

Bandon Coleman

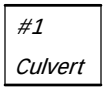
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	142.200	142.200	6.20	1.29

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	2.00	0.00	0.90

Culvert Results:

Design Discharge = 6.20 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	109.100	0.146	0.000	0.000	75.000	M	3.44	0.747
	2	17.600	0.070	0.068	0.412	75.000	M	1.46	0.146
	3	4.000	0.041	0.078	0.412	75.000	M	0.33	0.033
	4	4.000	0.047	0.092	0.412	75.000	M	0.33	0.033
	5	7.500	0.114		0.000	90.000	F	6.20	0.329
	Σ	**142.200**						**6.20**	**1.288**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	15.57	425.00	2,730.00	5.910	0.128
#1	**1**	**Time of Concentration:**					**0.146**
#1	2	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	15.56	175.00	1,125.00	5.910	0.052
#1	**2**	**Time of Concentration:**					**0.070**
#1	3	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	15.00	75.00	499.99	5.800	0.023
#1	**3**	**Time of Concentration:**					**0.041**
#1	4	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	10.00	50.00	500.00	4.740	0.029
#1	**4**	**Time of Concentration:**					**0.047**
#1	5	8. Large gullies, diversions, and low flowing streams	7.00	229.60	3,280.00	7.930	0.114
#1	**5**	**Time of Concentration:**					**0.114**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	137.27	1,961.00	7.930	0.068
#1	**2**	**Muskingum K:**					**0.068**
#1	3	8. Large gullies, diversions, and low flowing streams	7.00	156.59	2,237.00	7.930	0.078
#1	**3**	**Muskingum K:**					**0.078**
#1	4	8. Large gullies, diversions, and low flowing streams	7.00	185.78	2,654.00	7.930	0.092
#1	**4**	**Muskingum K:**					**0.092**

HR-20 Culvert

This is the design for the culvert HR-20 that passes under the haul road the jumob dome area

Bandon Coleman

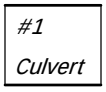
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	227.400	227.400	6.63	1.68

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	2.00	0.00	0.90

Culvert Results:

Design Discharge = 6.63 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	223.400	0.408	0.000	0.000	75.000	M	6.11	1.504
	2	4.000	0.061		0.000	90.000	F	3.31	0.175
	Σ	**227.400**						**6.63**	**1.680**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	6.19	325.00	5,250.06	3.730	0.390
#1	**1**	**Time of Concentration:**					**0.408**
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	122.50	1,750.00	7.930	0.061
#1	**2**	**Time of Concentration:**					**0.061**

HR-21 Culvert

This is the design for the culvert HR-21 that passes under the haul road the jumob dome area

Bandon Coleman

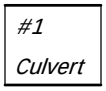
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	231.200	231.200	6.97	1.72

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	2.00	0.00	0.90

Culvert Results:

Design Discharge = 6.97 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	226.900	0.347	0.000	0.000	75.000	M	6.35	1.530
	2	4.300	0.066		0.000	90.000	F	3.56	0.189
	Σ	**231.200**						**6.97**	**1.719**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	7.64	375.00	4,910.00	4.140	0.329
#1	**1**	**Time of Concentration:**					**0.347**
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	132.30	1,890.00	7.930	0.066
#1	**2**	**Time of Concentration:**					**0.066**

HR-22 Culvert

This is the design for the culvert HR-22 that passes under the haul road the jumob dome area

Bandon Coleman

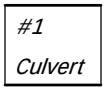
General Information

Storm Information:

Storm Type:	NRCS Type I
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haul Road Culvert



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	42.600	42.600	3.14	0.43

Structure Detail:

Structure #1 (Culvert)

Haul Road Culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.00	0.0150	1.50	0.00	0.90

Culvert Results:

Design Discharge = 3.14 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	38.800	0.147	0.000	0.000	75.000	M	1.22	0.266
	2	3.800	0.058	0.000	0.000	90.000	F	3.14	0.167
	Σ	**42.600**						**3.14**	**0.432**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	33.33	100.00	300.00	4.610	0.018
		6. Grassed waterway	8.58	175.00	2,040.00	4.390	0.129
#1	**1**	**Time of Concentration:**					**0.147**
#1	2	8. Large gullies, diversions, and low flowing streams	7.00	116.20	1,660.00	7.930	0.058
#1	**2**	**Time of Concentration:**					**0.058**

APPENDIX D9-3
TECHNICAL MEMORANDUM
JDRC CHANNEL DESIGN

MWH

BUILDING A BETTER WORLD

TECHNICAL MEMORANDUM

TO: *Tammy Scholten PE*
Senior Environmental Engineer
Usibelli Coal Mine, Inc

DATE: *August 2013*

FROM: *Thomas Leidich PE, MWH*

REFERENCE: *1009161*

SUBJECT: *JDHR Channel Designs*

MWH was retained by Usibelli Coal Mine to design the road side channels for the Jumbo Dome Haul Road Corridor (JDHR). Peak flows for the 10-year, 6 hour event between culverts were calculated as part of the culvert design package previously submitted. These flows ranged between 2 cfs to 8 cfs. For simplicity, MWH has designed a typical road side channel assuming a peak flow of 8 cfs. In addition, MWH has also designed a typical channel for any steep section that is required to divert runoff to the culvert inlets.

Methodology

Both the typical road side ditch and the typical steep section channel were designed to pass the peak discharge from the 10-year, 6-hour event while maintaining a minimum of 1 foot of freeboard. The typical roadside ditch is designed as a triangular shaped channel with a side slopes of 3H:1V on one side and 20H:1V on the other. In addition, MWH assumed the channel will be lined with road base made up of coarse gravel with a limiting velocity of 5 fps. As an extra measure, MWH recommends you add check dams were needed to help control sediment runoff. The typical steep section channel will be a riprap channel with a 2 foot bottom width and 3H:1V side slopes.

The ditches were designed using manning's equation for open channel flows. Riprap sizing for the steep channel was based on Robinson's Design of Rock Chutes from the American Society of Agricultural and Biological Engineers. The depth of the typical road side channel was based on a minimum grade of 1% and the maximum velocity was based on a maximum slope of 10%. The depth of the typical steep section channel was based on a minimum grade of 11% and the riprap requirement was based on a maximum slope of 50%.

Results

The channel inputs and results are shown in Attachment 1, JDHR Channel Runs. The results are summarized in Table 1.

Table 1- JDHR Channels

Channel	Flow	Slope	Bottom Width	Flow Depth	Channel Depth	Velocity	Riprap size
	(cfs)	(%)	(ft)	(ft)	(ft)	(H:1V)	(in)
Road Side	8	1 to 10	NA	0.6	1.6	4.5	Road Base
Steep Section	8	11- 50	2	0.6	1.6	7.2	12

Attachments: Attachment A: SEDCAD Results

Attachment A:
Channel Runs

Road Side Channel Report

Label	Discharge (ft^3/s)	Channel Slope (ft/ft)	Roughness Coefficient	Left Side Slope (ft/ft (H:V))	Right Side Slope (ft/ft (H:V))	Normal Depth (ft)	Velocity (ft/s)	Froude Number
Road Side 1%	8.00	0.01000	0.035	3.00	20.00	0.60	1.90	0.61
Road Side 10%	8.00	0.10000	0.035	3.00	20.00	0.39	4.51	1.79

