North

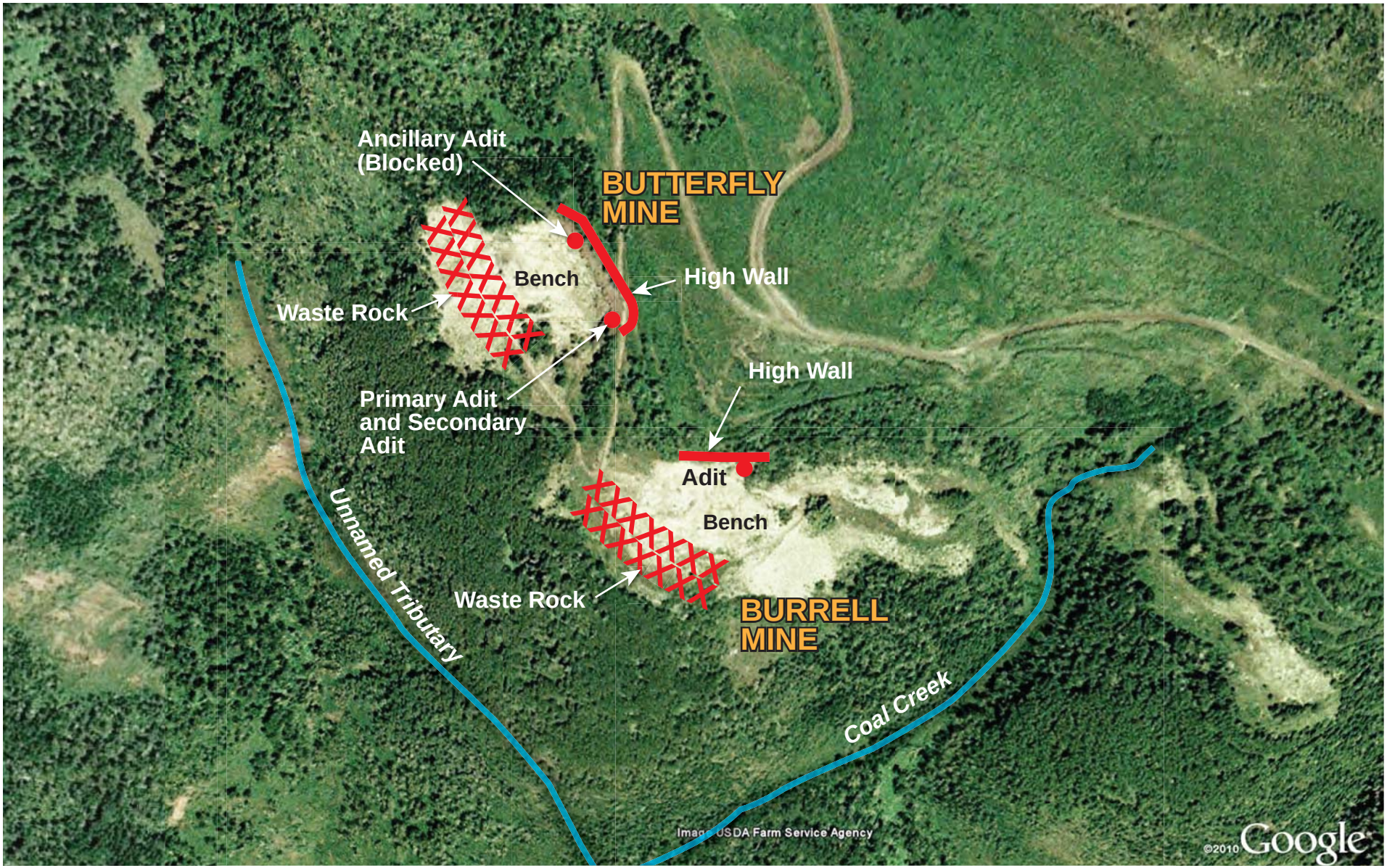
0 2 4

Approximate scale in miles

FIGURE 2-1
LOCATION MAP
Butterfly and Burrell Mines EECA
US Forest Service

ES101910062728BOI

CH2MHILL



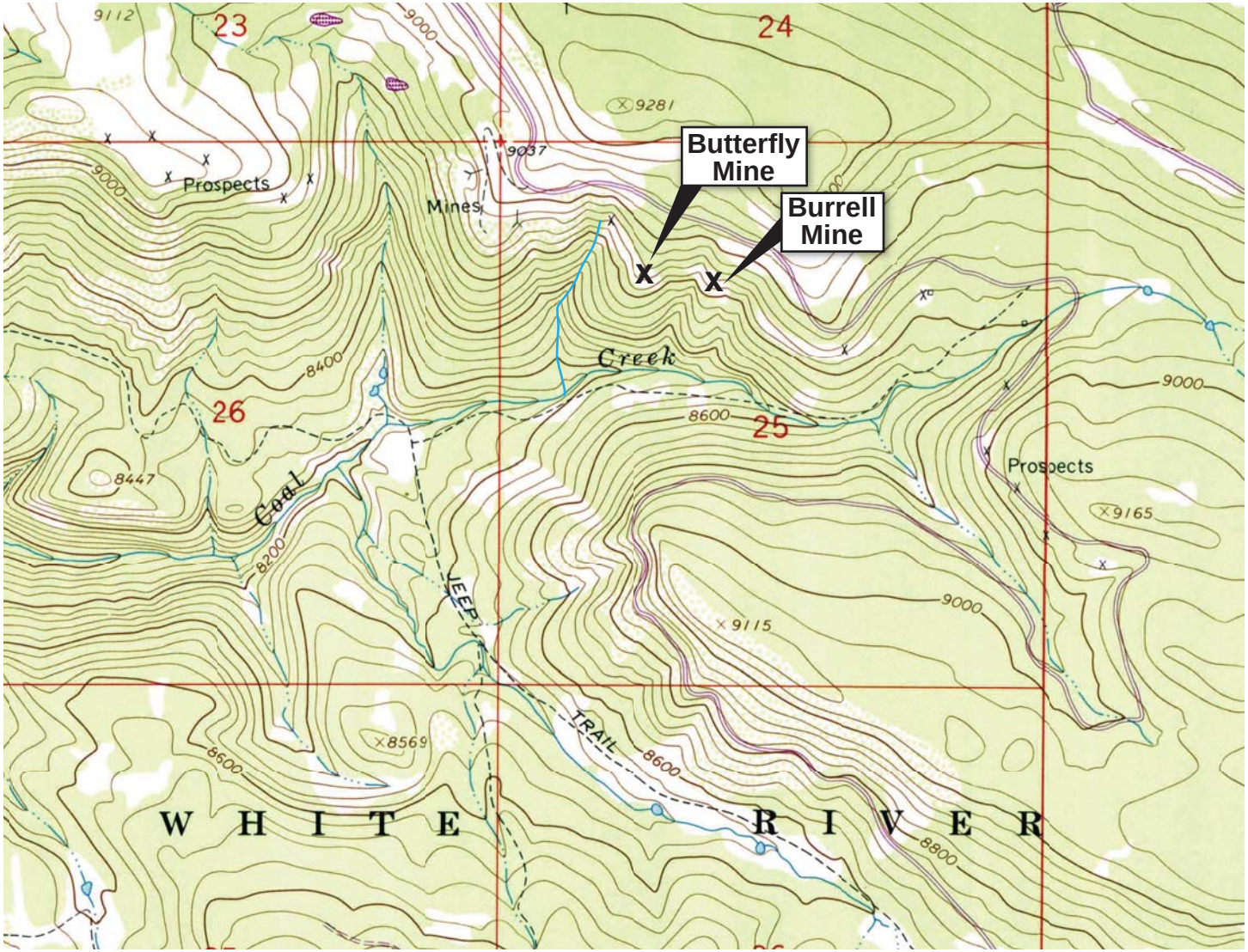
North

0 500 1000

Approximate scale in feet

FIGURE 2-2
BUTTERFLY AND BURRELL MINES
CURRENT CONDITIONS
Butterfly and Burrell Mines EECA
US Forest Service

CH2MHILL



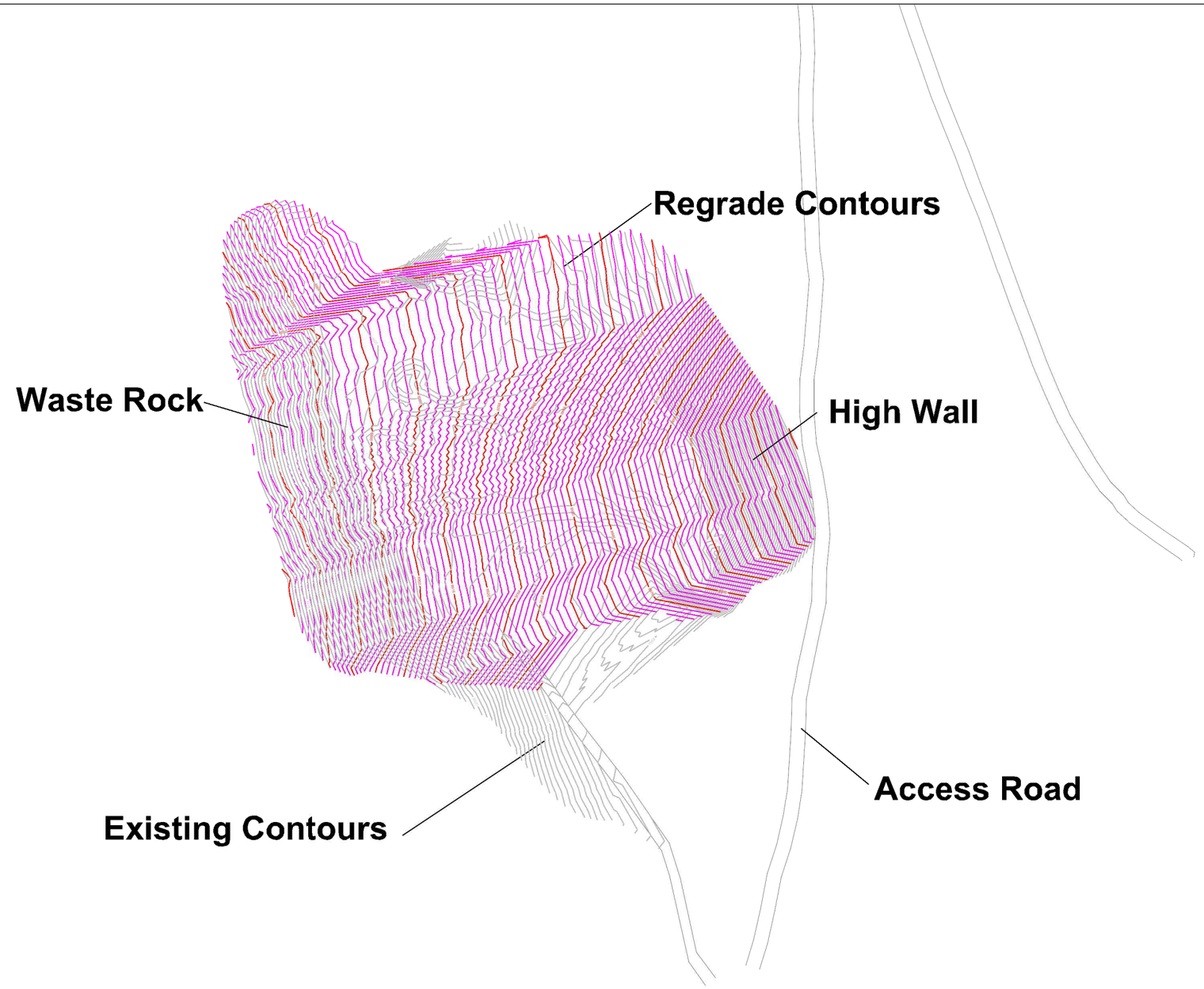
SOURCE: USGS 7.5 Minute Map, Sawmill Mountain, 1987.

