January 13, 2015
GEI Project Number 140297-1010

Peter Hays
Colorado Division of Mining, Reclamation, and Safety
1313 Sherman St., Room 215
Denver, CO 80203

Re: Geotechnical Stability Analysis for Martin Marietta Greeley 35th Avenue Mine, M-1973-036, Weld County, Colorado

Dear Mr. Hays,

This letter addresses the Geotechnical Stability Exhibit for the Martin Marietta, Inc. (MM) Greeley 35th Avenue Mine (M-1977-036) Reclamation Permit amendment, per Rule 6.5. The geotechnical stability exhibit is required in the event of unreturned Structure Agreement letters from owners of permanent structures within 200 feet of the mine boundary.

The Greeley 35th Avenue Mine is located in northeast quarter of Section 34, the southeast quarter of Section 35, and the north half of Section 35 of Township 6 North, Range 66 West of the 6th Principle Meridian.

Permanent man-made structures within 200 feet of the mine boundary include: Residential housing structures, below grade ponds, hydrological structures, concrete recreational path, gas pipelines and associated well pads, railroad tracks and miscellaneous appurtenances, electrical transmission lines, county owned roads, and a tennis court (see complete list of owners and structure descriptions on page 2).

Geologic Strata and Mining Conditions

The Greeley 35th Avenue Mine is located at 925 N. 35th Avenue in Greeley, Colorado and is adjacent to the Cache la Poudre River. Mining at the Greeley 35th Avenue Mine is ongoing and is anticipated to be completed by December 31, 2019, depending on market conditions. Approximately 130 acres of the western portion of the Greeley 35th Avenue known as the "West Pit" will be mined and reclaimed simultaneously. The West Pit is intended to be lined with a soil-bentonite cutoff wall. The cutoff wall construction will encompass the West Pit. Other work areas of the mine will not be changed from the current approved mine permit.

Boring data gathered from a field investigation in March of 2014 included 43 borings to investigate the subsurface soil, bedrock, and groundwater conditions within the Greeley 35th Avenue West Pit footprint. The boreholes, in addition to observations made within the mined pits, indicates that there is a layer of overburden above a layer of pit run (sand and gravel), overlaying bedrock. Overburden and pit run have variable depths, depending on locations in the mine and the mining phase. The bedrock underlying the mine is

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approximately 20-55 feet below existing ground surface. Boring data also indicates the groundwater surface is located approximately 10-40 feet below ground surface.

Select soil samples from test pits and boreholes were collected for testing at a geotechnical laboratory to evaluate the physical and engineering properties (Table 1).

Based on the results of the exploratory borings advanced along soil-bentonite cutoff wall alignment, the soil-bentonite cutoff wall trench depth is anticipated to range from 20 to 55 feet, including the key excavation. Upon completion of the soil-bentonite cutoff wall, the slopes can be graded back to a 3:1 slope, conforming to the permit (M-1977-036) and the requirements set by the Colorado Division of Reclamation, Mining, and Safety.

Known Man-Made Structures within 200 feet of Mining Limits

Known man-made structures within 200 feet of the mine boundary are listed below. Figures 1 through 3 show the structures within 200 feet of the West Pit:

Supplied a structure agreement

Owner: LG Everist, Inc.

- 2 below grade pond and associated embankments

Owner: Earl E. Wellnitz, 4700 O Street, 80631

- Residential housing structures

Owner: DCP Midstream

- Natural gas pipelines

Owner: Melvin D. Everhart, 4514 O Street, 80631

- Residential housing structures

Did NOT supply a structure agreement

Owner: 83 Joint Ventures, LLC

- Below grade pond and associated embankments

Owner: Candelario Nevarez, 3501 West F Street, 80631

- Residential housing structures

Owner: City of Greeley

- 2 below grade ponds and associated embankments
- Water monitoring station
- 2 Weirs
- Poudre River trail and associated appurtenances