Steep Section Channel Report

Label	Discharge (ft^3/s)	Channel Slope (ft/ft)	Bottom Width (ft)	Roughness Coefficient	Left Side Slope (ft/ft (H:V))	Right Side Slope (ft/ft (H:V))	Normal Depth (ft)	Velocity (ft/s)	Froude Number
Steep Section 11%	8.00	0.11000	2.00	0.060	3.00	3.00	0.54	4.14	1.20
Steep Section 50%	8.00	0.50000	2.00	0.060	3.00	3.00	0.36	7.15	2.43

RIPRAP DESIGN - ROBINSON METHOD

DATE: July 1, 2013
PROJECT: Usibelli Runaway Creek Channel Design
OBJECTIVE: Riprap sizing for downdrains at Runaway Ridge
CALCULATIONS BY: Brandon Coleman, T Leidich

INPUT PARAMETERS								RIPRAP SIZING - ROBINSON METHODOLOGY							
Channel ID	Channel Slope (ft/ft)	Bottom Width (ft)	Side Slope "z"H:1V (ft)	Storm Event	Design Flow (cfs)	Recommended Riprap (in)	Factor Of Safety	Calculated D50 (in)	Unit Discharge (cfs/ft)	Estimated Manning's n	Porosity	Vm	qm	qs	Depth of Flow
JDHR Channels	0.500	2	3	10yr-6hr	8.0	12	1.2	11.20	4.0	0.061	0.46	0.92	1.85	2.15	0.2859

1.2 Factor of Safety for unknowns in methodology

Assumptions:
1. Rock is angular in shape
2. The coefficent of uniformity of the rock is 1.25-1.73
3. The specific gravity of the stone ranges must from 2.54 to 2.82 or the safety factor must be adjusted to account for the specific gravity of the stone

APPENDIX D9-4
TECHNICAL MEMORANDUM
JDRC ROCK DRAINS

MWH

BUILDING A BETTER WORLD

TECHNICAL MEMORANDUM

TO:	*Tammy Scholten, Usibelli Coal Inc.*	DATE:	*January 20, 2014*
FROM:	*Brandon Coleman, MWH*	REFERENCE:	*1009161*
SUBJECT:	*Jumbo Dome Haul Road*		

Usibelli Coal Inc. requested the MWH estimate the flow capacity through the rock drains and 8" HDPE pipe constructed beneath the Jumbo Dome Haul Road. Locations of the drains, slopes and lengths were provided by Usibelli Coal Inc.

The rock drains were assumed to be constructed of 3-inch to 6-inch round rock material wrapped in geotextile fabric. The drains width and height were assumed to be 40-inches and 36-inches, respectively. The rock drains flow capacity was based on Leps equation for calculating average flow velocity through voids (USACE 1993).

$$v = W\, M^{0.5}\, i^{0.54}$$

Where,

v= seepage velocity, inch per second
W= constant, varies from 33 to 46, $in^{1/2}$ per second
M = hydraulic mean radius of the rock voids, in
i = hydraulic gradient

An 8-inch HDPE pipe was installed above each drain for additional flow capacity. It was assumed that the pipe was installed at the same slope as the corresponding rock drain. The full flow capacity of each pipe was calculated assuming 1 foot (ft) of head above the pipe.

The combined flow capacity of the rock drains and 8-inch HDPE pipe at the Jumbo Dome Haul Road crossings is summarized in **Table 1**.

Table 1. Jumbo Dome Haul Road Rock Drain and Pipe Flow Capacity

Crossing ID	Length (ft)	Elevation 1 (ft)	Elevation 2 (ft)	Slope (%)	Drain Flow (cfs)	Pipe Flow (cfs)	Combined Flow (cfs)
HR-7	1999	1948.8	1679.5	13.5	3.23	4.65	7.87
HR-9	536	2053.9	1881.9	32.1	5.16	6.99	12.15
HR-11	462	2117.4	2053.3	13.9	3.28	4.61	7.89
HR-12	643	2193.6	2097.5	14.9	3.41	4.82	8.23

Crossing ID	Length (ft)	Elevation 1 (ft)	Elevation 2 (ft)	Slope (%)	Drain Flow (cfs)	Pipe Flow (cfs)	Combined Flow (cfs)
HR-15	367	2428.6	2379.5	13.4	3.22	4.50	7.71
HR-16	421	2501.8	2473.5	6.7	2.22	3.25	5.46

References

U.S. Army Corps of Engineers. EM 1110-2-1901 Seepage Analysis and Control for Dams. April 1993.

Attachments: Attachment A: Calculations

cc: Thomas Leidich, MWH

Attachment A:
Calculations

Crossing ID	Length (ft)	Elevation 1 (ft)	Elevation 2 (ft)	Slope (%)	Drain Flow (cfs)	Pipe Flow (cfs)	Combined Flow (cfs)
HR-7	1999	1948.8	1679.5	13.5	4.50	4.65	9.15
HR-9	536	2053.9	1881.9	32.1	7.19	6.99	14.18
HR-11	462	2117.4	2053.3	13.9	4.57	4.61	9.18
HR-12	643	2193.6	2097.5	14.9	4.76	4.82	9.58
HR-15	367	2428.6	2379.5	13.4	4.48	4.50	8.98
HR-16	421	2501.8	2473.5	6.7	3.09	3.25	6.34

1. Pipe flow assumes full flow capacity and the pipe acts as a pressure conduit.
2. Pipe flow assumes 1 ft. of head above the top of the pipe.

Burrito Drain Properties		
Width	40	in
Height	36	in
Area	10	ft^2
D_{50} Rock Size	6	in
Porosity	0.4	

Burrito Drain Hydraulics

$$V_V = W\, m^{0.5}\, i^{0.54}$$

W=	46	in-sec
m=	0.75	in
i=	0.067	ft/ft
V_v =	0.77260864	ft/sec

*Equation developed by Leps 1973 for average velocity through voids
*Assumes less than 30% minus 1-inch particles, and preferably less than 10%
W = an empirical constant C for the rockfill material. (According to Wilknins W varies from 33 to 46 for polished marbles.), in-second
m = hydraulic mean radius of the rock voids, in.
i = hydraulic gradient, ft/ft

$$Q = A\, V_v\, n$$

A= cross-sectional area of drain, ft^2
n = drain porosity
V_v = velocity caclulated above, ft/sec

A =	10	ft^2
n =	0.4	
V_v =	0.773	ft/sec
Q =	**3.09**	**cfs**

$$v = \sqrt{\frac{H}{\frac{1+k_e}{2g} + \frac{n^2 L}{2.21\, R^{4/3}}}}$$

Pipe ID	Pipe Diameter (inner) (in)	Area (ft^2)	Perimeter (ft)	Slope (%)	Length (ft)	Available Head above Pipe (ft)	Velocity (ft/s)	Q (cfs)
HR-7	7.92	0.34	2.07	0.135	1999	1	13.58	4.65
HR-9	7.92	0.34	2.07	0.321	536	1	20.45	6.99
HR-11	7.92	0.34	2.07	0.139	462	1	13.48	4.61
HR-12	7.92	0.34	2.07	0.149	643	1	14.09	4.82
HR-15	7.92	0.34	2.07	0.134	367	1	13.15	4.50
HR-16	7.92	0.34	2.07	0.067	421	1	9.49	3.25

1. Assume a 8" HDPE smooth wall pipe with I.D. 7.92".
2. Manning's "n" = 0.012 per HY-8.
3. Minor entrance loss coefficent =0.9 for projecting, square edge
4. Pipe is flowing full and acting as a pressure conduit