North

0 1/2 1

Approximate scale in miles

FIGURE 2-3
TOPOGRAHPY
Butterfly and Burrell Mines EECA
US Forest Service



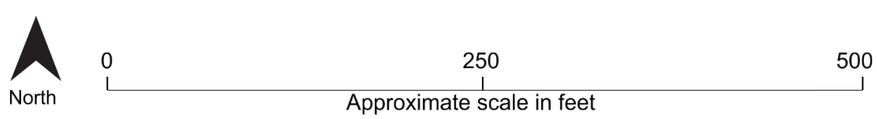
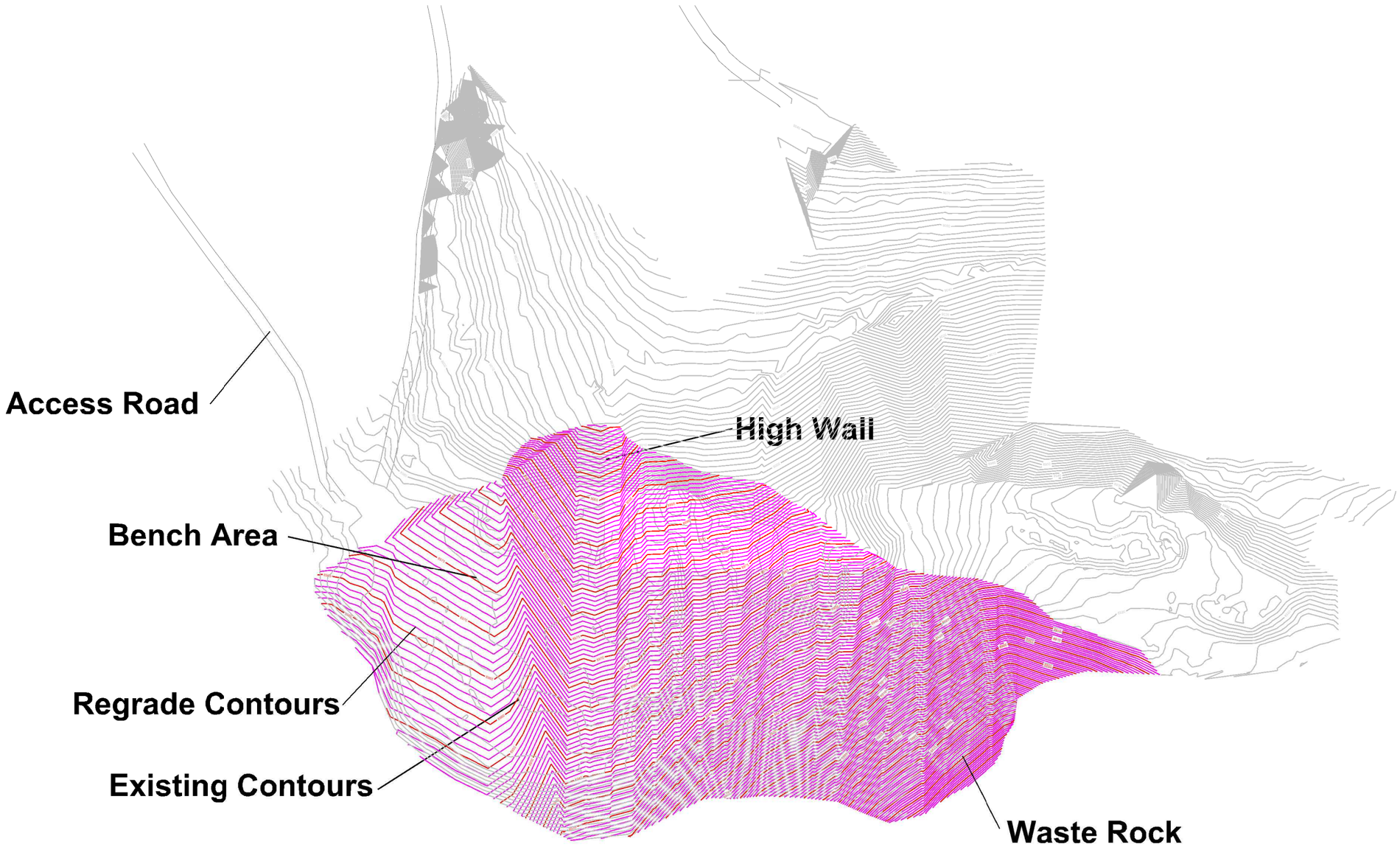


FIGURE 4-1
Butterfly Mine Alternative 2
Butterfly and Burrell Mines EECA
US Forest Service



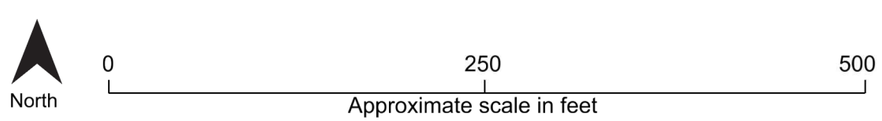


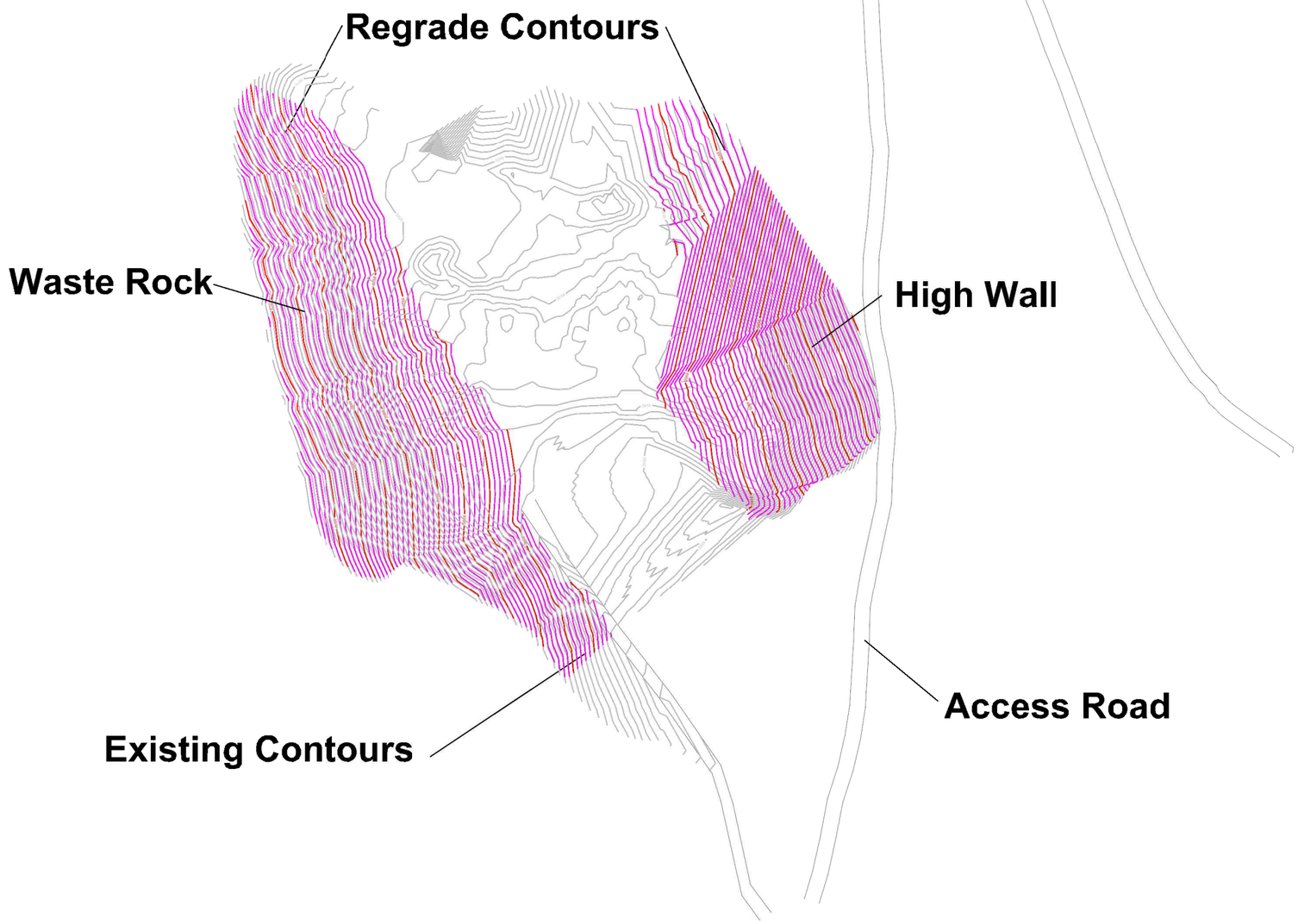
FIGURE 4-2

Burrell Mine Alternative 2

Butterfly and Burrell Mines EECA

US Forest Service

ES101910062728BOI



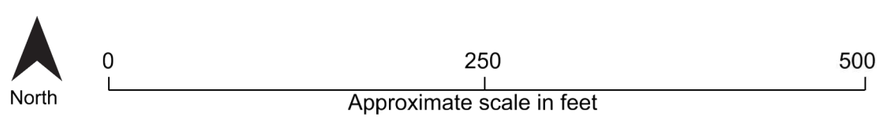
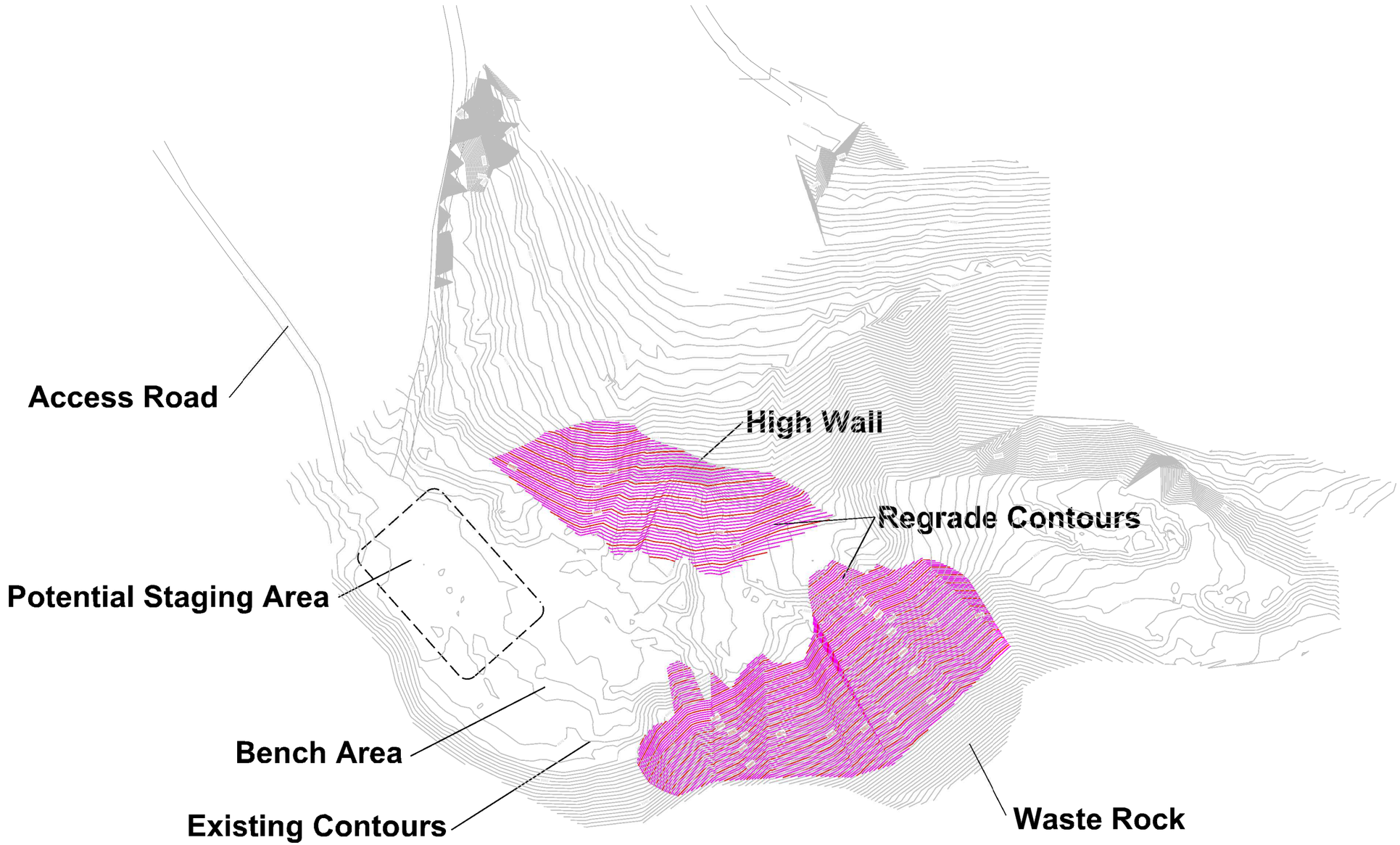


