



J&T Consulting, Inc.

January 30, 2024

Mr. Eric Scott
Environmental Protection Specialist

Physical Address:

1313 Sherman Street, Room 215
Denver, CO 80203

Mailing Address:

Division of Reclamation, Mining and Safety, Room 215
1001 East 62nd Avenue
Denver, CO 80216

RE: W.W. Clyde & Co. – Derr Pit, DRMS Permit M2008-017, Incomplete Application for Transfer of Permit and Succession of Operators (SO1) Response

Dear Mr. Scott,

W.W. Clyde & Co. received the Incomplete Application for Transfer of Permit and Succession of Operators (SO1) Review Letter from you on December 6, 2023. In response to your letter J&T Consulting, Inc. is providing the following responses on behalf of W.W. Clyde & Co.

1. As noted on Page 3 of the application form, The Division requires a valid Demonstration of Legal Right to Enter: All Permittees must provide a description of the basis for legal right of entry to the site and to conduct mining and reclamation. See Hard Rock and Construction Materials Rules 6.3.7 and 6.4.14. To comply with this requirement, the Prospective Successor must demonstrate that he/ she/ it has obtained a legal right of entry from any and all surface and mineral rights owners in the affected lands, independent of the current Permittee. See Hard Rock and Construction Materials Rules 6.3.7, 6.4.14, and 1.6.2(1)(e)(i). This may be a copy of an access lease, deed, abstract of title, current tax receipt, or a signed and notarized statement by the property owners stating that the Prospective Successor has a legal right to enter. See Hard Rock and Construction Materials Rule 6.3.7.

Response: *We have provided the Notice of Name Change and Succession by Merger for the name change from IHC Scott, Inc. to W.W. Clyde & Co. that was recorded with Weld County's Clerk and Recorder. This document confirms the name change and ownership of the property which are the same as the operator.*

2. Because both parties chose to maintain their right to a 30 day decision, a replacement financial warranty provided by the successor operator, W.W. Clyde and Co., in the amount currently posted for the site (\$1,972,000.00) is required to be submitted with the SO application. Please contact DRMS Financial Assurance Specialist Sara Stevenson-Benn at sara.stevenson-benn@state.co.us for any questions regarding available/appropriate bonding mechanisms, required forms, and proper submittal of the required financial warranty.

Response: *W.W. Clyde & Co.'s bonding company is sending or has sent the updated financial warranty directly to Sara Stevenson-Benn's attention at the mailing address of 1001 East 62nd Avenue, Denver CO 80216.*



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3. An original Affidavit of Authority signed by Andy Carpenter and properly notarized is required. This form is available on the DRMS website near the bottom of the listing of financial warranty forms.

Response: The Affidavit of Authority is attached signed by John Thompson. We have also provided a Performance Warranty that is signed by John Thompson.

4. Revised Structure Agreements, as listed in item 6 of Page 3 of the SO application form: Operators must provide the Division copies of agreements to compensate the owners of any significant, valuable, and permanent man-made structures and utilities within 200 feet of the affected land ("Structure Agreements"). See Hard Rock Rules 6.3.12 and 6.4.20; Construction Materials Rules 6.3.12 and 6.4.19. If the Permittee was required to provide Structure Agreements, the Prospective Successor must obtain new Structure Agreements from each owner and provide copies of the same to the Division with the Application. Owners of structures that have been installed within 200' of the permit after the existing permit was issued will also need to be identified and included.

The most efficient way to provide documentation that structure agreements were provided to structure owners is to provide a map identifying all structures within and within 200' of the permit boundary, correlated to a table containing ownership information of the identified structures. This information can then be matched against proof of mailing, such as certified mail "green cards", of structure agreements to the identified structure owners.

Response: Certified mail receipts are included for the structure owners within 200 feet of the permit boundary. We had some land owners change and those changes are reflected in the agreements that are also attached for the Division's reference.

W.W. Clyde & Co. appreciates your consideration of this response and looks forward to your approval of this Application for Transfer of Permit and Succession of Operators.

Please feel free to contact me with any questions or comments.

Sincerely,



J.C. York, P.E.

J&T Consulting, Inc.

Attachments:

Notice of Name Change and Succession by Merger
Updated Affidavit of Authority
Updated Performance Warranty
Updated Exhibit S – Documenting Land Owner Changes
Certified Mail Receipts and Structure Agreement Letters
Updated Slope Stability Study

cc: W.W. Clyde & Co.
File



Recording Requested by and
After Recording Return to:

Clyde Companies, Inc.
Attn: Bill Gammell
730 N 1500 West
Orem, UT 84057

SPACE ABOVE THIS LINE FOR RECORDER'S USE ONLY

**NOTICE OF NAME CHANGE AND SUCCESSION
BY MERGER**

This instrument shall serve to provide record notice that IHC Scott, Inc., a Michigan company, on or about October 1, 2023, merged with and changed its name to W. W. Clyde & Co., a Utah corporation, as evidenced by the Articles of Merger filed with the Utah Department of Commerce Division of Corporations on October 1, 2023, a true and correct copy of which Articles is attached hereto as Exhibit A and incorporated herein. This instrument, therefore, shall service to provide notice that the Company is the successor by merger of IHC Scott, Inc., a Michigan Corporation

Accordingly, this instrument shall constitute constructive notice to all parties that all real property owned of record and appearing vested in IHC Scott, Inc. , a Michigan Corporation, and all other rights and interests in favor of IHC Scott, Inc., a Michigan Corporation, including without limitation the real property and rights and interests as more particularly set forth on Exhibit B attached hereto and incorporated herein, is deemed legally owned by or vested in W. W. Clyde & Co..

[Signature/notary on following page]

IN WITNESS WHEREOF, the party has executed the within instrument as of the 23 day
of October, 2023.

W. W. Clyde & Co.,
a Utah corporation

By:


DUSTIN OLSON
Its: PRESIDENT

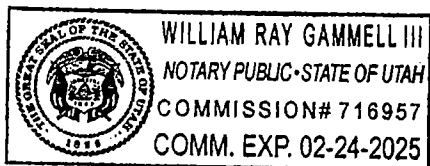
STATE OF UTAH)

County of Utah)

On October 23, 2023, before me, William Gammell
personally appeared Dustin Olson, who proved to me on the basis of satisfactory evidence to
be the person whose name is subscribed to the within instrument and acknowledged to me that
he/she executed the same in his authorized capacity, and that by his signature on the instrument
the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of Utah that the
foregoing paragraph is true and correct.

WITNESS my hand and official seal.




Notary Public
My commission expires: 2-24-2025

Exhibit A

Articles of Merger



State of Utah
DEPARTMENT OF COMMERCE
Division of Corporations & Commercial Code
Statement/Articles of Merger

4927381 10/24/2023 02:20 PM
Page 4 of 13

Non-Refundable Processing Fee: \$37.00

Surviving Entity

Name of Business Entity: W. W. Clyde & Co.

Entity Type: Corporation Jurisdiction: Utah

**Mailing Address for Service of Process pursuant to Subsection 16-17-301(2)
(for Non-registered Foreign Surviving Entities ONLY)**

Address: _____

City: _____ State: _____ Zip: _____

Surviving Entity Creation/Existence

- ☐ The surviving entity is created by this Statement of Merger. The formation document that creates the surviving entity is attached (for Domestic LLCs, LPs, LLPs, or LLLPs only).
- ☐ The surviving entity is a Non-registered Foreign Entity.
- ☒ The surviving entity existed before this Statement/Articles of Merger.

Pursuant to Utah code the undersigned parties of the merger execute and deliver the following Statement of Merger:

Non-surviving Entities that are Parties to the Merger:

Name of Business Entity: IHC Scott, Inc.

Entity Type: Corporation Jurisdiction: Michigan

Name of Business Entity: _____

Entity Type: _____ Jurisdiction: _____

Name of Business Entity: _____

Entity Type: _____ Jurisdiction: _____

Name of Business Entity: _____

Entity Type: _____ Jurisdiction: _____

Additional Business Entities that are Parties to the Merger have been named in an attached Exhibit and made a part hereof.

The delayed effective date of the merger described herein shall be the date upon which this document is filed with the Utah Division of Corporations and Commercial Code, or October 1, 2023.

Plan of Merger or Share Exchange

The Plan of Merger or Share Exchange, containing such information as required by Utah Code 16-10a-1101, is set forth in "Exhibit A," attached hereto and made a part hereof.

Manner of Adoption & Vote of Surviving Corporation (must complete Section 1 or 2)

Section 1

☒ Shareholder vote not required. The merger/ share exchange was adopted by the incorporators or board of directors without shareholder action and shareholder action was not required.

Section 2

☐ Vote of shareholders (complete either A or B) The designation (i.e., common, preferred or any classification where different classes of stock exist), number of outstanding shares, number of votes entitled to be cast by each voting group entitled to vote separately on the merger / share exchange and the number of votes of each voting group represented at the meeting is set forth below:

A. Unanimous written consent executed on _____, 20__ and signed by all shareholders entitled to vote.

B. Vote of shareholders during a meeting called by the Board of Directors.

	TOTAL	A	B	C
Designation of each voting group (i.e. preferred and common)				
Number of outstanding shares				
Number of votes entitled to be cast				
Number of votes represented at meeting				
Shares voted in favor				
Shares voted against				

Manner of Adoption & Vote of Non-surviving Corporation (must complete Section 1 or 2)

Section 1

☐ Shareholder vote not required. The merger/ share exchange was adopted by the incorporators or board of directors without shareholder action and shareholder action was not required.

Section 2

☒ Vote of shareholders (complete either A or B) The designation (i.e., common, preferred or any classification where different classes of stock exist), number of outstanding shares, number of votes entitled to be cast by each voting group entitled to vote separately on the merger / share exchange and the number of votes of each voting group represented at the meeting is set forth below:

A. Unanimous written consent executed on August 16, 20 23 and signed by all shareholders entitled to vote.

B. Vote of shareholders during a meeting called by the Board of Directors.

	TOTAL A		B	C
Designation of each voting group (i.e. preferred and common)				
Number of outstanding shares				
Number of votes entitled to be cast				
Number of votes represented at meeting				
Shares voted in favor				
Shares voted against				

Approval Statement

This merger was approved by each domestic merging entity (if any) in accordance with Sections 48-3a-1021 through 48-3a-1026 and by each foreign merging entity (if any) in accordance with the law of its jurisdiction of formation.

Required Signatures

Surviving Entity: W. W. Clyde & Co.

Name: Dustin Olson Title: President

Signature:  Date: September 21, 2023

Non-surviving Entity: IHC Scott, Inc.

Name: Brandon Hale Title: Secretary

Signature:  Date: September 21, 2023

Non-surviving Entity: _____

Name: _____ Title: _____

Signature: _____ Date: _____

Non-surviving Entity: _____

Name: _____ Title: _____

Signature: _____ Date: _____

Non-surviving Entity: _____

Name: _____ Title: _____

Signature: _____ Date: _____

Non-surviving Entity: _____

Name: _____ Title: _____

Signature: _____ Date: _____

Include complete signatures for any additional Business Entities that have been named in an attached Exhibit.

Under GRAMA {63G-2-201}, all registration information maintained by the Division is classified as public record. For confidentiality purposes, you may use the business entity physical address rather than the residential or private address of any individual affiliated with the entity.

Utah Articles of Merger

Final Audit Report

2023-09-22

Created:	2023-09-22
By:	Brandon Hale (bhale@clydeinc.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAA0DurWJNvolGJIWN45TZ0BNc4xYAkGZjp

"Utah Articles of Merger" History

-  Document created by Brandon Hale (bhale@clydeinc.com)
2023-09-22 - 2:02:36 PM GMT
-  Document emailed to Dustin Olson (dolson@wwclyde.net) for signature
2023-09-22 - 2:03:12 PM GMT
-  Document e-signed by Dustin Olson (dolson@wwclyde.net)
Signature Date: 2023-09-22 - 4:33:27 PM GMT - Time Source: server
-  Document emailed to Brandon Hale (bhale@clydeinc.com) for signature
2023-09-22 - 4:33:29 PM GMT
-  Email viewed by Brandon Hale (bhale@clydeinc.com)
2023-09-22 - 4:37:33 PM GMT
-  Document e-signed by Brandon Hale (bhale@clydeinc.com)
Signature Date: 2023-09-22 - 4:37:42 PM GMT - Time Source: server
-  Agreement completed.
2023-09-22 - 4:37:42 PM GMT

Exhibit B

Legal Descriptions

Weld County (Greeley Milliron location)

PARCEL I:

LOT B, RECORDED EXEMPTION NO. 0961-04-1-RE1638, RECORDED NOVEMBER 30, 1994 AS RECEPTION NO. 2417257, BEING A PART OF THE NE 1/4 OF SECTION 4, TOWNSHIP 5 NORTH, RANGE 65 WEST OF THE 6TH P.M., COUNTY OF WELD, STATE OF COLORADO

PARCEL II:

ALL THAT PART OF THE NW 1/4 OF THE SE 1/4 LYING AND BEING NORTH OF THE EIGHTH STREET ROAD, AND ALL THAT PART OF THE WEST 245 FEET TO THE NE 1/4 OF THE SE 1/4 LYING NORTH OF THE EIGHTH STREET ROAD, ALL IN SECTION 4, TOWNSHIP 5 NORTH, RANGE 65 WEST OF THE 6TH P.M., COUNTY OF WELD, STATE OF COLORADO