Table 1: 35th Avenue Pit Laboratory Testing Summary

Sample Location	Approximate Depth (ft)	Gradation			Atterberg Limits		In-Situ Moisture Content (%)	Unified Soil Classification
		Gravel (%)	Sand (%)	Fines (%)	Liquid Limit (%)	Plasticity Index (%)		
BH-1, S2	5	17	80	3	NL	NP		Pit Run
BH-1, S4	15	41	51.2	7.8	NL	NP		Pit Run
BH-3, S11	50	0	47.7	52.3	NL	NP		Bedrock – classified as Sand with Silt
BH-3, S6	25	44	45.3	10.7	NL	NP		Pit Run
BH-4, S1	0	0	38.5	61.5	32	15		Sandy Lean Clay
BH-4, S5	50	3	59	38	48	22		Bedrock- classified as Clayey Sand
BH-7, S6	20	12	68.1	9.9	NL	NP		Pit Run
BH-9	50	0	24.7	75.3	38	9	50.7	Claystone Bedrock- classified as Lean Clay with Sand (CL)
BH-9	30	43	45.6	11.4	22	0	7.8	Claystone Bedrock – Lean Clay with Sand (CL)
BH-13	35	49	45.6	5.4	NL	NP	6.5	Pit Run- classified as Silty Sand with Gravel
BH-14	0-Fill	6	46.6	47.4	30	11	10.8	Fill- classified as Clayey Sand (SC)/Sandy Lean Clay (CL)
BH-15	55	0	25.4	74.6	31	5	7.1	Claystone Bedrock- classified as Lean Clay with Sand (CL)
BH-15	15	4	45.4	50.6	34	14	15.1	Claystone Bedrock- classified as Sandy Lean Clay (CL)
BH-15	5-Fill	10	63.6	26.4	NL	NP	5.7	Fill- classified as Silty Sand (SM)
BH-20	25	0	83.1	16.9	NL	NP	21.3	Fill- classified as Silty Sand (SM)
BH-21	5	68	28.8	3.2	NL	NP	1.2	Pit Run- classified as Silty Sand with Gravel
BH-23	35	26	33.7	40.3	34	5	13.5	Siltstone/Sandstone Bedrock- classified as Clayey Sand (SC)
BH-25	34	24	43.7	32.3	26	1	15.9	Siltstone/Sandstone Bedrock- classified as Silty Clayey Sand (SM-SC)
BH-32	0-Fill	5	39.9	55.1	31	12	13	Fill- classified as Sandy Lean Clay
BH-33	16	0	6.4	93.6	52	30	33.9	Claystone Bedrock- Fat Clay (CH)
BH-34, S3	10	48	46	5.8	No Limit (NL)	Non-Plastic (NP)		Pit Run
BH-34, S5	20	35	41	24	47	18		Bedrock- classified as Clayey Sand
BH-36, S1	0	26	46.5	27.5	26	18		Pit Run- classified as Clayey Sand
BH-36, S6	25	9	84.9	6.1	NL	NP		Pit Run

Owner: Great Western Railway of Colorado

- Railroad bridges
- Railroad tracks
- Miscellaneous appurtenances

Owner: Jeff Everhart, 4704 O Street, 80631

- Residential housing structures

Owner: Martin Marietta Materials, Inc.

- Scale house
- Mineral processing facility
- Asphalt lab
- Asphalt plant
- Asphalt tank
- Concrete plant
- Pump house
- Miscellaneous buildings associated with mine QA/QC
- Miscellaneous maintenance facilities
- Miscellaneous outbuildings
- Mine office

Owner: Michael P. Kelly, 4620 O Street, 80631

- Residential housing structures

Owner: River View Homeowner's Association

- Tennis Court
- Below grade pond and associated embankments

Owner: Weld County

- N. 35th Avenue
- W. O St.
- Poudre River Trail
- Fence

Owner: William A. Rodman, 3613 West F Street, 80631

- Residential housing structures

Owner: Xcel Energy

- Electrical transmission lines

Owner: Noble Energy, Inc.

- 05-123-11900, Mobile Premix 4-35
- 05-123-23229, Mobile Premix I 35-8
- 05-123-23233, Mobile Premix I 35-17
- 05-123-23231, Mobile Premix I 35-4
- 05-123-23234, Mobile Premix I 35-23
- 05-123-23235, Mobile Premix I 35-23
- 05-123-23860, Mobile Premix I 35-1
- 05-123-11901, Mobile Premix 1A-35
- 05-123-10981, Mobile Premix 3-25
- 05-123-22216, Flathead I 35-12
- 05-123-23194, Mobile Premix I 35-19
- 05-123-23218, Mobile Premix I 35-6
- 05-123-10980, Mobile Premix 2-35

Owner: F Street Property LLC, 1639, 35th Ave Ct, Greeley, 806342

- Commercial structure

Stability Analyses

Stability analyses were performed in order to evaluate potential for damage to existing permanent structures in relation to the soil-bentonite cutoff wall design. Analyses were performed with Slope/W 2012 v. 8.12.3.7901 computer program. For each case we analyzed the most critical soil profiles based on exploratory boring data (i.e. tallest section of the soil-bentonite cutoff wall, shortest section of the soil-bentonite cutoff wall, thickest overburden, etc.).

Conservative strength parameters were utilized based on GEI experience near the 35th Avenue property. The reclamation slope was assumed to be constructed with compacted sandy clay or clayey sand obtained from the overburden available onsite.

The strength parameters and properties utilized in the analyses are summarized in Table 2.