FIGURE 4-3
Butterfly Mine Alternative 3
Butterfly and Burrell Mines EECA
US Forest Service



North

0 250 500

Approximate scale in feet

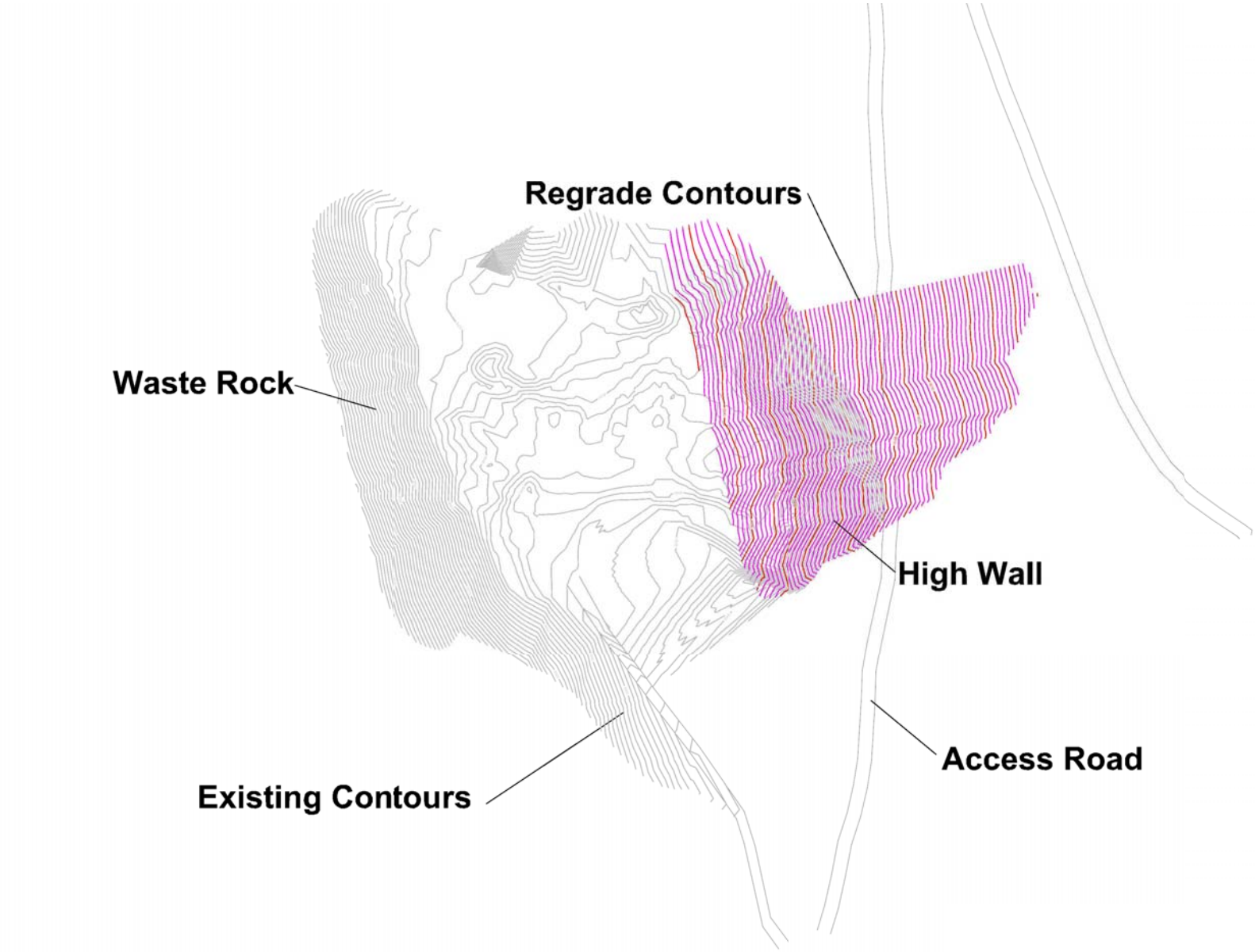
FIGURE 4-4

Burrell Mine Alternative 3

Butterfly and Burrell Mines EECA

US Forest Service

ES101910062728BOI



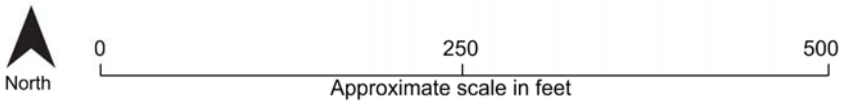


FIGURE 4-5
Butterfly Mine Alternative 4
Butterfly and Burrell Mines EECA
US Forest Service

