112c Annual Report

RECEIVED
FEB 01 2016
DIVISION OF RECLAMATION, MINING & SAFETY-MINERALS
FEE REPORT MAP

(DRMS Office Use Only)

Permit Number:	M-1973-021
Permittee Name:	Aggregate Industries - WCR, Inc.
Operation Name:	Morrison Quarry
County:	Jefferson
Anniversary Date:	December 31, 2015
Current Bond Amt:	$1,595,615.00
Annual Fee Due:	$791.00
Permit Acreage:	355.00
DRMS Specialist	MACC

According to C.R.S. 34-32.5-116 or 34-32-116, each year, on the anniversary date of the permit, an operator shall submit the Annual Fee, an Annual Report and Map showing the extent of current disturbances to affected land, required monitoring information, reclamation accomplished to date and during the preceding year, any new disturbance that is anticipated to occur during the upcoming year, any reclamation that will be performed during the upcoming year, the dates for the beginning of active operations, and the date active operations ceased for the year.

Information contained in this report will be reviewed by the Division upon receipt and prior to the next compliance inspection of the site. If, while completing this report, you learn that your site is not in compliance with the rules and the act, it is advisable that the issues be rectified promptly to avoid possible enforcement action.

1. Is the site identification sign posted in accordance with Rule 3.1.12(1)? YES NO

2. Is the affected area boundary clearly marked in accordance with Rule 3.1.12(2)? YES NO

3. Is the mine site in final reclamation (all material extraction and stockpile removal is complete)? YES NO
   If "YES," please note time limits related to completion of reclamation, Rule 3.1.3.

4. What was the date of last excavation, processing or hauling activity at the mine? N/A

5. Does the mine operate more than 180 days per year? YES NO
   If "NO", please review Rule 1.13 to assure that your mine is in compliance.

6. Has this mine been granted: a) approval of TEMPORARY CESSATION Status? YES NO
   b) approval for INTERMITTENT OPERATION? YES NO

7. Number of acres currently affected (mining + incomplete and or unreleased reclamation): _____
   See GEI Consultants Report for responses to report items 7 through 12.

8. Number of acres that were newly affected during the current report year: _____

9. Number of acres that were reclaimed during the current report year: _____

10. Estimated new acreage to be affected in the next report year: _____

11. Estimated acres to be reclaimed in the next report year: _____

12. **Total acres** in various stages of reclamation, since permitted mining activities began:

Total acres backfilled:		Total acres seeded w/ approved mix:		Total acres w/topsoil replaced:		Total acres mulched w/ approved mulch:	
Total acres graded:		Total acres fertilized w/ apvd fertilizer:		Topsoil replacement depth (in.):		Mulch application rate (tons/ac):	
Seed application method:		Fertilizer application method:		Mulch application method:			

13. Is weed control being conducted in accordance with an approved Weed Control Plan? YES NO N/A
If "YES", indicate the weed species, control area, control type, application rate and treatment date on the report map.

14. Is adequate topsoil reserved for reclamation, based on your approved permit? YES NO N/A
If "NO", please explain:

15. Is the reserved topsoil vegetated/stabilized in accordance with Rule 3.1.9(1)? YES NO N/A
If "NO" please explain:

16. If mining has exposed groundwater, is the site in compliance with the approved mining plan and Office of the State Engineer (Well Permit, S.W.S.P., and/or Permanent Augmentation Plan)? YES NO N/A

17. Are all hazardous materials stored within approved spill containment structures? YES NO N/A

18. Is your financial warranty value sufficient to cover the cost to complete reclamation? YES NO N/A

19. Is your basis for legal right to enter still valid? YES NO

20. Does your permit require you to submit monitoring information annually? YES NO N/A
If "Yes", please attach the required monitoring results to this Annual Report.

21. As required by Colorado Mined Land Reclamation Act and/or Colorado Land Reclamation Act for the Extraction of Construction Materials (C.R.S. 34-32-116 or 34-32.5-116), attach a map to this report that accurately depicts the permit boundary, current affected area boundary and location of the acreages specified in items 7- 12 and 14. UPDATED

MAP ATTACHED: X

Division records indicate the following permittee contact information. If this information is not current, please type or print **current** contact information:

Permittee Contact:	Michael C. Refer	
Permittee Company:	Aggregate Industries - WCR, Inc.	
Address:	1687 Cole Blvd., Ste. 300 Golden, CO 80401	
Phone Number:	(303) 985-1070	
Fax Number:	(303) 716-5299	(303) 716-5295
Email Address:	Mike.refer@aggregate-us.com	

I, the undersigned, hereby state that the information provided in this report is true and accurate, and that site operations are being conducted in accordance with the Division approved mining and reclamation plans.

Signature of Permittee, Corporate Officer, Owner, or Documented Designee

1/27/2016
Date

Consulting
Engineers
and
Scientists

GEI Consultants

Memorandum

To: Ms. Michelle Ramirez
Colorado Division of Reclamation, Mining, and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

From: Jeremy Deuto, P.E., P.G.

CC: Mike Refer
Connie Davis
Scottie Tate

Date: January 29, 2016

Re: Aggregate Industries – WCR Inc., Morrison Quarry, MLRB Permit M 1973-021, 2015 Annual Report

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Dear Ms. Ramirez,

This report presents the Geotechnical Addendum to the 2015 Annual Report for MLRB Permit M 1973-021. Summary of the 2015 mining activities are as follows:

- The area disturbed by mining activities in 2015 totaled approximately 71.9 acres.
- The area partially reclaimed in 2015 totaled approximately 2.8 acres.
- The area to be disturbed by mining activities in 2016 is anticipated to be 71.9 acres. The mining activity is anticipated to include overburden stripping and mine development in the expanded quarry area defined in the Fifth Amendment to Permit M 1973-021 in addition to contained mining. All of the anticipated disturbed areas are within the active mine.
- The area anticipated to be partially reclaimed in 2015 is approximately 0.52 acres within the Central Quarry. The area anticipated to be partially reclaimed in 2015 for the South Quarry is unknown at this time and will depend on 2015 market conditions. South Quarry reclamation will occur in the western portion of the South Quarry.

Permittee contact information is:

Permittee Contact:	Michael C. Refer
Permittee Name:	Aggregate Industries – WCR, Inc.
Address:	1707 Cole Blvd. Suite 100 Golden, CO 80401
Phone:	303-985-1070
Fax:	303-716-5229

GEI Consultants, Inc.
2625 Redwing Road, Suite 370, Fort Collins, CO 80526
970.224.7342
www.geiconsultants.com

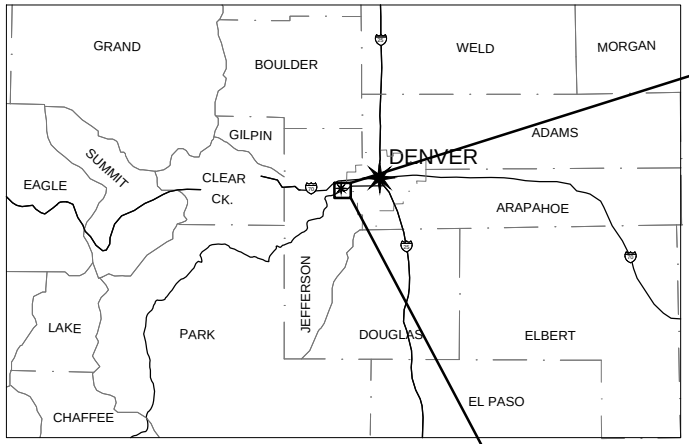
If you have questions, comments or require additional information, please contact me at 970.224.7343(o) or 303.775.2063(c) or email me at jdeuto@geiconsultants.com.

Sincerely,

GEI CONSULTANTS, INC.

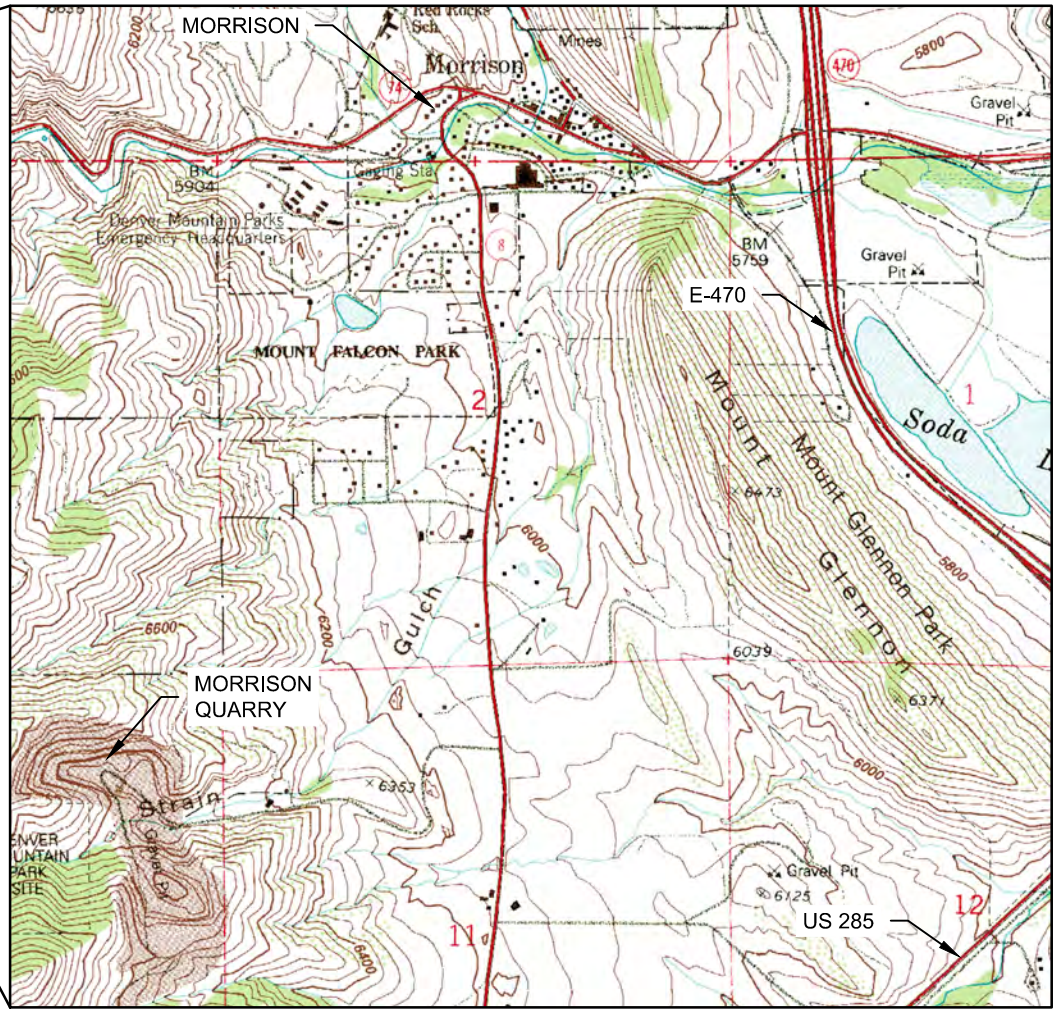
Jeremy Deuto, P.E., P.G.
Project Manager, Geotechnical Engineer

JD/bt



PROJECT LOCATION MAP

(NOT TO SCALE)



SITE LOCATION MAP

(NOT TO SCALE)

SOURCE:
USGS DIGITAL RASTER GRAPHIC,
MORRISON QUADRANGLE

DRAWING LIST:

SHEET 1	COVER SHEET
SHEET 2	NORTH QUARRY
SHEET 3	CENTRAL QUARRY
SHEET 4	SOUTH QUARRY

Morrison Quarry Annual Report 2015
MLRB Permit M 1973-021

Aggregate Industries

GEI Consultants

COVER SHEET

Project 1600260

January 2016

Sheet 1

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Sheet 1 - Site Vicinity Map.dwg Jan 2016

NOTES:

1. NO MINING OR RECLAMATION PLANNED FOR 2015.
2. DATE OF TOPOGRAPHY: NOVEMBER 2015.
3. BOUNDARY AREAS ARE BASED ON INFORMATION PROVIDED BY AGGREGATE INDUSTRIES.
4. NO AREAS DISTURBED OR RECLAIMED IN 2015.

0 400 800

SCALE, FEET

Morrison Quarry Annual Report 2015
MLRB Permit M 1973-021

Aggregate Industries

GEI Consultants

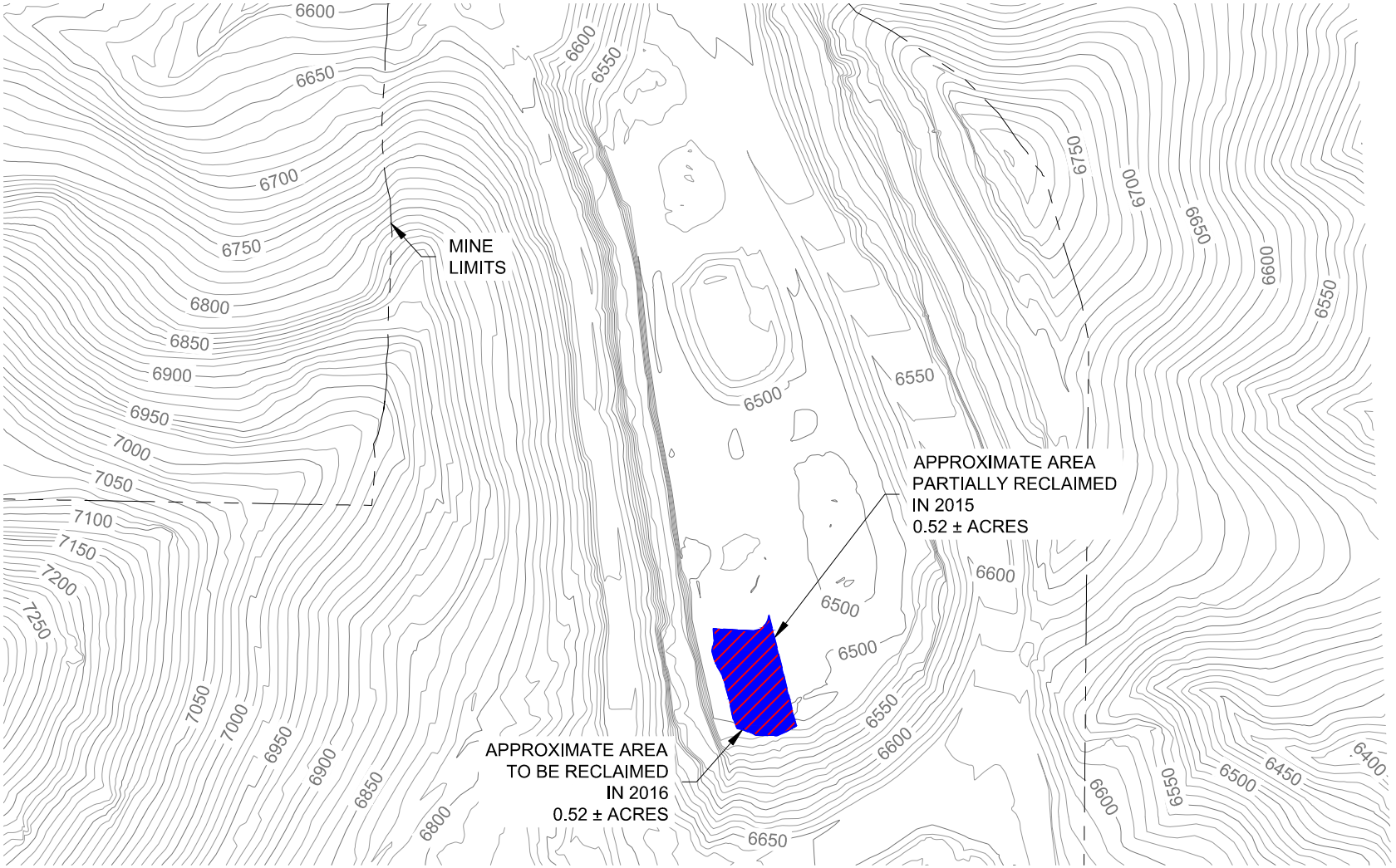
NORTH QUARRY

Project 1600260

January 2016

Sheet 2

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Sheet 2 - North Quarry.dwg Jan 2016



LEGEND:

RECLAIMED IN 2015

TO BE RECLAIMED IN 2016

NOTE: AREA TO BE RECLAIMED IN 2016 WILL BE VIA SLURRY PLACEMENT. AREA WILL BE FILLED FROM BOTTOM UP.

NOTE: DATE OF TOPOGRAPHY NOVEMBER 2015.

0 300 600

SCALE, FEET

Morrison Quarry Annual Report 2015
MLRB Permit M 1973-021

Aggregate Industries

GEI Consultants

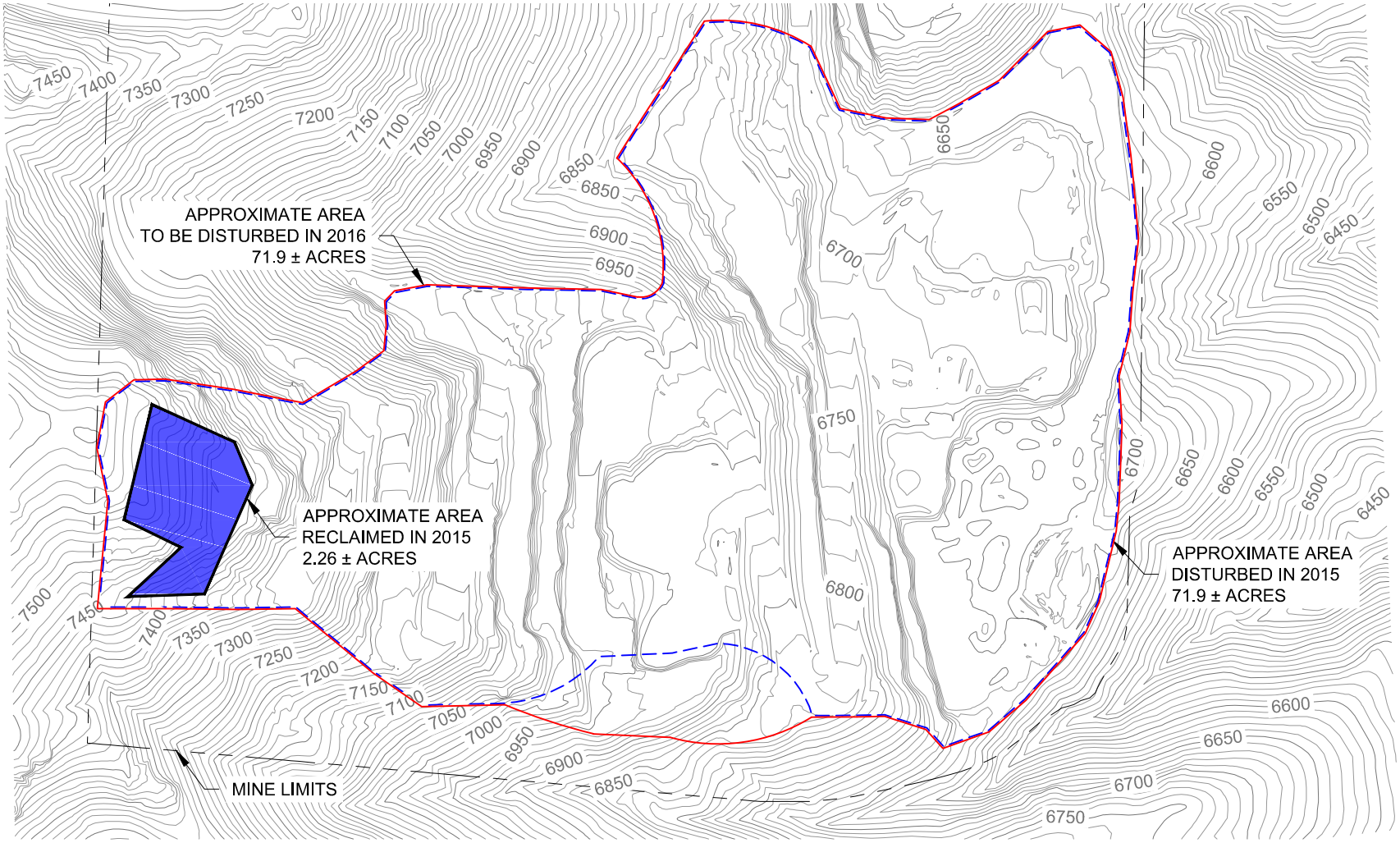
CENTRAL QUARRY

Project 1600260

January 2016

Sheet 3

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Sheet 3 - Central Quarry.dwg Jan 2016



LEGEND:

- RECLAIMED IN 2015
- 2015 DISTURBANCE LIMITS
- 2016 DISTURBANCE LIMITS

0 400 800

SCALE, FEET

N

NOTE:
DATE OF TOPOGRAPHY NOVEMBER 2015.