EXCEPT A TRACT OF LAND CONVEYED TO THE DEPARTMENT OF HIGHWAYS BY DEED MAY 9, 1956 IN BOOK 1450 AT PAGE 130 AND ALSO EXCEPT A TRACT OF LAND CONVEYED TO THE CITY OF GREELEY BY DEED RECORDED NOVEMBER 21, 1985 IN BOOK 1092 AT RECEPTION NO. 2032995

PARCEL III:

A tract of land located in the Northeast Quarter of Section 4, Township 5 North, Range 65 West of the 6th P.M., Weld County, Colorado, and being more particularly described as follows:

COMMENCING at the North Quarter corner and considering the West line of said Northeast quarter to bear South 00°24'25" West with all other bearings contained herein being relative thereto;

THENCE South 00°24'25" West a distance of 1150.00 feet along the West line of the Northeast quarter of said Section 4 to an existing fence line and the TRUE POINT OF BEGINNING;

THENCE along said fence line by the following Twelve (12) courses:

THENCE South 83°26'16" East a distance of 509.80 feet;

THENCE North 76°16'44" East a distance of 589.30 feet;

THENCE South 00°06'44" West a distance of 82.20 feet;

THENCE South 29°44'16" East a distance of 39.30 feet;

THENCE South 00°14'16" East a distance of 226.70 feet;

THENCE South 84°16'16" East a distance of 201.80 feet;

THENCE North 08°02'44" East a distance of 164.80 feet;

THENCE North 87°30'44" East a distance of 218.50 feet;
THENCE South 22°46'16" East a distance of 481.30 feet;
THENCE South 01°30'16" East a distance of 353.50 feet;
THENCE South 45°55'16" East a distance of 237.00 feet;
THENCE South 27°57'16" East a distance of 415.57 feet to a point on the South line of said Northeast Quarter;
THENCE North 89°14'21" West a distance of 2112.20 feet along said South line to the Southwest corner of the Northeast Quarter of said Section 4;
THENCE North 00°24'25" East a distance of 1410.09 feet to the TRUE POINT OF BEGINNING.

Weld County (Bernhardt Milliken location)

PARCEL I:

THE E 1/2 OF SECTION 13 AND THE NE 1/4 OF SECTION 24, ALL IN TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M., COUNTY OF WELD, STATE OF COLORADO, EXCEPTING THEREFROM THE FOLLOWING 13 TRACTS OF LAND DESCRIBED IN THE FOLLOWING DOCUMENTS:

DEED RECORDED SEPTEMBER 6, 1906 IN BOOK 248 AT PAGE 102 DESCRIBED AS FOLLOWS: A STRIP, PIECE OR PARCEL OF LAND 200 FEET IN WIDTH BEING 100 FEET IN WIDTH ON EACH SIDE OF THE CENTER LINE OF THE MAIN TRACK OF UNION PACIFIC RAILROAD AS NOW SURVEYED, STAKED OUT AND LOCATED, THROUGH, UPON, OVER, AND ACROSS THE NE 1/4 OF SECTION 24 AND THE SE ¼ OF SECTION 13, BOTH IN TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M.

DEED RECORDED SEPTEMBER 10, 1906 IN BOOK 247 AT PAGE 162 DESCRIBED AS: STRIP OR PARCEL OF LAND 100 FEET WIDE FOR RAILROAD AND PUBLIC UTILITY PURPOSES ONLY, SAID STRIP OR PARCEL HEREINAFTER DESCRIBED IS A PART OF AND LOCATED THROUGH THE FOLLOWING DESCRIBED PROPERTY, TO-WIT: THE SE 1/4 OF SECTION 13, TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M., SAID 100 FOOT STRIP OR PARCEL OF LAND BEING 50 FEET ON EACH SIDE OF THE CENTER LINE AS SURVEYED THROUGH THE PROPERTY ABOVE MENTIONED, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS, TO-WIT: BEGINNING AT A POINT ON THE SOUTH LINE OF THE PROPERTY ABOVE MENTIONED 2059 FEET MORE OR LESS FROM THE SE CORNER OF THE SAID PROPERTY AND CONTINUING N 44° 56' E, 157 FEET TO A POINT, THENCE ON A 5° CURVE TO THE LEFT, 434 FEET TO A POINT, THENCE N 23° 14' E, 1297 FEET TO A POINT, THENCE ON A 7° CURVE TO THE RIGHT 334 FEET TO A POINT, THENCE 46° 36' E, 1094 FEET TO THE NORTH LINE OF SAID PROPERTY 240 FEET, MORE OR LESS, FROM THE NE CORNER OF SAID PROPERTY. DEED RECORDED SEPTEMBER 10, 1906 IN BOOK 247 AT PAGE 163 DESCRIBED AS

FOLLOWS: A STRIP OR PARCEL OF LAND 100 FEET WIDE FOR RAILROAD AND PUBLIC UTILITY PURPOSES ONLY, SAID STRIP OR PARCEL HEREINAFTER DESCRIBED IS A PART OF AND LOCATED THROUGH THE FOLLOWING DESCRIBED PROPERTY, TO-WIT: THE NE 1/4 OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M., SAID 100 FOOT STRIP OR PARCEL OF LAND BEING 50 FEET ON EACH SIDE OF THE CENTERLINE AS SURVEYED THROUGH THE PROPERTY ABOVE MENTIONED, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS, TO-WIT: BEGINNING AT A POINT ON THE WEST LINE OF THE PROPERTY ABOVE MENTIONED 600 FEET MORE OR LESS FROM THE NW CORNER OF THE SAID PROPERTY AND CONTINUING N 44° 56' E 845 FEET TO THE NORTH LINE OF SAID PROPERTY 2059 FEET, MORE OR LESS, FROM THE NE CORNER OF SAID PROPERTY.

DEED RECORDED DECEMBER 3, 1906 IN BOOK 248 AT PAGE 380 DESCRIBED AS FOLLOWS: A STRIP PIECE OR PARCEL OF LAND 200 FEET IN WIDTH BEING 100 FEET IN WIDTH ON EACH SIDE OF THE CENTERLINE OF THE MAIN TRACK OF UNION PACIFIC RAILROAD AS THE SAME IS NOW SURVEYED, STAKED OUT AND LOCATED, THROUGH, OVER AND ACROSS THE NE 1/4 OF SECTION 13, TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M.

DEED RECORDED JUNE 9, 1908 IN BOOK 280 AT PAGE 230 DESCRIBED AS FOLLOWS: A STRIP, PIECE OR PARCEL OF LAND 200 FEET IN WIDTH, BEING 100 FEET IN WIDTH ON EACH SIDE OF THE CENTER LINE OF THE MAIN TRACK OF THE UNION PACIFIC RAILROAD, (KNOWN AS THE PLATTEVILLE CONNECTION WITH PROPOSED DENVER TO FT. COLLINS LINE) AS THE SAME HAS BEEN SURVEYED, LOCATED AND STAKED OUT, THROUGH, UPON, OVER, AND ACROSS THE SE 1/4 OF THE NE 1/4 OF SECTION 13-4-67 WEST OF THE 6TH P.M., SAID STRIP OF LAND BEGINNING AT THE SOUTH LINE OF SAID NE 1/4 AND EXTENDING NORTHERLY TO AN INTERSECTION WITH THE EASTERLY RIGHT OF WAY LINE OF UNION PACIFIC RAILROAD, (AS SHOWN IN DEED TO UNION PACIFIC RAILROAD RECORDED IN BOOK 248 AT PAGE 380).

DEED RECORDED APRIL 26, 1909 IN BOOK 300 AT PAGE 466 DESCRIBED AS FOLLOWS: A STRIP, PIECE OR PARCEL OF LAND 200 FEET IN WIDTH, BEING 100 FEET IN WIDTH ON EACH SIDE OF THE CENTER LINE OF THE MAIN TRACK OF UNION PACIFIC RAILROAD, (KNOWN AS THE DENVER-NORTHERN LINE, LA SALLE CONNECTION), AS THE SAME HAS BEEN SURVEYED, LOCATED AND STAKED OUT THROUGH, UPON, OVER AND ACROSS THE E 1/2 OF THE NE 1/4 OF SECTION 13-4-67 WEST OF THE 6TH P.M. SAID CENTERLINE CROSSES THE EAST LINE OF SAID SECTION 225.0 FEET SOUTH OF THE NE CORNER OF SAID SECTION, AND EXTENDS S 44° 55' W TO INTERSECTION WITH THE EASTERLY RIGHT OF WAY LINE OF UNION PACIFIC RAILROAD, (KNOWN AS PLATTEVILLE CONNECTION WITH EXTENSION OF GRANT MINE SPUR TRACK) AS SHOWN IN DEED RECORDED IN BOOK 280 AT PAGE 230.

DEED RECORDED JUNE 23, 1909 IN BOOK 305 AT PAGE 247 DESCRIBED AS FOLLOWS: A TRIANGULAR TRACT OR PARCEL OF LAND SITUATE IN THE SW CORNER OF THE

NE 1/4 OF SECTION 13-4-67 WEST OF THE 6TH P.M., AND MORE FULLY DESCRIBED AS FOLLOWS: BEGINNING AT THE SW CORNER OF SAID NE 1/4; THENCE EAST ALONG THE SOUTH LINE THEREOF 189 FEET, MORE OR LESS TO A POINT 100 FEET EASTERLY OF AND AT RIGHT ANGLES TO THE CENTER LINE OF THE DENVER, LARAMIE AND NORTHWESTERN RAILWAY AS THE SAME IS NOW LOCATED, SURVEYED AND STAKED OUT, OVER AND ACROSS SAID SECTION 13, THENCE N 24° 22' W 430 FEET, MORE OR LESS TO THE WEST LINE OF SAID NE 1/4, 75 FEET EASTERLY OF AND RIGHT ANGLES TO SAID CENTERLINE; THENCE SOUTH ALONG THE WEST LINE OF SAID NE 1/4 395 FEET TO THE PLACE OF BEGINNING.

DEED RECORDED SEPTEMBER 6, 1910 IN BOOK 330 AT PAGE 494 DESCRIBED AS FOLLOWS: ALL THAT PART OF THE NE 1/4 OF SECTION 13-4-67 WEST 6TH P.M., AND DESCRIBED AS FOLLOWS, TO-WIT: COMMENCING AT A POINT IN THE PRESENT WESTERLY RIGHT OF WAY LINE OF UNION PACIFIC RAILROAD (KNOWN AS THE LA SALLE CONNECTION) 540 FEET SOUTH OF THE NORTH LINE OF SAID SECTION 13, WHEN MEASURED ALONG SAID WESTERLY RIGHT OF WAY LINE; THENCE SOUTHERLY ALONG SAID PRESENT WESTERLY RIGHT OF WAY LINE A DISTANCE OF 1610 FEET, MORE OR LESS, TO ITS INTERSECTION WITH THE PRESENT EASTERLY RIGHT OF WAY LINE OF UNION PACIFIC RAILROAD (KNOWN AS THE FORT COLLINS BRANCH); THENCE NORTHWESTERLY ALONG SAID PRESENT EASTERLY RIGHT OF WAY LINE OF SAID FORT COLLINS BRANCH, A DISTANCE OF 1525 FEET TO A POINT; THENCE EASTERLY ON A CURVED LINE TO THE LEFT HAVING A RADIUS OF 855.36 FEET A DISTANCE OF 1750 FEET, MORE OR LESS, TO THE PLACE OF BEGINNING.

DEED RECORDED APRIL 24, 1911 IN BOOK 341 AT PAGE 310 DESCRIBED AS FOLLOWS: ALL THAT PART OF THE SE 1/4 OF THE NE 1/4 OF SECTION 13-4-67 WEST OF THE 6TH P.M. AND DESCRIBED AS FOLLOWS, TO WIT: COMMENCING AT THE 1/4 SECTION CORNER BETWEEN SECTION 13-4-67 WAND SECTION 18-4-66 WEST; THENCE NORTH A DISTANCE OF 350 FEET TO A POINT; THENCE S 54° 28' W A DISTANCE OF 602.2 FEET TO A POINT IN THE EAST AND WEST CENTER LINE OF SAID SECTION 13; THENCE EAST A DISTANCE OF 490 FEET TO THE PLACE OF BEGINNING. DEED RECORDED MARCH 29, 1918 IN BOOK 479 AT PAGE 233 DESCRIBED AS FOLLOWS: A STRIP OF GROUND 20 FEET IN WIDTH OFF OF THE EAST SIDE OF THE NE 1/4 OF SECTION 13-4-67 WEST, COMMENCING AT A POINT 550 FEET SOUTH OF THE NE CORNER OF THE NE 1/4 OF SAID SECTION 13; THENCE SOUTH FOR A DISTANCE OF 1960 FEET, THENCE A STRIP OF GROUND 30 FEET IN WIDTH EXTENDING SOUTHWESTERLY TO A POINT ON THE SOUTH LINE OF THE NE 1/4 OF SAID SECTION 13, A DISTANCE OF 210 FEET WEST OF THE SE CORNER OF THE NE 1/4 OF SAID SECTION 13.