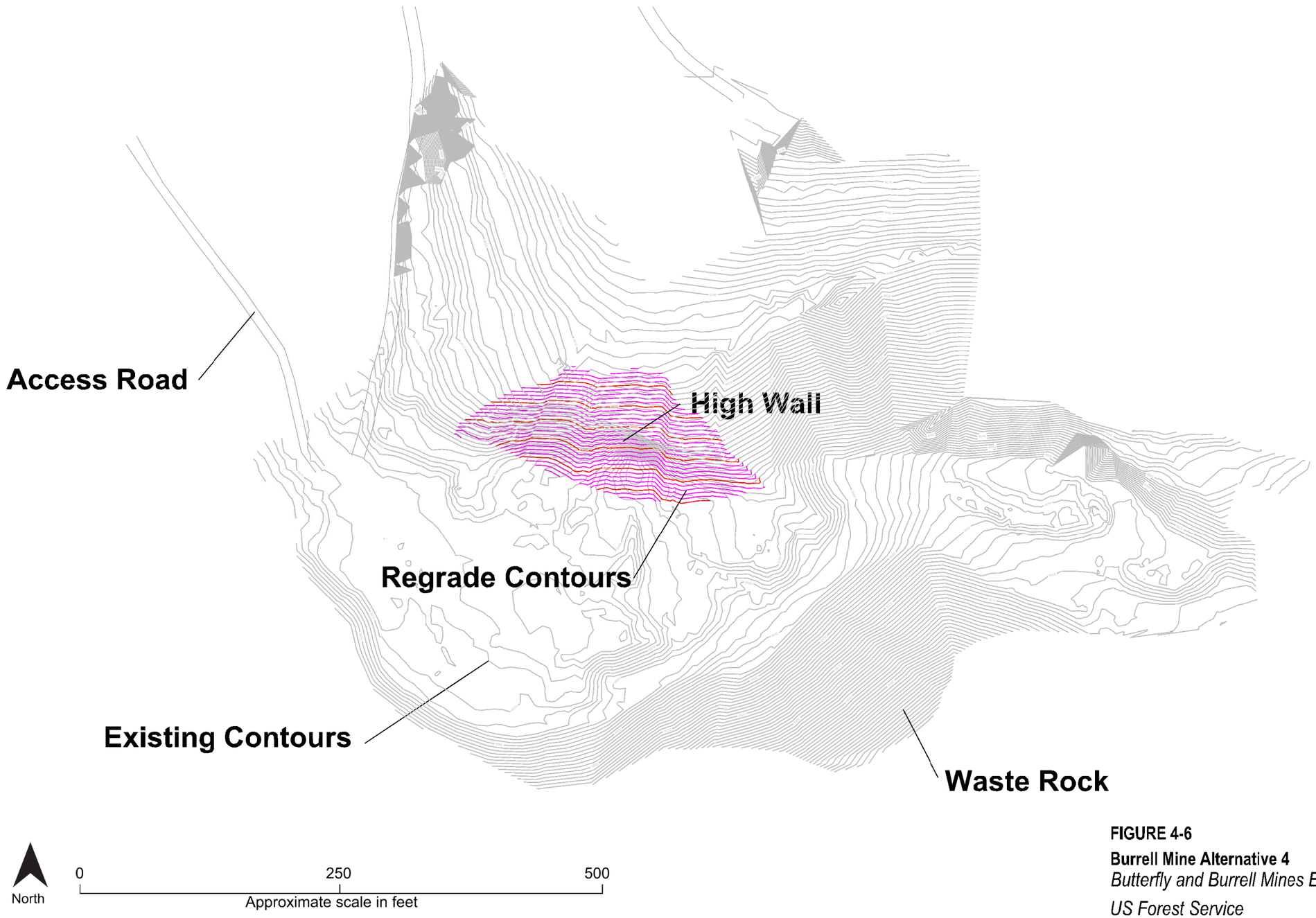


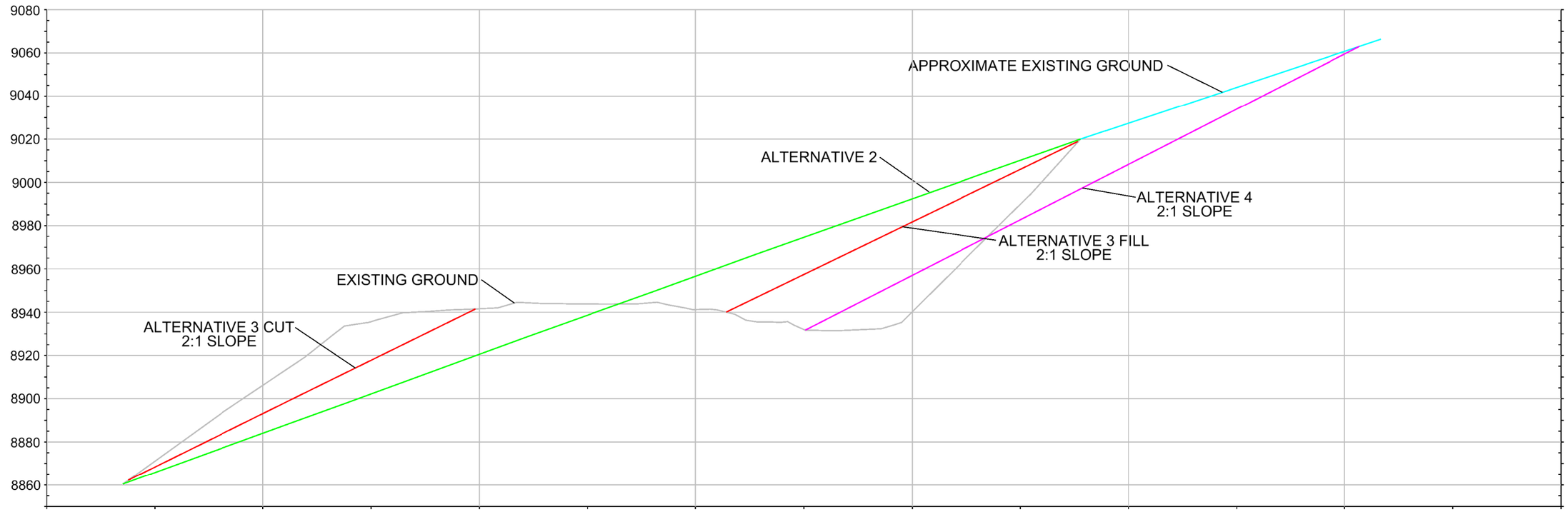
FIGURE 4-6

Burrell Mine Alternative 4

Butterfly and Burrell Mines EECA

US Forest Service

ES101910062728BOI

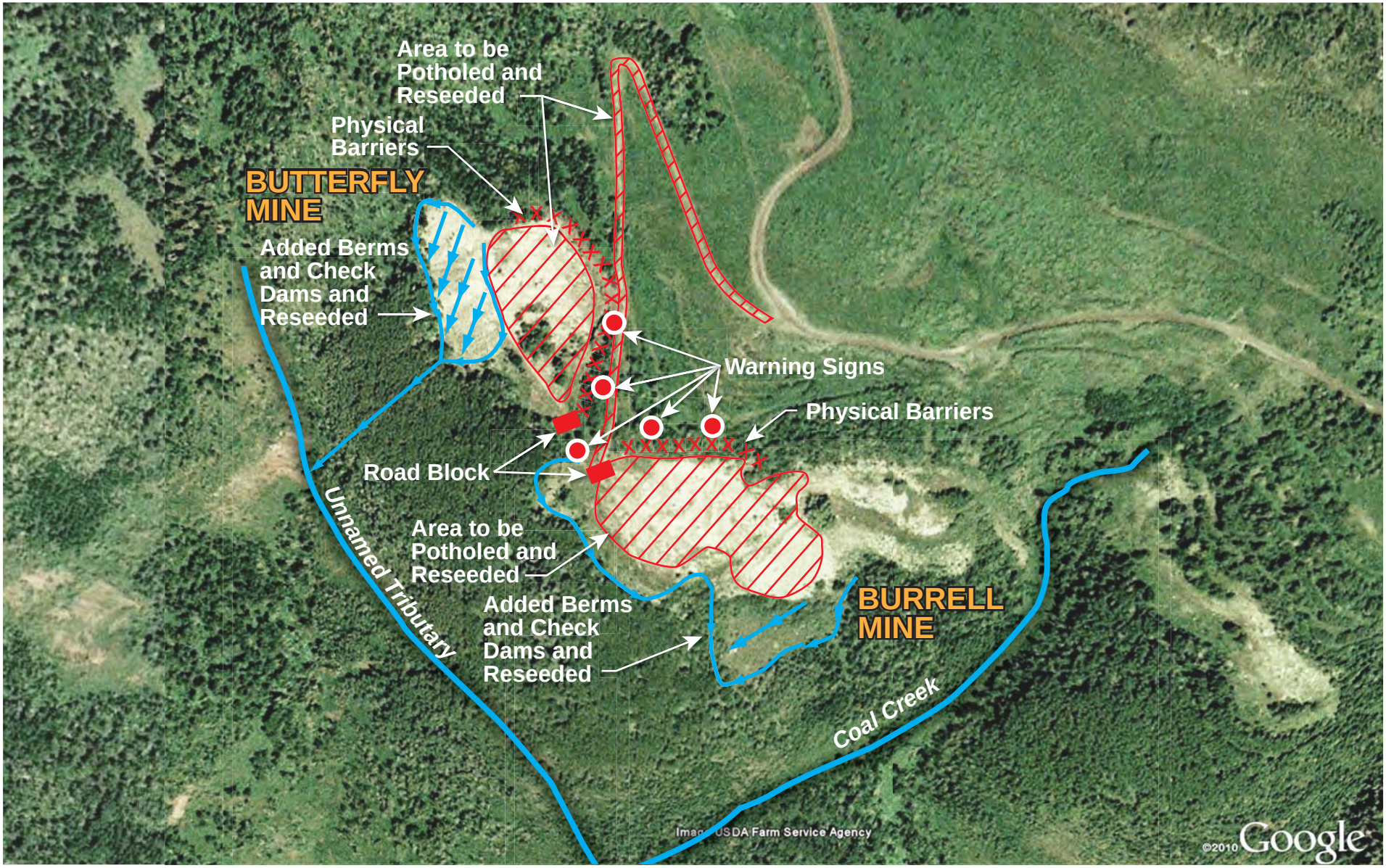


North

0 250

Approximate scale in feet

FIGURE 4-7
Butterfly Mine Cross-Section
Butterfly and Burrell Mines EECA
US Forest Service



North

0 500 1000

Approximate scale in feet

FIGURE 4-8
ALTERNATIVE 5
Butterfly and Burrell Mines EECA
US Forest Service

ES101910062728BOI

CH2MHILL

APPENDIX A

Alternative Cost Estimates

Cost Estimate for Alternative 2 - Excavate waste rock pile, restore bench area to natural grade - Butterfly

Site Information

SITE:	Butterfly Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 30,250	$ 30,250		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	500	LF	$ 2.50	$ 1,250		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for the silt fencing.
Excavate waste rock pile	53600	CY	$ 14.00	$ 750,400		Assume $6/CY to excavate waste rock pile, $8/CY to transport and stockpile at Grizzly or high wall ($14/CY total). Assume 53,600 CY of waste rock material excavated.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Sort rock for rip rap	883	CY	$ 20.00	$ 17,667		Assume sort 883 CY of waste rock to generate 177 CY of rip rap.
Transport remaining sorted material to high wall	707	CY	$ 10.00	$ 7,067		Assume $10/CY to transport and stockpile at high wall
Close one adit at Butterfly	1	ls	$ 3,000.00	$ 3,000		Assume part of task to move fill rock to high wall. Assume adit is partially backfilled.
Place fill rock at high wall for 3:1 slope	53600	CY	$ 6.00	$ 321,600		Assume $3/CY to place, $3/CY to lightly compact and final grade ($6/CY total). Assume 53,600 cy of waste rock material placed. Assume no additional fill material is required.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Import topsoil	3227	CY	$ 47.00	$ 151,653		Assume 3,227 CY of topsoil to be delivered for placement on 4 acres at depth of 0.5 ft . Assume $35/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($47/CY total)
Construct drainage swale and berms	530	LF	$ 6.00	$ 3,180		Assume one 530 LF swale along top of high wall and half way down the slope on either side
Line swale with rip rap	530	LF	$ 8.00	$ 4,240		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 530 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 1,491,932***	
Subtotal Direct Capital Cost					**$ 1,491,932**	
Project Management	8%	of	$ 1,491,932	$ 119,355		
Design	10%	of	$ 1,491,932	$ 149,193		
Construction Management	10%	of	$ 1,491,932	$ 149,193		
Subcontractor General Requirements	10%	of	$ 1,491,932	$ 149,193		
				Subtotals	***$ 566,934***	
Subtotal Indirect Capital Cost					**$ 566,934**	
Contingency	25%	of	$ 566,934		**$ 141,734**	
TOTAL CAPITAL COST					**$ 2,200,599**	
				Minus 30%	**$ 1,540,419**	
				Plus 50%	**$ 3,300,899**	

Cost Estimate for Alternative 2 - Excavate waste rock pile, restore bench area to natural grade - Burrell

Site Information

SITE:	Burrell Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 30,246	$ 30,246		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	600	LF	$ 2.50	$ 1,500		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for silt fencing.
Excavate waste rock pile	52939	CY	$ 14.00	$ 741,146		Assume $6/CY to excavate waste rock pile, $8/CY to transport and stockpile at Grizzly or high wall ($14/CY total). Assume 52,939 CYC of waste rock material excavated.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Sort rock for rip rap	1150	CY	$ 20.00	$ 23,000		Assume sort 1,150 CY of waste rock to generate 230 CY of rip rap.
Transport remaining sorted material to high wall	920	CY	$ 10.00	$ 9,200		Assume $10/CY to transport and stockpile at high wall
Place fill rock at high wall for 3:1 slope	52939	CY	$ 6.00	$ 317,634		Assume $3/CY to place, $3/CY to lightly compact and final grade ($6/CY total). Assume 52,939 CY of waste rock material placed. Assume no additional fill material is required.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Import topsoil	3227	CY	$ 47.00	$ 151,653		Assume 3,227 CY of topsoil to be delivered for placement on 4 acres at depth of 0.5 ft . Assume $35/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($47/CY total).
Construct drainage swale	690	LF	$ 6.00	$ 4,140		Assume one swale 690 LF along top of high wall and half way down the slope on either side
Line swale with rip rap	690	LF	$ 8.00	$ 5,520		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 690 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 1,485,664***	
Subtotal Direct Capital Cost					**$ 1,485,664**	
Project Management	8%	of	$ 1,485,664	$ 118,853		
Design	10%	of	$ 1,485,664	$ 148,566		
Construction Management	10%	of	$ 1,485,664	$ 148,566		
Subcontractor General Requirements	10%	of	$ 1,485,664	$ 148,566		
				Subtotals	***$ 564,552***	
Subtotal Indirect Capital Cost					**$ 564,552**	
Contingency	25%	of	$ 564,552		**$ 141,138**	
TOTAL CAPITAL COST					**$ 2,191,355**	
				Minus 30%	**$ 1,533,948**	
				Plus 50%	**$ 3,287,032**	

Cost Estimate for Alternative 3 - Partially excavate waste rock dump, build 2:1 slope on face of high wall - Butterfly