Table 2: Slope/W Input Parameters

Soil Unit	Unit Weight (pcf)	Cohesion, c' (psf)	Friction Angle, Φ (degrees)
Slurry Wall	115	0	20
Working Platform	130	0	33
Sand and Gravel	125	0	35
Bedrock	120	100	30

The closest structure to mine excavation limits is listed in Table 3. Only the closest structure was modeled, per DRMS suggestion. It is assumed any structure beyond this distance will have a higher factor of safety. Thus, this closest permanent structure is the critical, lowest stability value. The Slope/W program calculated the Factors of Safety (FOS) using the Spencer Method. The FOS correlates more closely with observations of actual slope failure, providing a realistic and more rigorous FOS. On the annotated cross sections (Attachment A), the Spencer FOS is listed. The results of the analyses are listed in Table 3.

Table 3: Structures and Entities within 200 Feet of Excavation Limits and the Stability Results

Scenario	Structure	Structure Owner	Distance to Structure	Factor of Safety
Mining	Oil well and appurtenances	Noble Energy	77’	1.9
Reclamation	Oil well and appurtenances	Noble Energy	77’	3.6

Figures

LEGEND

STRUCTURE BOUNDARY

LIMIT OF EXCAVATION

PERMIT BOUNDARY

0 300 600

SCALE, FEET

Geotechnical Stability Exhibit
Greeley 35th Avenue Mine
Greeley, Colorado

Martin Marietta
Fort Collins, Colorado

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SITE PLAN
AND LOCATION OF
STRUCTURES

January 2015 Figure 3

P:\1402970 - 35th Ave Slurry Wall\Civil\Production Drawings\Figures\ DRMS Stability - DETAIL 2.dwg Dec 2014

LEGEND

STRUCTURE BOUNDARY

LIMIT OF EXCAVATION

PERMIT BOUNDARY

0 200 400

SCALE, FEET

Geotechnical Stability Exhibit
Greeley 35th Avenue Mine
Greeley, Colorado

Martin Marietta
Fort Collins, Colorado

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SITE PLAN
AND LOCATION OF
STRUCTURES

January 2015 Figure 1

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LEGEND

- STRUCTURE BOUNDARY
- LIMIT OF EXCAVATION
- PERMIT BOUNDARY

0 500 1000

SCALE, FEET

Geotechnical Stability Exhibit
Greeley 35th Avenue Mine
Greeley, Colorado

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SITE PLAN
AND LOCATION OF
STRUCTURES

January 2015 Figure 1

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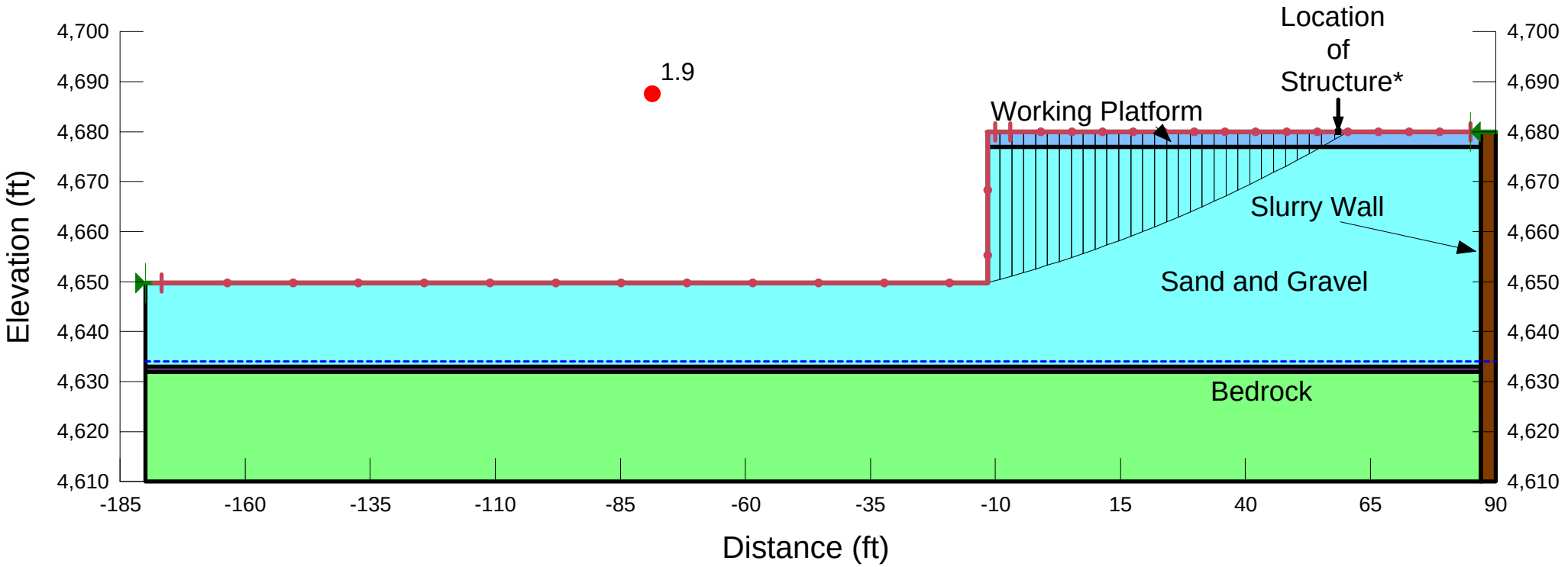
Attachment A