DEED RECORDED SEPTEMBER 30, 1969 AT RECEPTION NO. 1537418 AND RECORDED NOVEMBER 13, 1969 AT RECEPTION NO. 1539251 DESCRIBED AS FOLLOWS: THE NORTH 225 FEET OF THE NE 1/4 OF SECTION 24 AND THE EAST 225 FEET OF THE E 112 OF SECTION 13, TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M. DEED RECORDED AUGUST 27, 1975 AT RECEPTION NO. 1668329 DESCRIBED AS FOLLOWS:

A PARCEL OF LAND LYING IN THE NE 1/4 OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M., MORE FULLY DESCRIBED AS FOLLOWS: BEGINNING AT THE E 114 CORNER OF SAID SECTION 24, THENCE CLOCKWISE AROUND THE SAID PROPERTY ALONG THE FOLLOWING COURSES: 1) WESTERLY ALONG THE SOUTH LINE OF THE NE 114 OF SECTION 24, A DISTANCE OF 588.23 FEET. 2) DEFLECTION ANGLE RIGHT IS $109^{\circ} 06' 27''$, A DISTANCE OF 1568.10 FEET. 3) DEFLECTION ANGLE RIGHT IS $157^{\circ} 59' 52''$, A DISTANCE OF 1483.57 FEET ALONG THE EAST LINE OF SAID SECTION 24 TO THE POINT OF BEGINNING.

DEED RECORDED JULY 28, 1987 AT RECEPTION NO. 2108488 DESCRIBED AS: LOT A, OF AMENDED RECORDED EXEMPTION NO 1059-13-1-RE 948, RECORDED MARCH 25, 1987 IN BOOK 1150 AT RECEPTION NO. 2093258, BEING A PART OF THE NE 114 OF SECTION 13, TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE 6TH P.M.

PARCEL II:

TRACT 1, SUBDIVISION EXEMPTION NO. 469, RECORDED AUGUST 30, 1993 AT RECEPTION NO. 2348079, BEING A PART OF THE W 1/2 OF THE NW 1/4 OF SECTION 18, TOWNSHIP 4 NORTH, RANGE 66 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 18 AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER TO BEAR NORTH $89^{\circ} 53' 50''$ EAST WITH ALL OTHER BEARINGS CONTAINED HEREIN RELATIVE THERETO; THENCE NORTH $89^{\circ} 53' 50''$ EAST, 742.05 FEET, THENCE SOUTH $00^{\circ} 41' 19''$ EAST, 1662.12 FEET; THENCE NORTH $89^{\circ} 30' 38''$ WEST, 738.37 FEET; THENCE SOUTH $00^{\circ} 13' 08''$ WEST, 19.65 FEET; THENCE NORTH $89^{\circ} 30' 38''$ WEST, 30.00 FEET TO THE WEST LINE OF SAID NORTHWEST QUARTER; THENCE NORTH $00^{\circ} 13' 08''$ EAST, 1673.77 FEET ALONG SAID WEST LINE TO THE POINT OF BEGINNING; EXCEPTING THEREFROM DEED RECORDED APRIL 14, 1910 IN BOOK 325 AT PAGE 405.

PARCEL III:

A TRIANGULAR TRACT OF LAND SITUATE IN THE SW 1/4 OF THE NE 114 OF SECTION 13, TOWNSHIP 4 NORTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS: BEGINNING AT THE SOUTHWEST CORNER OF SAID NE 1/4; THENCE, EAST ALONG THE SOUTH LINE THEREOF 189 FEET, MORE OR LESS, TO A POINT 100 FEET EASTERLY OF AND AT RIGHT ANGLES TO THE CENTER LINE OF THE DENVER, LARAMIE AND NORTHWESTERN RAIL WAY AS THE SAME IS NOW LOCATED, SURVEYED AND STAKED OUT, OVER AND ACROSS SAID SECTION 13; THENCE, NORTH $24^{\circ} 22'$ WEST 430 FEET, MORE OR LESS, TO THE WEST LINE OF SAID NE 1/4, 75 FEET EASTERLY OF AND AT RIGHT ANGLES TO SAID CENTER LINE; THENCE, SOUTH ALONG THE WEST LINE OF SAID NE 1/4, 395 FEET TO THE PLACE OF BEGINNING, COUNTY OF WELD, STATE OF COLORADO.

Garfield County (Rifle Pit)

TOWNSHIP 6 SOUTH, RANGE 92 WEST OF THE 6TH P.M.,

SECTION 8: SE 1/2 SW 1/4

SECTION 17: NE 1/4 NW 1/4 AND NW 1/4 NW 1/4

Northeast Corner Section 8 (193' Witness Corner)

Found 3" Dia. Garfield County Surveyor Brass Cap

on 2.5" Iron Pipe (1965) properly marked, 193'

distance of Witness Corner based on Monument-

Report filed August 20, 2002 by Frank Harrington

(existing Monument Record matches found bearing

objects)

LESS AND EXCEPTING THE FOLLOWING TRACTS OF LAND PREVIOUSLY

CONVEYED AND RECORDED: A TRACT OF LAND LOCATED IN THE SW 1/4 SW 1/4

SECTION 8, AND THE NW 1/4 NW 1/4 OF SECTION 17, CONVEYED BY GEORGE YULE

BY WARRANTY DEED RECORDED APRIL 17, 1893 IN BOOK 32 AT PAGE 425. A

TRACT OF LAND LYING IN THE SE CORNER OF THE NE 1/4 NW 1/4 OF SECTION 17

AS GRANTED TO SCHOOL DISTRICT 27 OF GARFIELD COUNTY BY WARRANTY

DEED DATED OCTOBER 10, 1891, RECORDED OCTOBER 12, 1891 IN BOOK 25 AT

PAGE 188. A TRACT OF LAND LYING IN THE SE 1/4 SW 1/4 SECTION 8, AND N 1/2 NW

1/4 SECTION 17 COMPRISING INTERSTATE HIGHWAY 70 R.O.W., INCLUDING: THAT

PART OF THE N 1/2 NW 1/4 SECTION 17 CONVEYED TO THE BOARD OF COUNTY

COMMISSIONERS OF THE COUNTY OF GARFIELD, STATE OF COLORADO AND

STATE DEPARTMENT OF HIGHWAYS, DIVISION OF HIGHWAYS, STATE OF

COLORADO BY COURT ORDER RECORDED IN FEBRUARY 24, 1977 IN BOOK 493 AT

PAGE 768. THAT PORTION OF THE NE 1/4 NW 1/4 AND NW 1/4 NW 1/4 OF SECTION 17,

TOWNSHIP 6 SOUTH, RANGE 92 WEST, SITUATE SOUTHERLY OF THE INTERSTATE

HIGHWAY 70 RIGHT OF WAY, AS CONVEYED TO JACQUE COUEY BURRIS BY

SPECIAL WARRANTY DEED RECORDED OCTOBER 4, 1991 IN BOOK 814 AT

PAGE 812.

Adams County (Ulster St. shop)

SUB: INTERSTATE HIGHWAY CONSTRUCTION LOT: 1



COLORADO

Division of Reclamation,
Mining and Safety

Department of Natural Resources

Documentation of Legal Authority to Execute Financial Warranty Documents

The Colorado Mined Land Reclamation Board ("Board") has adopted the attached Affidavit of Authority to Execute Financial Warranty Documents pursuant to the Mined Land Reclamation Act (C.R.S. § 34-32-101 et. seq.) and the Land Reclamation Act for the Extraction of Construction Materials (C.R.S. § 34-32.5-101 et. seq.). The Board and the Division of Reclamation Mining and Safety ("Division") have determined that, in order to carry out the financial warranty requirements set forth in C.R.S. §§ 34-32-117 and 34-32.5-117 with reasonable diligence, it is prudent to verify the legal authority of the individual signing all necessary documents.

Accordingly, you must provide confirmation of the legal authority of the individual signing all Financial Warranty Documents to the Division. You may do so either by submitting a resolution of the decision-making body of your company that authorizes an individual to sign the Financial Warranty Documents on the company's behalf, or by completing and notarizing the attached affidavit. The Division reserves the right to require the attached affidavit in all circumstances. Please note that if you are a sole proprietor who is executing documents on your own behalf, documentation of legal authority is unnecessary.



Affidavit of Authority to Execute Financial Warranty Documents

Before me this day, the undersigned John Thompson [name of authorized person], in his/her capacity as Area Manager, Aggregates [title of authorized person] ("Affiant"), personally appeared and, being first duly sworn upon oath said:

1. This affidavit is being executed and submitted on behalf of W.W. Clyde & Co. [name of business organization], a(n) Corporation [legal form of business organization, e.g., corporation, partnership, limited liability company, etc.], in good standing in the State of Colorado (the "Company").
2. It is in the interest of the Company to execute certain financial warranty documents associated with file number M2008-017 (DRMS file number), which are required by the Colorado Mined Land Reclamation Board and Division of Reclamation Mining and Safety pursuant to Colorado law ("Financial Warranty Documents").
3. Affiant is duly authorized to sign such Financial Warranty Documents on behalf of the Company and to bind the Company to the same.
4. Affiant is not prohibited or limited by the Company's governing documents or by any applicable law from executing the Financial Warranty Documents.
5. Affiant will inform the Division of Reclamation Mining and Safety within thirty (30) days in the event that his/her authorization to execute Financial Warranty Documents on the Company's behalf is terminated.

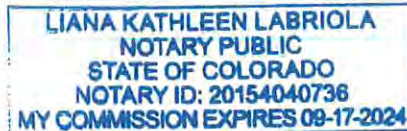
Further, Affiant sayeth not.

John Thompson

Affiant's Name

Signature

STATE OF Colorado)
) ss.:
COUNTY OF Wapiti)



The foregoing instrument was acknowledged before me this 29th day of January, 2024
by John Thompson as Area Manager, Aggregates of W.W. Clyde & Co.

Notary Public

My Commission Expires

9/17/2024



COLORADO

Division of Reclamation,
Mining and Safety

Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

PERFORMANCE WARRANTY

Permittee/Operator: W.W. Clyde & Co.
Operation known as: Derr Pit
Permit Number: M2008-017

This form is approved by the Colorado Mined Land Reclamation Board ("Board") pursuant to C.R.S. 34-32-117 of the Colorado Mined Land Reclamation Act and C.R.S. 34-32.5-117 of the Colorado Land Reclamation Act for the Extraction of Construction Materials.

All parties are on Notice from this Document that:

The above listed Operator provides this warranty to the Board in conjunction with a reclamation Permit to conduct the above described mining operation on certain lands in Colorado. The "Affected Lands" are described in the above listed reclamation Permit, and include any Permit Amendment(s) approved by the Division of Reclamation Mining and Safety ("Division").

The Colorado Mined Land Reclamation Act, C.R.S. 34-32-101 *et seq.* ("Hard Rock Act"), and the Colorado Land Reclamation Act for the Extraction of Construction Materials, C.R.S. 34-32.5-101 *et seq.* ("Construction Materials Act"), both require a permit issued by the Board to include a written promise by the Operator to comply with all requirements of the Hard Rock and Construction Materials Acts (referred to herein together as "Acts").

Through the terms and conditions of this performance warranty and Permit, the Operator agrees to be bound by all requirements of the Acts and all Mineral Rules and Regulations of the Board for Hard Rock, Metal, and Designated Mining Operations (2 C.C.R. 407-1) and all Mineral Rules and Regulations of the Board for the Extraction of Construction Materials (2 C.C.R. 407-4) (referred to herein together as "Rules").

The Operator hereby provides the Board warranties of performance pursuant to C.R.S. 34-32-117(2), (3), and (4)/C.R.S. 34-32.5-117(2), (3), and (4), and promises the Board it will comply with all applicable requirements of the Acts and Rules.

The Operator hereby promises the Board it will comply with all of the terms of the reclamation Permit, including any Permit Amendment(s) approved by the Division. This performance warranty obligation of the Operator shall continue until the Operator's liability is released by the Board.

The Operator promises to be responsible for reclamation costs up to the amount established by the Board and incorporates its financial warranty to this performance warranty. The Operator agrees to maintain a financial warranty (or warranties) in good standing for the reclamation costs for the entire life of the



Permit. The amount of the financial warranty shall be sufficient to assure the completion of reclamation of affected lands if the Division has to complete such reclamation due to forfeiture. If the Board determines the Operator is in default under this performance warranty and the Operator fails to cure such default, the Operator's financial warranty shall be subject to forfeiture pursuant to C.R.S. 34-32-118/34-32.5-118.

This performance warranty by the Operator is perpetual and shall remain in full force and effect until all obligations have been met and all associated financial warranty is released by the Board. Any release of liability in a succession of Operators shall comply with C.R.S. 34-32-119/34-32.5-119.

The provisions hereof shall bind and inure to the benefit of the parties hereto and their successors and assigns.

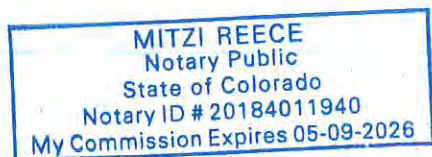
SIGNED, SEALED AND DATED this 26 day of January, 20 24.