Site Information

SITE:	Butterfly Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 27,500	$ 27,500		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	500	LF	$ 2.50	$ 1,250		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for silt fencing.
Excavate waste rock pile for sorting	16700	CY	$ 14.00	$ 233,800		Assume $6/CY to excavate waste rock pile, $8/CY to transport and stockpile at Grizzly or high wall ($14/CY total). Assume 16,700 CY of waste rock material excavated.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Sort rock for rip rap	1200	CY	$ 20.00	$ 24,000		Assume sort 1,200 CY of waste rock to generate 240 CY of rip rap.
Transport remaining sorted material to high wall	960	CY	$ 10.00	$ 9,600		Assume $10/CY to transport and stockpile at high wall
Close one adit at Butterfly	1	CY	$ 3,000.00	$ 3,000		Assume part of task to move fill rock to high wall. Assume adit is partially backfilled.
Place fill rock at high wall for 2:1 slope	16700	CY	$ 6.00	$ 100,200		Assume $3/CY to place, $3/CY to lightly compact and final grade ($6/CY total). Assume 16,700 CY of waste rock material placed. Assume no additional fill material is required.
Permanent site access control	1.16	acre	$ 5,000.00	$ 5,800		Pothole and add boulders and timbers to remaining flat bench area (80% of original). Place boulders at entrance to mine site and block vehicular access.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Import topsoil	3227	CY	$ 47.00	$ 151,653		Assume 3,227 CY of topsoil to be delivered for placement on 4 acres at depth of 0.5 ft . Assume $25/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($37/CY total)
Construct drainage swale	1230	LF	$ 6.00	$ 7,380		Assume 4 swales: 350 LF at top of high wall and half way down the slope on either side, 230 LF half way down the newly graded high wall, 370 LF at top of waste rock pile and half way down the slope on either side, 280 LF half way down the waste rock pile.
Line swale with rip rap	720	LF	$ 8.00	$ 5,760		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 720 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 771,568***	
Subtotal Direct Capital Cost					**$ 771,568**	
Project Management	8%	of	$ 771,568	$ 61,725		
Design	10%	of	$ 771,568	$ 77,157		
Construction Management	10%	of	$ 771,568	$ 77,157		
Subcontractor General Requirements	10%	of	$ 771,568	$ 77,157		
				Subtotals	***$ 293,196***	
Subtotal Indirect Capital Cost					**$ 293,196**	
Contingency	25%	of	$ 293,196		**$ 73,299**	
TOTAL CAPITAL COST					**$ 1,138,063**	
				Minus 30%	**$ 796,644**	
				Plus 50%	**$ 1,707,095**	

Cost Estimate for Alternative 3 - Partially excavate waste rock dump, build 2:1 slope on face of high wall - Burrell

Site Information

SITE:	Burrell Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 27,500	$ 27,500		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	600	LF	$ 2.50	$ 1,500		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for silt fencing.
Excavate waste rock pile for sorting	9100	CY	$ 14.00	$ 127,400		Assume $6/CY to excavate waste rock pile, $8/CY to transport and stockpile at Grizzly or high wall ($14/CY total). Assume 9,100 CY of waste rock material excavated.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Sort rock for rip rap	2250	CY	$ 20.00	$ 45,000		Assume sort 2,250 CY of waste rock to generate 450 CY of rip rap.
Transport remaining sorted material to high wall	1800	CY	$ 10.00	$ 18,000		Assume $10/CY to transport and stockpile at high wall
Place fill rock at high wall for 2:1 slope	9100	CY	$ 6.00	$ 54,600		Assume $3/CY to place, $3/CY to lightly compact and final grade ($6/CY total). Assume 9,100 CY of waste rock material placed. Assume no additional fill material is required.
Permanent site access control	1.05	acre	$ 5,000.00	$ 5,240		Pothole and add boulders and timbers to remaining flat bench area (80% of original). Place boulders at entrance to mine site and block vehicular access.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Import topsoil	3227	CY	$ 47.00	$ 151,653		Assume 3,227 CY of topsoil to be delivered for placement on 4 acres at depth of 0.5 ft . Assume $35/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($47/CY total)
Construct drainage swale	2130	LF	$ 6.00	$ 12,780		Assume 4 swales: 630 LF at top of high wall and half way down the slope on either side, 240 LF half way down the newly graded high wall, 720 LF at top of waste rock pile and half way down the slope on either side, 540 LF half way down the waste rock pile.
Line swale with rip rap	1350	LF	$ 8.00	$ 10,800		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 1,350 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 656,098***	
Subtotal Direct Capital Cost					**$ 656,098**	
Project Management	8%	of	$ 656,098	$ 52,488		
Design	10%	of	$ 656,098	$ 65,610		
Construction Management	10%	of	$ 656,098	$ 65,610		
Subcontractor General Requirements	10%	of	$ 656,098	$ 65,610		
				Subtotals	***$ 249,317***	
Subtotal Indirect Capital Cost					**$ 249,317**	
Contingency	25%	of	$ 249,317		**$ 62,329**	
TOTAL CAPITAL COST					**$ 967,745**	
				Minus 30%	**$ 677,422**	
				Plus 50%	**$ 1,451,618**	

Cost Estimate for Alternative 4 - Smooth waste rock pile, shave area above high wall to 2:1 slope to flat bench area - Butterfly

Site Information

SITE:	Butterfly Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 22,000	$ 22,000		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	500	LF	$ 2.50	$ 1,250		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for silt fencing.
Reduce high wall (blast rock face)	3333	CY	$ 12.00	$ 40,000		Assume $12/CY to blast. This cost is based on *Means Heavy Construction Cost Data* , 2009 (Blasting Rock, open face, over 1500 cy). Assume a volume of 10 feet thick, 30 feet high, and 300 feet long (3,300 CY)
Reduce high wall and generate topsoil (excavate soil)	10193	CY	$ 10.00	$ 101,933		Assume $10/CY to excavate. Assume a total of 10,300 CY of material excavated for high wall and 3,227 CY soil excavated for surface restoration, minus the 3,333 that was blasted.
Stockpile soil	3227	CY	$ 15.00	$ 48,400		Assume $15/CY to stockpile soil. Assume 3,227 CY soil.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Grade waste rock pile and transport to Grizzly	1683	CY	$ 12.00	$ 20,200		Assume $6/CY excavate, $6/CY to transport and stockpile at Grizzly ($12/CY total).
Sort rock for rip rap	1683	CY	$ 20.00	$ 33,667		Assume sort 1,683 CY of waste rock to generate 337 CY of rip rap.
Transport remaining sorted material to high wall	1347	CY	$ 10.00	$ 13,467		Assum $10/CY to transport to high wall
Close one adit at Butterfly	1	CY	$ 3,000.00	$ 3,000		Assume part of task to move fill rock to high wall. Assume adit is partially backfilled.
Place fill at high wall for 2:1 slope	10300	CY	$ 6.00	$ 61,800		Assume $3/CY to place, $3/CY to lightly compact and final grade ($6/CY total). Assume 10,300 CY of fill material placed. Assume no additional fill material is required.
Permanent site access control	1.31	acre	$ 5,000.00	$ 6,525		Pothole and add boulders and timbers to remaining flat bench area (90% of original). Place boulders at entrance to mine site and block vehicular access.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Amend and place soil	3227	CY	$ 15.00	$ 48,400		Assume 3,227 CY of soil will be available on site for placement on 4 acres at depth of 0.5 ft . Assume $35/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($47/CY total)
Construct drainage swale	1630	LF	$ 6.00	$ 9,780		Assume 4 swales: 500 LF at top of high wall and half way down the slope on either side, 200 LF half way down the newly graded high wall, 510 LF at top of waste rock pile and half way down the slope on either side, 420 LF half way down the waste rock pile.
Line swale with rip rap	1010	LF	$ 8.00	$ 8,080		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 1,010 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 620,127***	
Subtotal Direct Capital Cost					**$ 620,127**	
Project Management	8%	of	$ 620,127	$ 49,610		
Design	10%	of	$ 620,127	$ 62,013		
Construction Management	10%	of	$ 620,127	$ 62,013		
Subcontractor General Requirements	10%	of	$ 620,127	$ 62,013		
				Subtotals	***$ 235,648***	
Subtotal Indirect Capital Cost					**$ 235,648**	
Contingency	25%	of	$ 235,648		**$ 58,912**	
TOTAL CAPITAL COST					**$ 914,687**	
				Minus 30%	**$ 640,281**	
				Plus 50%	**$ 1,372,030**	

Cost Estimate for Alternative 4 - Smooth waste rock pile, shave area above high wall to 2:1 slope to flat bench area - Burrell

Site Information

SITE:	Burrell Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 16,000	$ 16,000		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	600	LF	$ 2.50	$ 1,500		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for silt fencing.
Reduce high wall (blast rock face)	556	CY	$ 12.00	$ 6,667		Assume $12/CY to blast. This cost is based on *Means Heavy Construction Cost Data*, 2009 (Rock, open face, over 1500 cy inc. Butterfly). Assume a volume of 10 feet thick, 10 feet high, and 150 feet long (556 CY)
Reduce high wall and generate topsoil (excavate soil)	4571	CY	$ 10.00	$ 45,711		Assume $10/CY to excavate. Assume a total of 1,900 CY of material excavated for high wall and 3,227 CY soil excavated for surface restoration, minus the 556 that was blasted.
Stockpile soil for final cover	3227	CY	$ 15.00	$ 48,400		Assume $15/CY to stockpile soil. Assume 3,227 CY soil.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Grade waste rock pile and transport to Grizzly	2533	CY	$ 12.00	$ 30,400		Assume $6/CY excavate, $6/CY to transport and stockpile at Grizzly ($12/CY total).
Sort rock for rip rap	2533	CY	$ 20.00	$ 50,667		Assume sort 2,533 CY of waste rock to generate 507 CY of rip rap.
Transport remaining sorted material to high wall	2027	CY	$ 10.00	$ 20,267		Assum $10/CY to transport to high wall
Place fill at high wall for 2:1 slope	1900	CY	$ 6.00	$ 11,400		Assume $3/CY to place, $3/CY to lightly compact and final grade ($6/CY total). Assume 1,900 CY of fill material placed. Assume no additional fill material is required.
Permanent site access control	1.18	acre	$ 5,000.00	$ 5,895		Pothole and add boulders and timbers to remaining flat bench area (90% of original). Place boulders at entrance to mine site and block vehicular access.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Amend and place soil	3227	CY	$ 15.00	$ 48,400		Assume 3,227 CY of soil will be available on site for placement on 4 acres at depth of 0.5 ft . Assume $35/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($47/CY total)
Construct drainage swale	2400	LF	$ 6.00	$ 14,400		Assume 4 swales: 800 LF at top of high wall and half way down the slope on either side, 370 LF half way down the newly graded high wall, 720 LF at top of waste rock pile and half way down the slope on either side, 560 LF half way down the waste rock pile.
Line swale with rip rap	1520	LF	$ 8.00	$ 12,160		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 1,520 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 513,491***	
Subtotal Direct Capital Cost					**$ 513,491**	
Project Management	8%	of	$ 513,491	$ 41,079		
Design	10%	of	$ 513,491	$ 51,349		
Construction Management	10%	of	$ 513,491	$ 51,349		
Subcontractor General Requirements	10%	of	$ 513,491	$ 51,349		
				Subtotals	***$ 195,127***	
Subtotal Indirect Capital Cost					**$ 195,127**	
Contingency	25%	of	$ 195,127		**$ 48,782**	
TOTAL CAPITAL COST					**$ 757,399**	
				Minus 30%	**$ 530,180**	
				Plus 50%	**$ 1,136,099**	

Cost Estimate for Alternative 5 - Smooth waste rock pile, add barriers on top of high wall and limit access to site - Butterfly