APPENDIX D9-5
TECHNICAL MEMORANDUM
JDRC Culvert Map

Sec.31
Sec.30
Sec.19
Sec.18
Sec.7
Sec.6
Sec.31
Sec.32
Sec.29
Sec.20
Sec.17
Sec.8
Sec.5
Sec.32
Sec.33
Sec.28
Sec.21
Sec.16
Sec.9
Sec.4
Sec.33
Sec.34
Sec.27
Sec.22

HR-1
HR-2
HR-3
HR-4
HR-5
HR-6
HR-7
HR-8
HR-9
HR-10
HR-11
HR-12
HR-13
HR-14
HR-15
HR-16
HR-17
HR-18
HR-19
HR-20
HR-21

Rock Drain
Rock Drain No. 1
Rock Drain No. 2
Rock Drain No. 3
Rock Drain No. 4
Rock Drain No. 5

JDRC PERMIT BOUNDARY
HAUL ROAD LOCATION
SECOND WETLANDS CROSSING
FIRST WETLANDS CROSSING
MARGUERITE CREEK CROSSING
JDRC PERMIT BOUNDARY
JUMBO DOME MINE PERMIT BOUNDARY
COAL REMOVAL LIMITS

Jumbo Dome Mine Permit Road
Marguerite Creek

LEGEND

- ORIGINAL TOPOGRAPHY
- COAL REMOVAL LIMITS
- NATURAL DRAINAGE
- TRAIL
- HAUL ROAD CENTERLINE (APPROXIMATE AS BUILT)
- CULVERTS
- WATERSHEDS
- ROCK DRAINS
- JDRC PERMIT BOUNDARY
- JDM PERMIT BOUNDARY

NOTES:

1. HORIZONTAL DATUM IS BASED ON ALASKA STATE PLANE COORDINATES, ZONE-4, NAD 27, AS EXPRESSED IN U.S. SURVEY FEET.
2. VERTICAL DATUM IS BASED ON MEAN SEA LEVEL.

SCALE: 1"= 1000'
1000' 0 1000' 2000'
CONTOUR INTERVAL= 25'

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
1	11/16	RCS	Added Rock Drains, Permit Boundaries, and Updated Culverts

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
XREF DWG FILE:

USIBELLI COAL MINE INC.

HAUL ROAD JDRC CULVERT WORKING DRAWING

JUMBO DOME ROAD CORRIDOR

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743

PLATE No. D9-5
SHEET No. 1 OF 1

REV. 1

LEGEND
JUMBO DOME ROAD CORRIDOR (JDRC) PERMIT BOUNDARY
APPROXIMATE EXISTING CONTOUR AND ELEVATION, FT
JDRC CENTERLINE
JDRC BREAKLINE
TOPSOIL STOCKPILE (BRUSH BARRIERS NOT SHOWN)
EXISTING STREAM
BMP -Waddle
BMP -Straw Bale
BMP -Sed Fence
BMP -Veg Berm

Sec.7
Sec.8
Sec.18
Sec.17
Sec.19
Sec.20
2

245+00
230+00
215+00
205+00
MARGUERITE CREEK CROSSING
DESCENT TO MARGUERITE CREEK
North Wetlands
South Wetlands
09SW 11A&B
09SW 12A
09SW 12B
BRUSH BARRIER, WADDLE CHECK DAMS, AND SILT FENCE
BRUSH BARRIER (TOPSOIL) ALONG EDGES OF ACCESS TRAIL
CUT 13
CUT 12
CUT 11
CUT 10
CUT 9
CUT 8
CUT 7
CUT 6
WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS
BRUSH BARRIER (TOPSOIL) ALONG TOE OF OUTSLOPE
WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS
BRUSH BARRIER (TOPSOIL) ALONG LENGTH OF ACCESS E
WADDLE AND STRAW BALE CHECK DAMS AND SILT FENCE AT ROCK DRAIN INLETS

USIBELLI COAL MINE INC.
UCM
P.O. Box 1000, Healy, Alaska 99743

Jumbo Dome Road Corridor

SWPP Working map

Date: December 9, 2016 Update
Scale: 1" = 400'
By: JK
Rev:RCS 12-09-2016

SECTION 10.0

RECLAMATION PLAN

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

EXHIBITS

10.0 RECLAMATION PLAN

10.1 GENERAL RECLAMATION PLAN

Reclamation of construction related disturbance will occur as an integral part of ongoing construction operations. Reclamation of disturbance areas will focus on establishment of a stable self-sustaining vegetation community consistent with the proposed post-mining land use. The reclamation plan as outlined in the following sections will be implemented for all disturbance areas within the Jumbo Dome Road Corridor area permit boundary. At the end of the life of the road the surface will be scarified and seeded and temporary culverts, if any, will be removed.

The reclamation activities, practices, and considerations which will be implemented for construction disturbance areas within the JDRC permit area, are described in the following sections:

- Post Construction Land Use
- Reclamation Plan
- Reclamation Timetable
- Reclamation Costs

10.2 POSTCONSTRUCTION LAND USE

Consistent with the pre-mining land use and the prevailing use of surrounding undeveloped lands, UCM proposes to reclaim road embankments initially and in the future and the road surface to the primary post-mining land use of wildlife habitat. Public recreation will be a related secondary land use. These proposed primary and secondary post-mining uses are consistent with the Tanana Basin Area Plan for State Lands.

10.3 RECLAMATION PLAN

The reclamation plan for the haul road consists of three types of reclamation efforts; temporary slope stabilization, final slope stabilization and final reclamation. Temporary slope stabilization will consist of aerial, mechanical, or hydroseeding using Seed Mix 2, Table D10-2, as a BMP for

erosion control for road embankment fill slopes during construction. The objective of temporary stabilization is to quickly develop vegetation cover for erosion control.

Final slope stabilization will occur once final road construction has been completed. Final stabilization will consist of placement of topsoil (See Section D-3, Topsoil Handling), where practicable, and aerial, mechanical, or hydroseeding with Seed Mix 1, Table D10-1. The seed mixture will include a mixture of native and adapted introduced plant species. Topsoil will be fertilized at the time of the first year of seeding. Additional fertilizer may be placed on a limited basis following seeding to encourage initial establishment of grass growth. Fertilizer application will be at a rate of 450 pounds of 20-20-10 fertilizer per acre. Adjustments will be made to the fertilizer schedule based on annual monitoring. No surface preparation of topsoil will be necessary prior to seeding since topsoil will be left in a roughened condition following placement.

Usibelli may use Seed Mix 3, Table D10-3 for final stabilization in areas where the vegetation growth is not meeting the expected goals. Seeding efforts will occur between May 15 and August 15 on an as-needed basis. Seed application rate will be approximately 43 pounds per acre.