Morrison Quarry Annual Report 2015
MLRB Permit M 1973-021

Aggregate Industries

GEI Consultants

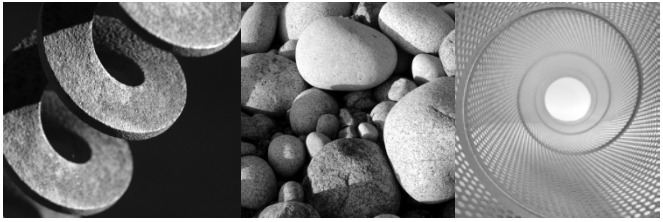
SOUTH QUARRY

Project 1600260

January 2016

Sheet 4

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Sheet 4 - South Quarry.dwg Jan 2016



GEI Consultants

Consulting
Engineers and
Scientists

Geotechnical Addendum

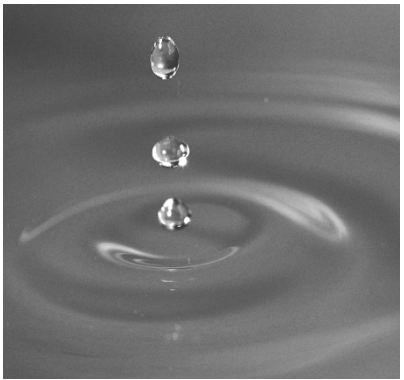
2015 Annual Report

Aggregate Industries Morrison Quarry
Permit M-1973-021
Jefferson County, Colorado

Submitted to:
Aggregate Industries
1707 Cole Blvd., Suite 100
Golden, CO 80401

Submitted by:
GEI Consultants, Inc.
2625 Redwing Rd., Suite 370
Fort Collins, CO 80526

January 2016
Project 1600260



Jeremy Deuto, P.E., P.G.
Project Manager

Paul Eggers, P.E.
Senior Reviewer

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1. Introduction

This report summarizes geotechnical observations gathered on January 11 and 12, 2016 at the Morrison Quarry, operated by Aggregate Industries (AI). This report supplements the "2015 Notice of Intent to Continue Mining Operations / Annual Report" for the Morrison Quarry. Rock characteristics such as joint and foliation orientation, shear zones, faults, and instability zones were mapped for areas mined in 2015. Recommendations provided for mine highwall configurations provided are based on GEI Consultants, Inc. (GEI) observations and data analysis. This addendum provides information required by Permit Amendment #5 (carried over from Permit Amendment #3 and #4) to Mining Permit M-1973-021.

1.1 Observational Method

The observational method for the Morrison Quarry is described in detail in Mine Plan Amendments #3 and #4. This step-wise approach to slope design uses new observational data to regularly update quarry highwall configuration. This methodology is used as a practical approach to mine highwall design for rock mass with variable condition that is difficult to classify. Newly obtained data will be compared to baseline data obtained during previous geotechnical addendums for analysis. This method has been used for slopes in the North, Central, and South Quarries of the Morrison Quarry.

The annual geotechnical addendums allow for Colorado Division of Reclamation, Mining, and Safety review of existing and evolving quarry conditions.

1.2 Site Description

The Morrison Quarry is located west of Colorado Highway 8 and approximately a ½ mile north of U.S. Highway 285 in Morrison, Colorado. The site location is shown in Figure 1. The mine site is located west of the Dakota hogback along the Front Range west of Denver, Colorado.

The Morrison Quarry consists of three cells; the North Quarry, the Central Quarry, and the South Quarry. Active mining no longer occurs within the North or Central Quarries. The North Quarry currently holds water utilized as mine process water. Within the North Quarry footprint, the North Repository acts as repository area for undesirable material such as waste aggregate from mine operations or damaged or inoperable mine equipment. The North Quarry was mined to an approximate bottom elevation of 6220 feet above mean sea level (MSL) utilizing highwalls and benches at a nominal 1:1 ([horizontal:vertical] H:V) slope. Equipment was placed in/removed from the North Repository during 2015 but no waste aggregate was placed.

The Central Quarry was mined to an approximate bottom elevation of 6330 above MSL utilizing highwalls and benches at a nominal 1:1 (H:V) or steeper slope. In 2015, reclamation continued within the Central Quarry. The reclamation consisted of placing material stripped from mining activities within the Central Quarry in addition to jade air fines created during aggregate production.

In the South Quarry, mining activity continued in 2015. Mining continued between approximate elevations 6900 and 7520 above MSL. The mining, utilizing highwalls and benches, primarily occurred on the western (east facing) portions of the South Quarry. Additional 2015 activities within the South Quarry included reclamation, construction and maintenance of haul roads, and overburden stripping.

2. 2015 Mining Summary

2.1 North Quarry

Mining in the North Quarry was completed in 2007 therefore no mining activity occurred in the North Quarry in 2015. The North Quarry is currently being used as a raw water storage reservoir for the Town of Morrison and production water storage for AI. The pond has a water elevation of approximately 6400 feet above MSL. Figure 2 shows the current configuration of the North Quarry, including the reservoir and the North Repository. A minor rockfall disturbance, possibly caused by freeze-thaw action, was noted in the northeast corner in 2014 (Fig. 28). GEI did not observe a change in the rockfall disturbance in 2015.

2.2 Central Quarry

Mining activity was completed in the Central Quarry in 2001. No mining activity occurred in 2015 and the Central Quarry experienced no major rock disturbances. Stripped materials including overburden, sillimanitic gneiss, and other undesirable material from the South Quarry were deposited as reclamation backfill in the Central Quarry during mining operations in 2015. In addition, jade air fines slurry was placed in the Central Quarry, filling the remaining area to be reclaimed. Figure 3 shows the configuration of the Central Quarry.

2.3 South Quarry

Mining operations continued in the South Quarry in 2015. The 2015 mining operations did not result in an expansion of the South Quarry 2014 mining footprint. Mining occurred primarily on the west (east facing) and south (north facing) portions of the South Quarry. The general configuration of the South Quarry is shown in Figure 4.

Mining in the South Quarry occurred between approximate elevation 6900 and 7520 above MSL. The mining resulted in several temporary mine highwall configurations of approximately 15 to 75 feet with benches of 20 to greater than 50 feet. Mining in 2015 resulted primarily in existing highwall expansion and minor highwall development. Total highwall height did not increase.

In addition, mine haul roads were modified to accommodate the revised highwall configuration, resulting in new or modified haul road highwalls. The approximate areas mined or disturbed in the South Quarry are shown in Figure 4. Figures 5 through 25 show the highwalls included in the scanline surveys conducted for the 2015 Geotechnical Addendum.

3. Field Data

Rock mass characteristics were documented at locations exposed during 2015 mining operations. Items documented include joint and foliation orientation and dip, highwall trends, and rock mass rating (RMR) classification estimates. In addition, unusual rock features exposed in the highwalls such as shear zones, intrusions, adversely dipping foliation, and areas of potential instability were documented.

Dip and orientation data was gathered using a Brunton compass with a 9 degree east magnetic declination and measurements were taken using the right hand rule. Measurements were estimated a safe distance from the highwalls and excavated areas to address safety considerations at the request of AI and GEI personnel.

RMR classification is determined from highwall conditions noted with the following parameters and associated point scales (numbers in parentheses):

- Estimated Strength of Intact Rock Material
  - Very High (15 points): >36,260 psi
  - High (12): 14,500 – 36,260 psi
  - Medium High (7): 7,250 – 14,500 psi
  - Moderate (4): 3,625 – 7,250 psi
  - Low (2): 725 – 3,625 psi
  - Very Low (1): 145 – 725 psi
- Estimated Drill Core Quality (RQD)
  - Excellent Quality (20 points): 90 – 100%
  - Good Quality (17): 75 – 90%
  - Fair Quality (13): 50 – 75%
  - Poor Quality (8): 25 – 50%
  - Very Poor Quality (3): <25%
- Spacing of Discontinuities
  - Very Wide (20 points): >6.5 feet
  - Wide (15): 2 – 6.5 feet
  - Moderate (10): 8 – 24 inches
  - Close (8): 2.4 – 8 inches
  - Very Close (5): <2.4 inches

- Groundwater Conditions
  - Inflow (liters per 10 m) or water pressure
  - Notes

- Discontinuity Persistence
  - Very Low (6 points): <3.3 feet
  - Low (4): 3.3 – 9.9 feet
  - Medium (2): 9.9 – 33 feet
  - High (1): 33 – 66 feet
  - Very High (0): >66 feet

- Discontinuity Separation (Aperture)
  - Very Tight Joints (6 points): <0.003 inches
  - Tight Joints (5): 0.003 – 0.02 inches
  - Moderately Open Joints (4): 0.02 – 0.1 inches
  - Open Joints (1): 0.1 – 0.4 inches
  - Very Wide Aperture (0): >0.4 inches

- Discontinuity Roughness
  - Very Rough Surfaces (6 points): VR
  - Rough Surfaces (5): R
  - Slightly Rough Surfaces (3): SR
  - Smooth Surfaces (1): SM
  - Slickened Surfaces (0): SL

- Discontinuity Filling (Gouge)
  - Type – clay, staining, shear, etc.
  - Thickness
  - Estimated Compressive Strength
  - Seepage – none, moist, dripping, etc.

- Discontinuity Wall Face Weathering
  - Unweathered (6 points): UW
  - Slightly Weathered (5): SW
  - Moderately Weathered (3): MW
  - Highly Weathered (1): HW
  - Completely Weathered (0): CW
  - Residual Soil (0): RS

The point scales were tallied resulting in a range of overall RMR values and classification for a given highwall. The classifications are as follows:

RMR Value	RMR Classification
0 – 20	Very Poor
21 – 40	Poor
41 – 60	Fair
61 – 80	Good
81 – 100	Very Good

3.1 North Quarry

No mining within the North Quarry occurred in 2015 and no major rock disturbances were noted, so no new orientation data was obtained during the 2015 review. Observations of the existing highwalls and benches, the repaired north slope, and the north repository area were conducted. Local raveling of rocks and minor instabilities were noted within the main trunk of the North Quarry. These instabilities and raveling events are assumed to be a result of adverse joint conditions, rock alteration, or freeze thaw weathering cycles. Typically, rocks loosened in this manner will be small (usually less than 18 inches) and will likely be contained on the benches. A minor rockfall event was noted in the northeast corner of the North Quarry at approximate elevation (El.) 6454 feet in 2014. The rockfall (Fig. 28) was mainly contained on the bench immediately below, with a few rock fragments extending beyond. GEI did not observe any changes in the rockfall disturbance in 2015. No instability was noted on the reposed north slope or the north repository.

No large-scale seepage was observed within the North Quarry. The water level was 6399.9 feet above MSL at the time of the 2015 review.

3.2 Central Quarry

No mining activity in the Central Quarry occurred in 2015 and no new orientation data was obtained during the 2015 review. Local raveling of rocks and minor instabilities were noted within the Central Quarry. These instabilities and raveling events are assumed to be a result of adverse joint conditions, rock alteration, or freeze thaw weathering cycles. Typically, rocks loosened in this manner will be small (usually less than 18 inches) and will likely be contained on the benches.

Minor groundwater seepage was visible in the west (east facing) highwall at approximate elevation 6600 feet. This seepage activity, noted as a changed condition in the 2013 geotechnical addendum, was compared to the 2013 documented condition (Fig. 27). The seepage was not observed to have expanded in 2015. This seepage, while still considered minor, should be monitored by AI in 2016.

Some material stripped from areas within the South Quarry in 2015 was deposited in the Central Quarry as part of ongoing quarry reclamation. The area of current reclamation is being filled with jade air fines. The current level of the fill was visibly close to the existing grade in the quarry at an approximate elevation of 6500 feet. The reclamation began at the northern end of the quarry and has continued south. 2015 reclamation was conducted as shown in Figure 3.

3.3 South Quarry

Geotechnical data was collected for areas mined in the South Quarry in 2015. These areas included three mined highwalls and benches at elevations 7000, 6950, and 6900 feet, and three partially reclaimed highwalls at elevations 7520, 7480, and 7450 feet. A highwall at approximate El. 7050 feet was not mapped due to safety concerns. Mining during 2015 did not deepen the South Quarry beyond the depths established in 2012, but represents expanded extraction to the south (north facing), and west (east facing).

The rock type observed within the South Quarry is consistent with rock type found within the North and Central Quarries, as well as rock type found at the South Quarry which has been described in previous geotechnical addenda. The rock type of the South Quarry is generally described as fine- to medium-grained granitic gneiss or biotite gneiss. Occasional intrusions are present in the granitic gneiss. Intrusions are composed of biotitic schist and pegmatitic material. Shear zones are also present and visible. Shear widths range from several inches to approximately 20 feet.

The rock type is typically slightly weathered to moderately weathered. Several highwall sections are more highly weathered. These sections are typically in areas proximal to the original (pre-mining) ground surface. Two prominent joint sets are visible throughout the South Quarry with prominent foliation. Joint sets are spaced by several inches to approximately 10 feet. The typical aperture of the joint sets is approximately one-tenth of an inch. Larger apertures are likely the result of mine blasting. The rock surfaces of the prominent joint sets are typically slightly rough to rough; joint openings range from very tight to moderately open. Iron staining is present on most joint faces, with less staining present at lower elevations. Joints generally do not contain infill material with several localized exceptions.

Foliation spacing is highly variable and ranges from less than one inch to several feet. The aperture of the foliation is typically tight; less than one-tenth of an inch. Foliation plane surfaces are generally characterized similarly to the two prominent joint sets: the surface is slightly rough to rough, and slightly weathered to moderately weathered with iron oxide staining. Infill material is not present except in localized incidences.

Sillimanitic gneiss associated with the shear zone was exposed and excavated on the 6640 Bench in localized areas. The persistence of this material appears to be consistent with the shear zone trend mapped in previous geotechnical addenda.

Average rock strength estimated using the RMR values indicate rock of poor to fair quality.

Detailed RMR bench data are included in Appendix A. Brief descriptions of scanline observations including notes on unusual rock features such as shear zones, intrusions, adversely dipping foliation, and areas of potential instability are presented below. The strike direction is established using the right-hand rule. The right-hand rule is an arbitrary standardization that states that of the two opposing strike directions the strike that is 90 degrees to the right of the dip direction shall be selected.

3.3.1 *Bench 7520*

The Bench 7520 scanline is approximately 315 feet long. The trend of a majority of the scanline is approximately 10 degrees. The bench is broken into sections at Station (Sta.) 0+25, 0+65, and 1+05. The 7520 highwall has been reclaimed and was therefore not mappable.

- Sta. 0+00 to Sta. 0+65 – Reclamation includes the placement of waste rock. No topsoil is present.
- Sta. 0+65 to the end at Sta. 3+15 – Reclamation includes the placement of topsoil and erosion control over waste rock. Some seeding has been conducted.

Photographic documentation of Bench 7520 is presented in Figures 5 and 6.

3.3.2 *Bench 7480*

The Bench 7480 scanline is approximately 380 feet long. The trend of a majority of the scanline is approximately 345 degrees. The bench is broken into two sections at Sta. 0+65. The 7480 highwall has been reclaimed and was therefore not mappable.

- Sta. 0+00 to the end at Sta. 3+80 – Reclamation includes the placement of topsoil and erosion control over waste rock. No seeding has been conducted.

Photographic documentation of Bench 7480 is presented in Figures 7 and 8.

3.3.3 *Bench 7450*

The Bench 7450 scanline is approximately 360 feet long. The trend of a majority of the scanline is approximately 355 degrees. The bench is broken into two sections at Sta. 1+45. The 7450 highwall has been reclaimed and was therefore not mappable.

- Sta. 0+00 to the end at Sta. 3+60 – Reclamation includes placement of waste rock and soil. No topsoil or erosion control has been placed. No seeding has been conducted.

Photographic documentation of Bench 7450 is presented in Figures 9 and 10.

3.3.4 *Bench 7000*

The Bench 7000 scanline is approximately 450 feet long and divided into two sections. All consisted primarily of granitic and biotic gneiss with a few mafic and pegmatite intrusions. Highly variable joint sets were present throughout the scanline.

- Approximately 400 feet of the southern portion of Bench 7000 was not mapped due to a narrowing of the bench that GEI determined presented unsafe mapping conditions.

- Section A (Sta. 0+00 to Sta. 0+80) of the scanline trended 340 degrees. Foliations exhibited a strike ranging from 340 degrees to 350 degrees with dips ranging from 35 degrees to 60 degrees. Two primary joint sets were evident. The first primary set exhibited an average strike of 345 degrees and average dip of 83 degrees. The second set exhibited an average strike of 80 degrees and an average dip of 82 degrees. Iron oxide staining was prevalent. The RMR classification is Poor to Fair.

- Section B (Sta. 0+80 to Sta. 3+70) of the scanline trended 340 degrees. Foliations exhibited a strike ranging from 340 degrees to 350 degrees with dips ranging from 310 degrees to 350 degrees. Two primary joint sets were evident. The first primary set exhibited an average strike of 147 degrees and average dip of 78 degrees. The second set exhibited an average strike of 45 degrees and average dip of 80 degrees. Iron oxide staining was prevalent. The RMR classification is Poor to Fair.

- Sta. 3+70 to Sta. 4+50 was not mappable due to overburden, mine waste, and/or rockfall obscuring the wall.

- A vertical pegmatite was visible at Sta. 0+00.

Figures 11 through 13 present photographic documentation of the Bench 7000 scanline. Figure 25 shows typical tension cracks visible on the bench and the highwall scanline.

3.3.5 *Bench 6950*

The Bench 6950 scanline is approximately 1330 feet long and divided into six distinct sections. All consisted primarily of granitic and biotic gneiss with several mafic and pegmatite intrusions. Highly variable joint sets were present throughout the scanline.

- Sta. 0+00 to Sta. 1+90 was not mappable due to overburden, mine waste, and/or rockfall obscuring the wall.

- Section A (Sta. 1+90 to Sta. 2+40) of the scanline trended 10 degrees. Foliations exhibited a strike ranging from 330 degrees to 30 degrees with dips ranging from 10 degrees to 40 degrees. Two primary joint sets and one secondary joint set were evident. The first primary set exhibited an average strike of 168 degrees and an average dip of 73 degrees. The second set exhibited an average strike of 67 degrees and an average dip of 83 degrees. The secondary set exhibited an average strike of 300 degrees and an average dip of 88 degrees. Iron oxide staining was prevalent. The RMR classification is Poor to Fair.

- Section B (Sta. 2+40 to Sta. 3+15) of the scanline trended 10 degrees. Foliations exhibited a strike ranging from 330 degrees to 10 degrees with dips ranging from 15 degrees to 40 degrees. Two primary joint sets and one secondary joint set were evident. The first primary set exhibited an average strike of 343 degrees and an average dip of 77 degrees. The second set exhibited an average strike of 52 degrees and an average dip of 87 degrees. The secondary set exhibited an average strike of 303 degrees and an average dip of 80 degrees. Iron oxide staining was slightly less prevalent than in Section A. The RMR classification is Poor to Fair. A vertical pegmatite was visible at Sta. 2+55 and a mafic complex was visible at Sta. 3+15.