Site Information

SITE:	Butterfly Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 10,000	$ 10,000		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	500	LF	$ 2.50	$ 1,250		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for silt fencing.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Gate for adit at Butterfly	1	each	$ 6,300.00	$ 6,300		Fabricate, deliver, and install a 8-ft by 8-ft gate at the portal entrance.
Grade waste rock pile and transport to Grizzly	1683	CY	$ 12.00	$ 20,200		Assume $6/CY excavate, $6/CY to transport and stockpile at Grizzly ($12/CY total).
Sort rock for rip rap	1683	CY	$ 20.00	$ 33,667		Assume sort 1,683 CY of waste rock to generate 337 CY of rip rap.
Transport remaining sorted material to high wall	1347	CY	$ 10.00	$ 13,467		Assum $10/CY to transport to high wall
Permanent site access control	1.45	acre	$ 5,000.00	$ 7,250		Pothole and add boulders and timbers to flat bench area (1.45 acres). Place boulders at entrance to mine site to block vehicular access.
Permanent barrier above high wall	600	LF	$ 60.00	$ 36,000		Construct permanent barrier above high wall using native boulders. Assume sufficient amount of boulders in the immediate vicinity to transport to site and place.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Import topsoil	3227	CY	$ 47.00	$ 151,653		Assume 3,227 CY of topsoil to be delivered for placement on 4 acres at depth of 0.5 ft . Assume $35/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($47/CY total)
Construct drainage swale	1430	LF	$ 6.00	$ 8,580		Assume 3 swales: 500 LF at top of high wall and half way down the slope on either side, 510 LF at top of waste rock pile and half way down the slope on either side, 620 LF half way down the waste rock pile.
Line swale with rip rap	1010	LF	$ 8.00	$ 8,080		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 1,010 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 498,072***	
Subtotal Direct Capital Cost					**$ 498,072**	
Project Management	8%	of	$ 498,072	$ 39,846		
Design	10%	of	$ 498,072	$ 49,807		
Construction Management	10%	of	$ 498,072	$ 49,807		
Subcontractor General Requirements	10%	of	$ 498,072	$ 49,807		
				Subtotals	***$ 189,267***	
Subtotal Indirect Capital Cost					**$ 189,267**	
Contingency	25%	of	$ 189,267		**$ 47,317**	
TOTAL CAPITAL COST					**$ 734,656**	
				Minus 30%	**$ 514,259**	
				Plus 50%	**$ 1,101,984**	

Cost Estimate for Alternative 5 - Smooth waste rock pile, add barriers on top of high wall and limit access to site - Burrell

Site Information

SITE:	Burrell Mine
DESCRIPTION:	Conceptual Cost Estimate
PREPARED BY:	CH2M HILL
PROJECT NUMBER:	411795

Assumptions

1. The accuracy of the cost estimate is approximately -50% to +100%, and highly dependent on assumed volumes
2. Unit prices from similar mine reclamation projects were used to develop cost estimates
3. Costs are for the construction only; long term stability or maintenance is not included

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Subtotals	Comments and References
Site Preparation						
Mobilization/Demobilization	1	event	$ 10,000	$ 10,000		Earthmoving equipment (bulldozer, front-end loader, and backhoe), Grizzly, office trailer. Assume field work at both mines completed with one mobilization/demobilization
Silt fencing	600	LF	$ 2.50	$ 1,500		Install silt fencing and hay bales around site for erosion control during construction activities. Assume $2.50 per LF for silt fencing.
Radiological survey and soil testing for pH	1	ls	$ 625.00	$ 625		One month rental and shipping for radiation survey meter (Ludlum model 3) and pH meter. Assume testing to be performed by Construction Manager.
Grade waste rock pile and transport to Grizzly	2583	CY	$ 12.00	$ 31,000		Assume $6/CY excavate, $6/CY to transport and stockpile at Grizzly ($12/CY total).
Sort rock for rip rap	2583	CY	$ 20.00	$ 51,667		Assume sort 2,583 CY of waste rock to generate 517 CY of rip rap.
Transport remaining sorted material to high wall	2067	CY	$ 10.00	$ 20,667		Assum $10/CY to transport to high wall
Permanent site access control	1.31	acre	$ 5,000.00	$ 6,550		Pothole and add boulders and timbers to the flat bench area (1.31 acres). Place boulders at entrance to mine site and block vehicular access.
Permanent barrier above high wall	350	LF	$60.00	$ 21,000		Construct permanent barrier above high wall using native boulders. Assume sufficient amount of boulders in the immediate vicinity to transport to site and place.
Add Biochar to Top 12 inches Waste Rock	4	acre	$ 44,000	$ 176,000		Mix in 20 tons/acre of biochar into top 12 inches of waste rock. Conversation with Mr. Morgan Williams (Flux Farm) on 2/14/2011 suggests biochar can range up to $2/lb and is highly dependent on available feedstock but for larger projects like this, a cost of $1/lb delivered or generated on site is reasonable ($2,000/ton or $40,000/acre). Assume dump, spread out, and mix in with disk or ripper. From Means (2009), a rippers production rate in till or boulder/clay (most appropriate category) is 6,300 cy per day. Assume make 4 passes to mix thoroughly or about 1,600 cy per day, which is one acre. Each 4-acre site with mob/demob is 5 working days for a crew consisting of two operator, two pieces of equipment including a dozer and one laborer (Crew B-32B in Means) at about $3,300/day or $16,000 per week . Assume $4000/per acre ($16,000 / 4 acres) for application for a total price of $44k/acre.
Import topsoil	3227	CY	$ 47.00	$ 151,653		Assume 3,227 CY of topsoil to be delivered for placement on 6 acres at depth of 0.5 ft . Assume $35/CY to deliver fill, $8/CY to place, $4/CY to lightly compact and final grade ($47/CY total)
Construct drainage swale	2110	LF	$ 6.00	$ 12,660		Assume 3 swales: 800 LF at top of high wall and half way down the slope on either side, 750 LF at top of waste rock pile and half way down the slope on either side, 560 LF half way down the waste rock pile.
Line swale with rip rap	1550	LF	$ 8.00	$ 12,400		Assume 1/3 CY rip rap required per LF of swale at $24/CY. Assume sufficient rip rap material on site. Assume 1,550 LF require rip rap and manual placement.
Remove access road to mine sites	2000	CY	$ 6.00	$ 12,000		Grade the road to match surrounding slope. Assume a total length of 2,000 feet and that 1 cy per lineal foot of road will be excavated in order to grade the road (2,000 cy total).
Surface restoration	4	acre	$ 3,250	$ 13,000		Assume hydroseeding with seed/mulch mix
				Subtotal	***$ 520,722***	
Subtotal Direct Capital Cost					**$ 520,722**	
Project Management	8%	of	$ 520,722	$ 41,658		
Design	10%	of	$ 520,722	$ 52,072		
Construction Management	10%	of	$ 520,722	$ 52,072		
Subcontractor General Requirements	10%	of	$ 520,722	$ 52,072		
				Subtotals	***$ 197,874***	
Subtotal Indirect Capital Cost					**$ 197,874**	
Contingency	25%	of	$ 197,874		**$ 49,469**	
TOTAL CAPITAL COST					**$ 768,064**	
				Minus 30%	**$ 537,645**	
				Plus 50%	**$ 1,152,097**	

APPENDIX B

Site Visit Report

CH2M HILL
215 S. State Street
Suite 1000
Salt Lake City, UT 84111
Tel (801) 350-5200
Fax (801) 355-2301

Serving Utah for over 30 years

January 14, 2011

Ms. Olivia Garcia
AML Coordinator
White River National Forest
900 Grand Avenue
Glenwood Springs, CO 81602

Subject: Site Visit Report, Butterfly/Burrell Mines

Dear Ms. Garcia:

This site visit report summarizes the results of the site visit performed on October 7, 2010, by CH2M HILL. This letter report documents the work performed onsite during the site visit, documents site conditions at the time of the visit, and presents a summary of observations from the site visit. This report was revised based on comments provided by the United States Forest Service (USFS) on the draft site visit report.

Background

The site visit was performed on October 7, 2010, by Mr. David Waite, the project manager for CH2M HILL. Before the site visit, Mr. Waite met with Ms. Olivia Garcia (USFS project manager), Mr. Greg Glasgow (USFS) and Mr. Craig Bissonnette (Colorado Division of Reclamation Mining & Safety [DRMS]) to discuss the project and the site conditions. Recent work performed at the site was discussed along with the scope of work for the upcoming EE/CA.

Site Visit

All parties arrived onsite about 10:30 a.m. after briefly stopping and looking at a potential riprap borrow source located about 1 mile north of the mine sites. The weather was sunny and windy, with temperatures in the 50s.

We visited the Burrell mine site first, looking at the work recently completed by DRMS (September 2010). This work included closure of the adits at Burrell and reducing the height of the highwall. The bench area surface was roughly graded to promote vegetation growth, reduce erosion, and discourage camping in the area.

We next visited the larger Butterfly mine site. The work completed by the DRMS was inspected, and the work included closure of adits, adding bat exclusion netting to the only remaining open adit (called the primary adit), and creation of a soil berm to divert surface water runoff away from the face of the waste rock dumps. The history of the mine reclamation was discussed and we walked the entire site, observing the site conditions including erosion of the waste rock dump.

Survey Work

CH2M HILL used a geographic positioning system (GPS) unit to survey both the Butterfly and Burrell sites. The survey was not intended to be performed to achieve survey-grade accuracy, similar to the existing topographic map. Rather, the GPS survey was primarily performed in order to assess the general area around the mine features and to note particular features of interest.

Specifically, the natural slope immediately surrounding the mine areas was surveyed to establish the grade of these areas. This is important in order to understand how potential removal actions will "tie in" to the native slopes. Other site features such as roads, drainages, bottom and top of highwalls, and the perimeter of the waste rock dumps were surveyed. This survey information will not be used to replace any of the recent topographic survey provided by the USFS but will be used to supplement the existing survey in areas not covered.

A handheld Trimble GeoXT GPS was used to perform the work. After the data were post-processed, the horizontal accuracy was generally confirmed to be within 50 centimeters. Some points had limited satellite access due to the amount of trees near the survey point and therefore did not have this level of accuracy, but these locations were limited in number. The data are shown on a site map, and the information for each data point is provided in Attachment 1. This information will also be used to develop the figures that will be provided in the EE/CA.

Significant Observations

The information collected during the site visit will be captured in the EE/CA and is therefore only summarized in this section. Some of the more significant observations are as follows:

- Erosion of the waste rock dumps due to surface water runoff from the bench area is presently occurring. There are large erosional gullies on the Butterfly dump, with smaller gullies at Burrell. Most of this erosion appears to be caused by concentrated flow from the bench areas. There is little evidence of erosion on the dumps other than these gullies that receive concentrated flow from the bench areas.

- Dump materials consist of granular, sand-sized material with lesser quantities of rock. This material may be processed as a potential source of riprap. Some of the rock onsite appears to contain a fair amount of quartzite. This material appears to be quite durable and may be appropriately sized for riprap. The candidate borrow area located a little more than 1 mile north of the site may also serve as a borrow source for riprap.

- There currently exists easy access to the top of the Butterfly highwall via the road that exists immediately above the highwall. The area above the Burrell highwall would be more difficult to access with a vehicle, due to the lack of a road and the presence of quite a few trees immediately above the highwall. Butterfly currently poses a significant physical risk due to the proximity of the road and the height of the highwall.

- Site soils appear to be able to support vegetation, especially in areas where the soil consists of more fine-grained material. There is a moderate presence of grasses and other plants on the waste rock dumps, which consist of relatively coarser-grained material with little fines.

The bench areas have been disturbed recently, but they appear to be able to support limited vegetation.

The observations and data collected during the site visit are generally consistent with the information provided in the documents submitted previously to CH2M HILL, including the *Site Assessment Report Butterfly and Burrell Mines Rio Blanco County, Colorado* (Au' Authum Ki, 2005).

Closing

Please call Mr. Waite at (801) 350-5272 if you have any questions concerning this letter report. CH2M HILL appreciates the opportunity to assist the USFS with this work.

Sincerely,

David Waite, P.E.
Project Manager

References

Au' Authum Ki, 2005. *Site Assessment Report Butterfly and Burrell Mines Rio Blanco County, Colorado*. December.