TABLE D10-1 REVEGETATION SEED MIX 1

Common Name	***Percent of Seed Mix***
'Arctared' and/ or 'Boreal' Red Fescue	25
'Nortran' Tufted Hairgrass	18
'Wainwright' Slender Wheatgrass	20
Kentucky Bluegrass	5
American Sloughgrass	2
Polar (Manchar) Brome	10
Annual Ryegrass	10
'Tobin' Rapeseed	5
*'Peace', 'Rangelander' and/or 'Ranger' Alfalfa**	5
Total	*100%*

TABLE D10-2 REVEGETATION SEED MIX 2

Common Name	***Percent of Seed Mix***
'Boreal Red Fescue'	*45%*
'Annual Rye'	*45%*
'Tobin Rapeseed	*5%*
'Peace', 'Rangelander' and/or 'Ranger' Alfalfa	*5%*
Total	*100%*

TABLE D10-3 REVEGETATION SEED MIX 3

Common Name	***Percent of Seed Mix***
'Wainwright' Slender Wheatgrass	*30%*
'Nortran' Tufted Hairgrass	*25%*
'Arctared' Fescue	*15%*
'Boreal' Red Fescue	*10%*
Annual Ryegrass	*10%*
Manchar Brome	10%
Total	***100%***

In addition, if needed, a variety of woody plant species native to the area will be planted. However, it is likely that natural reinvasion of woody species will occur. The objective of final stabilization is to re-establish native vegetation through natural recolonization of native plants. If needed, a variety of native woody plant species including felt-leaf willow (*Salix alaxensis),* alder (*Alnus* spp.), and white spruce (*Picea glauca)* may be transplanted in reclamation areas. Transplanting activities will be

scheduled for June through August in order to take advantage of warmer conditions and increased soil moisture levels. Planting materials will include bare-root stock and cutting transplants or seed dispersion with ongoing evaluation of success rates for the various types of planting stock. Woody transplants will be established in clumps distributed over the reclaimed area to encourage effective propagation and provide an initial vegetative culture to support future natural seeding and reinvasion. Plantings will vary in shape and location to take advantage of favorable slope and aspect conditions including wet areas, water drainage embankments for willow and cottonwood and drier areas for birch and spruce where feasible.

Final reclamation will occur once mining operations have ceased and the road is reclaimed to the post-mining land use. Final reclamation will consist of removing any remaining facilities, scarifying the road surface and aerial or hydroseeding with Seed Mix 1.

10.4 RECLAMATION TIMETABLE

As previously noted in Section 10.1, reclamation will occur as an integral part of ongoing construction operations. Temporary slope stabilization will occur each growing season until final road embankment construction is completed. Final slope stabilization will occur during the first growing season once the final road embankment construction is completed. Topsoil will be placed where practicable, as per Section D-3, Topsoil Handling, and the area will be seeded using either aerial or hydroseeding with Seed Mix 1.

Final reclamation of the road corridor will occur after mining has concluded at Jumbo Dome Mine. Final reclamation will include removal of any remaining facilities, scarifying the surface of the road and revegetation of the road with Seed Mix 1 by aerial or hydroseeding.

10.5 RECLAMATION COSTS

The cost of reclaiming construction disturbances over the second 5 year term will be constantly decreasing as construction of the road nears completion. Therefore, UCM proposes to post the reclamation bond in one stage that reflects the maximum reclamation cost liability expected to accrue through year 10.

BOND ADJUSTMENT FOR GRAVEL SOURCE DISTURANCE

UCM has adjusted the Full Bond Calculation to reflect the reclamation of the additional 2.0 acre of disturbance for the gravel source area.

Table D10-4 provides a breakdown of the reclamation cost estimate and includes direct, indirect, and subcontractor cost. The detail bond calculations can be found in Appendix D10-1. It is proposed the bond be released one phase, after removal of facilities and reclamation of the road surface.

Table D10-4 Summary of Jumbo Dome Road Corridor 2018 Reclamation Bond Costs

Direct Cost Items			
Earthmoving/Drain Construction		$	232,399
Revegetation (seed bed prep)		$	9,300
Aerial Seeding & Fertilizing		$	86,490
Facility Removal		$	-
Subtotal Direct Costs		**$**	**328,189**
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	4.0	$	13,128
Contingency Allowance	5.0	$	16,409
Engineering Redesign Fee	4.0	$	13,128
Contracor Profit & Overhead	15.0	$	49,228
Reclamation Management Fee	4.0	$	13,128
Subtotal Indirect Costs		**$**	**105,021**
Grand Totals		**$**	**433,210**

APPENDIX D10-1
RECLAMATION BOND CALCULATION

Summary of Jumbo Dome Road Coriddor 2018 Reclamation Bond Costs

Direct Cost Items			
Earthmoving/Drain Construction		$	232,399
Revegetation (seed bed prep)		$	9,300
Aerial Seeding & Fertilizing		$	86,490
Facility Removal		$	-
Subtotal Direct Costs		**$**	**328,189**
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	4.0	$	13,128
Contingency Allowance	5.0	$	16,409
Engineering Redesign Fee	4.0	$	13,128
Contracor Profit & Overhead	15.0	$	49,228
Reclamation Management Fee	4.0	$	13,128
Subtotal Indirect Costs		**$**	**105,021**
Grand Totals		**$**	**433,210**

Summary Calculation of Earthmoving Costs
Jumbo Dome Road Corridor

Task	Equipment	Operating Costs	Labor Costs	Unit Cost	Total Hours	Quantity BCY	Sub Total
Regrade	D10R Bulldozer	$311.00	$62.93		20	0	$7,479
Drill and Blast				$ 0.30		0	$0
Topsoil Respread				$1.75		75,827	$132,697
Roads	D8R Bulldozer	176.75	$62.93		384.78		$92,224
Drainage Construction	D8R Bulldozer	$176.75	$62.93		0		$0
	966 Loader	$106.19	$62.93		0		$0
	15 CY Truck	$117.28	$57.47		0		$0
	Riprap Screened			$8.00		0	$0
	Labor Tasks		$62.93		0		$0
	Geocloth			$1.75		0	$0
Pond Regrade	D10R Bulldozer	$311.00	$62.93		0	0	$0
Pond Drill and Blast				$ 0.30		0	$0
					TOTAL		**$232,399**

Equipment Costs (input by DNR)

Dataquest Guide

	Dataquest	AK factor	subtotal	Fuel (g/hr)	$/gal	$/hr	TOTAL
D10R Bulldozer (w/EROPS*)	$ 188.00	1.25	$ 235.00	20	3.8	$76.00	**$311.00**
D8R Bulldozer (w/EROPS)	$ 111.00	1.25	$ 138.75	10	3.8	$38.00	**$176.75**
966F Loader	$ 62.15	1.25	$ 77.69	7.5	3.8	$28.50	**$106.19**
15 cy Truck	$ 76.20	1.20	$ 91.44	6.8	3.8	$25.84	**$117.28**

Jumbo Dome Road Coriddor Drain Costs 2012

Cut Terrace Drain, Lay Geocloth, Screen and Haul and Spread Riprap

	Amount	Rate (units per hr)	Rip-Rap BCY	Cloth	Labor	D8N	Loader	Truck
Cut Drain	0 LF	125				0		
Lay Cloth	Assume coverage of 2 sq. yd. Per ft of ditch							
	0 LF	325		0 sq. yd.	0			
Rip-Rap	Assume an average coverage rate of 0.75 BCY per LF ditch							
	0 LF	30	0			0	0	0
	**See UCM Backup Calculation for Riprap Support production cost of $8 per BCY							
	***See Morrison-Knudsen Riprap Caluclation (Backup Data)							
	Haul 3720 CY of Riprap With 15 CY Truck							
	Assume a Production Rate of 30 CY/Hr. with 966 Loader and 15 CY truck							
	Spread Riprap With D8N Dozer Hours							
Totals			**0**	**0 sq. yd.**	**0**	**0**	**0**	**0**

Drainage subcalcs (back-calculate to find 2002 assumptions)

Given:

LF Ditch	8200
D8 Hrs	238
BCY Rip-Rap	3720
LF Cloth	5,000
Loader Hours	124
Truck Hours	124