Operator: W.W. Clyde & Co.
Signature: [Signature]
Name: John Thompson
Title: Senior Vice President

NOTARIZATION OF OPERATOR'S ACKNOWLEDGEMENT

STATE OF Colorado)
) ss.
COUNTY OF Arapahoe)

The foregoing instrument was acknowledged before me this 26 day of January, 20 24
(Day) (Month) (Year)
by [Signature] as Sr. Vice President
(Name) (Title)
of W.W. Clyde & Co.
(Operator)



[Signature]
NOTARY PUBLIC

My Commission expires: May 9, 2026

APPROVED:
State of Colorado
Mined Land Reclamation Board
Division of Reclamation, Mining and Safety

By: _____ Date: _____
Division Director

EXHIBIT S

Permanent Man-Made Structures within 200 Ft of the Affected Land

Surface Use/Damage Waiver Agreements that have been obtained, and associated structures:

Owner: W.W. Clyde & Co. (Used to be owned by Global Asset Recovery)
Structures: Fencing, Ditch

Surface Use/Damage Waiver Agreements that are being pursued, and associated structures:

Owner: DCP Midstream
Structures: Oil/Gas Lines

Owner: City of Greeley
Structures: Improved/gravel roadway, culverts

Owner: Ogilvy Irrigating and Land Company / Ogilvy Augmentation Company (Used to be owned by Loloff Construction, Inc.)
Structures: Fencing, Slurry Wall

Owner: Centurylink
Structures: Phone/Fiber lines

Owner: City of Greeley
Structures: Improved roadway/ROW, signs, culverts, borrow ditches

Owner: David Bliss
Structures: Buildings, fencing

Owner: DCP Operating Company, LP
Structures: Oil/Gas Lines

Owner: Dixie Ann Hoffner and Jerry Winters
Structures: Fencing

Owner: Extraction Oil and Gas, LLC
Structures: Oil/Gas lines, Oil/Gas Wells

Owner: Gene Murata
Structures: Building

Owner: Leafgren Farms, LLC (Used to be owned by Hoshiko Land)
Structures: Irrigation Structure



Owner: Koehler Sisters, LLC (Used to be owned by James Koehler Revocable Trust)
Structures: Buildings, fencing

Owner: JBS
Structures: Sewer Force Main

Owner: Jeanette Snow
Structures: Buildings, fencing

Owner: Noble Energy
Structures: Oil/Gas lines, wells, pumps, tanks

Owner: North Weld County Water District
Structures: Water lines

Owner: Sylvia Parker (Used to be owned by Sylvia and Verne Parker)
Structures: Buildings

Owner: Weld County Planning and Building
Structures: Improved roadway/ROW, signs, culverts, borrow ditches

Owner: Xcel Energy
Structures: Power lines/poles, Electric lines (buried)

W.W. Clyde & Co. believes that the mining operation, as proposed, will not adversely affect any of the permanent, man-made structures located within 200 ft of the affected area. However, the applicant still anticipates providing evidence of agreements for compensation with the appropriate structure owners or engineering evaluations that adequately demonstrate that the proposed mining and reclamation operations will not result in damage to the structures.



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City, State, ZIP+4® Greeley CO 80631

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

0392 09
FORT LUPTON CO
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Greeley, CO 80634

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☐ Return Receipt (hardcopy)	\$0.00
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☐ Certified Mail Restricted Delivery	\$0.00
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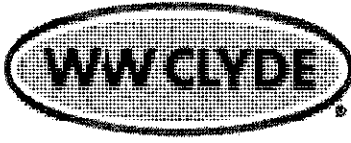
Total Postage and Fees \$8.73



Sent To Noble Energy - Chevron Rockies Bus. Unit
Street and Apt. No., or P.O. Box No. 2115 117th Ave.
City, State, ZIP+4® Greeley CO 80634

PS Form 3800, April 2015 PSN 7530-02-000-9047

See Reverse for Instructions



W.W. Clyde & Co.
10303 East Dry Creek Road,
Suite 300
Englewood, CO 80112

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

DRMS approval requires a notarized agreement between the applicant and owners of structures within 200 feet of the mining activities, providing compensation for any damage to the structure; or preparation of an engineering evaluation acceptable to the DRMS, demonstrating that such structure(s) shall not be damaged by the mining activities if an agreement cannot be reached.

W.W. Clyde & Co. has had an engineering evaluation performed to determine acceptable setbacks from their mining permit boundary and mining limit to structures adjacent to the mining. The proposed mining slopes and setbacks were analyzed using the Galena v7.1 computer program. Galena was designed to analyze the slope stability of earth embankments subjected to several critical situations that may occur during the life of the embankment. The procedure searches for circular shear failures and automatically searches for the lowest safety factor. 5,000 separate failure surfaces were analyzed for each case. The required minimum safety factors are based on the current standards used by the Colorado State Engineer's Office (SEO) for high hazard embankment dams, and industry accepted standards for the evaluation of embankments during construction. The safety factors attained using the setbacks shown on the Mining Plan are greater than the required safety factors specified by the SEO for an earth embankment during construction, and an earth embankment subjected to earthquake loading, based on the United States Geological Survey earthquake peak acceleration factors for the area. This evaluation indicated that damage to structures adjacent to the mining should not occur, even during earthquake conditions, which are very unlikely to be present.

With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Fence

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,

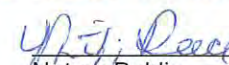


Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

Date 1/26/24

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

_____, as _____,
Area Manager



Notary Public

MITZI REECE
Notary Public
State of Colorado
Notary ID # 20184011940
My Commission Expires 05-09-2026

My Commission Expires: May 9, 2026

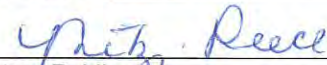


W.W. Clyde & Co.

Date January 26, 2024

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

_____, as _____,
Senior Vice President



Notary Public

My Commission Expires: May 9, 2026

MITZI REECE
Notary Public
State of Colorado
Notary ID # 20184011940
My Commission Expires 05-09-2026



Centurylink
1919 65th Ave.
Greeley, CO 80634

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

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W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by, Andy Carpenter, as Area Manager,

Mitzi Reece
Notary Public

MITZI REECE
Notary Public
State of Colorado
Notary ID # 20184011940
My Commission Expires 05-09-2026

My Commission Expires: May 9, 2026

Centurylink

January 26th 2024

Date

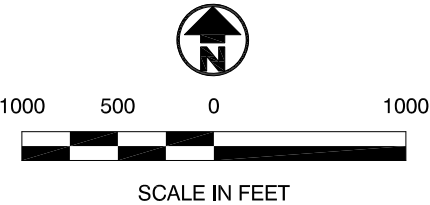
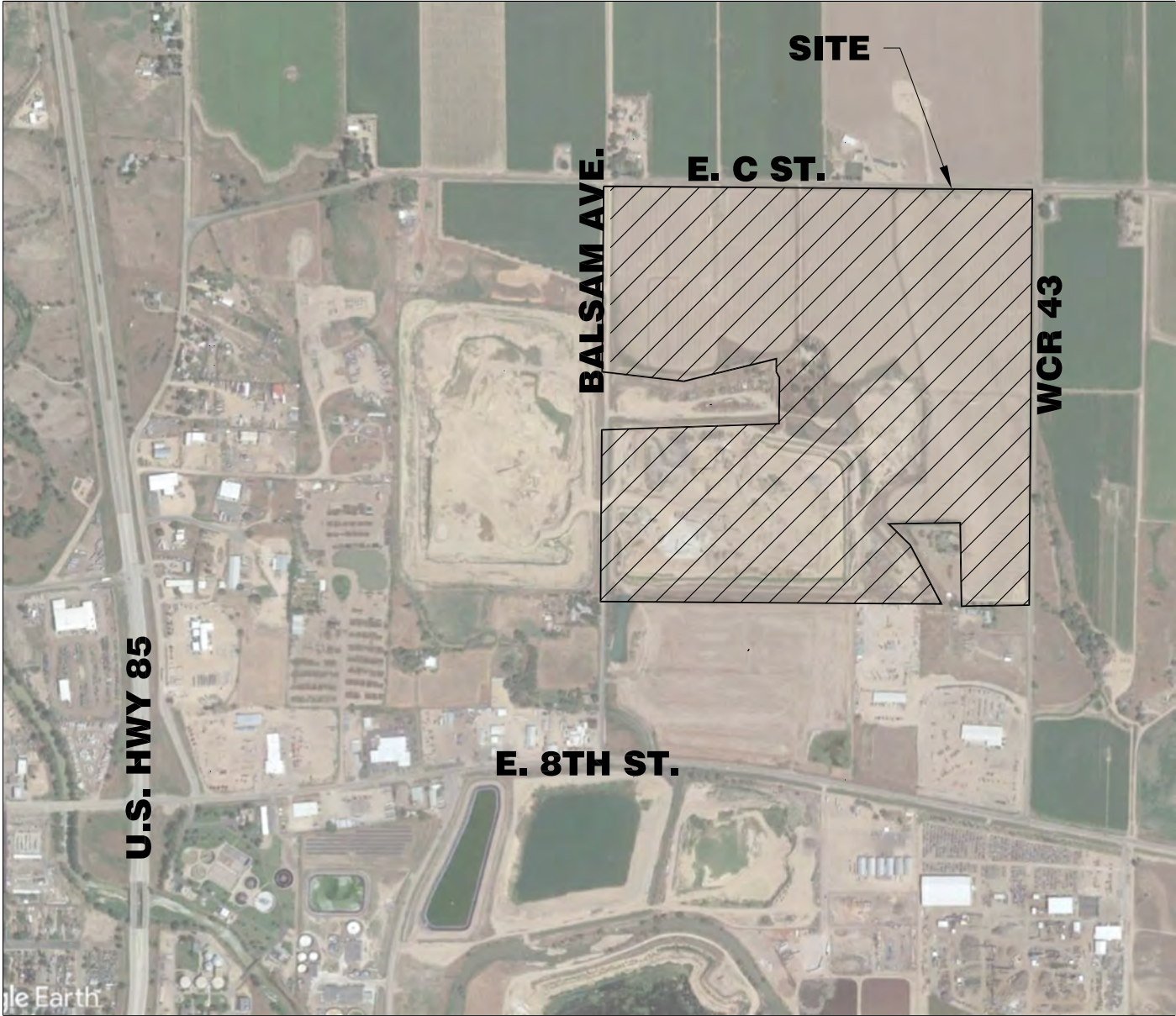
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM



J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



City of Greeley
Community Development
1100 10th St., Suite 202
Greeley, CO 80631

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Fence
2. ROW/Roadway
3. Borrow ditch and culverts

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

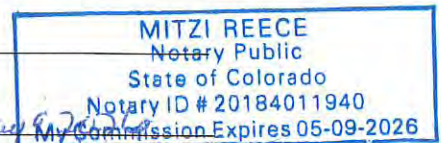
Date

The foregoing instrument was acknowledged before me this 26th day of January, 2024 by,
Andy Carpenter, as Area Manager



Notary Public

My Commission Expires: May 9, 2026



City of Greeley

January 26, 2024

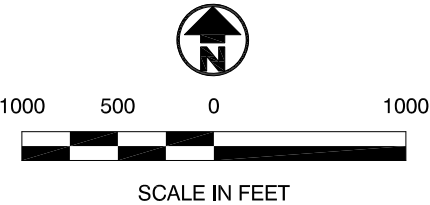
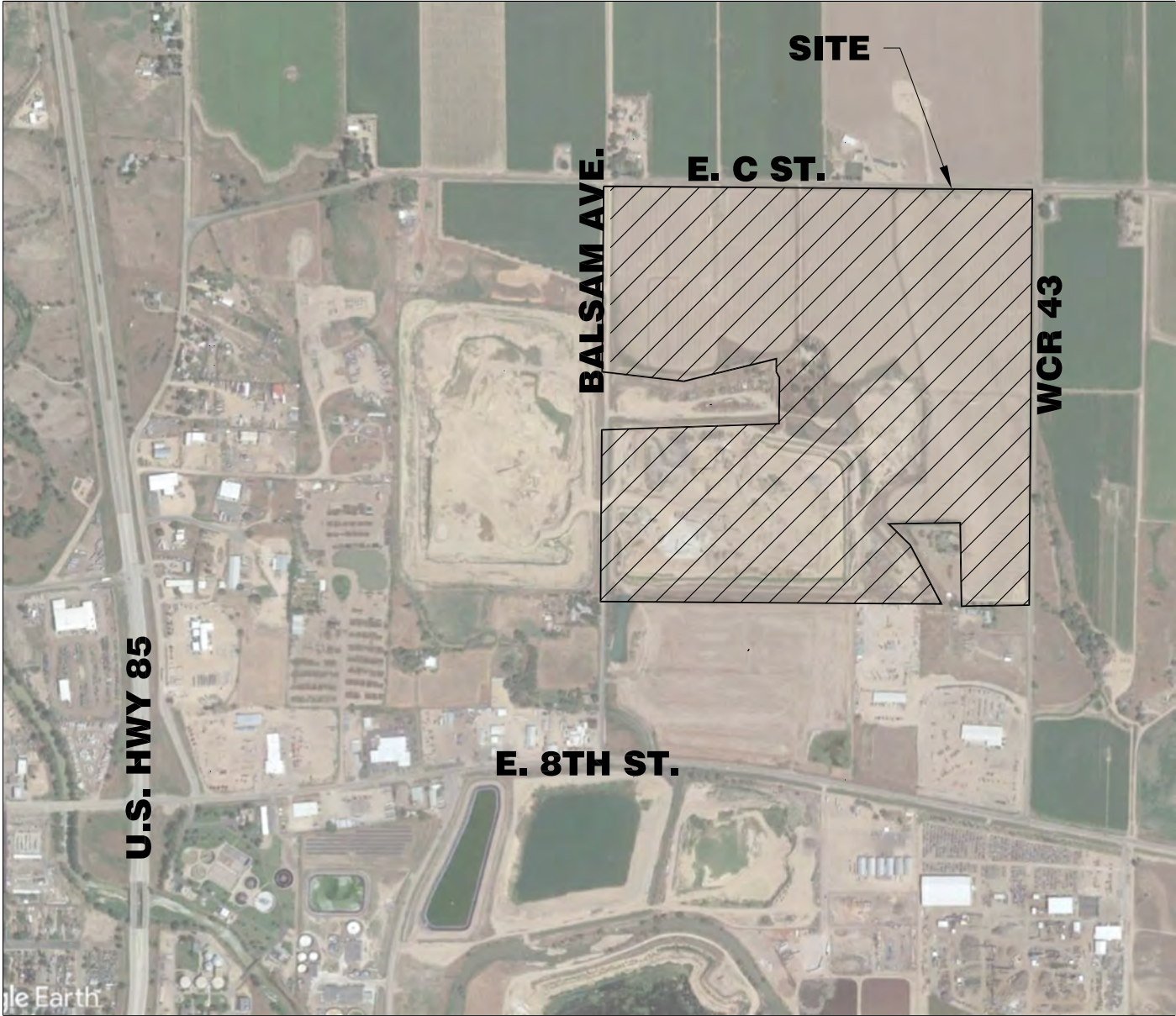
Date