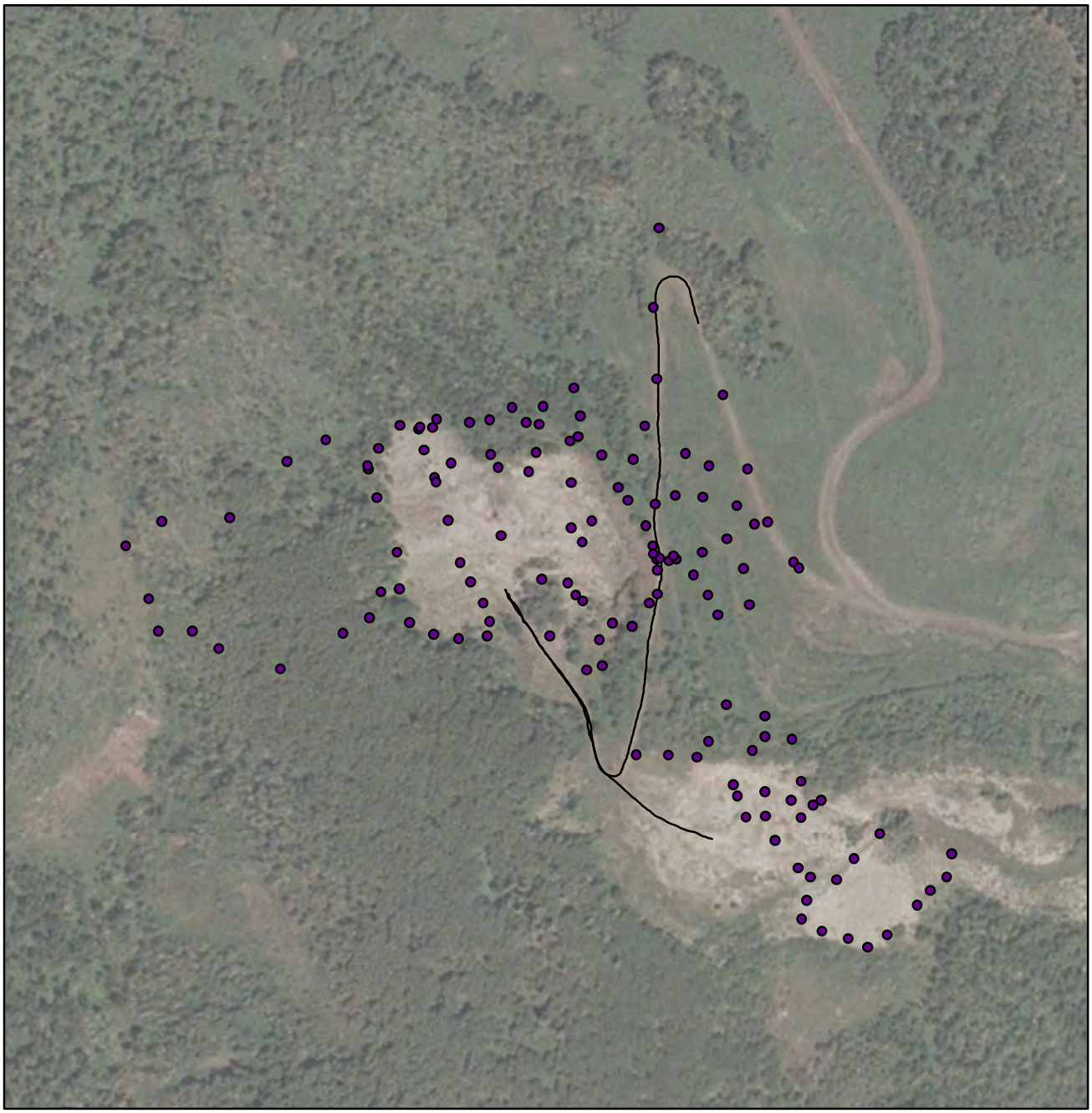
Enclosures

Attachments

1 GPS Survey Data—October 7, 2010
2 Site Visit Photographs—October 7, 2010
3 Video from Site Visit—October 7, 2010

ATTACHMENT 1

GPS Survey Data—October 7, 2010



LEGEND

- Point_ge
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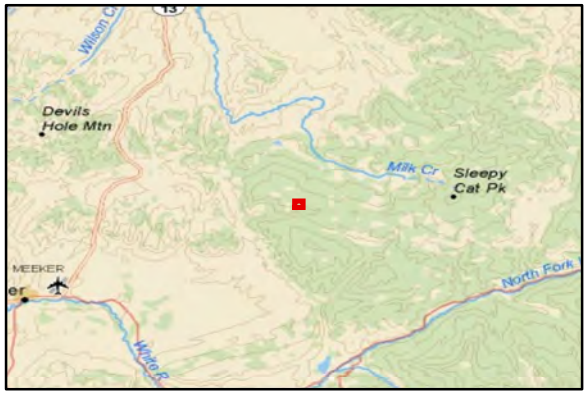
Notes:

1. Area of interest subject to change.
2.
3.

VICINITY MAP



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Feet

FIGURE X (all caps)
Figure Title (initial caps)
Report Name (initial caps)
Figure Caption or Project Name (initial caps, italic)

ATTACHMENT 1

GPS Survey of Butterfly and Burrell Mine Sites—October 7, 2010

Comment	GPS_Date	GPS_Time	GPS_Height (meter)	Vert_Prec (meter)	Horz_Prec (meter)	Latitude	Longitude	Point_ID
butterfly 1-3-20917	10/7/2010	11:33:57am	2694.246	0.4	0.4	40.119868879	-107.671398226	44
rd	10/7/2010	11:41:57am	2731.926	0.5	0.5	40.121298345	-107.670218858	46
rd	10/7/2010	11:43:26am	2729.353	0.4	0.4	40.120930876	-107.670185989	72
rd	10/7/2010	11:44:26am	2722.330	0.4	0.4	40.120289224	-107.670177758	73
rd	10/7/2010	11:48:14am	2718.633	0.5	0.4	40.119827833	-107.670147147	74
tp hghwll	10/7/2010	11:49:08am	2720.931	0.4	0.4	40.120007266	-107.670158446	75
rd	10/7/2010	11:49:33am	2721.106	0.5	0.5	40.120012440	-107.670135011	76
topo	10/7/2010	11:50:07am	2723.526	0.5	0.4	40.119999235	-107.670074694	77
topo	10/7/2010	11:50:43am	2725.587	0.5	0.4	40.120010140	-107.670024167	78
topo	10/7/2010	11:51:21am	2730.505	0.6	0.5	40.120047577	-107.669854692	79
topo	10/7/2010	11:52:09am	2734.630	0.8	0.6	40.120120808	-107.669691373	80
topo	10/7/2010	11:52:46am	2739.387	0.6	0.5	40.120199212	-107.669508347	81
topo	10/7/2010	11:53:21am	2737.151	0.6	0.5	40.120292320	-107.669631892	82
topo	10/7/2010	11:53:51am	2731.931	0.6	0.5	40.120331375	-107.669858853	83
topo	10/7/2010	11:54:35am	2727.872	0.5	0.4	40.120335734	-107.670041900	84
tp hghwll	10/7/2010	11:56:01am	2717.858	0.7	0.5	40.120369670	-107.670426159	85
tp hgwll	10/7/2010	11:56:53am	2715.332	0.6	0.4	40.120534703	-107.670544104	86
tp hghwll	10/7/2010	11:57:40am	2712.427	0.6	0.4	40.120624356	-107.670702340	87
topo	10/7/2010	11:58:41am	2714.649	1.0	0.6	40.120731864	-107.670692645	88
topo	10/7/2010	11:59:49am	2718.177	1.0	0.8	40.120875417	-107.670741164	89
drng	10/7/2010	12:00:30pm	2709.314	0.7	0.5	40.120777045	-107.670941945	90
topo	10/7/2010	12:01:07pm	2708.420	0.6	0.4	40.120683041	-107.670964943	91
tp hghwll	10/7/2010	12:02:12pm	2701.976	1.1	0.9	40.120539971	-107.670978391	92
tp hghwll	10/7/2010	12:06:05pm	2709.736	1.1	0.8	40.120602214	-107.670755719	93
topo	10/7/2010	12:09:12pm	2706.198	1.2	0.8	40.120692120	-107.671054107	94
topo	10/7/2010	12:09:40pm	2701.681	3.5	2.0	40.120767194	-107.671148452	95
drng	10/7/2010	12:10:44pm	2700.066	2.3	1.4	40.120701337	-107.671296028	96
topo	10/7/2010	12:11:11pm	2695.686	0.8	0.5	40.120684523	-107.671430204	97
tp hghwll	10/7/2010	12:12:11pm	2695.086	3.3	1.9	40.120524447	-107.671284313	98
btm hghwll	10/7/2010	12:14:17pm	2694.269	3.5	2.1	40.120459896	-107.671232936	141
btm hghwll	10/7/2010	12:14:47pm	2692.456	1.0	0.6	40.120441198	-107.671025338	142
btm hghwll	10/7/2010	12:15:44pm	2691.347	1.0	0.6	40.120387279	-107.670741668	143
btm hghwll	10/7/2010	12:16:56pm	2693.132	1.9	1.2	40.120197237	-107.670596588	144
bnch	10/7/2010	12:19:11pm	2693.564	0.7	0.4	40.120084365	-107.670658840	145
bnch	10/7/2010	12:19:30pm	2695.832	0.9	0.5	40.120157502	-107.670736901	146
bnch	10/7/2010	12:23:45pm	2696.403	0.7	0.4	40.120107620	-107.671200918	147
bnch	10/7/2010	12:24:42pm	2693.204	2.7	1.6	40.120476176	-107.671546183	148
tp dmp	10/7/2010	12:25:13pm	2690.889	1.9	1.1	40.120654901	-107.671677255	149
drng	10/7/2010	12:25:34pm	2687.254	0.6	0.4	40.120698893	-107.671649668	150
tp dmp	10/7/2010	12:26:04pm	2688.059	0.6	0.4	40.120644134	-107.671770532	151
tp dmp	10/7/2010	12:26:25pm	2688.806	0.7	0.4	40.120538643	-107.671732676	152
tp dmp	10/7/2010	12:26:51pm	2689.335	0.6	0.4	40.120399759	-107.671656972	153
drng	10/7/2010	12:27:06pm	2689.125	0.7	0.4	40.120373146	-107.671642695	154
tp dmp	10/7/2010	12:27:36pm	2690.713	0.7	0.4	40.120179544	-107.671559382	155
tp dmp	10/7/2010	12:28:08pm	2693.078	0.9	0.6	40.119964396	-107.671471035	156
tp dmp	10/7/2010	12:29:47pm	2694.910	0.6	0.4	40.119758826	-107.671310085	157
edge dmp	10/7/2010	12:30:16pm	2692.356	0.7	0.4	40.119668444	-107.671263559	158
edge dmp	10/7/2010	12:30:53pm	2686.438	0.7	0.4	40.119591442	-107.671278642	159
edge dmp	10/7/2010	12:31:52pm	2681.389	2.7	1.5	40.119575436	-107.671469028	160
edge dmp	10/7/2010	12:33:01pm	2673.025	0.7	0.5	40.119594228	-107.671635912	161
edge dmp	10/7/2010	12:33:54pm	2665.569	0.7	0.5	40.119651234	-107.671800154	162
edge dmp	10/7/2010	12:36:15pm	2668.226	1.8	1.2	40.119822751	-107.671871353	163
topo	10/7/2010	12:36:49pm	2663.471	2.4	1.6	40.119805546	-107.671992664	164
topo	10/7/2010	12:37:47pm	2665.399	7.9	4.8	40.119671377	-107.672069435	165
topo	10/7/2010	12:38:31pm	2651.107	2.3	1.3	40.119588985	-107.672242602	166
topo	10/7/2010	12:39:35pm	2660.811	7.1	3.6	40.119395783	-107.672654068	167
topo	10/7/2010	12:41:19pm	2625.145	2.2	1.2	40.119493929	-107.673066309	168
topo	10/7/2010	12:42:18pm	2618.371	5.3	3.1	40.119579945	-107.673249221	169
btrfly trib	10/7/2010	12:45:11pm	2604.388	0.7	0.4	40.119575326	-107.673474546	170
btrfly trib	10/7/2010	12:46:14pm	2606.750	1.0	1.0	40.119739259	-107.673544805	171
btrfly trib	10/7/2010	12:49:06pm	2609.650	0.6	0.4	40.120008077	-107.673706011	172
topo	10/7/2010	12:50:48pm	2623.118	3.4	2.0	40.120139620	-107.673471638	173
topo	10/7/2010	12:53:01pm	2644.222	9.7	5.3	40.120167625	-107.673018135	174
topo	10/7/2010	12:54:19pm	2649.576	1.9	1.1	40.120461462	-107.672645857	175
topo	10/7/2010	12:55:16pm	2658.017	0.7	0.4	40.120577230	-107.672388915	176
btm dmp	10/7/2010	12:56:21pm	2667.670	2.2	1.2	40.120434389	-107.672100808	177
drng	10/7/2010	12:58:10pm	2670.114	5.1	2.9	40.120287813	-107.672036650	178
btm dmp	10/7/2010	12:59:38pm	2666.481	1.2	0.6	40.120010459	-107.671894628	179
btm dmp	10/7/2010	01:04:27pm	2665.968	0.7	0.4	40.120450354	-107.672103819	180
edge dmp	10/7/2010	01:05:33pm	2670.340	1.4	1.2	40.120538741	-107.672034981	181
edge dmp	10/7/2010	01:07:33pm	2678.658	0.6	0.4	40.120660417	-107.671896762	182
tp edge dmp	10/7/2010	01:08:32pm	2686.646	0.8	0.6	40.120656034	-107.671761295	183
tp hghwll	10/7/2010	01:57:53pm	2700.467	0.6	0.5	40.119874026	-107.670746601	184
tp hghwll	10/7/2010	01:58:33pm	2702.785	0.5	0.4	40.119783007	-107.670646036	185
tp hghwll	10/7/2010	02:00:39pm	2716.199	0.6	0.4	40.119658984	-107.670312693	186
tp hghwll	10/7/2010	02:01:26pm	2718.070	0.5	0.4	40.119779517	-107.670202347	187
tp hghwll	10/7/2010	02:01:57pm	2719.923	0.5	0.4	40.119951180	-107.670150946	188
tp hghwll	10/7/2010	02:02:21pm	2720.994	0.5	0.4	40.120075157	-107.670184502	189
topo	10/7/2010	02:02:50pm	2724.890	0.6	0.5	40.120024466	-107.670049338	190
topo	10/7/2010	02:03:25pm	2727.815	0.6	0.5	40.119932691	-107.669908320	191