Calculated Assumptions:	**2002**	**Use in 2004**
Dozer rate (LF/Hr)	34.5	125.0
Rip-Rap Req'd (BCY/ft)	0.5	0.75
Loader/Truck/Spread Rate (BCY/Hr)	30.0	30.0
Geocloth (Sq. Yd. per LF ditch)	0.6	2

Jumbo Dome Road Corridor Revegetation Costs		
Total Disturbed Area (Acres)		155
Subcontract Costs		
Aerial Seeding & Fertilizing	$558 /acre	$86,490
Aerial Seeding Rate	$202/Acre	
Seed cost	$314/Acre	
fertilizer cost	$42/Acre	
Direct Cost		
Seedbed Preparation	$60 /acre	$9,300
Total Costs		$95,790

Facilities to be removed			
Full tank Removal			$0
Total Cost			$0

Jumbo Dome Road Corridor Regrade Volumetrics

Task	Area	Length	Regrade Volume	Push Distance	Grade (%)	Rate Calculation: Base Rate	Material Weight	Operator	Material Factor	Slot Dozing	Visibility	Work Hour	Grade	Equipment	Net Rate	Hours
Pit Regrade																
Spoil																
Highwall																
Blast Cast (30%)																
Subtotal			*0*													
Gravel Area Regrade																20
Total			**0**											D10R-SU		**20**
Pond Regrade																
			0	100	0	1800	0.81	0.75	1.2	1.05	1	0.83	1	D10R-SU	1145	0
			0	400	0	500	0.81	0.75	1.2	1.05	1	0.83	1	D10R-SU	318	0
			0	350	0	600	0.81	0.75	1.2	1.05	1	0.83	1	D10R-SU	382	0
Total			0													**0**

Topsoil Redistribution	Area (ac)	Depth (ft)	Quantity (BCY)	Drainage Length	Equipment	Acres
Road Surface	44	0.5	35,493		Truck/Loader/Dozer	
Laydown and topsoil stockpile	7.9	0.5	6,373			
Gravel Source	42.1	0.5	33,961			
Subtotal	*94*		***75,827***			

Drain Construction **See Drain Cost Sheet for details**

2693460 sq ft
61.83333 acres

-

	Length	Production ft/hr	Hours		
Roads (Rip and Regrade)	**38478**	**100**	384.78		D8H
Haul Road	28250				
Gravel Source	10228				

Furrow-Seed-Fertilize		94

Exhibit D10-2

2017 and Seed Trial for Reclamation, UCM

Notes:

1. Other suitable varieties of the same species may be substituted if available.
2. Some of the listed species/varieties may not be commercially available at the present time, but could be used if they become available in future.

Common Name	Variety(ies)	Scientific Name	Type	Max % (by wt)
Red Fescue	Arctared, Boreal	*Festuca rubra*	Native grass	30
Tufted Hairgrass	Nortran	*Deschampsia cespitosa*	Native grass	20
Bering Hairgrass	Norcoast	*Deschampsia beringensis*	Native grass	10
Slender Wheatgrass	Wainwright	*Elymus trachycaulis*	Native grass	30
Alpine Bluegrass	Gruening	*Poa alpina*	Native grass	10
Glaucous Bluegrass	Tundra, Nome	*Poa glauca*	Native grass	20
Kentucky Bluegrass	Nugget, Park	*Poa pratensis*	Native grass	10
Polargrass	Alyeska, Kenai	*Arctagrostis latifolia*	Native grass	10
American Sloughgrass	Egan	*Beckmannia syzigachne*	Native grass	5
Brome	Polar	Bromus inermis x pumpellianus	Native/non-native grass hybrid (cultivar)	10
Annual Ryegrass		*Lolium multiflorum*	Non-native grass	20
Rapeseed	Tobin, Essex	*Brassica napus*	Forb	5
Alfalfa	Peace, Rangelander, Ranger	*Medicago sativa* ssp. *sativa*	Forb (N fixer)	5
Tilesius' Wormwood	Caiggluk	*Artemisia tilesii*	Forb	5
Alpine Sweetvetch	Paxson	*Hedysarum alpinum*	Forb (N fixer)	5

Memorandum

P.O. Box 80410
Fairbanks, AK 99708

TO: Rich Sivils, Reclamation Engineer, Usibelli Coal Mine (UCM)
FROM: Susan C. Bishop, Senior Scientist, ABR
SUBJECT: Reclamation Seed Mix 2017 Minor Revision
DATE: 30 May 2017

As we've discussed in our recent meeting and phone conversations, in recent years UCM has not been completely satisfied with the results of their reclamation seeding program. At your request, this memo provides some recommendations for revising the seed mix, along with some background information and justification for the suggested changes.

Prior to 2010, the seed mix used for long-term[1] reclamation at UCM included native and non-native grasses as well as two non-native forbs (broadleaf species); alfalfa (*Medicago sativa* ssp. *sativa*) and rapeseed (*Brassica napus*). This seed mix produced good results in terms of both initial growth and continued development of the plant community through successional processes.

Following review of the reclamation plan for the Jumbo Dome Mine by the Alaska Department of Natural Resources in 2010, the forbs and several non-native grasses were removed from the mix. The current mix includes only grasses; these are mostly cultivars of species native to the region, in addition to the non-native annual ryegrass (*Lolium multiflorum*). Since changing to this seed mix, initial plant establishment and growth success on reclamation areas has been lower than in previous years. Natural colonization by native species also appears more limited compared to, which is inhibiting the successional processes that lead to development of a diverse, self-sustaining plant community.

Several factors may be contributing to the decreased success of reclamation, including variation in site factors and growth media, as well as the changes to the seed mix since 2010. For any large-scale reclamation effort, both short-term and long-term success will be enhanced by using a diverse seed mix that includes species capable of establishing over a range of conditions. Ideally the mix should include some fast-growing forbs as well as several grasses adapted to a range of conditions, with no one species contributing more than 30% by weight. Based on past record of success, the recommended forbs are alfalfa and rapeseed. Both species are listed on the Non-Native Plant Species List provided by the Alaska Exotic Plants Information Clearinghouse (AKEPIC), but their invasiveness scores are relatively low. The risk that either alfalfa or rapeseed would persist for more than a few years or become established outside the seeded areas appears minimal (see details below):

[1] A different seed mix containing only 2 species is used for short-term erosion control. 50% Annual Rye/50% Boreal Red Fescue

Alfalfa

- Grows rapidly, provides cover in first year after seeding
- Contributes nitrogen to the soil; symbiotic bacteria associated with the roots convert atmospheric nitrogen to forms that can be used by plants
- Appears to have limited potential to establish outside seeded areas:
    - Invasiveness ranking is 59, indicating that the species is modestly invasive
    - This ranking reflects relatively high potential to survive, but low score for potential ecological impact
    - In most areas alfalfa is perennial, but in Alaska it typically does not survive over the winter
    - Alfalfa seeds are large and do not disperse easily
    - At UCM, no indication that alfalfa spread beyond areas where it was previously seeded, or survived more than a few years after seeding

Rapeseed

- Grows rapidly, provides cover in first year after seeding
- Widely grown as a "green manure" crop because it contributes litter with a high nitrogen:carbon ratio, which enriches the soil
- Yellow flowers provide a useful marker, so areas missed by aerial seeding can be reseeded
- Appears to have limited potential to establish outside seeded areas:
    - Invasiveness ranking is 47, indicating that the species is weakly invasive (Carlson et al. 2008)
    - Rapeseed fruits shatter when mature, so dispersal distance is limited
    - It is not likely to persist beyond 2–4 years where natural successional process are allowed to proceed (Crawley and Brown 1995)
    - At UCM, no indication that rapeseed spread beyond areas where it was previously seeded, or survived more than a few years after seeding

REFERENCES

Alaska Exotic Plants Information Clearinghouse (AKEPIC). Alaska Center for Conservation Science, University of Alaska Anchorage. http://accs.uaa.alaska.edu/invasive-species/non-native-plant-species-list

Carlson, M. L., I. V. Lapina, M. Shephard, J. S. Conn, R. Densmore, P. Spencer, J. Heys, J. Riley, and J. Nielsen. 2008. Invasiveness Ranking System for Non-Native Plants of Alaska. Publication R10-TP-143, Forest Service, Alaska Region, United States Department of Agriculture, Washington DC.