- Section C (Sta. 3+15 to Sta. 3+95) of the scanline trended 10 degrees. Foliations exhibited a strike ranging from 150 degrees to 170 degrees with dips ranging from 35 degrees to 50 degrees. Two primary joint sets were evident. The first primary set exhibited an average strike of 340 degrees and an average dip of 73 degrees. The second set exhibited an average strike of 65 degrees and an average dip of 83 degrees. Iron oxide staining was prevalent. The RMR classification is Poor to Fair.

- Adversely dipping foliations were visible between Sta. 3+15 to Sta. 3+95.

- Section D (Sta. 3+95 to Sta. 7+00) of the scanline trended 10 degrees. Foliations exhibited a strike ranging from 150 degrees to 340 degrees with dips ranging from 5 degrees to 85 degrees. Two primary joint sets and one secondary joint set were evident. The first primary set exhibited an average strike of 354 degrees and average dip of 73 degrees. The second primary set exhibited an average strike of 276 degrees and an average dip of 73 degrees. The secondary set exhibited an average strike of 320 degrees and an average dip of 68 degrees. Iron oxide staining was slightly less prevalent than in Section C. The RMR classification is Poor to Fair. Pegmatites were visible at Sta. 5+35 and Sta. 6+25.

- Adversely dipping foliations were visible between Sta. 3+95 and Sta. 7+00.

- Section E (Sta. 7+00 to Sta. 8+20) of the scanline trended 10 degrees. Foliations exhibited a strike ranging from 20 degrees to 320 degrees with dips ranging from 10 degrees to 40 degrees. Two primary joint sets were evident but were recorded as secondary sets on RMR data sheets because they differed from previous primary joint sets. The first set exhibited an average strike of 300 degrees and an average dip of 77 degrees. The second set exhibited an average strike of 30 degrees and an average dip of 88 degrees. Iron oxide staining was intermittent on the secondary joint surfaces. The RMR classification is Poor to Fair. A vertical pegmatite was visible at Sta. 7+10.

- Section F (Sta. 8+20 to Sta. 9+80) of the scanline trended 10 degrees. Foliations exhibited a strike ranging from 310 degrees to 10 degrees with dips ranging from 5 degrees to 80 degrees. Two primary joint sets were evident but were recorded as secondary sets on RMR data sheets because they differed from previous primary joint sets. The first set exhibited an average strike of 333 degrees and an average dip of 65 degrees. The second set exhibited an average strike of 53 degrees and an average dip of 88 degrees. Iron oxide staining was intermittent on the secondary joint surfaces. The RMR classification is Poor to Fair. A mafic complex dipping 60 degrees was visible at Sta. 9+80.

- Sta. 9+80 to a corner at Sta. 11+00 was not mappable due to overburden, mine waste, and/or rockfall obscuring the wall. From Sta. 11+00, the scanline (not mappable) trended 100 degrees until a corner at Sta. 12+50 where the highwall trended 160 degrees to Sta. 13+30.

Figures 14 through 19 present photographic documentation of the Bench 6950 scanline.

3.3.6 *Bench 6900*

The Bench 6900 scanline is approximately 1260 feet long. The scanline is divided into four distinct sections. All consisted primarily of granitic and biotic gneiss with a few mafic and pegmatite intrusions.

- Section A (Sta. 0+00 to Sta. 3+50) of the scanline trended 260 degrees to a corner at Sta. 2+75 and trended 350 degrees to Sta. 3+50. Foliations exhibited a strike ranging from 210 degrees to 265 degrees with dips ranging from 20 degrees to 50 degrees. Two primary joint sets and two secondary joint sets were evident. The first primary set exhibited an average strike of 5 degrees and an average dip of 62 degrees. The second set exhibited an average strike of 86 degrees and an average dip of 81 degrees. The first secondary set exhibited an average strike of 205 degrees and an average dip of 73 degrees. The second secondary set exhibited an average strike of 80 degrees and average dip of 60 degrees. Iron oxide staining was abundant. There was some clay filling of the primary joint sets. The RMR

classification is Poor to Fair. Sta. 3+30 to Sta. 3+50 was not mappable due to mine waste and/or rockfall obscuring the wall.

- Section B (Sta. 3+50 to Sta. 6+25) of the scanline trended 350 degrees. Foliations exhibited a strike ranging from 330 degrees to 10 degrees with dips ranging from 5 degrees to 35 degrees. Two primary joint sets were evident. The first primary set exhibited an average strike of 10 degrees and average dip of 72 degrees. The second set exhibited an average strike of 103 degrees and average dip of 77 degrees. Iron oxide staining was prevalent. The RMR classification is Poor to Fair. Sta. 3+50 to Sta. 5+50 was not mappable due to mine waste and/or rockfall obscuring the wall. A vertical 2-foot-thick pegmatite was visible at Sta. 6+10.

- Section C (Sta. 6+25 to Sta. 8+00) of the scanline trended 350 degrees. Foliations exhibited a strike ranging from 10 degrees to 210 degrees with dips ranging from 25 degrees to 35 degrees. Two primary joint sets were evident. The first primary set exhibited an average strike of 343 degrees and average dip of 64 degrees. The second primary set exhibited an average strike of 227 degrees and average dip of 88 degrees. Iron oxide staining was prevalent. The RMR classification is Poor to Fair.

- Adversely dipping foliations were visible between Sta. 7+25 and Sta. 8+00.

- Section D (Sta. 8+00 to Sta. 9+00) of the scanline trended 350 degrees. Unusual foliations were present throughout this section. Conditions exhibited in Section D extended into the lower portion of Section C from Sta. 7+25 to 8+00 on an approximately 5H:1V slope. Foliations exhibited a strike ranging from 0 degrees to 170 degrees with dips ranging from 20 degrees to 45 degrees. Two primary joint sets and one secondary joint set were evident. The first primary set exhibited an average strike of 333 degrees and average dip of 63 degrees. The second primary set exhibited an average strike of 223 degrees and average dip of 81 degrees. The secondary joint set exhibited an average strike of 210 degrees and an average dip of 50 degrees. Iron oxide staining was prevalent. The RMR classification is Poor to Fair.

- Adversely dipping foliations were visible in the upper third of the highwall between 8+00 and 8+25.

- Sta. 9+00 to a corner at Sta. 9+30 was not mappable due to overburden, mine waste, and/or rockfall obscuring the wall. From Sta. 9+30, the scanline (not mappable) trended 90 degrees until a corner at Sta. 10+60 where the highwall trended 160 degrees to Sta. 12+60.

Figures 20 through 24 present photographic documentation of the Bench 6900 highwall scanline.

4. Results and Discussion

Based on observations made during the 2015 geotechnical field review of the Morrison Quarry performed in January 2016, staff familiarity with the site, and review of previous geotechnical addenda, the North Quarry has experienced little change in finished slope characteristics during 2015. Only small-scale, localized rockfall and highwall raveling occurred during the last year and are considered minor. GEI recommends that AI continues to monitor the minor rockfall location shown in Figure 28 for signs of increased instability such as increased volume of rockfall, an increase in rock size, and/or expansion of area impacted by the rockfall. While localized tension cracks observed in 2013 near the quarry office safe zone were not visible during the 2015 review, this area should also be monitored for signs of instability such as visible slope movement and/or tension cracks. The condition of the main trunk of the North Quarry is expected to remain stable during the course of the 2016 mining year with continued small-scale rockfall and highwall raveling expected to occur.

Based on observations made during the January 2016 field investigation of the Morrison Quarry, GEI staff familiarity with the site, and review of previous geotechnical addenda, the Central Quarry has experienced little change in finished slope characteristics during 2015. Only small-scale, localized rockfall and highwall raveling occurred during the last year and can be considered minor. The condition of the Central Quarry is expected to remain stable during the course of the 2016 mining year with continued small-scale rockfall and highwall raveling expected to occur. Reclamation was ongoing in 2015 and is expected to continue in 2016, bringing the floor of the quarry to an elevation of approximately 6500 feet. Seepage emanating from the west (east facing) highwall at approximate El. 6600 is considered minor (<2 – 3 gpm) and appears to not have impacted highwall stability. Although the seepage was noted in the 2013 addendum and no increase in seepage was observed in the 2015 review, the seepage area should be monitored in 2016 for increased flow rates, spreading, instability, etc. This area is not anticipated to impact highwall stability in 2016.

Amendment 3 to AI's Morrison Quarry Mining Permit M-1973-021 establishes requirements for rock stability at the Morrison Quarry. Granite and biotitic gneiss should be considered "competent"; rock and shear zones or highly weathered rock should be considered "poor" rock if the zones have the ability to decrease the overall stability of quarry highwalls and/or benches. The observed conditions in the newly-mined areas of the South Quarry are of predominantly "competent" rock quality. Localized "poor" zones were observed during the 2015 review. These "poor" areas are typically the result of the highwall's proximity to pre-mining topography ground or zones of sillimanitic gneiss.

An instability scarp was noted above Runaway Truck Ramp Highwall 6875 in the 2013 addendum. Additional movement was not observed during the 2014 review and the area was

removed in 2015 leaving a current slope that contains rock debris and exposed bedrock with adversely dipping foliation (Fig. 26). Changes in the Bench 6820 instability area were not observed during the 2015 review. GEI noted that mining activities above Bench 6820 have caused material to accumulate on the bench (Fig. 29). This is occurring along the entire bench, including the area of instability. The additional loading from the mining material on the instability area increases the possibility of additional movement/failure of the bench. As such, GEI advises AI to monitor and mitigate any additional loading of Bench 6820 caused by waste rock from mining at uphill highwalls.

In areas inspected for the 2015 Geotechnical Addendum, no conditions were observed that could lead to large-scale slope failures. There is likely a low probability of large wedge or toppling failures due to the joint and foliation orientation and RMR values observed in the rocks. Additionally, there is likely a low probability of large plane failures along foliation surfaces that can occur when the foliation surface dips into the highwall face at angles of 38 degrees or greater. There are areas where the unfavorable foliation conditions were observed or where small-scale wedge or toppling failures could occur, but the resulting blocks are anticipated to be relatively small and contained on the benches. Most of the unfavorable foliation orientations will likely change during mining operations due to the highly variable nature of the foliation planes; however, small-scale toppling or wedge conditions are likely to persist during mining. Kinematic analysis utilizing data obtained during the 2015 review supports the above conclusions. The results and stereonets are provided in Appendix B.

4.1 North Quarry

Observations in the North Quarry on January 11 and January 12, 2016 indicate:

- No major failures occurred last year;
- Minor, localized sloughing and raveling occurred;
- No change was observed in the 2014 minor rockfall in the northeast corner of the quarry near El. 6450. It is not anticipated to grow or impact safety to personnel or equipment;
- Nearly all rockfall was contained on the benches. Several puncture marks were present on the ice of the reservoir in the quarry, indicating some rockfall into the pond;
- Continued observation of the minor rockfall area and the reclaimed bench near mine office for signs of slope instability is recommended for 2016.

4.2 Central Quarry

Observations in the Central Quarry on January 11 and January 12, 2016 indicate:

- No major failures occurred last year;
- Minor, localized sloughing and raveling occurred;
- Nearly all rockfall was contained on the benches. Several puncture marks were present on the ice of the reservoir in the quarry, indicating some rockfall into the pond;
- The stabilized slope in the northeast section of the Central Quarry did not exhibit any instability or large erosional features;
- A small groundwater seepage area is visible on the west (east facing) side of the Central Quarry. This seepage should be monitored periodically during 2016. If the condition of the area worsens, engineering consultation is recommended.

4.3 South Quarry

Observations in the South Quarry on January 11 and January 12, 2016 indicate:

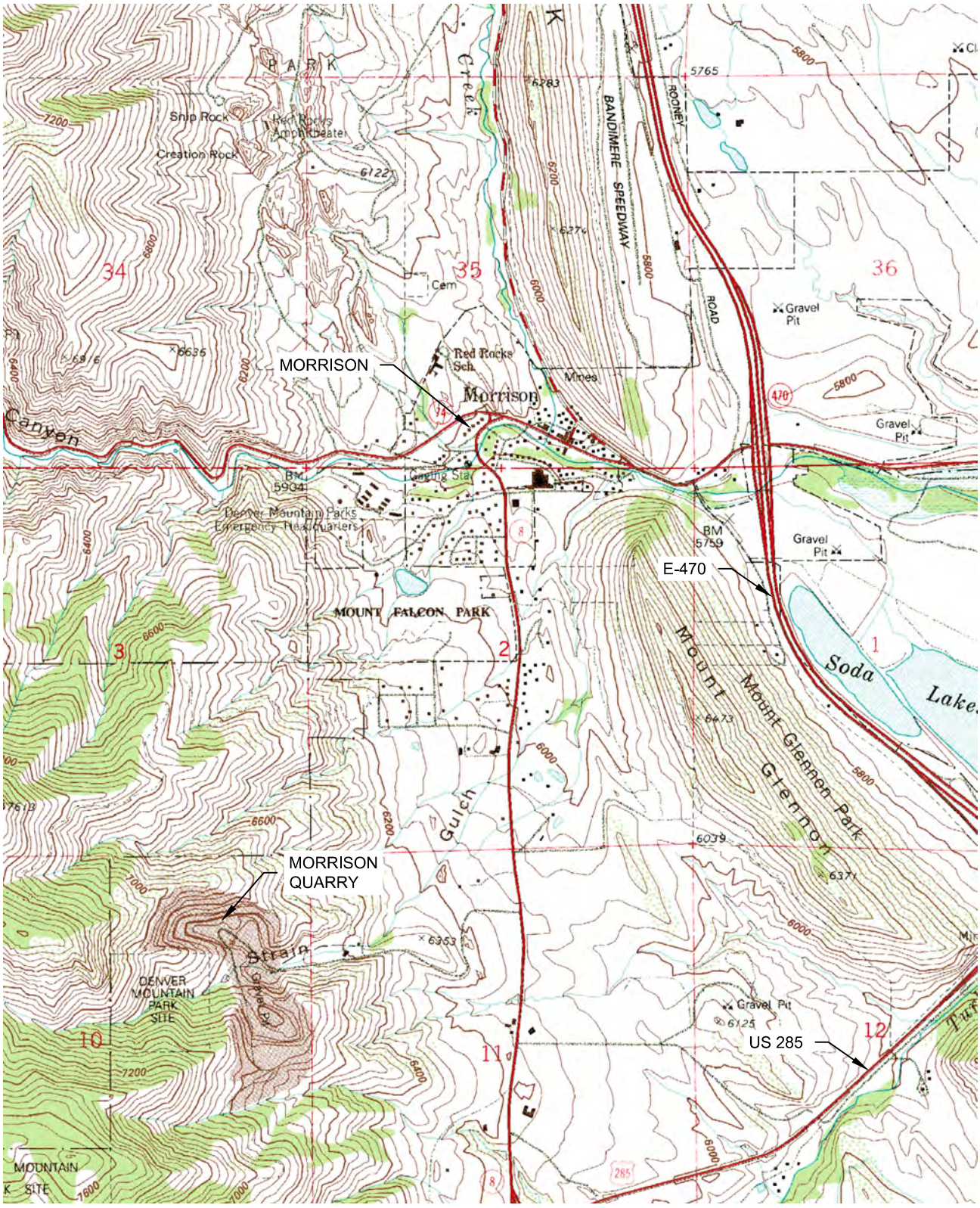
- No major failures occurred last year;
- Minor, localized sloughing and raveling occurred;
- Continued monitoring and mitigation of any additional loading of Bench 6820 instability area caused by uphill mining activity is recommended;
- Areas of adversely dipping foliation observed at Bench 6900 and Bench 6950 warrant extra caution when working near or below these areas. If the evidence of instability or movement in these areas is observed, engineering consultation is recommended;
- The tension cracks in the Bench 7000 highwall and bench warrant extra caution working near or below these areas due to the potential for minor toppling;
- The adversely dipping foliation above Runaway Truck Ramp 6875 warrants continued monitoring when working near or below this area. If the condition of the area worsens, engineering consultation is recommended.

Observations of mining activity in the South Quarry in 2015 appeared to follow the Permit and the Mine Plan. Mining did not increase the mine depth beyond 6640 or increase the overall footprint of the South Quarry. Rock types observed included granite and biotite or granitic gneiss with localized pegmatitic or mafic intrusions. The majority of the rock observed in the highwalls appeared fresh to moderately weathered, with the major exceptions located in highwalls proximal to the native topography. Highwall trends, typically north-south or east-west, along with observed typical joint and foliation orientations indicate favorable conditions to continue mining in accordance with the current mine plan.

5. References

GEI, 2015. Geotechnical Addendum, 2014 Annual Report, Morrison Quarry, Permit M-1973-021. January 2015.

Scott, Glenn R., Geologic Map of the Morrison Quadrangle, Jefferson County, Colorado 1972.

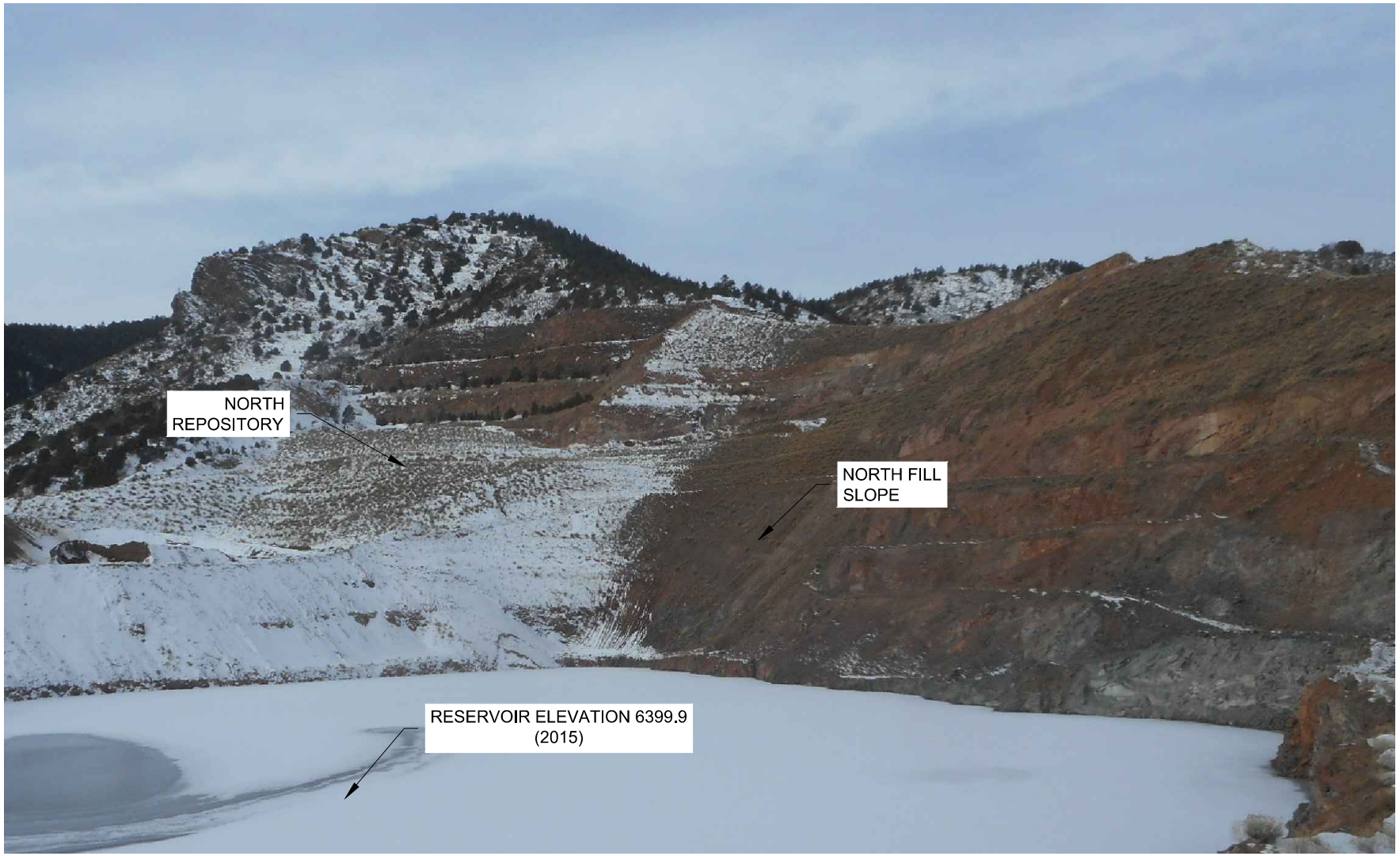


SOURCE:
USGS DIGITAL RASTER GRAPHIC,
MORRISON QUADRANGLE

NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	SITE LOCATION MAP
Aggregate Industries	Project 1600260	January 2016 Figure 1