ATTACHMENT 1

GPS Survey of Butterfly and Burrell Mine Sites—October 7, 2010

Comment	GPS_Date	GPS_Time	GPS_Height (meter)	Vert_Prec (meter)	Horz_Prec (meter)	Latitude	Longitude	Point_ID
topo	10/7/2010	02:03:47pm	2728.935	0.5	0.4	40.119829643	-107.669810096	192
topo	10/7/2010	02:04:22pm	2728.971	0.5	0.4	40.119730017	-107.669741138	193
topo	10/7/2010	02:05:09pm	2734.656	0.5	0.4	40.119784473	-107.669531821	194
topo	10/7/2010	02:05:44pm	2736.276	0.5	0.4	40.119971982	-107.669575544	195
gate	10/7/2010	02:06:39pm	2742.738	0.5	0.4	40.120009096	-107.669241303	211
rd	10/7/2010	02:06:58pm	2743.002	0.5	0.4	40.119979212	-107.669204356	212
rd	10/7/2010	02:07:29pm	2741.215	0.5	0.4	40.120212086	-107.669424003	213
rd	10/7/2010	02:08:06pm	2739.058	0.5	0.4	40.120483014	-107.669564351	214
rd	10/7/2010	02:08:51pm	2736.282	0.6	0.4	40.120857136	-107.669741739	215
post	10/7/2010	02:10:32pm	2736.748	0.6	0.4	40.121707384	-107.670196251	216
topo	10/7/2010	02:12:31pm	2725.881	0.6	0.4	40.120687497	-107.670258405	217
topo	10/7/2010	02:14:07pm	2721.263	0.5	0.5	40.120515969	-107.670331449	218
topo	10/7/2010	02:15:28pm	2733.284	0.4	0.4	40.120492913	-107.669821723	219
topo	10/7/2010	02:17:50pm	2729.885	0.5	0.4	40.120553927	-107.669983690	220
tp hghwll	10/7/2010	02:18:55pm	2721.170	0.5	0.4	40.120177529	-107.670234593	221
tp hghwll	10/7/2010	02:19:50pm	2719.320	0.6	0.5	40.120303782	-107.670360076	222
tp hghwll	10/7/2010	02:21:26pm	2720.315	0.5	0.4	40.120034790	-107.670179972	223
topo	10/7/2010	02:22:45pm	2710.591	0.6	0.6	40.119002094	-107.670261945	224
topo	10/7/2010	02:23:11pm	2715.048	0.5	0.5	40.119002963	-107.670045965	225
tp hghwll	10/7/2010	02:23:43pm	2718.755	0.5	0.4	40.118996754	-107.669858363	226
topo	10/7/2010	02:24:09pm	2721.136	0.5	0.5	40.119079307	-107.669781876	227
topo	10/7/2010	02:24:51pm	2724.178	0.4	0.4	40.119267388	-107.669669786	228
topo	10/7/2010	02:25:21pm	2725.990	0.5	0.4	40.119215751	-107.669410300	229
topo	10/7/2010	02:25:36pm	2724.138	0.5	0.4	40.119112472	-107.669405632	230
tp hghwll	10/7/2010	02:25:52pm	2723.502	0.5	0.5	40.119037820	-107.669485361	231
topo	10/7/2010	02:26:30pm	2723.810	0.6	0.6	40.119101962	-107.669222512	232
tp hghwll	10/7/2010	02:28:23pm	2715.295	0.5	0.5	40.118886423	-107.669154793	259
tp hghwll	10/7/2010	02:29:32pm	2709.156	0.5	0.5	40.118793076	-107.669021716	260
btm hghwll	10/7/2010	02:29:54pm	2707.228	0.5	0.5	40.118767293	-107.669072117	261
btm hghwll	10/7/2010	02:30:18pm	2706.238	0.5	0.4	40.118787535	-107.669222075	262
btm hghwll	10/7/2010	02:30:46pm	2707.420	0.8	0.8	40.118829536	-107.669398736	263
btm hghwll	10/7/2010	02:31:14pm	2707.232	0.4	0.4	40.118860251	-107.669609210	264
bnch	10/7/2010	02:31:34pm	2707.166	0.5	0.5	40.118802791	-107.669578517	265
bnch	10/7/2010	02:31:50pm	2705.585	0.5	0.4	40.118694909	-107.669517248	266
bnch	10/7/2010	02:32:10pm	2705.508	0.4	0.4	40.118579809	-107.669321011	267
tp dmp	10/7/2010	02:35:27pm	2697.509	0.5	0.4	40.118276286	-107.669099459	294
edge dmp	10/7/2010	02:35:59pm	2691.778	0.5	0.4	40.118180009	-107.669131024	295
edge dmp	10/7/2010	02:36:41pm	2684.310	0.5	0.4	40.118119063	-107.668992865	296
edge dmp	10/7/2010	02:37:11pm	2679.060	0.6	0.5	40.118085777	-107.668814943	297
btm dmp	10/7/2010	02:37:49pm	2671.622	0.5	0.4	40.118043634	-107.668687179	298
btm dmp	10/7/2010	02:38:28pm	2671.545	0.5	0.5	40.118108192	-107.668554228	299
btm dmp	10/7/2010	02:39:31pm	2672.192	0.5	0.4	40.118265497	-107.668358768	300
edge dmp	10/7/2010	02:40:34pm	2676.273	0.8	0.7	40.118341352	-107.668278340	301
edge dmp	10/7/2010	02:41:14pm	2680.677	1.1	1.1	40.118412278	-107.668167077	302
tp dmp	10/7/2010	02:48:00pm	2690.408	0.5	0.5	40.118533827	-107.668139258	303
tp dmp	10/7/2010	02:49:06pm	2699.129	0.5	0.5	40.118626835	-107.668623101	304
tp dmp	10/7/2010	02:49:37pm	2700.631	0.4	0.4	40.118497979	-107.668789187	305
tp dmp	10/7/2010	02:50:05pm	2700.067	0.4	0.4	40.118384846	-107.668905652	306
bnch	10/7/2010	02:50:34pm	2701.340	0.4	0.4	40.118395461	-107.669079272	307
bnch	10/7/2010	02:50:56pm	2704.301	0.5	0.4	40.118439455	-107.669163414	308
bnch	10/7/2010	02:52:23pm	2705.302	0.5	0.5	40.118698782	-107.669151496	309
bnch	10/7/2010	02:53:07pm	2704.570	0.4	0.4	40.118702677	-107.669388843	310
topo	10/7/2010	03:24:31pm	2703.550	0.5	0.4	40.119601456	-107.670859992	326
topo	10/7/2010	03:25:47pm	2706.622	0.5	0.4	40.119429421	-107.670606732	327
topo	10/7/2010	03:26:13pm	2707.897	0.7	0.7	40.119452765	-107.670505263	328
topo	10/7/2010	03:26:55pm	2707.497	0.5	0.5	40.119586401	-107.670526006	329
tp hghwll	10/7/2010	03:29:08pm	2702.910	0.5	0.4	40.119811804	-107.670690586	356
tp hghwll	10/7/2010	03:30:19pm	2708.506	0.5	0.5	40.119673647	-107.670443832	357
tp hghwall	10/7/2010	03:32:18pm	2701.096	0.7	0.6	40.119889783	-107.670925016	358
intersection	10/7/2010	04:06:15pm	2718.165	0.8	0.4	40.134673668	-107.682073817	359

ATTACHMENT 2

Site Visit Photographs—October 7, 2010

Butterfly and Burrell Mine Site Visit – October 7, 2010

Butterfly highwall and bench areas, looking northeast

Butterfly highwall and main adit, looking southeast

Butterfly adit

Butterfly highwall, looking southeast

Butterfly and Burrell Mine Site Visit – October 7, 2010

Butterfly bench, looking southwest

Butterfly dump, looking northwest

Butterfly dump, erosion gully

Butterfly tributary, about 500 feet below (west) of dumps, looking northwest

Butterfly and Burrell Mine Site Visit – October 7, 2010

Burrell bench and highwall, looking northeast

Burrell dump, top of dump, looking northwest

Burrell bench area, looking east

Burrell dump, bottom of dump, looking northwest

ATTACHMENT 3

Video from Site Visit—October 7, 2010

This attachment can be found on DVD provided with the report.

APPENDIX C

Site Visit Video

This appendix can be found on the CD provided with the report.