Crawley, M. and S. Brown. 1995. Seed limitation and the dynamics of feral oilseed reape on the M25 motorway. Proceedings: Biological Sciences. 259(1354): 49-54.

SECTION 11.0

FISH AND WILDLIFE PROTECTION PLAN

TABLE OF CONTENTS

Page

11.0 FISH AND WILDLIFE PROTECTION PLAN

11.1 INTRODUCTION

The Alaska Surface Coal Mining Program regulations require that each application include a plan to minimize or prevent disturbance and adverse impact to fish and wildlife resources (11 AAC 90.081). This plan addresses that requirement with emphasis on mitigation measures.

11.2 SUMMARY OF IMPORTANT RESOURCES

The vegetation and wildlife studies that have been conducted in the area (Part C, Chapters VIII and IX) indicate that the Jumbo Dome Mine Road Corridor area is typical of upland habitats in the vicinity, providing habitat for moose, bear, furbearers and songbirds. For the most part, wildlife abundance and habitat values are not exceptional. There is no critical wildlife habitat in the vicinity of the Jumbo Dome Mine Road Corridor project. Probably the most important wildlife species occurring in and near the permit area is moose. Moose are considered important because of their wide ranging distribution over the Tanana Basin, and their value as a subsistence and sport harvest species. There is also a residential and spawning population of arctic grayling and a residential population of slimy sculpin in Marguerite Creek.

11.3 GENERAL WILDLIFE PROTECTION STRATEGY

The value of strip-mined lands as wildlife habitat in the contiguous United States has been known for many years (Riley 1957). Characteristics of surface mined lands that are considered attributes of good wildlife habitat include topographic diversity, irregularity of vegetation and interspersion of micro habitats. These diversity features, which are also readily accessible in the undisturbed native habitats surrounding the proposed Jumbo Dome Mine Road Corridor project, greatly mediate any negative effects caused by mining disturbance. There are no threatened, endangered or other sensitive species known to occur in the proposed mine area so no special mitigation measures are deemed necessary.

The fact that animal populations are healthy and coal mining has been actively occurring in the general project area for over 75 years suggests that local wildlife populations have developed a successful coexistence strategy and are not greatly disturbed by mining activities. The goal of the Fish and Wildlife protection plan will be to introduce and encourage habitat diversity through a variety of management techniques which are discussed below. The reclamation plan will include the planting of trees and shrubs which will encourage greater use by a more diverse group of wildlife species.

Fish protection strategies as required by AS 16.05.841 will be met by designing crossings of Marguerite Creek to meet all requirements of Alaska Department of Fish and Games Guidelines. See Appendix D9-2: Marguerite Creek Culvert Design (This crossing is permitted under related ASMCRA permit S-0606 for the Jumbo Dome Mine. Additionally all blasting efforts will meet or exceed the Alaska Department of Fish and Games Blasting Standards for the Protection of Fish.

Bird protection strategies as required by The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and the Migratory Bird Treaty Act (16 U.S.C 703-712) will include practicable attempts to avoid "take" of protected birds and/or their nests. These efforts may include nest surveys and restricting vegetative clearing during migratory bird nesting periods. A preliminary eagle nest survey was conducted November of 2011 and no eagle nests were found within the project boundary but a golden eagle nest was found 0.5 miles outside of the boundary on Pop Nose and a follow up survey conducted in 2016 showed that it is still present. The United States Fish and Wildlife Service have recommended additional surveys within 5 miles of the project boundary in the spring of 2012. If take of an eagle is unavoidable, a permit will be obtained in accordance with 50 CFR Parts 13 and 22.

11.3.1 Sediment Control

Drainage and sediment controls for the proposed Jumbo Dome Mine Road Corridor project will be implemented to minimize the effects of the mining operation on the prevailing hydrologic balance by controlling disturbed area runoff. Drainage from undisturbed areas will be diverted away from areas of

disturbance to maintain the existing undisturbed drainage water quality. Drainage controls to collect and contain runoff from disturbed land within the project area will be implemented prior to any disturbance in an area.

11.3.2 Topographic Controls

The postmining topography depicted on Plate D1-1 will create differing micro climatic conditions conducive to vegetation and wildlife habitat diversity. This topographic landscape, combined with the revegetation program described in Section D10.0 will facilitate the reestablishment of diverse wildlife habitat types that are capable of supporting both game and non-game species.

11.3.3 No Toxic -Forming Materials in Ponds

UCM is exempt from the requirement in 11 AAC 90.423 (d)-2 regarding excluding wildlife from ponds which contain hazardous concentrations of toxic forming materials as a result of the operations because the sediment traps within the permit area are for water and sediment control only.

11.4 REFERENCES

Dames and Moore 1994. Northern intertie, revised macro-corridor study and project alternative study.

Riley, C. V. 1954. The utilization of reclaimed coal striplands for the production of wildlife. Trans. North Amer. Wildl. Conf. 19:324-337.

Woodward-Clyde Consultants 1979. Biological observations of two proposed power plant sites near Nenana and Healy, Alaska, Anchorage, Alaska.

Appendix D11-1
ABR Jumbo Dome Eagle Final Report June 2016

EAGLE NEST SURVEY OF JUMBO DOME MINE PERMIT AREAS 2 AND 3 NEAR HEALY, ALASKA, 25 JUNE 2016

FINAL REPORT

Prepared for
Usibelli Coal Mine, Inc.
Fairbanks, AK

By
Robert J. Ritchie and Julie Parrett
ABR, Inc.—Environmental Research & Services
P.O. Box 80410
Fairbanks, AK 99708

7 July 2016

INTRODUCTION

Usibelli Coal Mine, Inc., (Usibelli) is developing the Jumbo Dome prospect roughly 8 km (5 miles) from their coal mining operations along Lignite Creek. Bald (*Haliaeetus leucocephalus*) and Golden eagles (*Aquila chrysaetos*), protected by the Bald and Golden Eagle Protection Act, both are known to nest in the region (Roseneau and Springer 1991, Shook and Ritchie 2011, Ritchie and Shook 2012). Because suitable habitat and nests have been identified in the general area (Ritchie and Shook 2012), the USFWS recommended eagle nesting surveys within Permit Areas 2–5 and within a larger area extending 2.4 km (1.5 miles) from the boundaries of these permit areas. Usibelli contracted ABR to conduct these surveys within the area proposed for Permit Areas 2 and 3, expecting to survey Permit Areas 4 and 5 when these are closer to development. This report provides results of aerial surveys conducted on 25 June 2016 to satisfy these objectives.

STUDY AREA

The study area included all cliff and riparian forest stands within 1.5-mile buffer of Permit Areas 2 and 3 (Figure 1). A detailed description of this area can be found in Ritchie and Shook (2012).