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 1 - Site Location Map.dwg Jan 2016



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	CURRENT CONFIGURATION OF NORTH QUARRY
Aggregate Industries	Project 1600260	January 2016 Figure 2

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 2 - Current Configuration of North Quarry.dwg Jan 2016

NOTE: MATERIAL WAS PLACED IN 2015
VIA SLURRY

NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	CURRENT CONFIGURATION OF CENTRAL QUARRY
Aggregate Industries	Project 1600260	January 2016 Figure 3

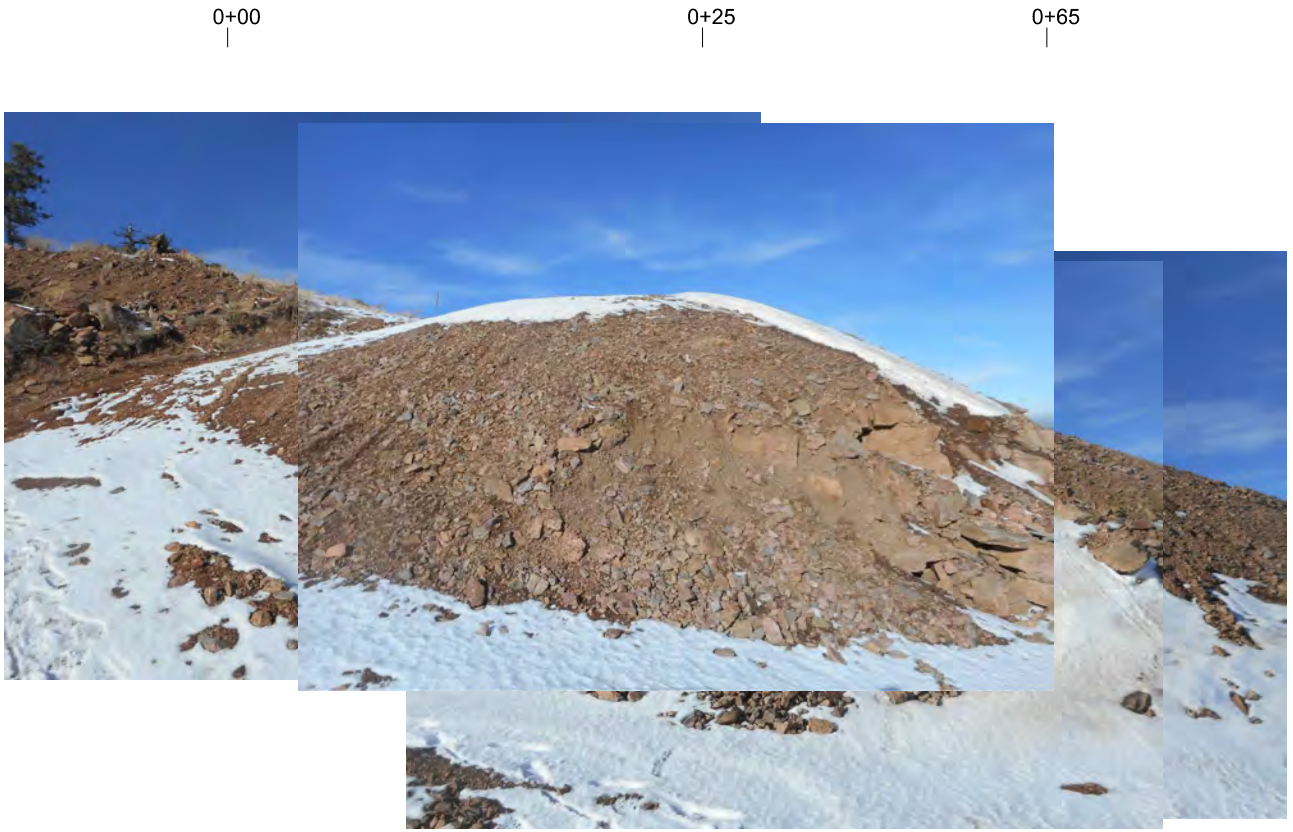
P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 3 - Current Configuration of Central Quarry.dwg Jan 2016

0 400 800

SCALE, FEET

Morrison Quarry	GEI Consultants	LIMITS OF MINING, 2015 AND HIGHWALL SCANLINES SOUTH QUARRY
Aggregate Industries	Project 1600260	January 2016 Figure 4

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 4 - Limits of Mining.dwg Jan 2016

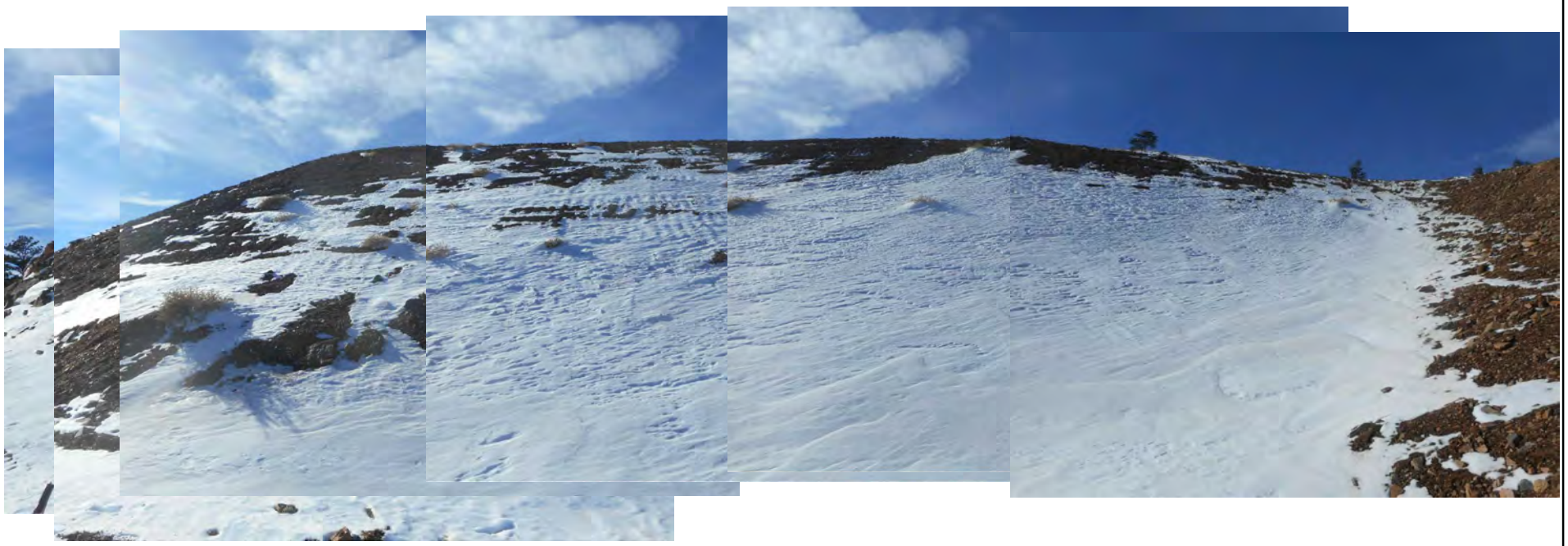


NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7520 (1 OF 2)
Aggregate Industries	Project 1600260	January 2016 Figure 5

1+05

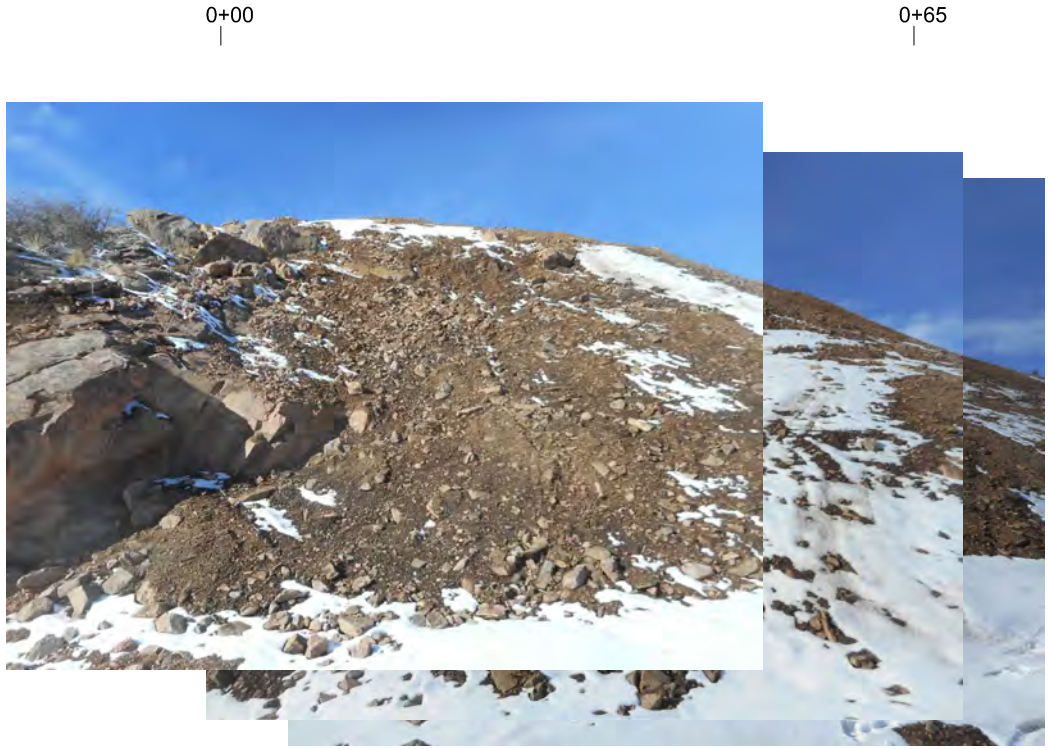
3+15



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7520 (2 OF 2)	
Aggregate Industries	Project 1600260	January 2016	Figure 6

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 6 - Reclamation Bench 7520 (2 OF 2).dwg Jan 2016



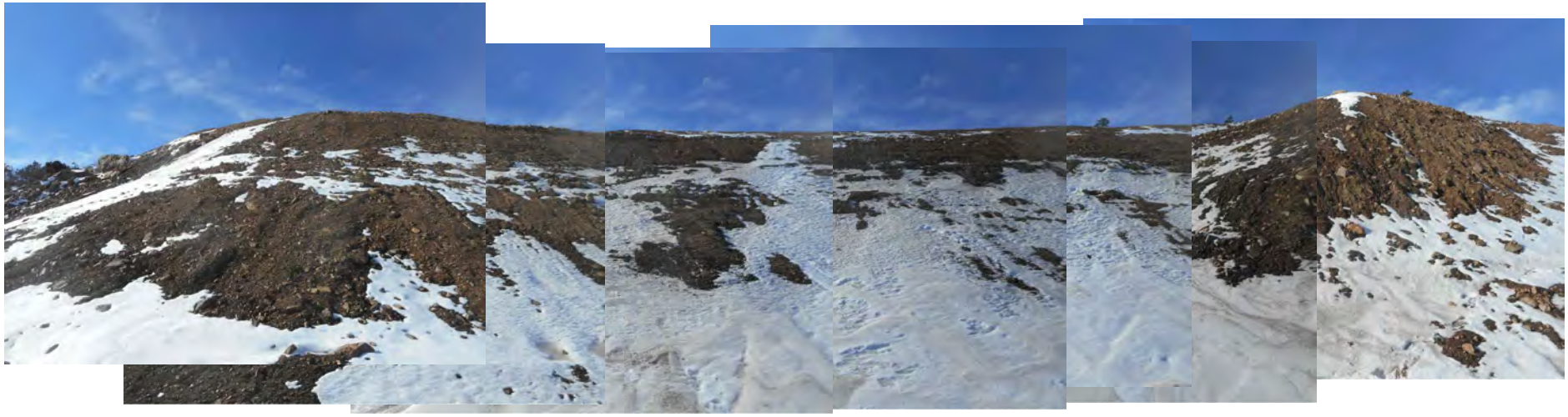
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7480 (1 OF 2)
Aggregate Industries	Project 1600260	January 2016 Figure 7

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 7 - Reclamation Bench 7480 (1 OF 2).dwg Jan 2016

0+65

3+80



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7480 (2 OF 2)
Aggregate Industries	Project 1600260	January 2016 Figure 8

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 8 - Reclamation Bench 7480 (2 OF 2).dwg Jan 2016

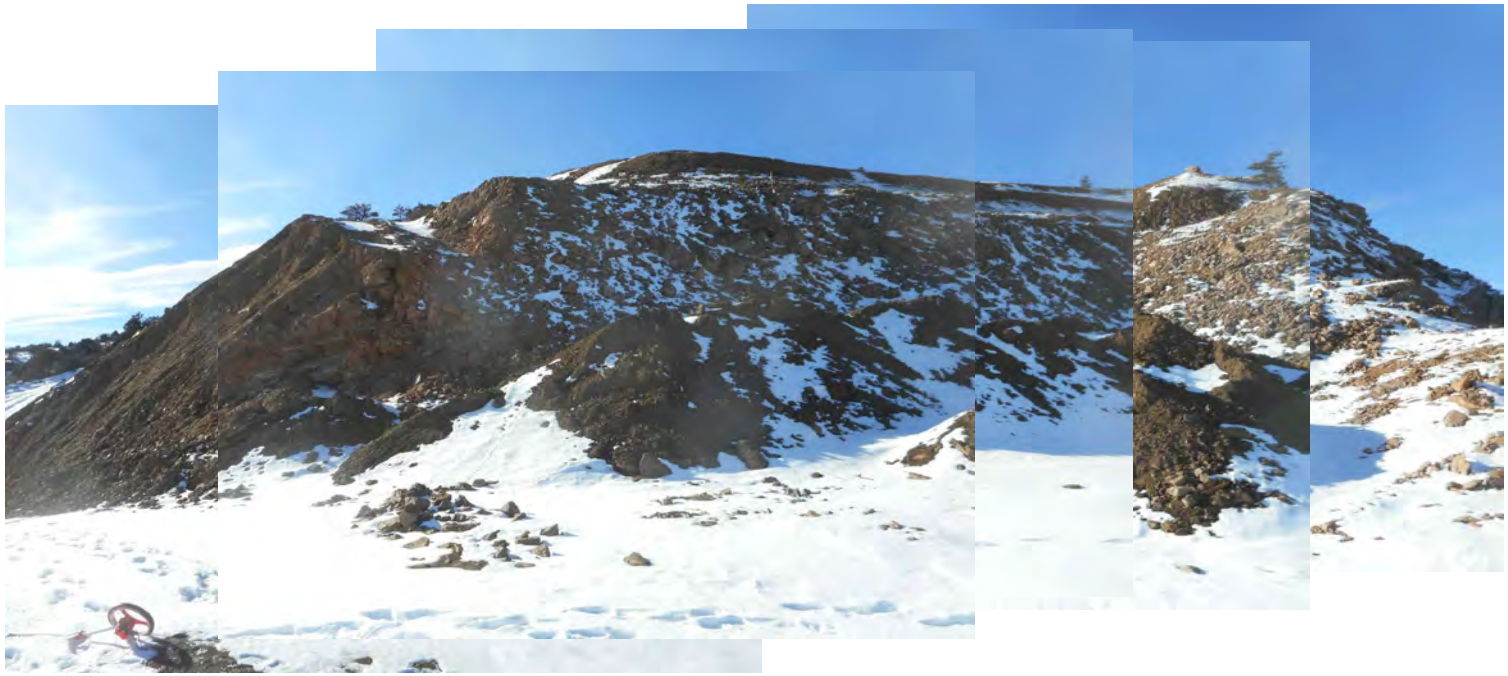
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7450 (1 OF 2)
Aggregate Industries	Project 1600260	January 2016 Figure 9

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 9 - Reclamation Bench 7450 (1 OF 2).dwg Jan 2016

1+45

3+60



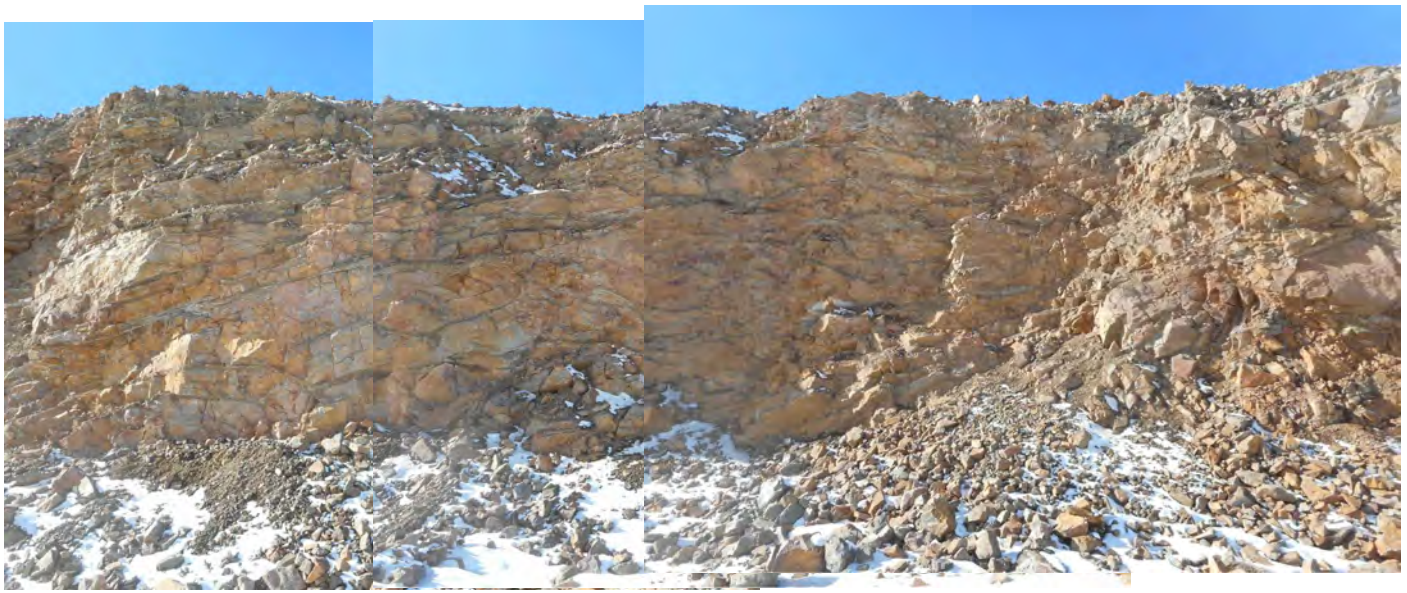
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7450 (2 OF 2)
Aggregate Industries	Project 1600260	January 2016 Figure 10

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 10 - Reclamation Bench 7450 (2 OF 2).dwg Jan 2016

0+00

0+80

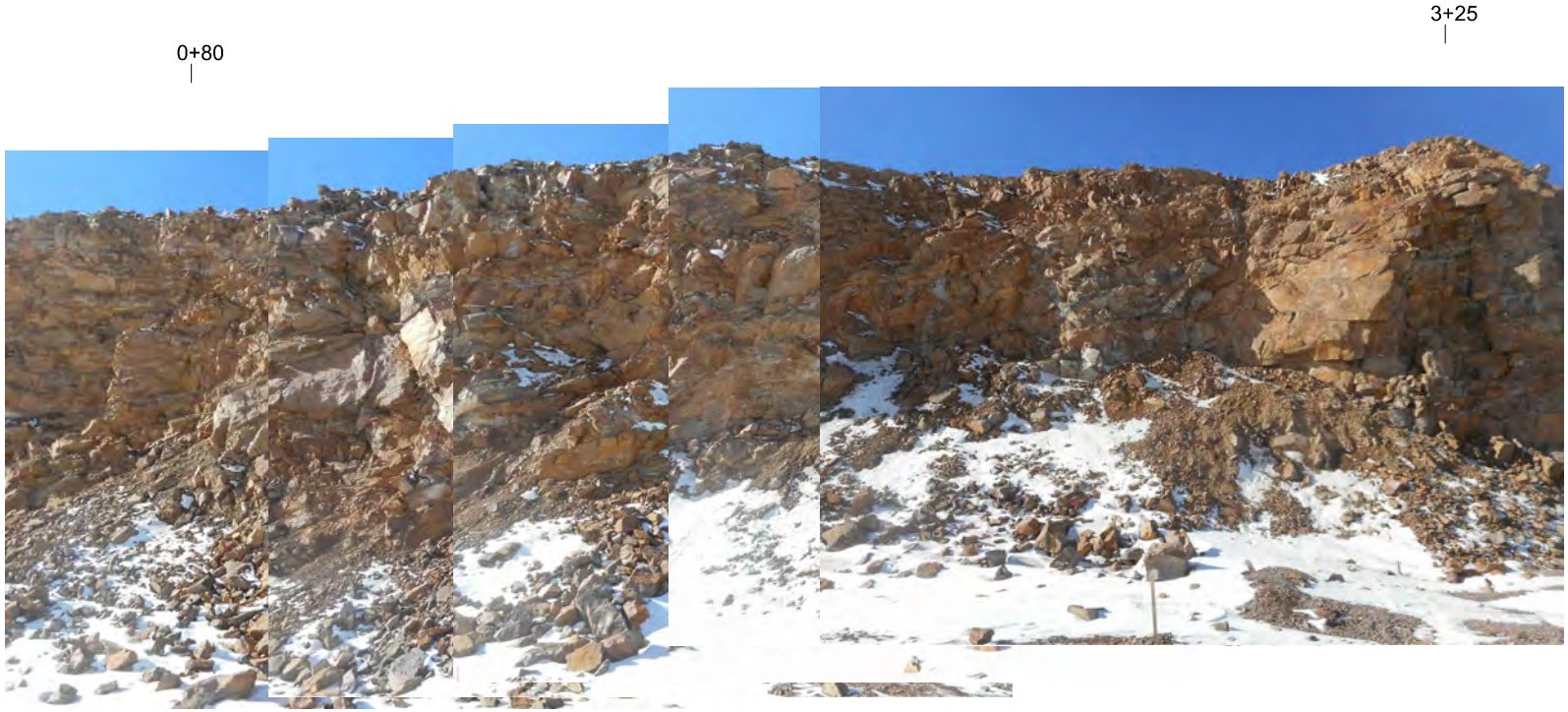


NOTE: HIGHWALL SOUTH OF 0+00 WAS NOT MAPPED OR PHOTOGRAPHED DUE TO UNSAFE CONDITIONS.

NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7000 SECTION A
Aggregate Industries	Project 1600260	January 2016 Figure 11

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 11 - Bench 7000 Section A.dwg Jan 2016



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7000 SECTION B (1 OF 2)
Aggregate Industries	Project 1600260	January 2016 Figure 12

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 12 - Bench 7000 Section B (1 OF 2).dwg Jan 2016

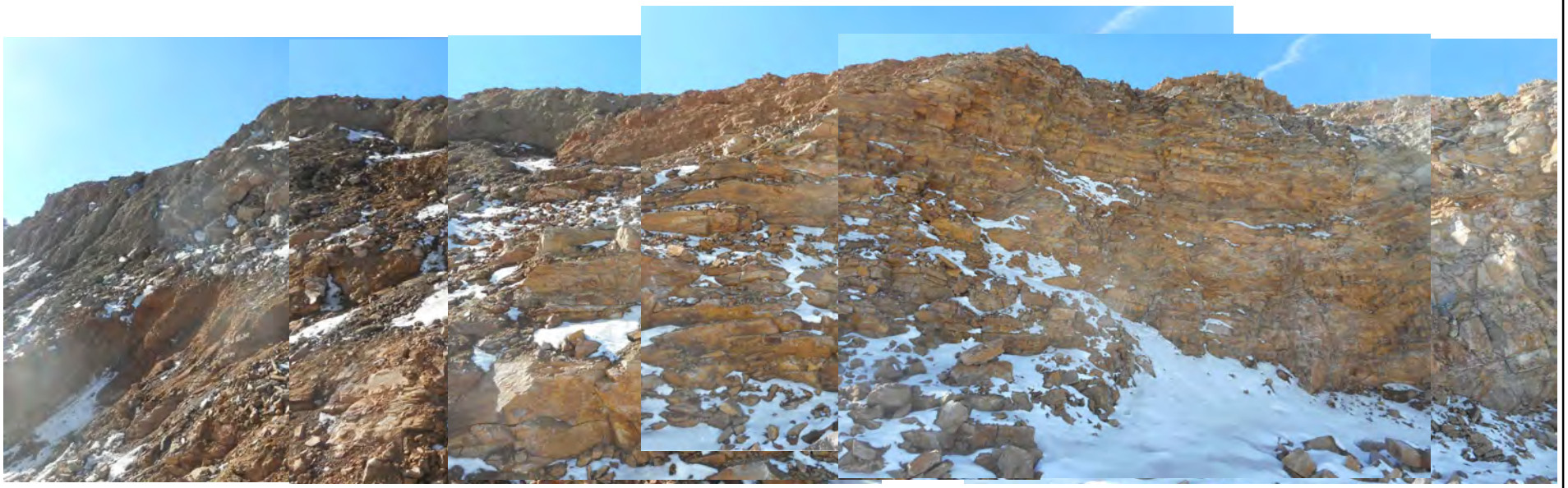
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 7000 SECTION B (2 OF 2)
Aggregate Industries	Project 1600260	January 2016 Figure 13

0+00

1+90

2+40



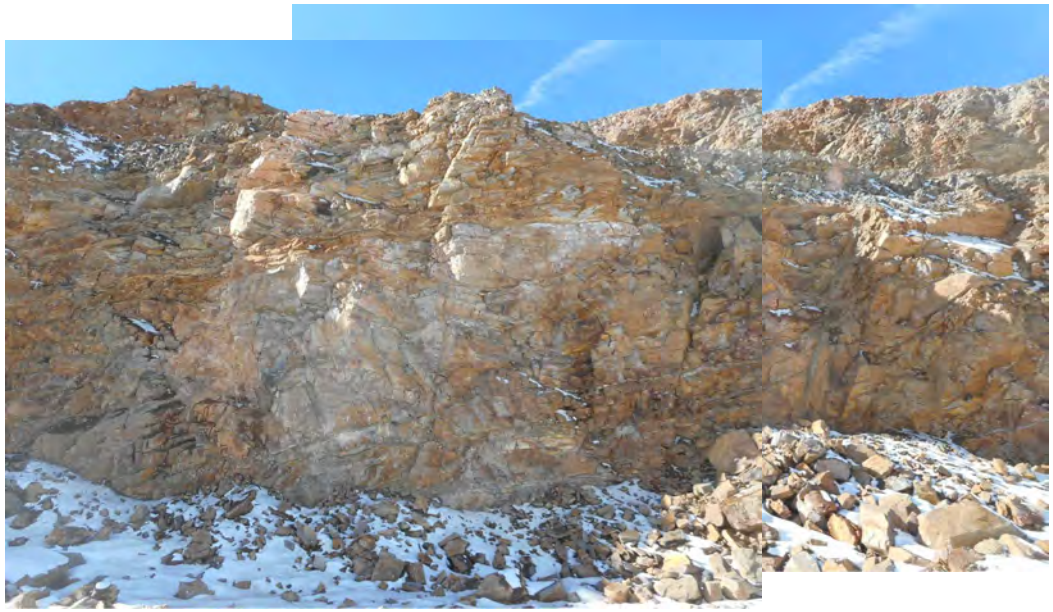
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6950 SECTION A
Aggregate Industries	Project 1600260	January 2016 Figure 14

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 14 - Bench 6950 Section A.dwg Jan 2016

2+40

3+15



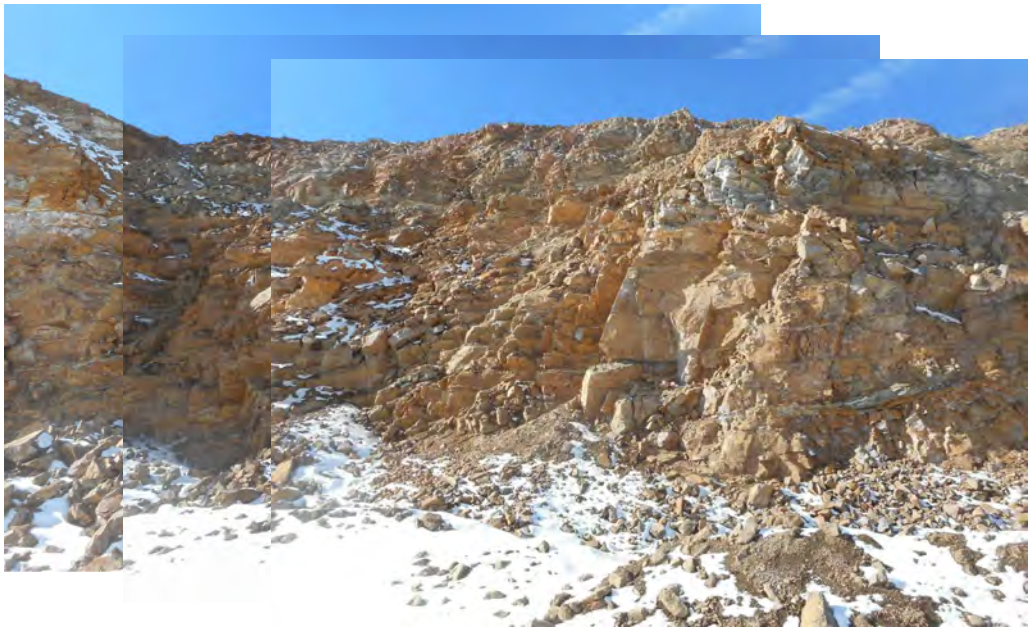
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6950 SECTION B
Aggregate Industries	Project 1600260	January 2016 Figure 15

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 15 - Bench 6950 Section B.dwg Jan 2016

3+15

3+95



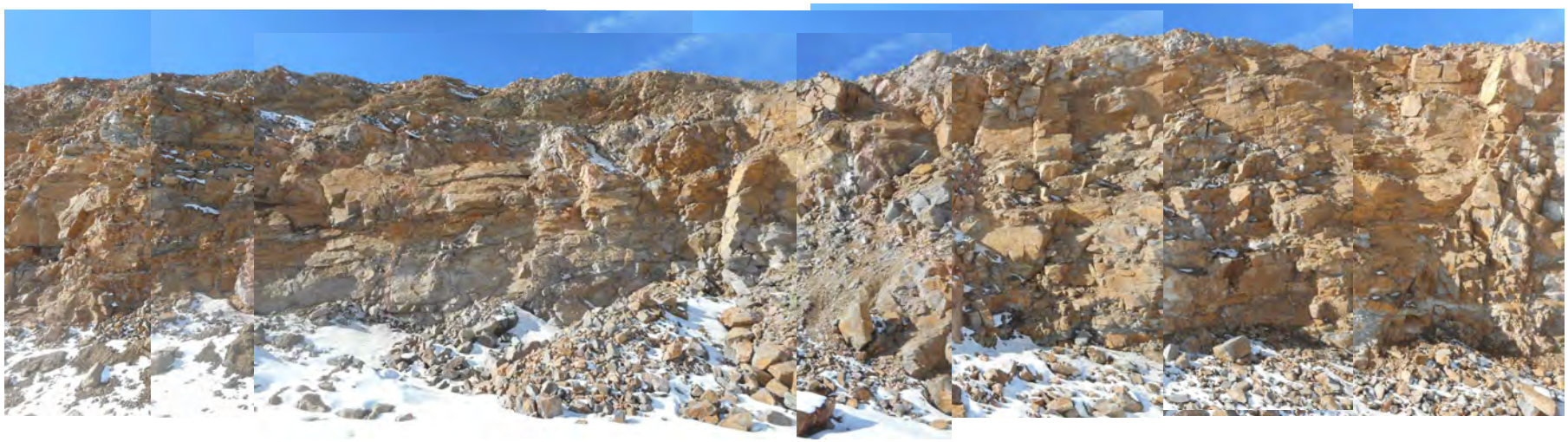
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6950 SECTION C
Aggregate Industries	Project 1600260	January 2016 Figure 16

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 16 - Bench 6950 Section C.dwg Jan 2016

3+95

7+00



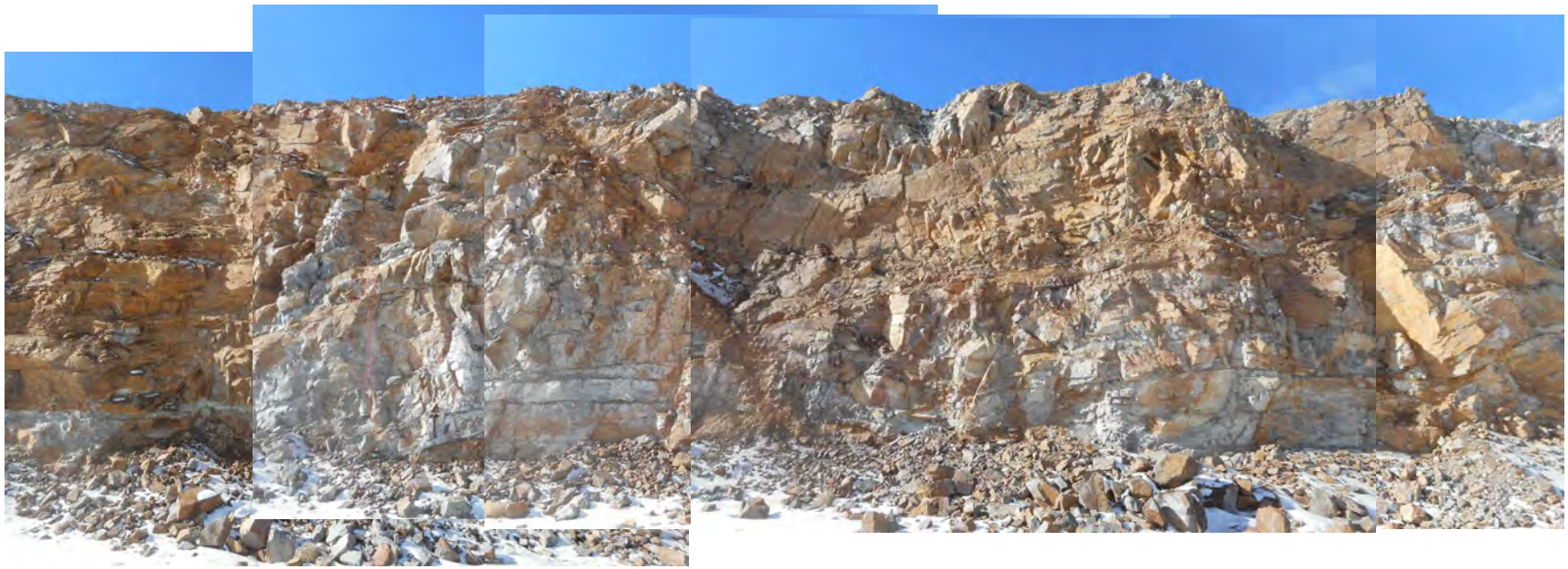
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6950 SECTION D	
Aggregate Industries	Project 1600260	January 2016	Figure 17

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 17 - Bench 6950 Section D.dwg Jan 2016

7+00

8+20



NOTE: DRAWING NOT TO SCALE.

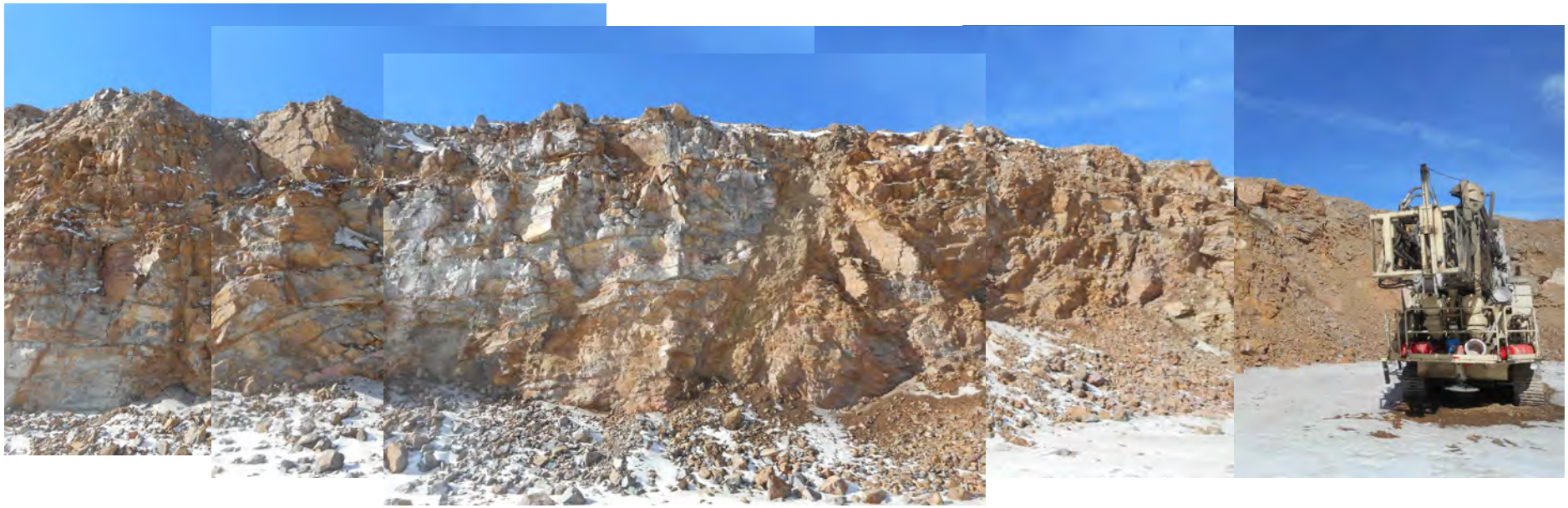
Morrison Quarry	GEI Consultants	BENCH 6950 SECTION E	
Aggregate Industries	Project 1600260	January 2016	Figure 18

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 18 - Bench 6950 Section E.dwg Jan 2016

8+20

9+80

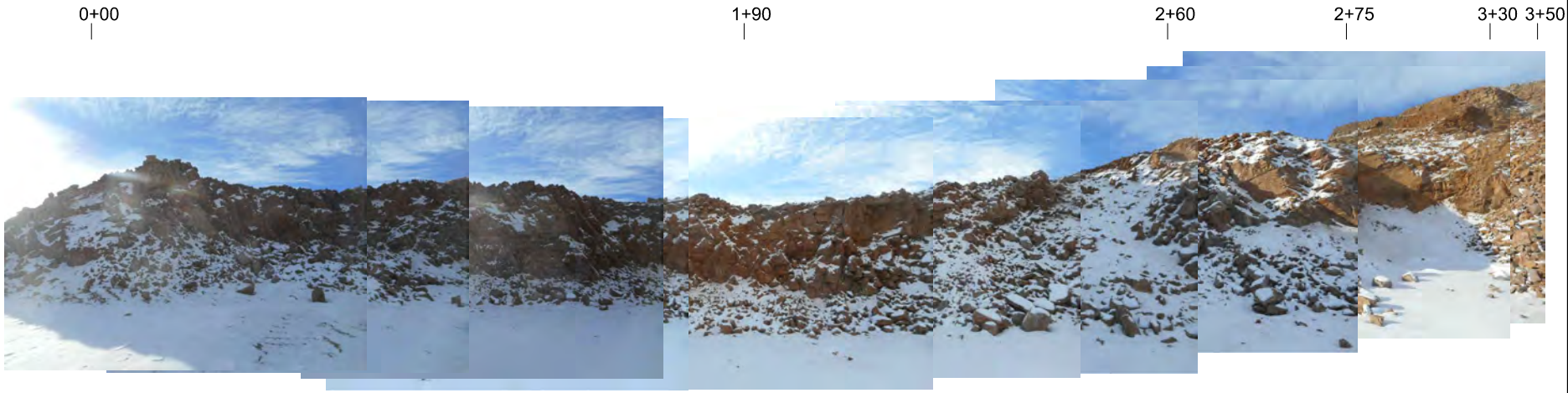
11+00



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6950 SECTION F	
Aggregate Industries	Project 1600260	January 2016	Figure 19