Seepage and Stability Analysis DRMS
File Name: DRMSStabilityExhibit.gsz
Date: 1/6/2015
Name: 35 Ave. Slurry Wall DRMS Stability
Kind: SLOPE/W
Method: Spencer

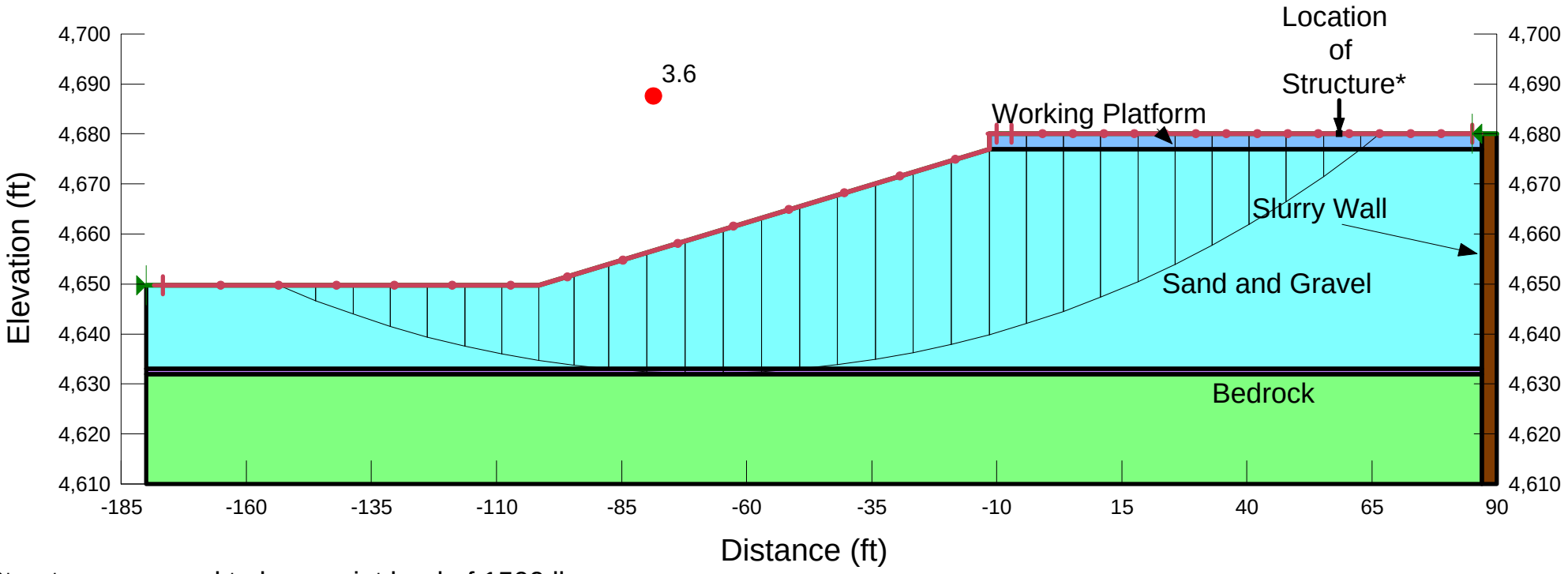
Name: Bedrock Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 100 psf Phi': 30 ° Phi-B: 0 °
Name: Slurry Wall Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 20 ° Phi-B: 0 °
Name: Sand & Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 35 ° Phi-B: 0 °
Name: Working Platform Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Weathered Bedrock Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 50 psf Phi': 15 ° Phi-B: 0 °



*Structure assumed to be a point load of 1500 lbs

Seepage and Stability Analysis Station 22+60
File Name: DRMSStabilityExhibit_WorstCase.gsz
Date: 1/12/2015
Name: 35 Ave. Slurry Wall Sta. 22+60 Section - Empty Reservoir
Kind: SLOPE/W
Method: Spencer

Name: Bedrock Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 100 psf Phi': 30 ° Phi-B: 0 °
Name: Slurry Wall Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 0 psf Phi': 20 ° Phi-B: 0 °
Name: Sand & Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 35 ° Phi-B: 0 °
Name: Working Platform Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Weathered Bedrock Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 50 psf Phi': 15 ° Phi-B: 0 °



*Structure assumed to be a point load of 1500 lbs