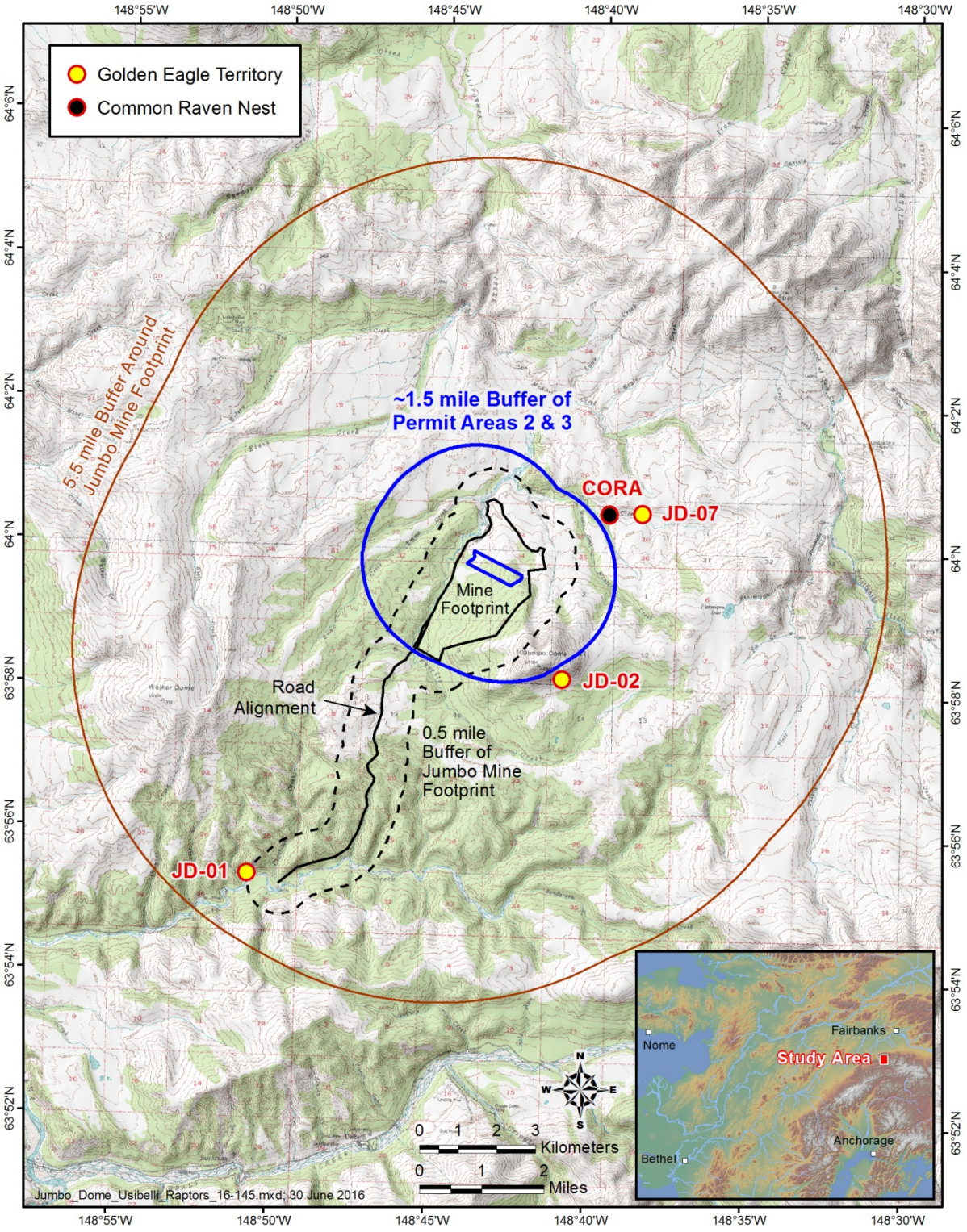


Figure 1. The 2012 and 2016 (blue boundary) eagle survey study areas and nests and cliffs located or revisited on 25 June 2016.

METHODS

A Robinson R-44 helicopter was used for our survey. Two trained observers, seated on the same side of the aircraft, searched for raptor nests. Standard operating procedures were to approach all suitable cliff and bluff habitats directly at ~50–65 km/h (30–40 mph) air speed and then fly at a lateral distance of ~25–50 m from the cliff. Smaller cliffs and bluffs (<20 m high) and riparian areas could be searched with a single pass, but larger cliffs required additional passes to check all available habitat. Observers recorded all signs of raptor and Common Raven (*Corvus corax*) use, including white wash, nests, and presence of adult and/or nestling birds. Once a nest was identified, the observers collected information on nest attributes, including status, condition, and location on cliffs, following the format of USFWS nest record cards. Coordinates were taken with a hand-held GPS directly above cliff or forest nest sites. Photos were taken of all nests not previously recorded by Ritchie and Shook (2012).

RESULTS AND DISCUSSION

Survey conditions were excellent on 25 June 2016: good visibility, temperatures 18–20 °C (65–69 °F), light overcast, and calm to 24 km/h (15 mph) winds. The survey was conducted between ~0800 h and 1250 h, including ferry time between Fairbanks and the study area and ground time to fuel the aircraft (~4 hours of flight time).

NESTS IN THE 2016 STUDY AREA

No new Golden or Bald eagle nests or nests of other raptors or Common Ravens were found within the 2016 study area (Figure 1). Potential cliff nesting habitats are limited to several small bluffs (<20 m high) along the west side of Emma Creek and along Bonanza Creek (Ritchie 2011, Ritchie and Shook 2012). In the 2016 study area, riparian areas are dominated primarily by small black and white spruce (<10 m tall) with limited potential for Bald Eagle nesting.

NESTS OUTSIDE OF THE 2016 STUDY AREA

NEW NESTS

The only new nests found during the 2016 survey were a successful Common Raven nest and a Golden Eagle (JD-02-4) nest, both just outside the 2016 study area (Appendix 1). The raven nest was in a spruce tree along Bonanza Creek (Figure 1). At least 3 young were seen perched and/or flying nearby. The Golden Eagle nest's condition was a remnant and located among Golden Eagle nests on Jumbo Dome (Figure 1, Appendix 1).

KNOWN NESTS

Suitable cliff nesting habitats are located just outside of the 2016 study area on the south side of Jumbo Dome and in upper Bonanza Creek (Figure 1). Six Golden Eagle nests were identified at 3 general locations (hereafter, territories) in both of these areas in 2011 and 2012 (see Ritchie and Shook 2012 for descriptions of nest sites) and we checked these nests again in 2016. Golden Eagles regularly have extra or supernumerary nests within their territories (Kochert et al. 2002). In 2016, these 6 stick nests ranged from collapsed to nests in good condition (Appendix 1). These nests were located 0.3 to 7.1 km (0.2 to 4.4 miles) outside the Permit Area 2 and 3 study area boundaries.

The stick nests at JD-01 were on a large (>75 m high), south-facing, stratified sandstone-coal cliff overlooking Lignite Creek and the mine road. JD-01-1 (Appendix 1) was in fair condition in 2016 with some sticks falling down the cliff and sliding rock and gravel accumulating in the nest. (An incubating adult was observed at this nest in May 2016 and the territory was considered occupied (J. Shook, ABR, personal communication). JD-01-2, within 5 meters of JD-01-01 has collapsed since 2012 (Figure 2). Although adults were not observed near the nest during the June survey, a single Golden Eagle was seen being chased by a Common Raven near the Usibelli airstrip, ~4 miles away. We visited this cliff enroute to refueling and did not search for additional nests because this area was not in the 2016 study area.