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 19 - Bench 6950 Section F.dwg Jan 2016



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6900 SECTION A
Aggregate Industries	Project 1600260	January 2016 Figure 20

3+50

5+50

6+25

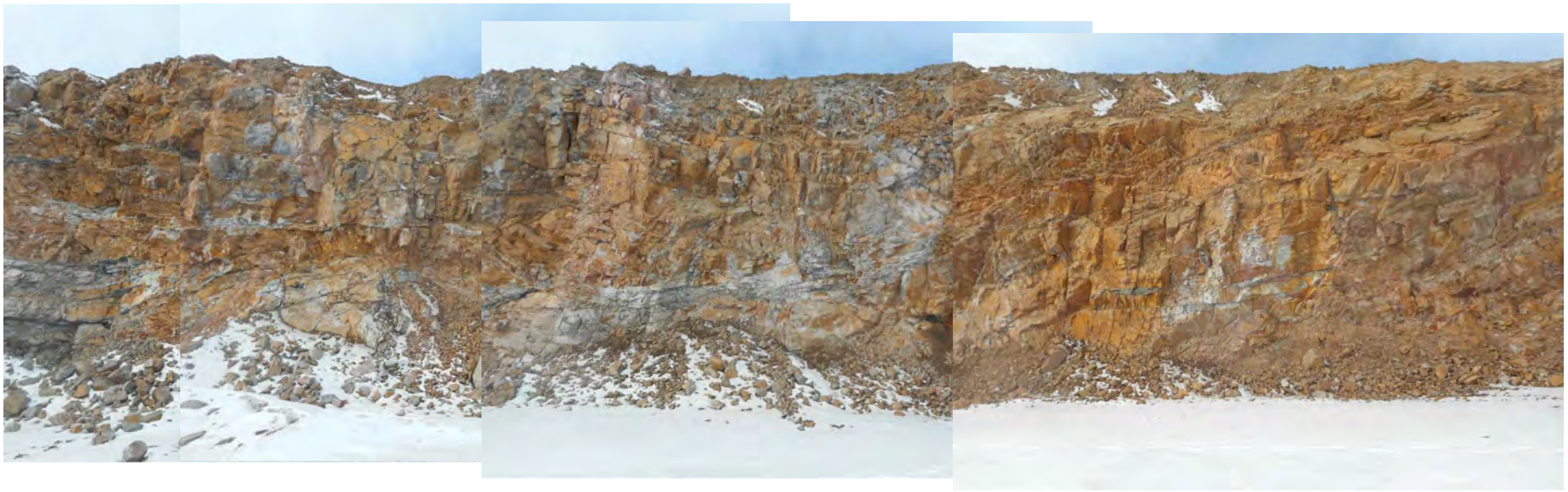
NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6900 SECTION B
Aggregate Industries	Project 1600260	January 2016 Figure 21

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 21 - Bench 6900 Section B.dwg Jan 2016

6+25

8+00



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6900 SECTION C
Aggregate Industries	Project 1600260	January 2016 Figure 22

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 22 - Bench 6900 Section C.dwg Jan 2016

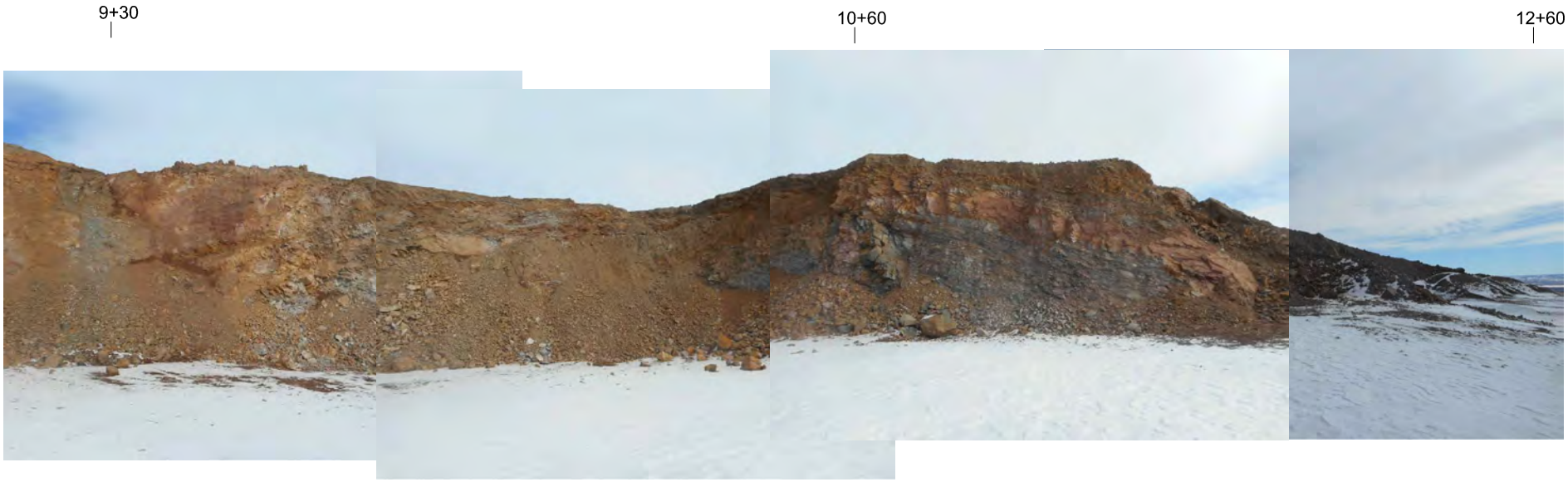
8+00

9+30

NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6900 SECTION D	
Aggregate Industries	Project 1600260	January 2016	Figure 23

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 23 - Bench 6900 Section D (1 OF 2).dwg Jan 2016



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6900
Aggregate Industries	Project 1600260	January 2016 Figure 24

	Morrison Quarry	GEI Consultants	BENCH 7000 TYPICAL TENSION CRACKS
NOTE: DRAWING NOT TO SCALE.	Aggregate Industries	Project 1600260	January 2016 Figure 25

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 25 - Bench 7000 Tension Cracks.dwg Jan 2016

2015

2016

NOTE: DRAWING NOT TO SCALE.

NOTE: SOIL REMOVED IN 2015. CURRENT SLOPE CONTAINS ROCK DEBRIS AND EXPOSED BEDROCK WITH ADVERSELY DIPPING FOLIATION.

Morrison Quarry	GEI Consultants	INSTABILITY ABOVE RUN AWAY TRUCK RAMP 6875 2015 - 2016 COMPARISON
Aggregate Industries	Project 1600260	January 2016 Figure 26

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 26 - Instability.dwg Jan 2016

2014

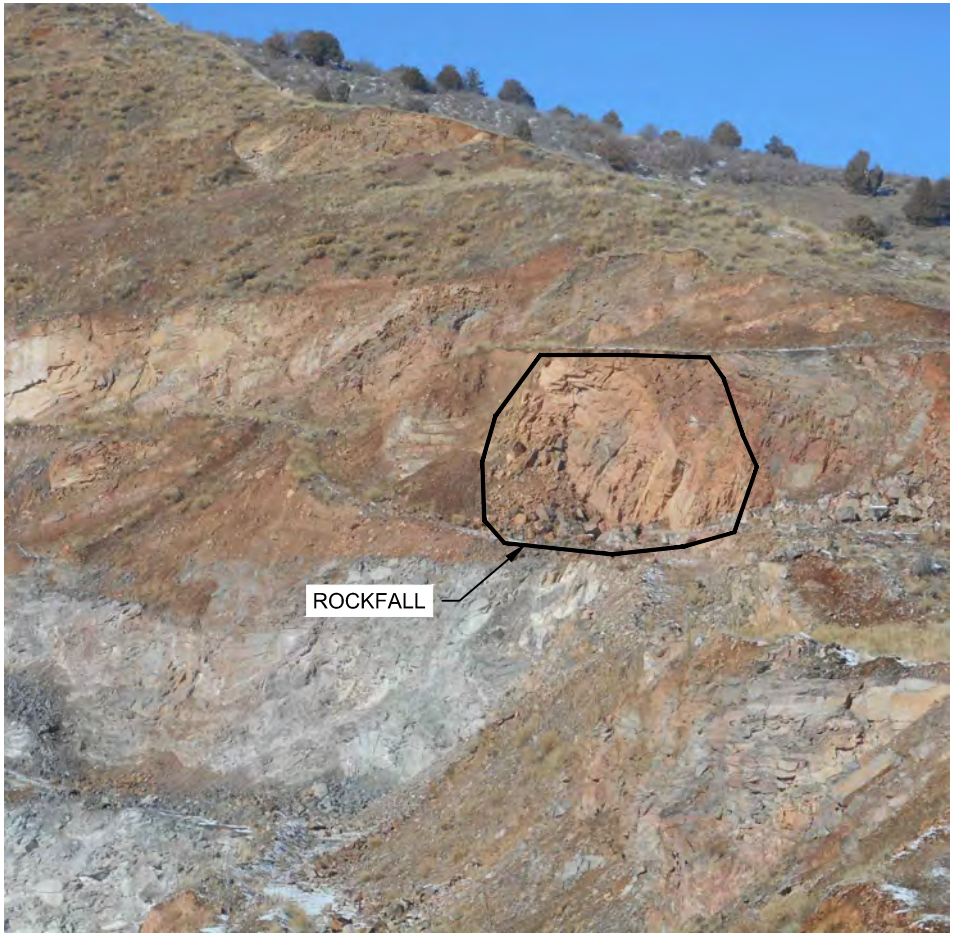
2015

2016

NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	CENTRAL QUARRY SEEPAGE COMPARISON 2014 - 2016
Aggregate Industries	Project 1600260	January 2016 Figure 27

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 27 - Central Quarry New Seepage.dwg Jan 2016



2015

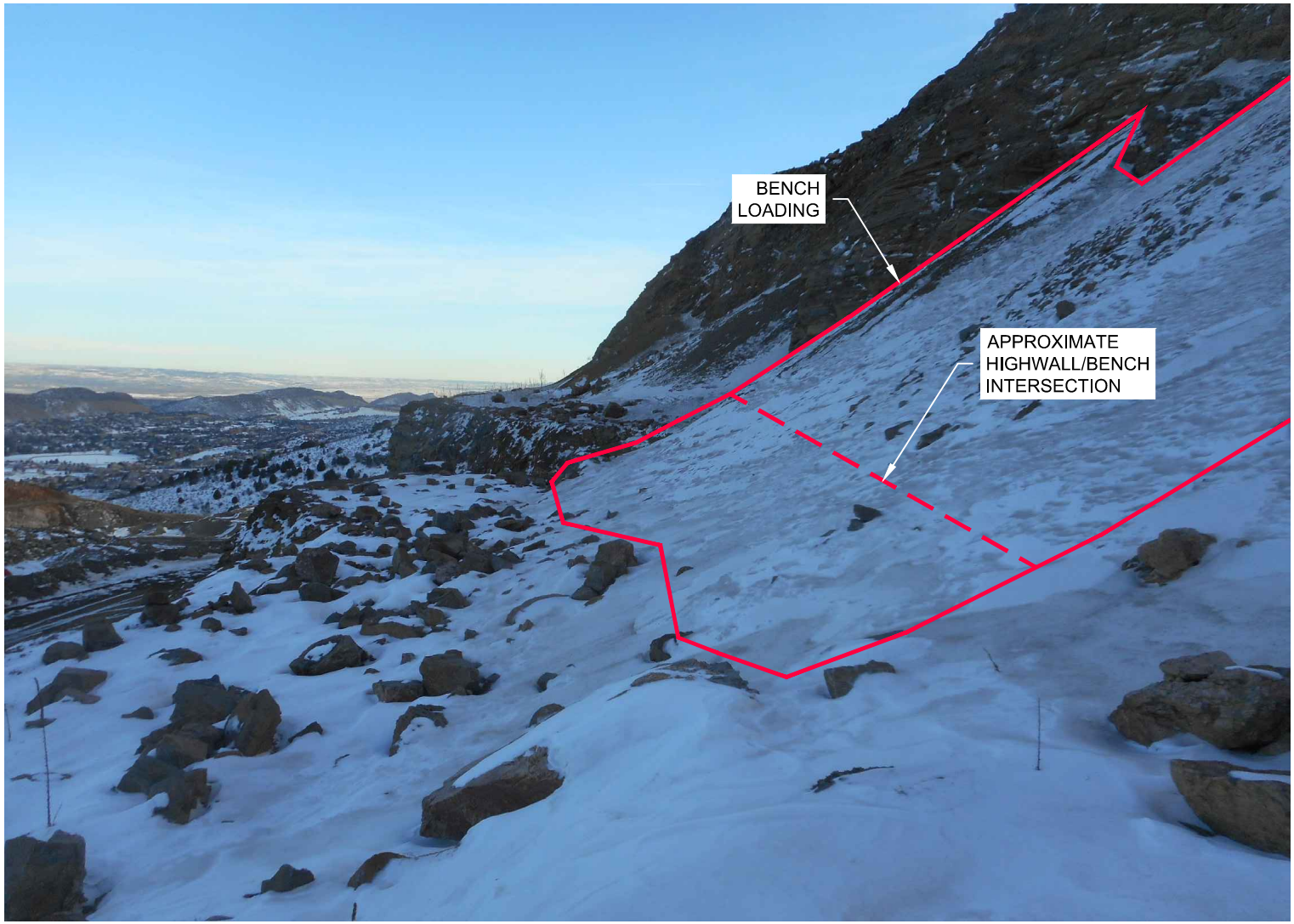
2016

NOTE: DRAWING NOT TO SCALE.

NOTE: NO CHANGE OBSERVED BETWEEN 2015 AND 2016.

Morrison Quarry	GEI Consultants	NORTH QUARRY MINOR ROCK FALL COMPARISON 2015-2016
Aggregate Industries	Project 1600260	January 2016 Figure 28

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 28 - North Quarry Office Area.dwg Jan 2016



NOTE: DRAWING NOT TO SCALE.

Morrison Quarry	GEI Consultants	BENCH 6820 INSTABILITY
Aggregate Industries	Project 1600260	January 2016 Figure 29

P:\1600260 - Morrison Quarry\Civil\Production Drawings\Working Drawings\ Figure 29 - North Quarry Office Area Instability.dwg Jan 2016

Appendix A RMR Data

APPENDIX A:

South Quarry Morrison Quarry, Bench 6900, Section A, 0+00 - 2+75 (corner) - 3+50

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	5	62	N	345	10	55	65
Set 2 (Primary 2)	86	81	E	75	100	80	85
Set 3 (Secondary 1)	205	73	SSW	195	220	65	80
Set 4 (Secondary 2)	80	60	E	80	80	60	60
Set 5 (Foliation)	248	31	WSW	210	265	20	50

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	X
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X			X
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)					

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)						
Medium (2)	3 - 10 m (9.9 - 33 ft)						
High (1)	10 - 20 m (33 - 66 ft)	X	X				
Very High (0)	>20 m (>66 ft)	X	X			X	

Discontinuity Separation (Aperture)						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Tight Joints (6)	<0.1 mm (< 0.003 in)	X	X	X	X	X
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X	X	X	X	
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)	X	X	X	X	
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)					
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X	X	X	X	
Slightly Rough Surfaces (3)	SR	X	X	X	X	X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW						
Slightly Weathered (5)	SW						
Moderately Weathered (3)	MW	X	X	X	X	X	
Highly Weathered (1)	HW	X	X	X	X	X	
Completely Weathered (0)	CW						
Residual Soil (0)	RS						

RMR Classification:	31 - Poor	to	50 - Fair

Additional Notes:	trending 260 deg; 1+50 to 1+70 unmappable due to rubble; corner at 2+75; trending 350 deg; 3+30 to 3+50 unmappable due to rubble. No groundwater inflow observed. Iron oxide staining and some clay filling of Sets 1 and 2.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6900, Section B, 3+50 to 6+25

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	10	72	N	340	30	65	80
Set 2 (Primary 2)	103	77	ESE	90	120	75	80
Set 3 (Secondary 1)							
Set 4 (Secondary 2)							
Set 5 (Foliation)	347	22	NNW	330	10	5	35

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X			X
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)					X

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X				
Medium (2)	3 - 10 m (9.9 - 33 ft)	X	X				
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Tight Joints (6)	<0.1 mm (< 0.003 in)	X	X			X
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X	X			
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)					
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)					
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X			X	
Slightly Rough Surfaces (3)	SR	X	X			X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering						
		Set 1	Set 2	Set 3	Set 4	Set 5
Unweathered (6)	UW					
Slightly Weathered (5)	SW	X	X			X
Moderately Weathered (3)	MW	X	X			X
Highly Weathered (1)	HW					
Completely Weathered (0)	CW					
Residual Soil (0)	RS					

RMR Classification:	26 - Poor	to	50 - Fair

Additional Notes:	trending 350 deg; 3+50 to 5+50 unmappable due to rubble; vertical 2-foot-thick pegmatite at 6+10. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6900, Section C, 6+25 to 8+00

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	343	64	NNW	330	360	60	70
Set 2 (Primary 2)	227	88	SW	30	60	85	90
Set 3 (Secondary 1)							
Set 4 (Secondary 2)							
Set 5 (Foliation)	143	31	SE	10	210	25	35

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	X
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X			X
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)					X

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X				
Medium (2)	3 - 10 m (9.9 - 33 ft)	X	X				
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Very Tight Joints (6)	<0.1 mm (< 0.003 in)	X	X			X	
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X	X			X	
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)						
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)						
Very Wide Aperture (0)	>10 mm (> 0.4 in)						

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X			X	
Slightly Rough Surfaces (3)	SR	X	X			X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW						
Slightly Weathered (5)	SW	X	X			X	
Moderately Weathered (3)	MW	X	X			X	
Highly Weathered (1)	HW						
Completely Weathered (0)	CW						
Residual Soil (0)	RS						

RMR Classification:	26 - Poor	to	50 - Fair

Additional Notes:	trending 350 deg; adversely dipping foliation in upper third of high wall between stations 7+25 and 8+00. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6900, Section D, 8+00 to 9+00

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	333	63	NNW	320	350	55	70
Set 2 (Primary 2)	223	81	SW	220	230	75	90
Set 3 (Secondary 1)	210	50	SSW	210	210	50	50
Set 4 (Secondary 2)							
Set 5 (Foliation)	85	31	E	0	170	20	45

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)			X		
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X			
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)	X	X			X

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)			X			Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X				
Medium (2)	3 - 10 m (9.9 - 33 ft)						
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Tight Joints (6)	<0.1 mm (< 0.003 in)					X	
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X	X	X		X	
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)	X	X	X			
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)						
Very Wide Aperture (0)	>10 mm (> 0.4 in)						

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X	X		X	
Slightly Rough Surfaces (3)	SR	X	X	X		X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW						
Slightly Weathered (5)	SW	X	X	X		X	
Moderately Weathered (3)	MW	X	X	X		X	
Highly Weathered (1)	HW						
Completely Weathered (0)	CW						
Residual Soil (0)	RS						

RMR Classification:	25 - Poor	to	50 - Fair

Additional Notes:	trending 350 deg; unusual foliation present throughout section; conditions exhibited in section D extend into the lower portion of section C from 7+25 to 8+00 on an approximately 5H:1V slope; adversely dipping foliation in upper third of high wall between stations 8+00 and 8+25; unmappable 9+00 to corner at 9+30 due to rubble; trend 90; unmappable 9+30 to corner at 10+60 due to rubble; trend 160; unmappable 10+60 to 12+60. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6950, Section A, 1+90 to 2+40