We rechecked 3 stick nests on Jumbo Dome (JD-02-1, 2, and 3) that were found during previous surveys (Ritchie and Shook 2012). All three were located ~0.3 km (0.2 miles) outside the 2016 survey area boundary on a large, south-facing cliff (>60 m high). One nest (JD-02-3) was in good condition in 2016 (Figure 3, Appendix 1); the other 2 were in fair condition and showed some signs of degradation (e.g., vegetation beginning to grow in the nests). As noted above, a fourth nest in remnant condition was located in 2016 (i.e., few large sticks; JD-02-4). Behaviors of a single adult Golden Eagle observed flying near and perching at the cliff and the absence of any sign of nesting at these nests (e.g., fresh boughs, white wash) did not indicate successful nesting.

Territory JD-07 contains a single stick nest located on a small cliff (<20 m high) on a south-facing talus slope about 3 km (2 miles) from the mouth of Bonanza Creek (Figure 1). In 2016, this nest showed no signs of recent use and it previously was classified as a nest in poor condition, portions of it sliding down the hill (Appendix 1). Eagles were not observed near this cliff and the nest may have deteriorated since 2012.

a)

b)

Figure 2. Golden Eagle nests at territory JD-01, near Lignite Creek, Alaska, 25 June 2016. a) Golden Eagle nest, JD-01-2; and b) Golden Eagle nest JD-01-2 (left circle) and nest JD-01-1 (2012 photo; right circle).

a)

b)

Figure 3. Golden Eagle nest locations at territory JD-02, Jumbo Dome, Alaska, 25 June 2016. a) The JD-02 cliff and locations of JD-02-1 and 2 (left circle), in fair condition, and JD-02-3 (right circle); and b) JD-02-3 in good condition.

LITERATURE CITED

Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). No. 684 *in* A. Poole, editor. The birds of North America online. Cornell Lab of Ornithology, Ithaca, NY. <http://bna.birds.cornell.edu/bna/species/684. Accessed 30 June 2016.

Ritchie, R. J. 2011. Eagle nest survey, Jumbo Dome Mine, 25 November 2011.Report for Usibelli Coal Mine, Inc., Fairbanks, AK, by ABR, Inc., Fairbanks, AK. 7 pp.

Ritchie, R. J., and J. E. Shook. 2012. Eagle nest surveys, Jumbo Dome Mine, Alaska: November 2011 and April 2012. Report for Usibelli Coal Mine, Inc., Fairbanks AK, by ABR, Inc., Fairbanks, AK. 14 pp.

Roseneau, D. G., and A. M. Springer. 1991. Raptor surveys in the vicinity of the Healy Clean Coal project near Healy, Alaska, May 30–31 and July 21–22, 1991. Report for Sone and Webster Engineering Corporation, Englewood, CO, by BioSystems Alaska, Fairbanks, AK. 50 pp.

Shook, J. E., and R. J. Ritchie. 2011. Raptor survey at proposed Eva Creek windfarm, Alaska, 2011. Report for SAIC Energy, Environment, and Infrastructure, LLC, Denver, CO, by ABR, Inc., Fairbanks, AK. 10 pp.

Appendix 1. Golden Eagle and Common Raven nests near the Jumbo Dome study area, 25 June 2016.

Species	Location	Nest Identification	Nest Condition	2016 Status	Distance to Study Area Boundary (miles)	Distance to Mine (miles)	Nest Coordinates	
							lat_wgs_84	long_wgs_84
Golden Eagle	Lignite Creek	JD-01-1	Fair	Proof of nesting[a]	4.4	4.5	63.92311	148.84742
		JD-01-2	Collapsed	No nest	4.4	4.5	63.92314	148.84725
Golden Eagle	Jumbo Dome	JD-02-1	Fair	Occupancy undetermined	0.2	1.3	63.96972	148.68369
		JD-02-2	Fair	Occupancy undetermined	0.2	1.3	63.96972	148.68392
		JD-02-3	Good	Occupancy undetermined[b]	0.2	1.3	63.97022	148.68097
		JD-02-4	Remnant	Unoccupied	0.2	1.3	63.96968	148.68362
Golden Eagle	Bonanza Creek	JD-07-1	Poor	Unoccupied	0.7	1.7	64.00872	148.64319
Common Raven	Bonanza Creek	CORA	Good	Successful; brood present	0.2	1.2	64.00834	148.66056

[a] An eagle was observed incubating earlier in the year but was not present during the June survey.
[b] Adult present but no conclusive signs of occupancy.

SECTION 13.0

AIR POLUTION CONTROL PLAN

TABLE OF CONTENTS

13.0 AIR POLLUTION CONTROL PLAN

13.1 GENERAL AIR PROTECTION PLAN

The only sources of potential air pollutants associated with the Jumbo Dome Road Corridor will be haul road traffic. There will be no coal processing within the area. Control of fugitive dust emissions has been and will continue to be an important potential environmental impact concern as well as an important safety matter.

Dust control plans have been developed to control potential emissions from the following specific activities:

- haul road dust
- open burning
- wind erosion control

13.2 HAUL ROAD CONTROL

Fugitive dust generation from haul road traffic is typically the most substantial source of potential air pollutants from coal mines. Fugitive dust will be controlled through a combination of design and operational controls. Most of the haul roads, with the exception of the in-pit hauls roads, will be surfaced with gravel to provide a coarse tire contact material and minimize smaller particle dust generation. Haul roads will also be watered with the UCM water truck, as needed, except when freezing conditions would cause ice build-up on roadways. During such conditions, haul road watering will be suspended.

13.3 OPEN BURNING

UCM does not currently have specific plans for open burning but regards this as an option for disposal of excessive vegetation from clearing activities. If open burning is needed, appropriate permits form Division of Forestry will be procured prior to commencement of burning operations.

13.4 WIND EROSION CONTROL

Although the generally damp or frozen ground conditions prevailing at the mine site limit the opportunity for wind erosion and dispersion of dust particles, wind erosion controls will be used for both environmental protection and safety reasons. UCM's experience at Gold Run Pass over the last 12 years has shown that prompt vegetative re-establishment provides the single most effective means of controlling wind erosion. Therefore construction practices have been designed so that the extent of exposed disturbed areas will be the minimum amount necessary to facilitate logical construction and reclamation activities. Reclamation will occur concurrently with construction operations as described in Section 10.0 (Part D) thereby minimizing the potential unprotected soil exposure period. Topsoil stockpiles will be seeded during the first favorable period following placement to prevent erosive material losses.

SECTION 14.0

PROTECTION OF PUBLIC PARKS AND HISTORIC PLACES

TABLE OF CONTENTS

14.0 PROTECTION OF PUBLIC PARKS AND HISTORIC PLACES

14.1 PUBLIC PARKS AND HISTORIC AREAS IN THE MINE VICINITY

There are no known public park areas or cultural or historic sites in or adjacent to the permit area. A plan for protection of these areas is therefore not included in this permit application.

14.2 MEASURES TO MINIMIZE IMPACTS

In the event that evidence of cultural or historic sites are discovered during mining, disturbance to the area will be suspended until it has been cleared by the State Historic Preservation Officer.

SECTION 15.0

RESPONSIBLE PARTIES

15.0 RESPONSIBLE PARTIES

Part D, Operation and Reclamation Plan, was prepared by Usibelli Coal Mine, Inc. With assistance from:

MWH Global, Inc., 1801 California Street, Suite 2900, Denver, Co. 80202