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	168	73	SSE	160	185	70	80
Set 2 (Primary 2)	67	83	ENE	60	70	80	85
Set 3 (Secondary 1)	300	88	WNW	290	310	85	90
Set 4 (Secondary 2)							
Set 5 (Foliation)	355	21	N	330	30	10	40

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)			X		
Moderate (10)	200-600 mm (8 - 24 in)	X	X			X
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)					X

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)	X	X				Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X	X			
Medium (2)	3 - 10 m (9.9 - 33 ft)					X	
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Very Tight Joints (6)	<0.1 mm (< 0.003 in)				X	
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X		X		X
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)	X	X			
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)		X			
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X	X		X	
Slightly Rough Surfaces (3)	SR	X	X	X		X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW					
Slightly Weathered (5)	SW	X	X	X		X
Moderately Weathered (3)	MW	X	X	X		X
Highly Weathered (1)	HW					
Completely Weathered (0)	CW					
Residual Soil (0)	RS					

RMR Classification:	22 - Poor	to	52 - Fair

Additional Notes:	trending 10 deg; highly variable joint sets throughout section; unmappable 0+00 to corner at 1+90 due to rubble. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6950, Section B, 2+40 to 3+15

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	343	77	NNW	320	20	65	85
Set 2 (Primary 2)	52	87	NE	40	60	85	90
Set 3 (Secondary 1)	303	80	WNW	290	320	75	85
Set 4 (Secondary 2)							
Set 5 (Foliation)	357	23	N	330	10	15	40

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	X
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X	X		X
Close (8)	60-200 mm (2.4 - 8 in)	X	X	X		X
Very Close (5)	<60mm (<2.4 in)					

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)	X	X				Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X	X			
Medium (2)	3 - 10 m (9.9 - 33 ft)						
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Very Tight Joints (6)	<0.1 mm (< 0.003 in)					
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X		X		X
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)	X	X			X
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)		X			
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X	X		X	
Slightly Rough Surfaces (3)	SR	X	X	X		X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW					
Slightly Weathered (5)	SW	X	X	X		X
Moderately Weathered (3)	MW	X	X	X		X
Highly Weathered (1)	HW					
Completely Weathered (0)	CW					
Residual Soil (0)	RS					

RMR Classification:	30 - Poor	to	56 - Fair

Additional Notes:	trending 10 deg; highly variable joint sets throughout section; pegmatite at 2+55, mafic at 3+15. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2 slightly less than section A.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6950, Section C, 3+15 to 3+95

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	340	73	NNW	340	340	65	80
Set 2 (Primary 2)	65	83	ENE	60	70	80	85
Set 3 (Secondary 1)							
Set 4 (Secondary 2)							
Set 5 (Foliation)	160	43	SSE	150	170	35	50

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X			X
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)					X

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)	X	X				Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X				
Medium (2)	3 - 10 m (9.9 - 33 ft)	X	X				
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Tight Joints (6)	<0.1 mm (< 0.003 in)					
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X				X
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)	X	X			X
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)		X			
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X			X	
Slightly Rough Surfaces (3)	SR	X	X			X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering						
		Set 1	Set 2	Set 3	Set 4	Set 5
Unweathered (6)	UW					
Slightly Weathered (5)	SW	X	X			X
Moderately Weathered (3)	MW	X	X			X
Highly Weathered (1)	HW					
Completely Weathered (0)	CW					
Residual Soil (0)	RS					

RMR Classification:	22 - Poor	to	51 - Fair

Additional Notes:	trending 10 deg; highly variable joint sets throughout section; adversely dipping foliation throughout section. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6950, Section D, 3+95 to 7+00

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	354	73	N	330	20	50	85
Set 2 (Primary 2)	276	73	W	260	300	65	85
Set 3 (Secondary 1)	320	68	NW	310	330	60	75
Set 4 (Secondary 2)							
Set 5 (Foliation)	211	34	SSW	150	340	5	85

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	X
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X	X		X
Close (8)	60-200 mm (2.4 - 8 in)	X	X	X		X
Very Close (5)	<60mm (<2.4 in)					

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X	X			
Medium (2)	3 - 10 m (9.9 - 33 ft)	X	X				
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Very Tight Joints (6)	<0.1 mm (< 0.003 in)					X	
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X	X	X		X	
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)	X	X				
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)						
Very Wide Aperture (0)	>10 mm (> 0.4 in)						

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X	X		X	
Slightly Rough Surfaces (3)	SR	X	X	X		X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW						
Slightly Weathered (5)	SW	X	X	X		X	
Moderately Weathered (3)	MW	X	X	X		X	
Highly Weathered (1)	HW						
Completely Weathered (0)	CW						
Residual Soil (0)	RS						

RMR Classification:	33 - Poor	to	55 - Fair

Additional Notes:	trending 10 deg; highly variable joint sets throughout section; adversely dipping foliation throughout section; pegmatites at stations 5+35 and 6+25. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2 slightly less than in section C.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6950, Section E, 7+00 to 8+20

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)							
Set 2 (Primary 2)							
Set 3 (Secondary 1)	300	77	WNW	290	310	65	85
Set 4 (Secondary 2)	30	88	NNE	20	40	85	90
Set 5 (Foliation)	163	30	SSE	20	320	10	40

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	X
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)			X	X	X
Close (8)	60-200 mm (2.4 - 8 in)			X	X	X
Very Close (5)	<60mm (<2.4 in)					

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)			X	X		
Medium (2)	3 - 10 m (9.9 - 33 ft)			X	X		
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Very Tight Joints (6)	<0.1 mm (< 0.003 in)		X	X	X	
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)		X	X	X	
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)					
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)					
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R			X	X	X	
Slightly Rough Surfaces (3)	SR			X	X	X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering						
	Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW					
Slightly Weathered (5)	SW		X	X	X	
Moderately Weathered (3)	MW					
Highly Weathered (1)	HW					
Completely Weathered (0)	CW					
Residual Soil (0)	RS					

RMR Classification:	36 - Poor	to	55 - Fair

Additional Notes:	trending 10 deg; highly variable joint sets throughout section; vertical pegmatite at 7+10. No groundwater inflow observed. Some iron oxide staining on some Set 3 and Set 4 joint surfaces.

APPENDIX A:

South Quarry Morrison Quarry, Bench 6950, Section F, 8+20 to 9+80

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)							
Set 2 (Primary 2)							
Set 3 (Secondary 1)	333	65	NNW	320	350	50	80
Set 4 (Secondary 2)	53	88	NE	40	60	85	90
Set 5 (Foliation)	353	36	N	310	10	5	80

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	X
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)			X	X	X
Close (8)	60-200 mm (2.4 - 8 in)			X	X	X
Very Close (5)	<60mm (<2.4 in)					

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)			X	X		
Medium (2)	3 - 10 m (9.9 - 33 ft)			X	X		
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Tight Joints (6)	<0.1 mm (< 0.003 in)			X	X	X	
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)			X	X	X	
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)						
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)						
Very Wide Aperture (0)	>10 mm (> 0.4 in)						

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R			X	X	X	
Slightly Rough Surfaces (3)	SR			X	X	X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Unweathered (6)	UW						
Slightly Weathered (5)	SW			X	X	X	
Moderately Weathered (3)	MW						
Highly Weathered (1)	HW						
Completely Weathered (0)	CW						
Residual Soil (0)	RS						

RMR Classification:	34 - Poor	to	55 - Fair

Additional Notes:	trending 10 deg; highly variable joint sets throughout section; mafic dipping 60 deg at 9+80; 9+80 to corner at 11+00 unmappable due to rubble; trend 100 deg, 11+00 to 12+50 unmappable due to rubble; trend 160 deg; 12+50 to 13+30 unmappable due to rubble. No groundwater inflow observed. Some iron oxide staining on some Set 3 and Set 4 joint surfaces.

APPENDIX A:

South Quarry Morrison Quarry, Bench 7000, Section A, 0+00 to 0+80

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	345	83	NNW	340	350	80	85
Set 2 (Primary 2)	80	82	E	70	90	80	85
Set 3 (Secondary 1)							
Set 4 (Secondary 2)							
Set 5 (Foliation)	345	48	NNW	340	350	35	60

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	X
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X			X
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)					

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X				
Medium (2)	3 - 10 m (9.9 - 33 ft)	X	X				
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Tight Joints (6)	<0.1 mm (< 0.003 in)					
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X	X			X
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)		X			
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)					
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X			X	
Slightly Rough Surfaces (3)	SR	X	X			X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering						
		Set 1	Set 2	Set 3	Set 4	Set 5
Unweathered (6)	UW					
Slightly Weathered (5)	SW	X	X			X
Moderately Weathered (3)	MW	X	X			X
Highly Weathered (1)	HW					
Completely Weathered (0)	CW					
Residual Soil (0)	RS					

RMR Classification:	28 - Poor	to	54 - Fair

Additional Notes:	trending 340 deg; approximately 400ft of southern portion of Bench 7000 was not mapped due to a narrowing of the bench that GEI determined was unsafe to map from; highly variable joint sets throughout section; vertical pegmatite at 0+00. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2.

APPENDIX A:

South Quarry Morrison Quarry, Bench 7000, Section B, 0+80 to 3+70

Strike and Dip Orientations:							
	Average Strike	Average Dip	Direction	Strike from	Strike to	Dip from	Dip to
Set 1 (Primary 1)	147	78	SSE	110	190	70	85
Set 2 (Primary 2)	45	80	NE	20	70	80	80
Set 3 (Secondary 1)							
Set 4 (Secondary 2)							
Set 5 (Foliation)	333	38	NNW	310	350	10	65

Estimated Strength of Intact Rock Material:		
Designation:	Compressive Strength Range	Estimated in Field
Very High (15)	>250 Mpa (>36,260 psi)	
High (12)	100-250 Mpa (14,500-36,260 psi)	X
Medium High (7)	50-100 Mpa (7,250-14,500 psi)	X
Moderate (4)	25-50 Mpa (3,625-7,250 psi)	
Low (2)	5-25 Mpa (725-3,625 psi)	
Very Low (1)	1-5 Mpa (145-725 psi)	

Estimated Drill Core Quality (RQD)		
Designation:	RQD Percentage Range	Estimated in Field
Excellent Quality (20)	90-100%	
Good Quality (17)	75-90%	
Fair Quality (13)	50-75%	
Poor Quality (8)	25-50%	X
Very Poor Quality (3)	<25%	X

Spacing of Discontinuities						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Wide (20)	>2m (>6.5 ft)					
Wide (15)	0.6 - 2 m (2 - 6.5 ft)					
Moderate (10)	200-600 mm (8 - 24 in)	X	X			X
Close (8)	60-200 mm (2.4 - 8 in)	X	X			X
Very Close (5)	<60mm (<2.4 in)					

Discontinuity Persistence							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Low (6)	<1m (<3.3 ft)						Notes:
Low (4)	1 - 3 m (3.3 - 9.9 ft)	X	X				
Medium (2)	3 - 10 m (9.9 - 33 ft)	X	X				
High (1)	10 - 20 m (33 - 66 ft)					X	
Very High (0)	>20 m (>66 ft)					X	

Discontinuity Separation (Aperture)						
		Set 1	Set 2	Set 3	Set 4	Set 5
Very Tight Joints (6)	<0.1 mm (< 0.003 in)					
Tight Joints (5)	0.1 - 0.5 mm (0.003 - 0.02 in)	X	X			X
Moderately Open Joints (4)	0.5 - 2.5 mm (0.02 - 0.1 in)		X			
Open Joints (1)	2.5 - 10 mm (0.1 - 0.4 in)					
Very Wide Aperture (0)	>10 mm (> 0.4 in)					

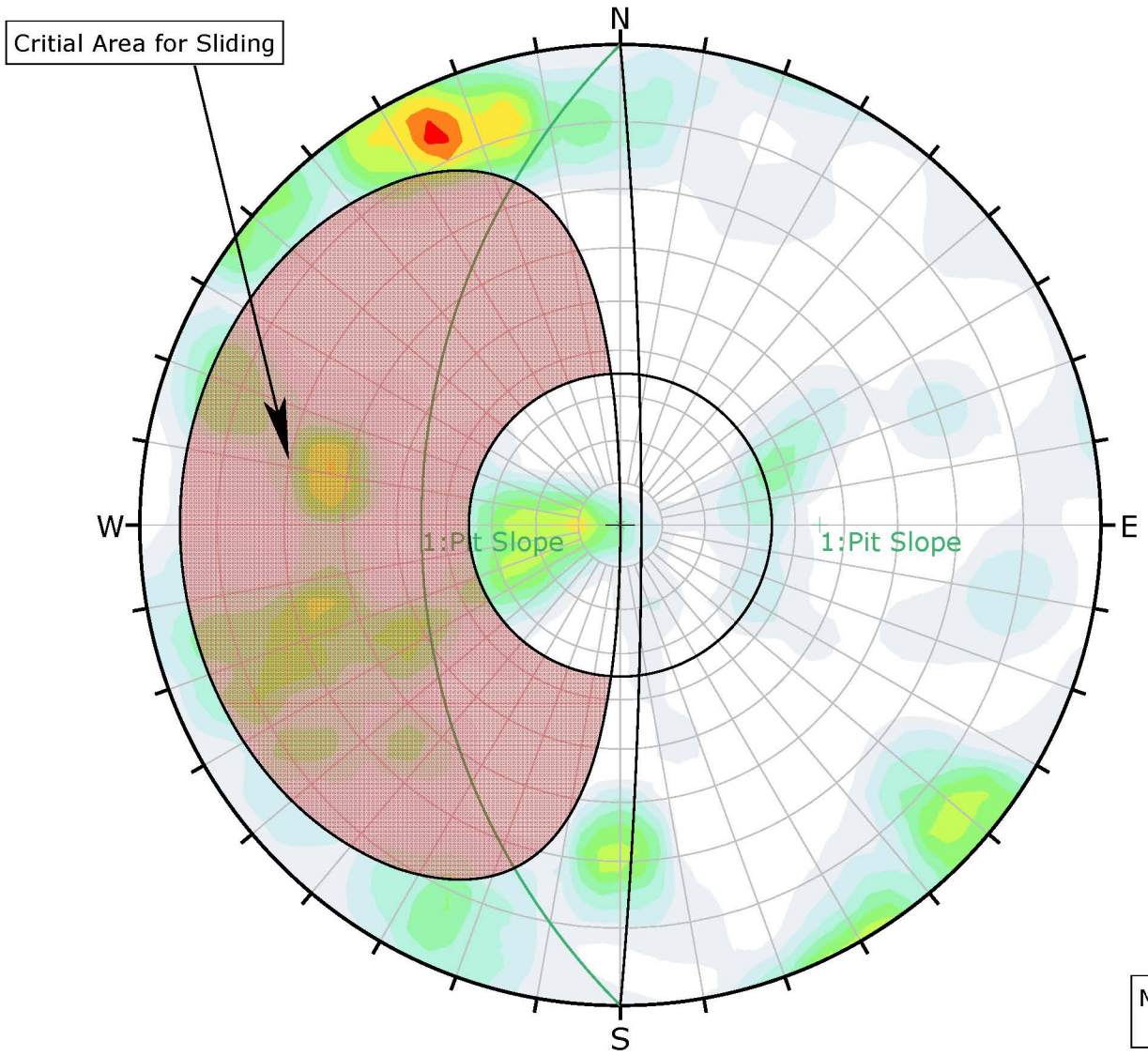
Discontinuity Roughness							
		Set 1	Set 2	Set 3	Set 4	Set 5	
Very Rough Surfaces (6)	VR						Notes:
Rough Surfaces (5)	R	X	X			X	
Slightly Rough Surfaces (3)	SR	X	X			X	
Smooth Surfaces (1)	SM						
Slickensided Surfaces (0)	SL						

Discontinuity Wall Face Weathering						
		Set 1	Set 2	Set 3	Set 4	Set 5
Unweathered (6)	UW					
Slightly Weathered (5)	SW	X	X			X
Moderately Weathered (3)	MW	X	X			X
Highly Weathered (1)	HW					
Completely Weathered (0)	CW					
Residual Soil (0)	RS					

RMR Classification:	28 - Poor	to	49 - Fair

Additional Notes:	trending 340 deg; approximately 400ft of southern portion of Bench 7000 was not mapped due to a narrowing of the bench that GEI determined was unsafe to map from; highly variable joint sets throughout section; unmappable from 3+70 to 4+50 due to rubble. No groundwater inflow observed. Iron oxide staining on Sets 1 and 2.

Appendix B Stereonets



Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Maximum Density	5.58%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding
Slope Dip	85
Slope Dip Direction	90
Friction Angle	35°

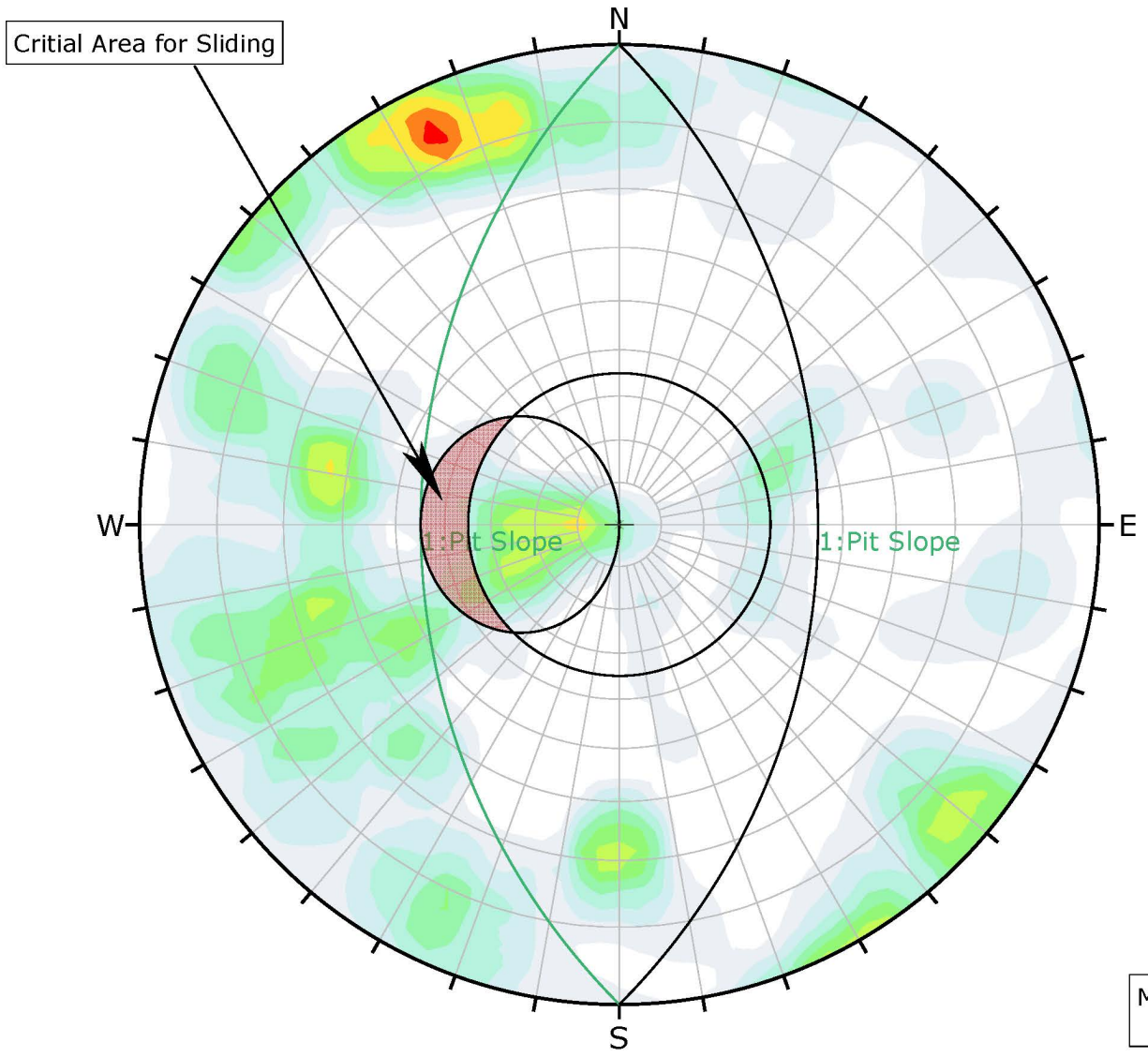
	Critical	Total	%
Planar Sliding (All)	53	148	35.81%

Plot Mode	Pole Vectors
Vector Count	148 (148 Entries)
Hemisphere	Lower
Projection	Equal Angle

Morrison Quarry 2015 Geotechnical Addendum
Sliding (Individual Bench)

rocscience	*Project*	Morrison Quarry 2015 Annual Report Geotechncial Addendum	
	Analysis Description		
	Drawn By	J. Deuto	*Company* GEI Consutlants, Inc.
	Date	1/27/2016, 7:55:57 AM	*File Name* Morrison Quarry 2016.dips6

DIPS 6.017



Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Maximum Density	5.58%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding
Slope Dip	45
Slope Dip Direction	90
Friction Angle	35°

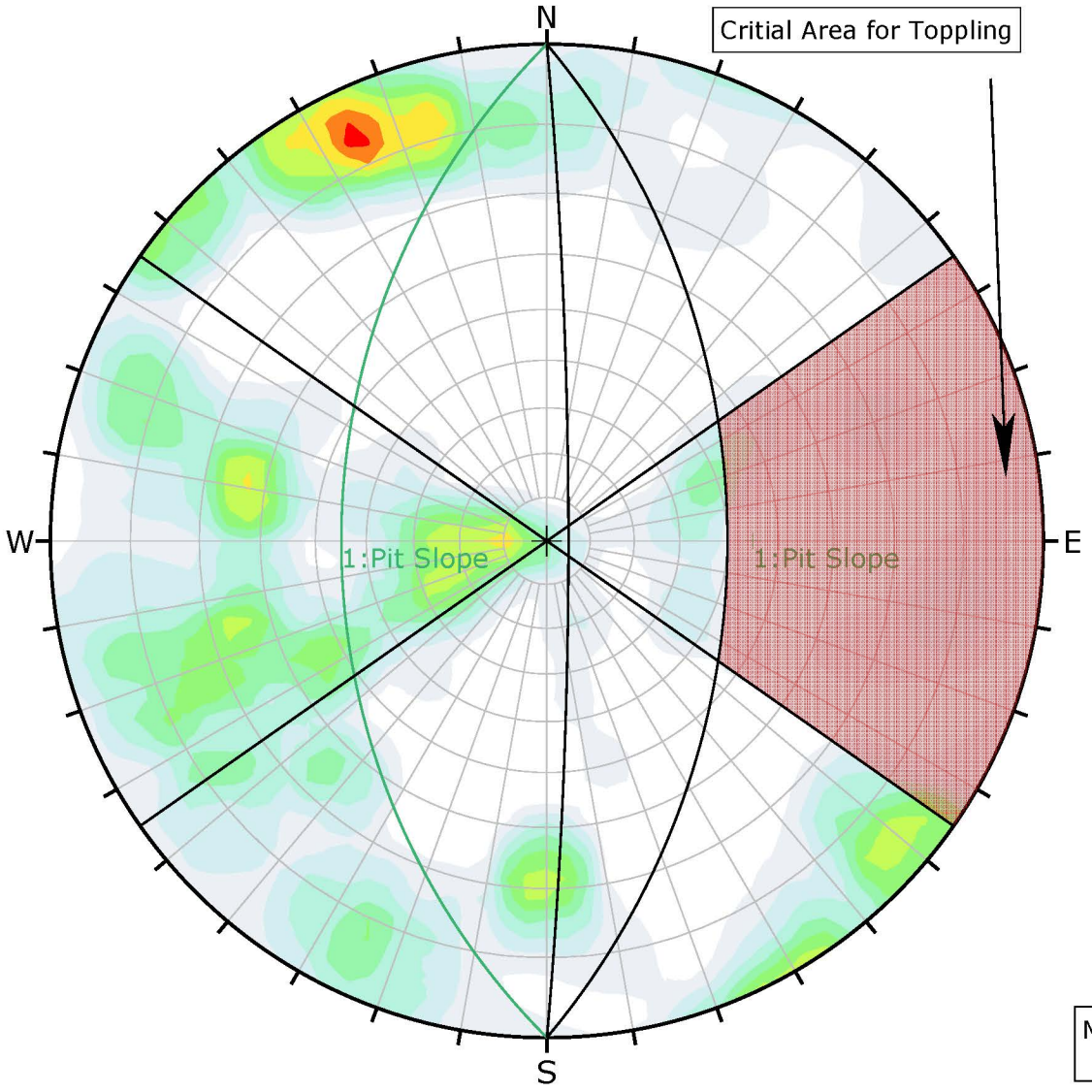
	Critical	Total	%
Planar Sliding (All)	6	148	4.05%

Plot Mode	Pole Vectors
Vector Count	148 (148 Entries)
Hemisphere	Lower
Projection	Equal Angle

Morrison Quarry 2015 Geotechnical Addendum
Sliding (Global)

rocscience	*Project*	Morrison Quarry 2015 Annual Report Geotechncial Addendum	
	Analysis Description		
	Drawn By	J. Deuto	*Company* GEI Consutlants, Inc.
	Date	1/27/2016, 7:55:57 AM	*File Name* Morrison Quarry 2016.dips6

DIPS 6.017



Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Maximum Density	5.58%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Flexural Toppling
Slope Dip	85
Slope Dip Direction	90
Friction Angle	35°
Lateral Limits	35°

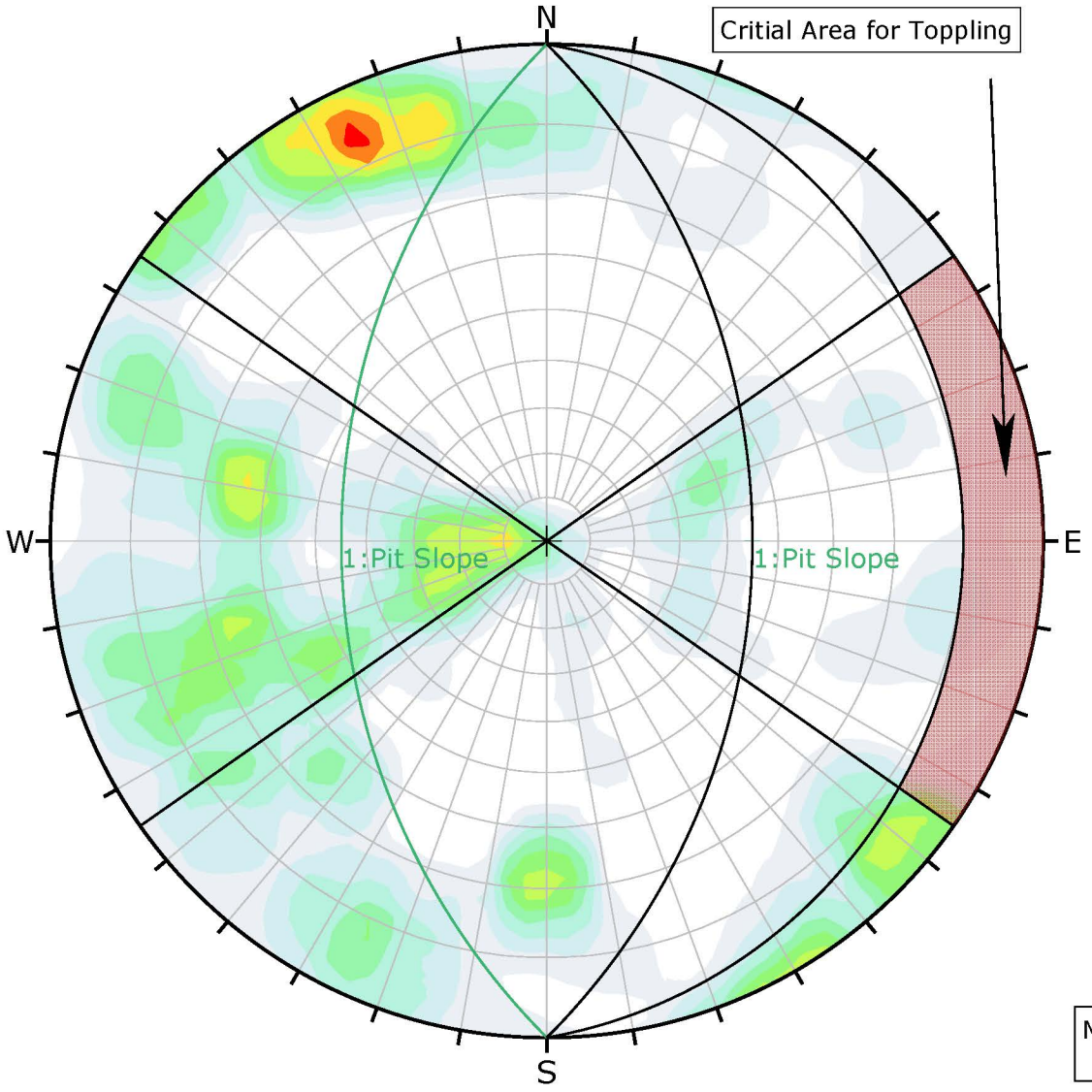
	Critical	Total	%
Flexural Toppling (All)	12	148	8.11%

Plot Mode	Pole Vectors
Vector Count	148 (148 Entries)
Hemisphere	Lower
Projection	Equal Angle

Morrison Quarry 2015 Geotechnical Addendum
Toppling (Individual Bench)

DIPS 6.017

Project	Morrison Quarry 2015 Annual Report Geotechncial Addendum		
Analysis Description			
Drawn By	J. Deuto	*Company*	GEI Consutlants, Inc.
Date	1/27/2016, 7:55:57 AM	*File Name*	Morrison Quarry 2016.dips6



Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Maximum Density	5.58%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Flexural Toppling
Slope Dip	45
Slope Dip Direction	90
Friction Angle	35°
Lateral Limits	35°

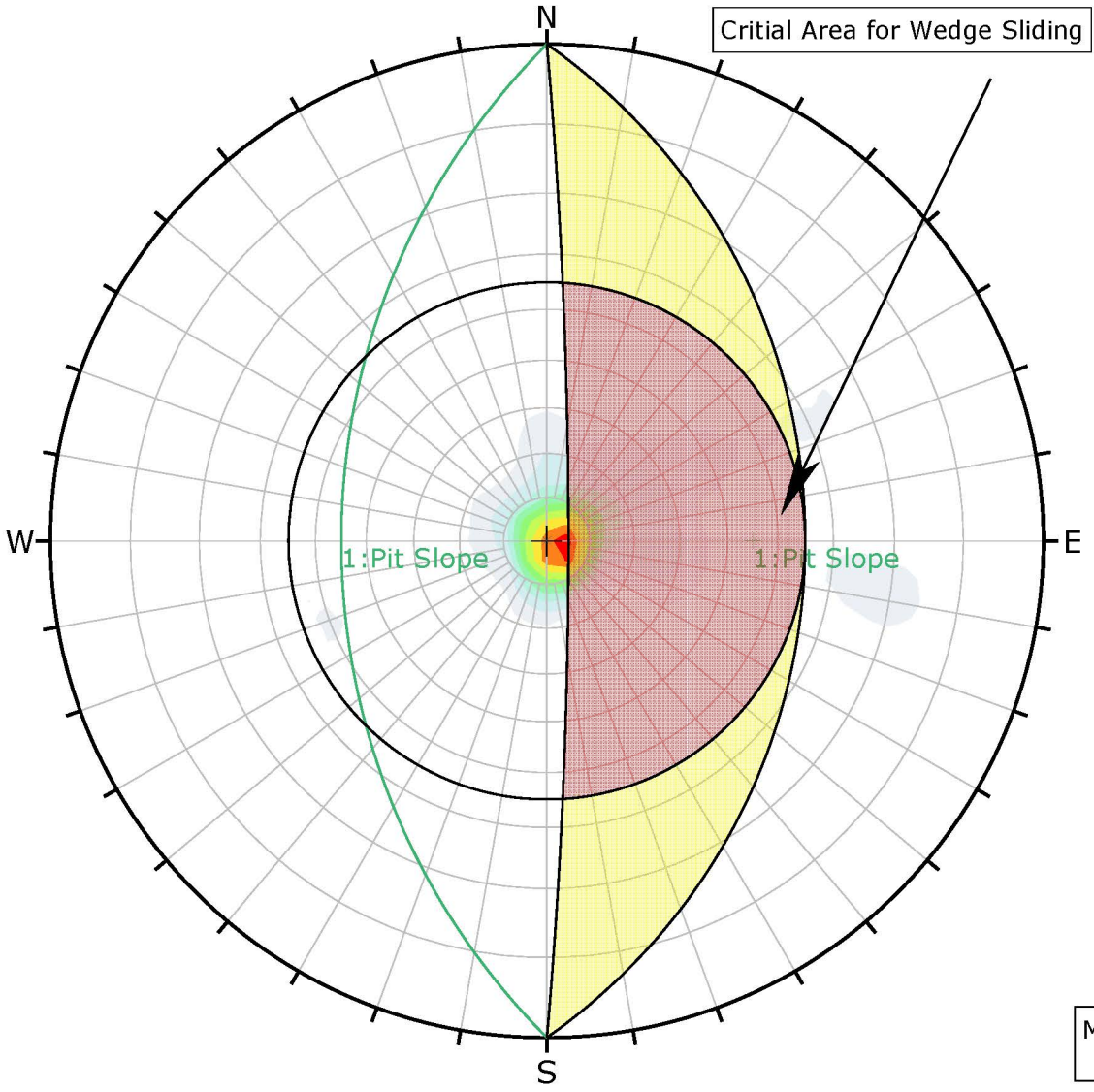
	Critical	Total	%
Flexural Toppling (All)	2	148	1.35%

Plot Mode	Pole Vectors
Vector Count	148 (148 Entries)
Hemisphere	Lower
Projection	Equal Angle

Morrison Quarry 2015 Geotechnical Addendum
Toppling (Global)

rocscience	*Project*	Morrison Quarry 2015 Annual Report Geotechncial Addendum	
	Analysis Description		
	Drawn By	J. Deuto	*Company* GEI Consutlants, Inc.
	Date	1/27/2016, 7:55:57 AM	*File Name* Morrison Quarry 2016.dips6

DIPS 6.017



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 2.30
	2.30 - 4.60
	4.60 - 6.90
	6.90 - 9.20
	9.20 - 11.50
	11.50 - 13.80
	13.80 - 16.10
	16.10 - 18.40
	18.40 - 20.70
	20.70 - 23.00

Maximum Density	22.37%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

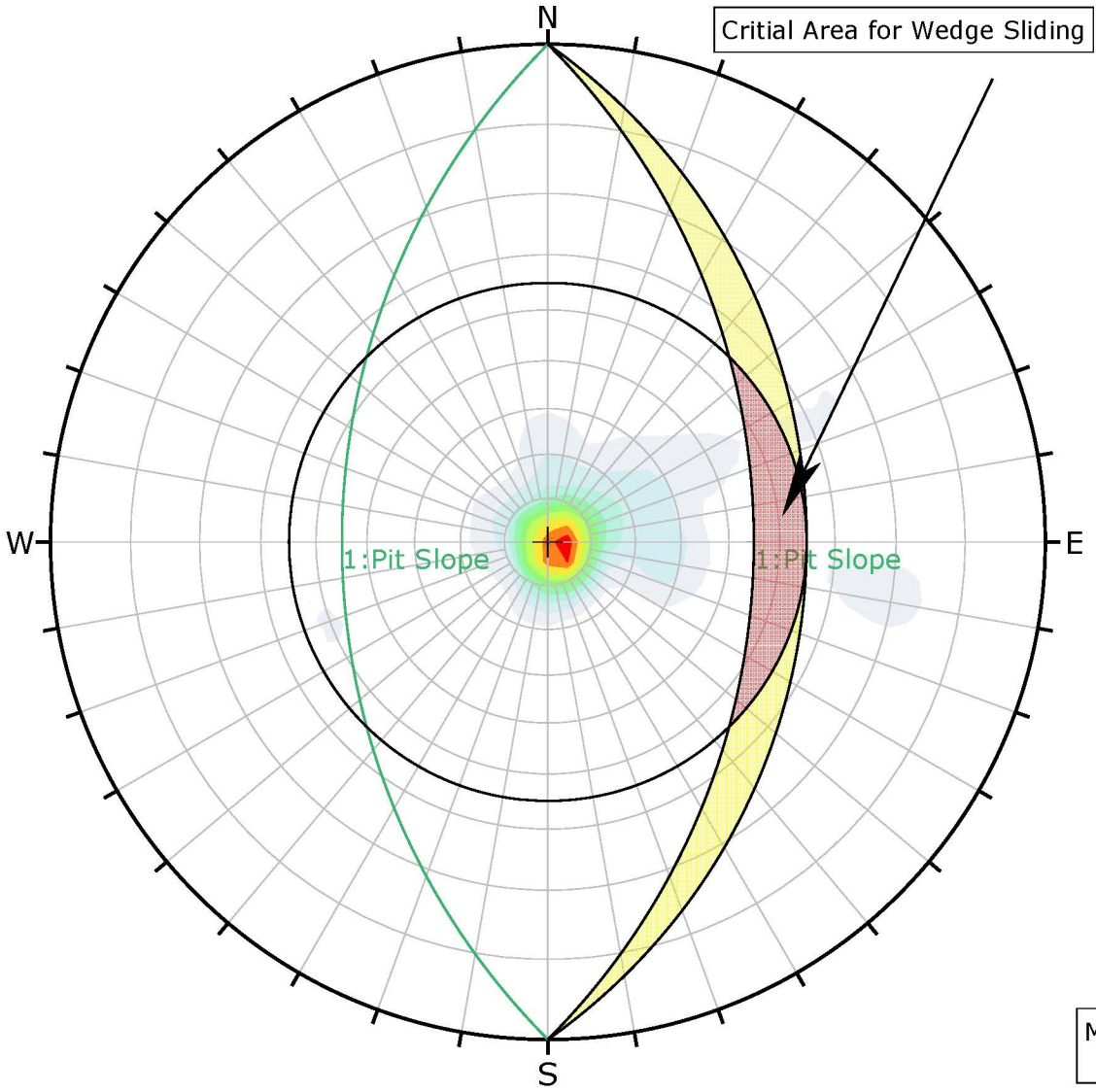
Kinematic Analysis	Wedge Sliding		
Slope Dip	85		
Slope Dip Direction	90		
Friction Angle	35°		
	Critical	**Total**	**%**

Plot Mode	Dip Vectors
Vector Count	148 (148 Entries)
Intersection Mode	All Set Planes
Intersections Count	0
Hemisphere	Lower
Projection	Equal Angle

Morrison Quarry 2015 Geotechnical Addendum
Wedge Sliding (Individual Bench)

DIPS 6.017

Project	Morrison Quarry 2015 Annual Report Geotechncial Addendum		
Analysis Description			
Drawn By	J. Deuto	*Company*	GEI Consutlants, Inc.
Date	1/27/2016, 7:55:57 AM	*File Name*	Morrison Quarry 2016.dips6



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 2.30
	2.30 - 4.60
	4.60 - 6.90
	6.90 - 9.20
	9.20 - 11.50
	11.50 - 13.80
	13.80 - 16.10
	16.10 - 18.40
	18.40 - 20.70
	20.70 - 23.00

Maximum Density	22.37%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding
Slope Dip	45
Slope Dip Direction	90
Friction Angle	35°

	Critical	Total	%
Wedge Sliding	0	0	0%

Plot Mode	Dip Vectors
Vector Count	148 (148 Entries)
Intersection Mode	All Set Planes
Intersections Count	0
Hemisphere	Lower
Projection	Equal Angle

Morrison Quarry 2015 Geotechnical Addendum
Wedge Sliding (Global)

DIPS 6.017

Project	Morrison Quarry 2015 Annual Report Geotechncial Addendum		
Analysis Description			
Drawn By	J. Deuto	*Company*	GEI Consutlants, Inc.
Date	1/27/2016, 7:55:57 AM	*File Name*	Morrison Quarry 2016.dips6