The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,
_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM

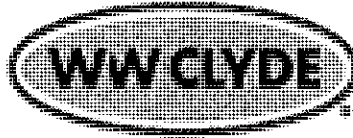


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



David Bliss
13165 E. County Line Rd.
Longmont, CO 80504

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

Mr. Bliss:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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1. Fence
2. Buildings

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

Date

The foregoing instrument was acknowledged before me this 26th day of January, 2024 by,

Andy Carpenter, as AREA MANAGER

Mitzi Reece

Notary Public

MITZI REECE Notary Public State of Colorado Notary ID # 20184011940 My Commission Expires 05-09-2026
--

My Commission Expires: May 9, 2026

David Bliss

January 26th 2024

Date

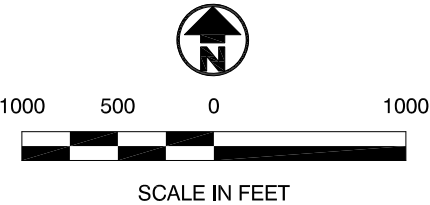
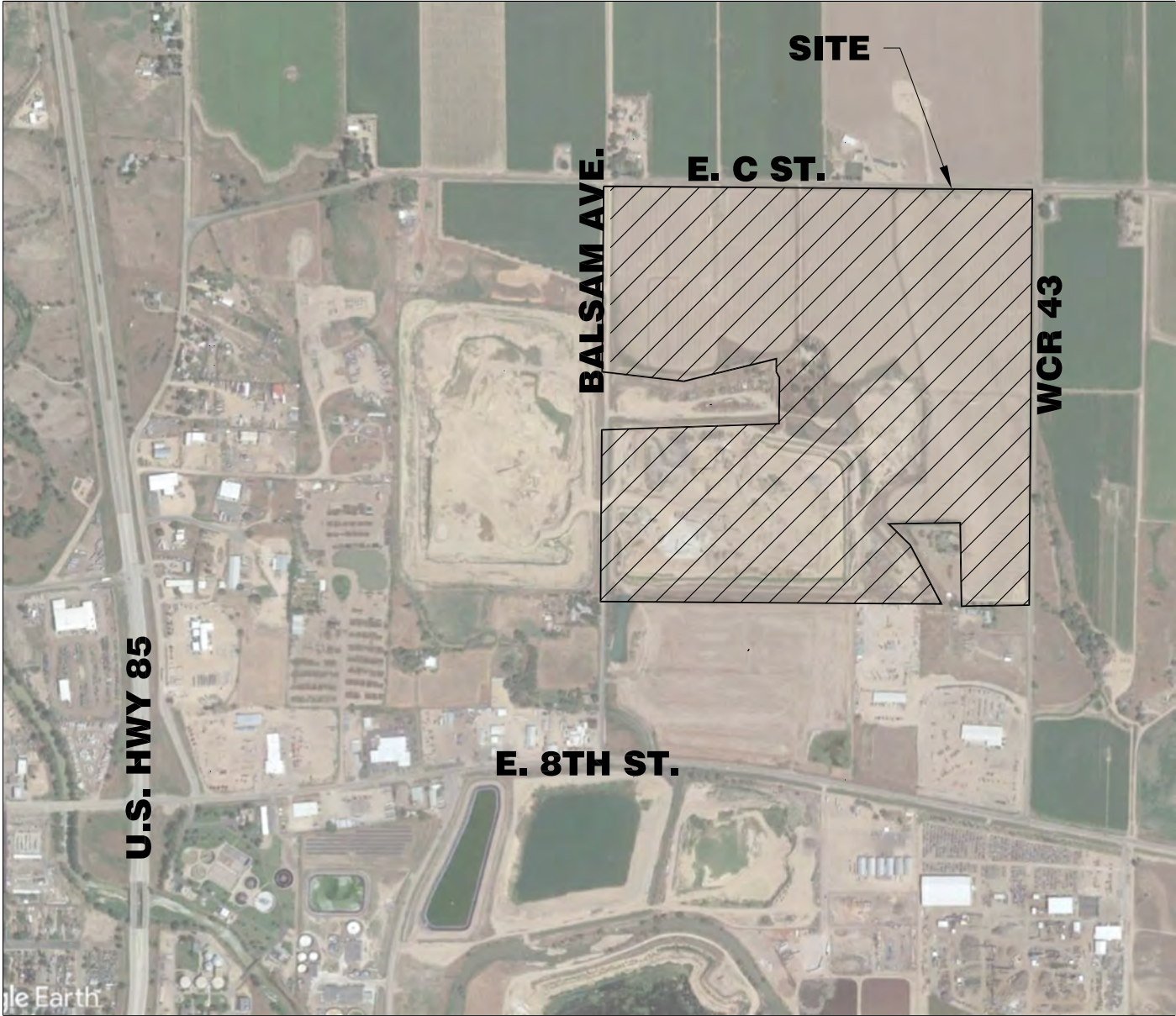
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

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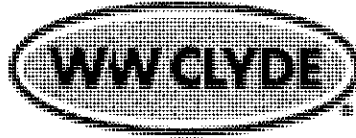


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



DCP Operating Company
3026 4th Ave.
Greeley, CO 80631

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Oil / Gas pipelines

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,

[Signature]
Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager

Mitzi Reece
Notary Public

MITZI REECE
Notary Public
State of Colorado
Notary ID # 20184011940
My Commission Expires 05-09-2026

My Commission Expires: May 9, 2026

DCP Operating Company, LP

January 26, 2024
Date

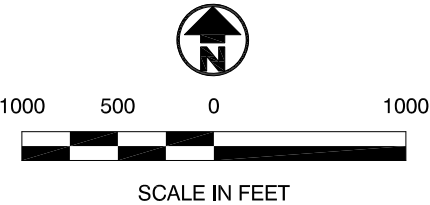
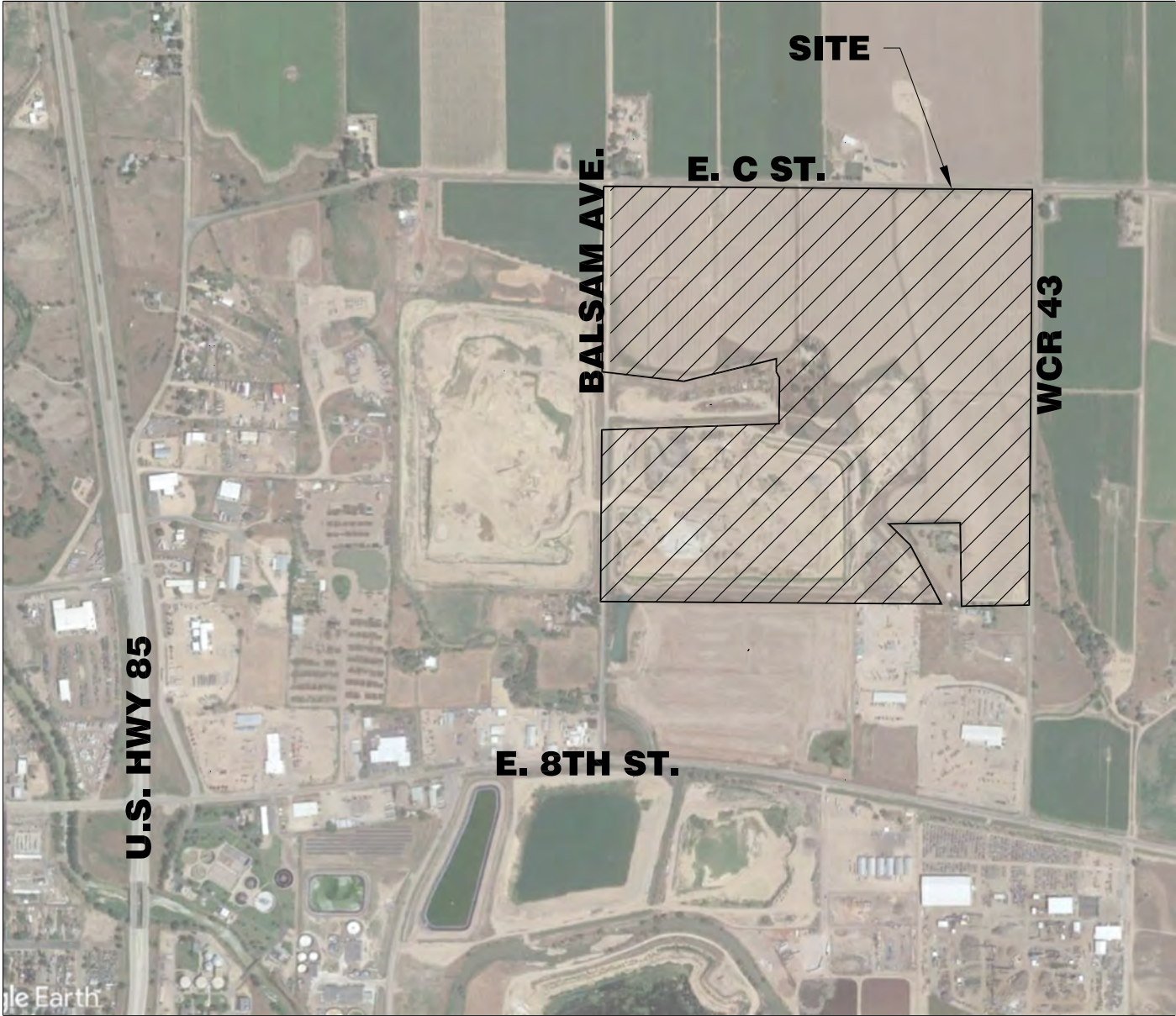
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_____, as _____

Notary Public

My Commission Expires: _____

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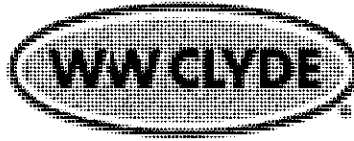


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Dixie Ann Hoffner & Jerry Winters
49 Willowcroft Dr.
Littleton, CO 80123

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

Ms. Hoffner and Mr. Winters:

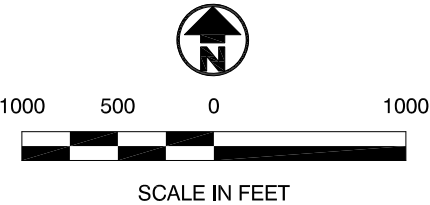
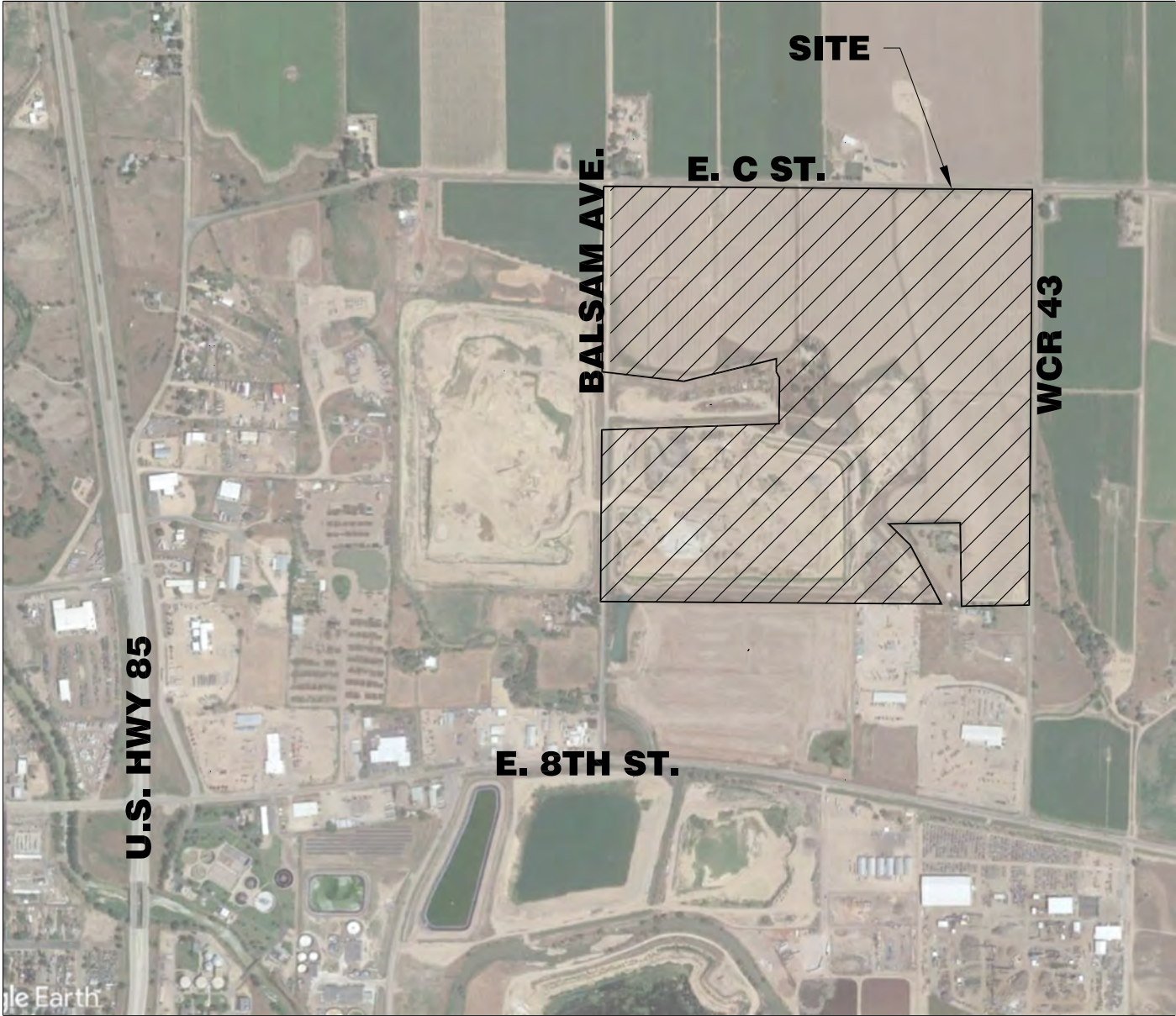
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My Commission Expires: _____

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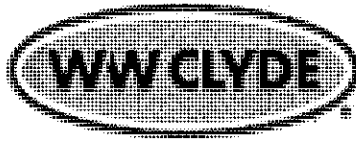


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Doug Derr
699 North First Ave.
Greeley, CO 80631

January 26, 2024

Re: *Agreement for Compensation for Damage to Structures within 200 feet of mining activities*

Mr. Derr:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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W.W. Clyde & Co. has had an engineering evaluation performed to determine acceptable setbacks from their mining permit boundary and mining limit to structures adjacent to the mining. The proposed mining slopes and setbacks were analyzed using the Galena v7.1 computer program. Galena was designed to analyze the slope stability of earth embankments subjected to several critical situations that may occur during the life of the embankment. The procedure searches for circular shear failures and automatically searches for the lowest safety factor. 5,000 separate failure surfaces were analyzed for each case. The required minimum safety factors are based on the current standards used by the Colorado State Engineer's Office (SEO) for high hazard embankment dams, and industry accepted standards for the evaluation of embankments during construction. The safety factors attained using the setbacks shown on the Mining Plan are greater than the required safety factors specified by the SEO for an earth embankment during construction, and an earth embankment subjected to earthquake loading, based on the United States Geological Survey earthquake peak acceleration factors for the area. This evaluation indicated that damage to structures adjacent to the mining should not occur, even during earthquake conditions, which are very unlikely to be present.

With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Fence

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

Date

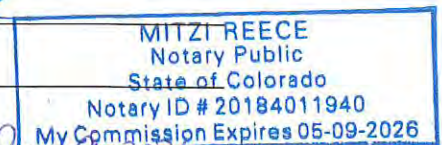
The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager

Mitzi Reece

Notary Public

My Commission Expires: May 9, 2026



Doug Derr

January 26, 2024

Date

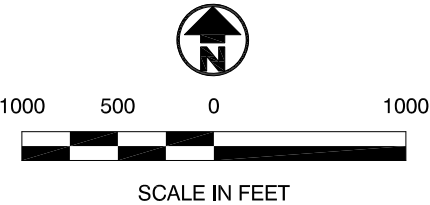
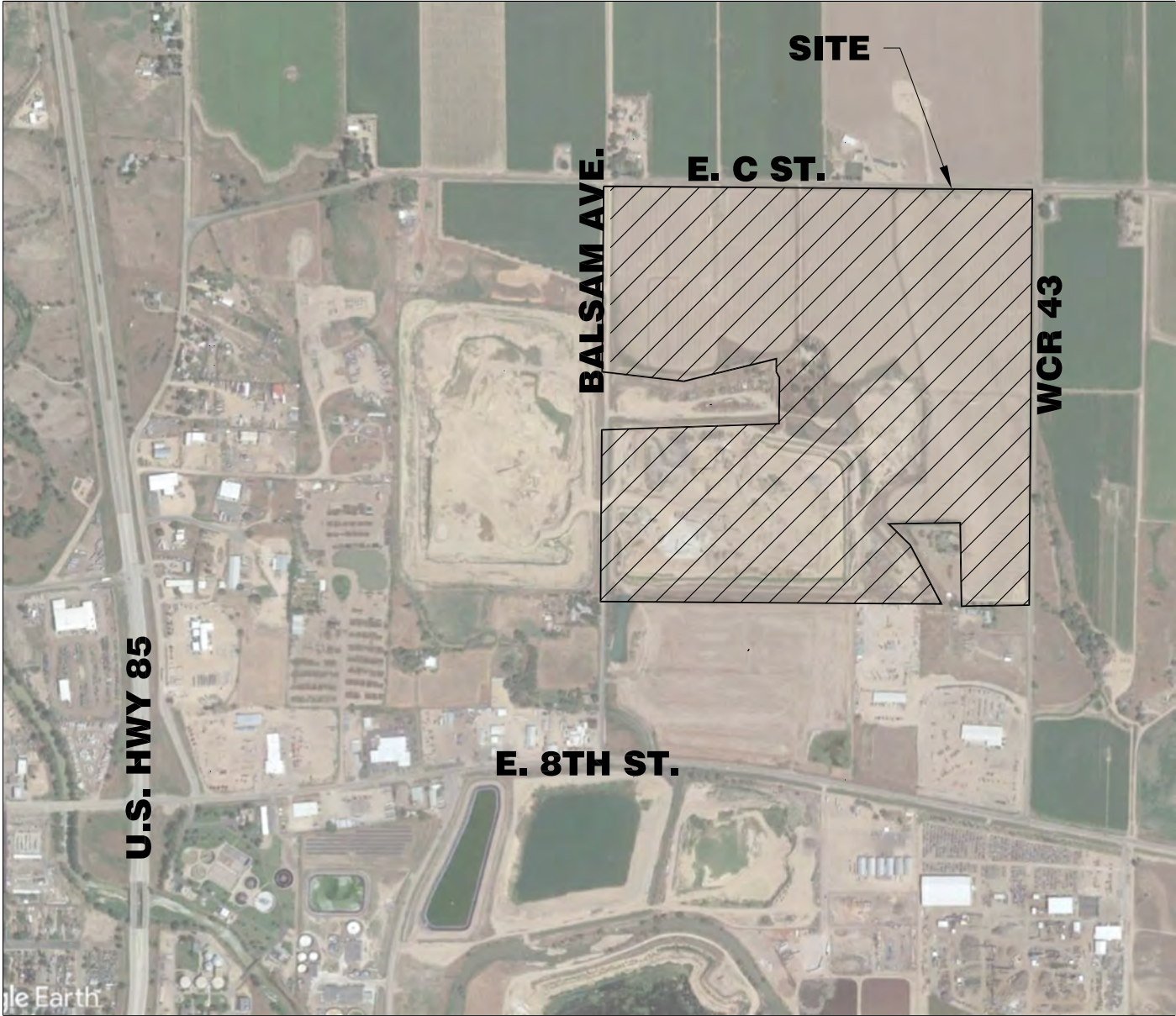
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM

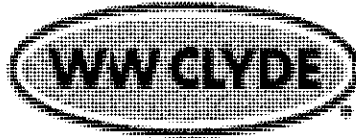


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Extraction Oil & Gas, LLC
370 17th St., Suite 5300
Denver, CO 80202

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

DRMS approval requires a notarized agreement between the applicant and owners of structures within 200 feet of the mining activities, providing compensation for any damage to the structure; or preparation of an engineering evaluation acceptable to the DRMS, demonstrating that such structure(s) shall not be damaged by the mining activities if an agreement cannot be reached.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Oil/Gas pipeline
2. Oil/Gas well (abandoned)

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by

Andy Carpenter, as AREA MANAGER

Mitzi Reece

Notary Public

MITZI REECE
Notary Public
State of Colorado
Notary ID # 20184011940
My Commission Expires 05-09-2026

My Commission Expires: May 9, 2026

Extraction Oil & Gas, LLC

January 26, 2024

Date

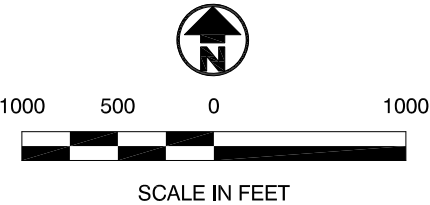
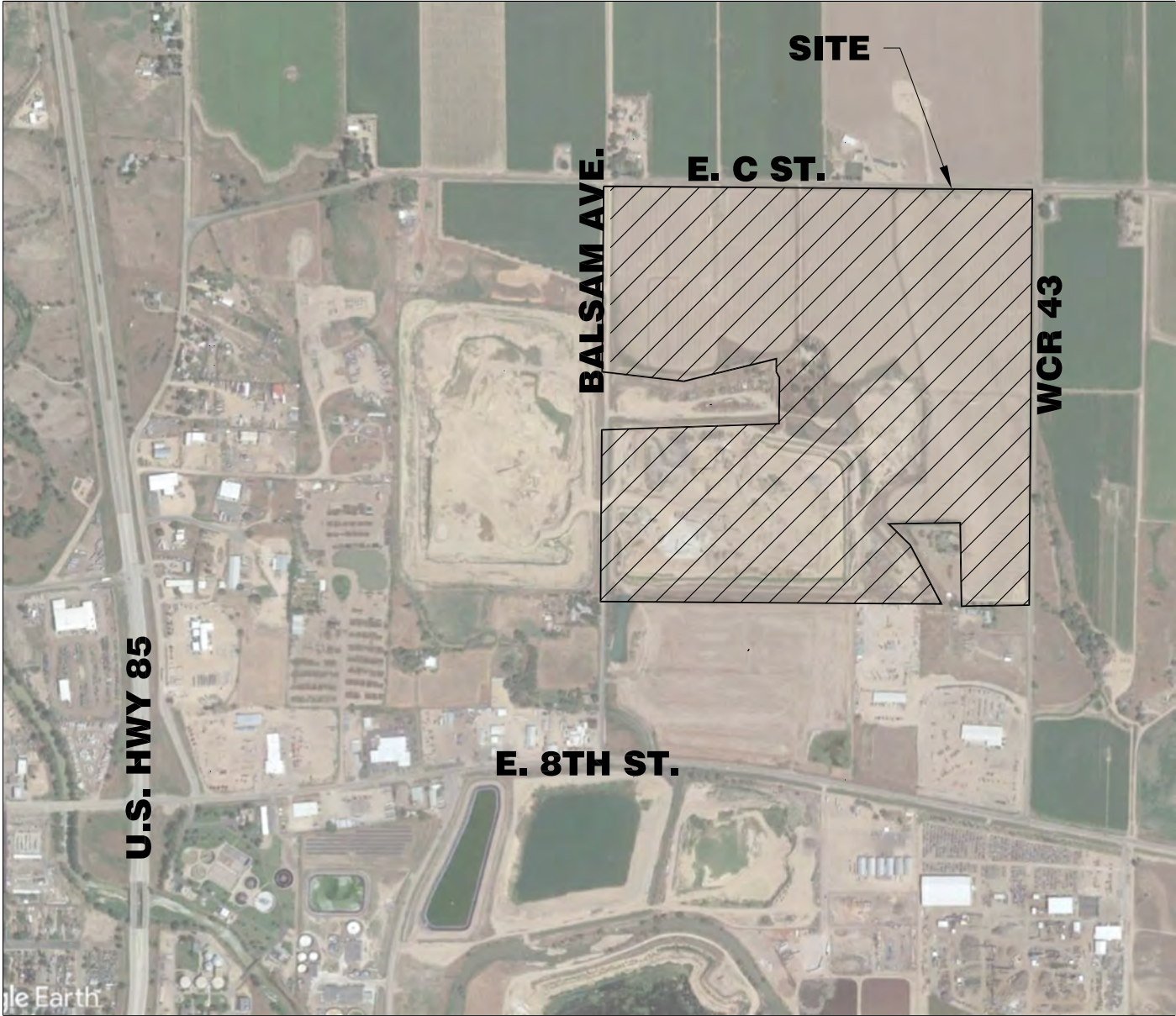
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM



J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Gene Murata
22000 County Road 62
Greeley, CO 80631-9601

January 29, 2024

Re: *Agreement for Compensation for Damage to Structures within 200 feet of mining activities*

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Fence
2. Building

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



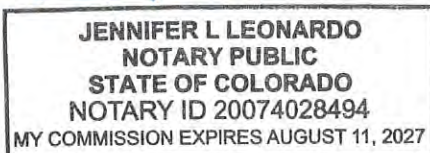
Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/30/24

Date

The foregoing instrument was acknowledged before me this 30th day of January, 2024 by,

Andy Carpenter, as Area Manager - Aggregates





Notary Public

My Commission Expires: August 11, 2027

Gene Murata

Date

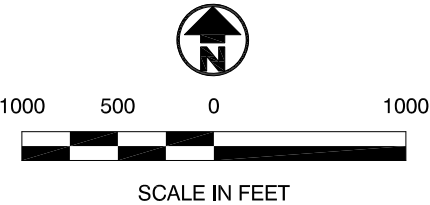
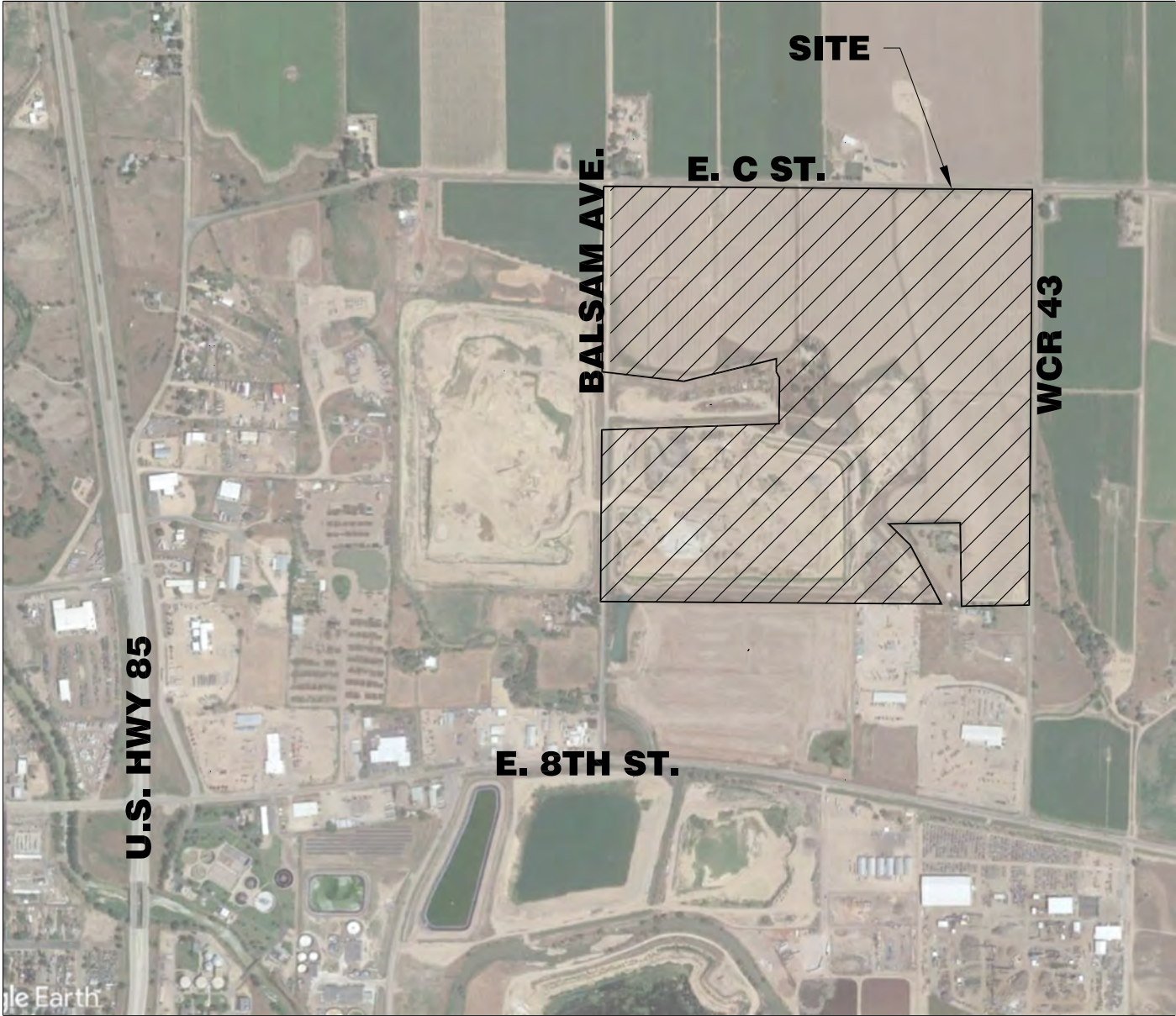
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM

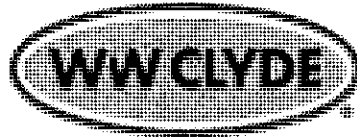


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



JBS
800 N. 8th Ave.
Greeley, CO 80631

January 26, 2024

Re: *Agreement for Compensation for Damage to Structures within 200 feet of mining activities*

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Sewer Force Main pipeline

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager

Mitzi Reece

Notary Public

MITZI REECE Notary Public State of Colorado Notary ID # 20184011940 My Commission Expires 05-09-2026

My Commission Expires: May 9, 2026

JBS

January 26, 2024

Date

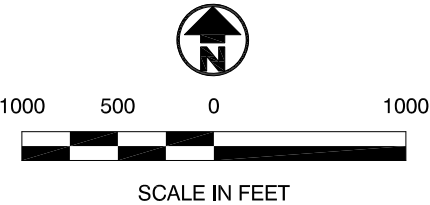
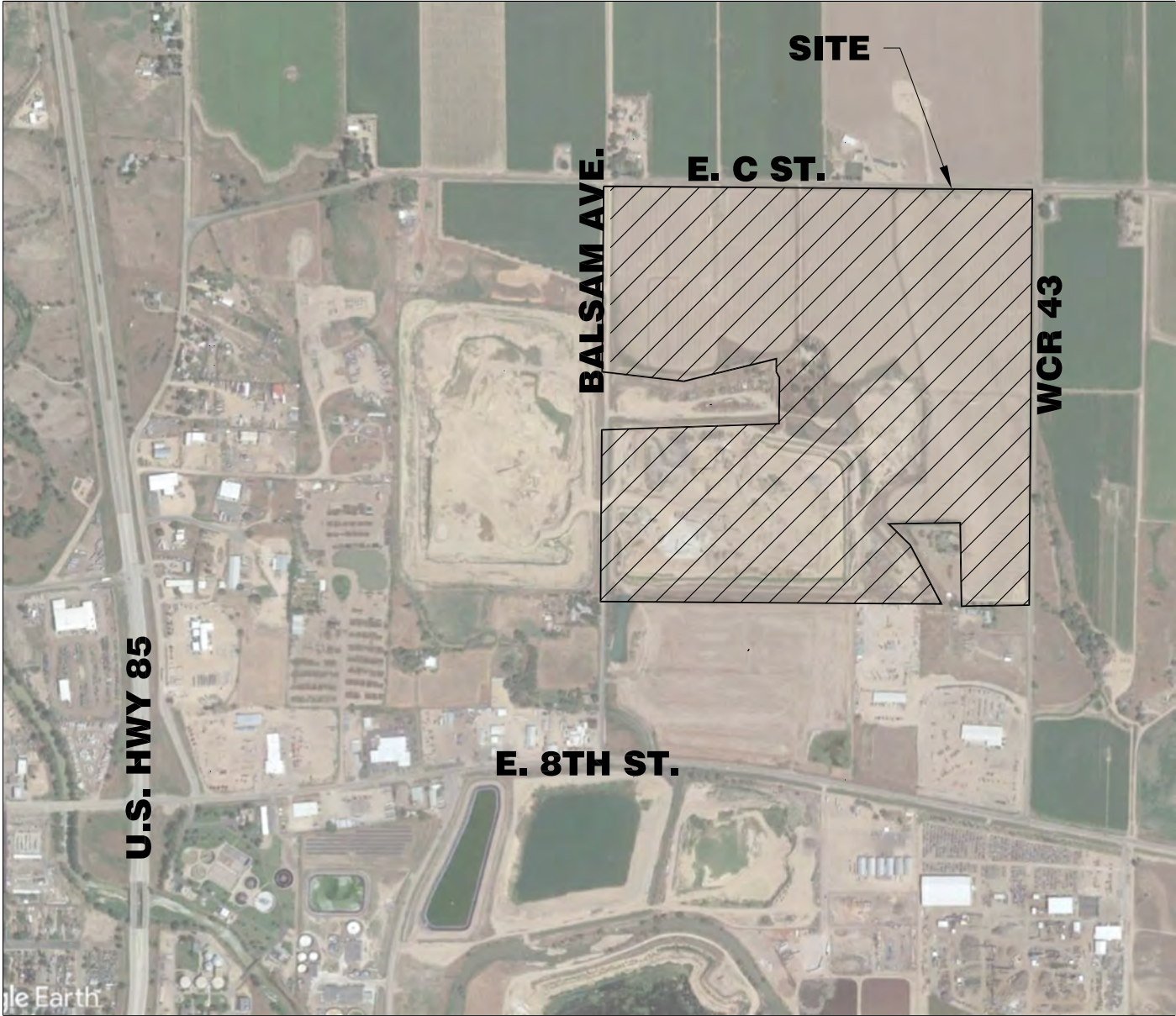
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM



J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Jeanette Snow
503 Cherry Ave.
Greeley, CO 80631

January 26, 2024

Re: *Agreement for Compensation for Damage to Structures within 200 feet of mining activities*

Ms. Snow:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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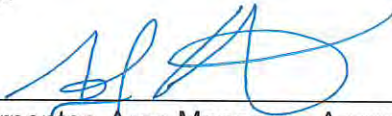
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1. Fence
2. Building

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Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

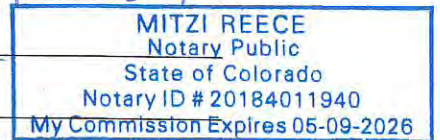
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager

Mitzi Reece

Notary Public



My Commission Expires: May 9, 2026

Jeanette Snow

January 26, 2024

Date

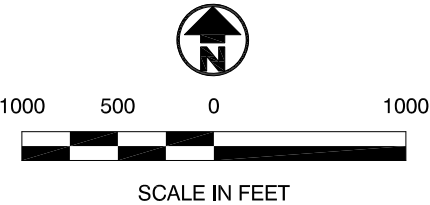
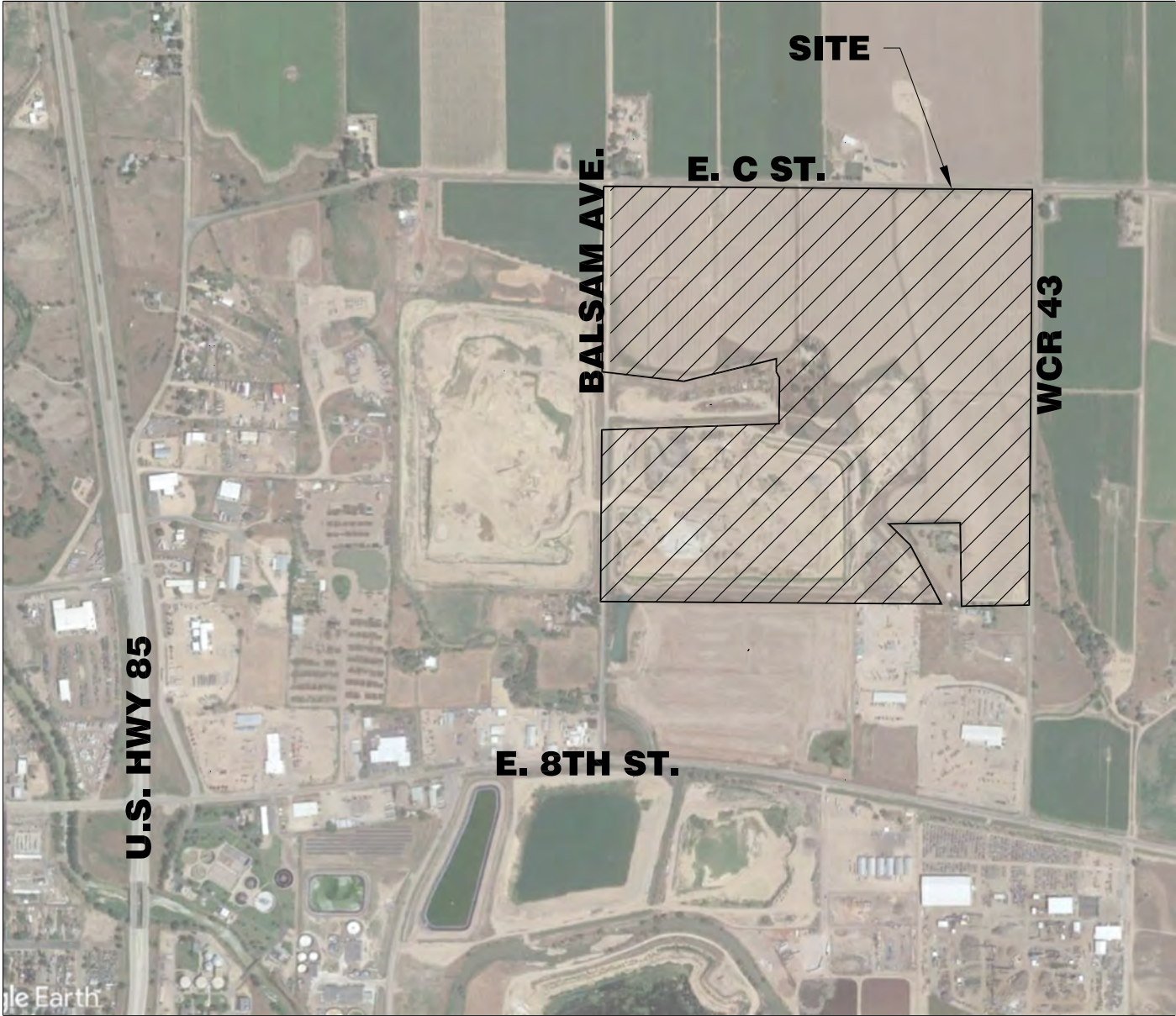
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM

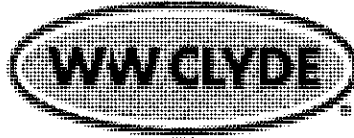


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Kerr McGee Oil & Gas Onshore LP
1099 18th St., Suite 1500
Denver, CO 80202

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Oil/Gas pipelines
2. Oil/Gas wells

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,

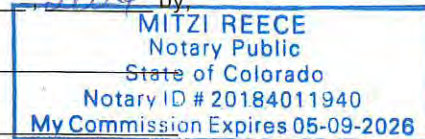

Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager

Mitzi Reece
Notary Public



My Commission Expires: May 9, 2026

Kerr McGee Oil & Gas Onshore, LP

January 26, 2024
Date

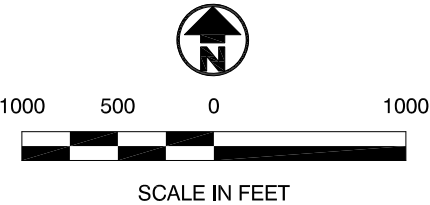
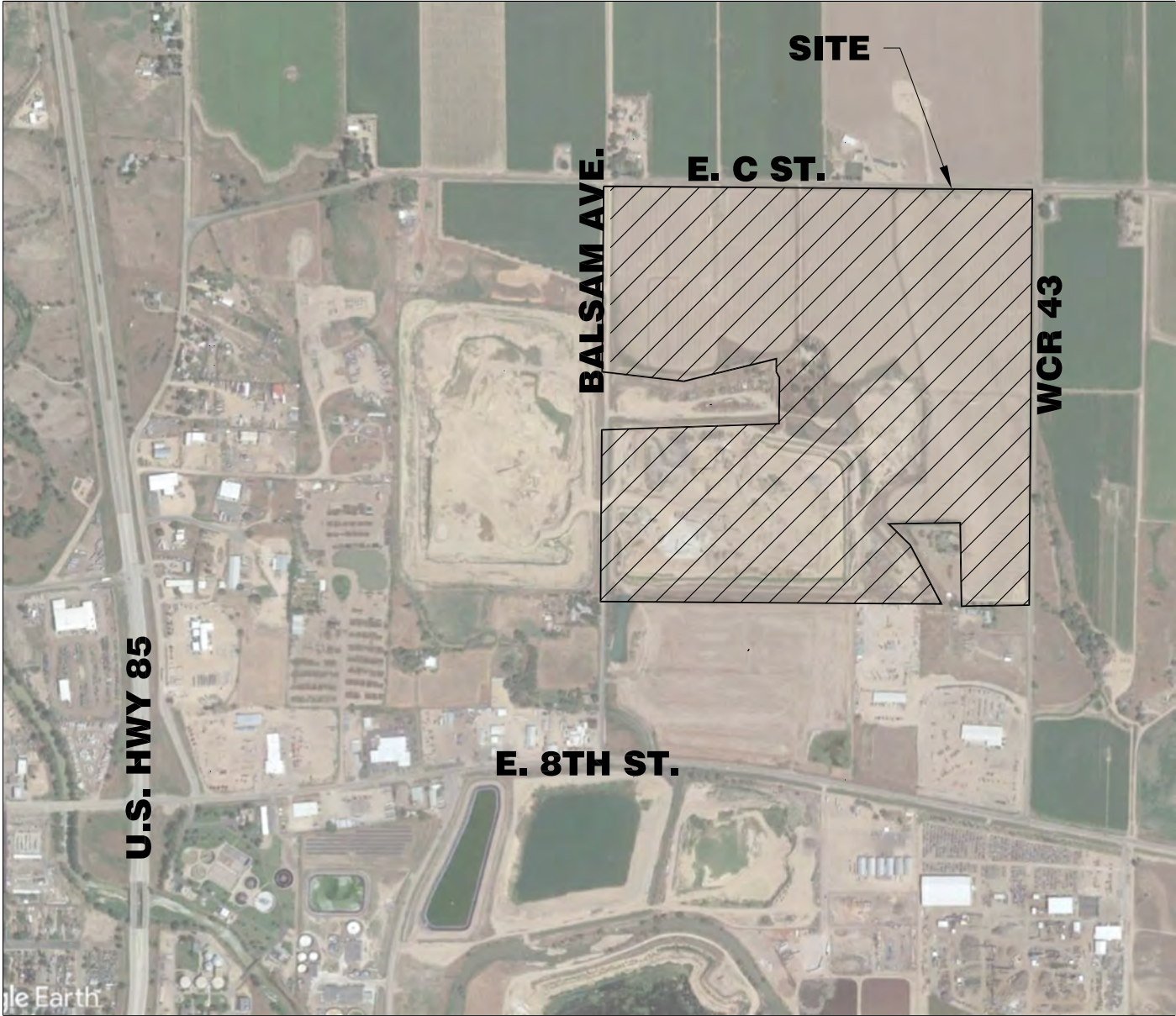
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM



J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Koehler Sisters, LLC
6941 S. Yantley Ct.
Aurora, CO 80016

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

DRMS approval requires a notarized agreement between the applicant and owners of structures within 200 feet of the mining activities, providing compensation for any damage to the structure; or preparation of an engineering evaluation acceptable to the DRMS, demonstrating that such structure(s) shall not be damaged by the mining activities if an agreement cannot be reached.

W.W. Clyde & Co. has had an engineering evaluation performed to determine acceptable setbacks from their mining permit boundary and mining limit to structures adjacent to the mining. The proposed mining slopes and setbacks were analyzed using the Galena v7.1 computer program. Galena was designed to analyze the slope stability of earth embankments subjected to several critical situations that may occur during the life of the embankment. The procedure searches for circular shear failures and automatically searches for the lowest safety factor. 5,000 separate failure surfaces were analyzed for each case. The required minimum safety factors are based on the current standards used by the Colorado State Engineer's Office (SEO) for high hazard embankment dams, and industry accepted standards for the evaluation of embankments during construction. The safety factors attained using the setbacks shown on the Mining Plan are greater than the required safety factors specified by the SEO for an earth embankment during construction, and an earth embankment subjected to earthquake loading, based on the United States Geological Survey earthquake peak acceleration factors for the area. This evaluation indicated that damage to structures adjacent to the mining should not occur, even during earthquake conditions, which are very unlikely to be present.

With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Fence
2. Building

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



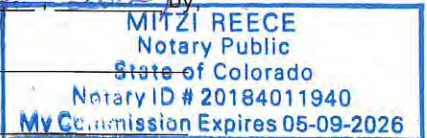
Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by

Andy Carpenter, as Area Manager

Mitzi Reece
Notary Public



My Commission Expires: May 9, 2026

Koehler Sisters, LLC

January 26, 2024
Date

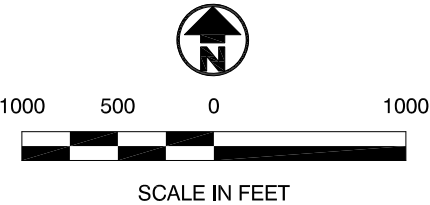
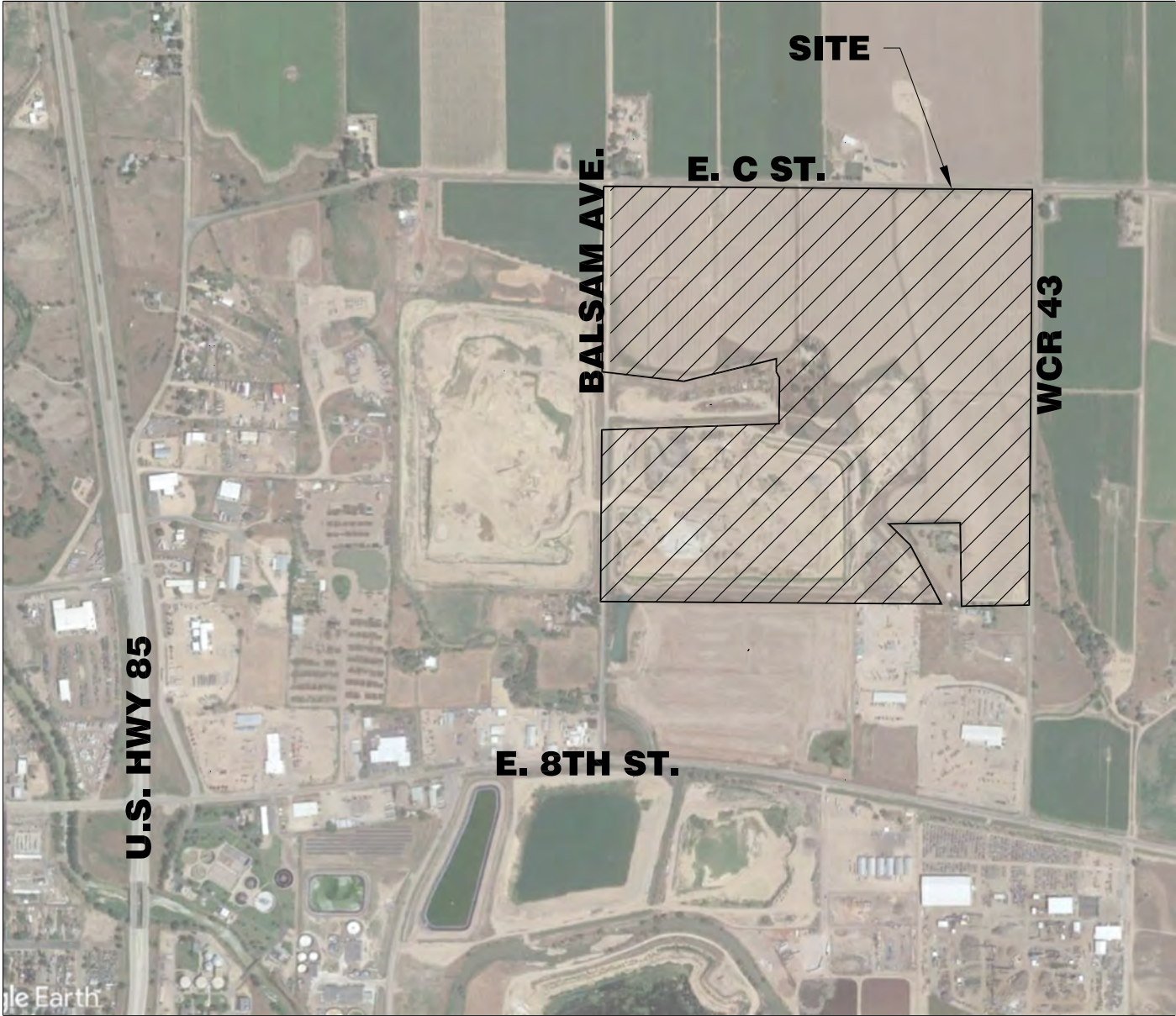
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM

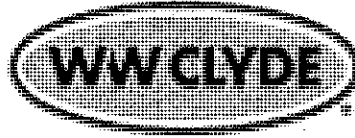


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Leafgren Farms. LLC
970 Hawkridge Ct.
Eaton, CO 80615

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

DRMS approval requires a notarized agreement between the applicant and owners of structures within 200 feet of the mining activities, providing compensation for any damage to the structure; or preparation of an engineering evaluation acceptable to the DRMS, demonstrating that such structure(s) shall not be damaged by the mining activities if an agreement cannot be reached.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Irrigation Structure

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

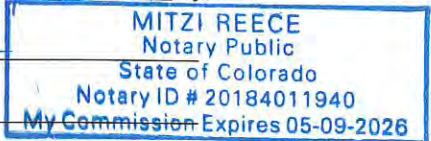
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager

Mitzi Reece

Notary Public



My Commission Expires: May 9, 2026

Leafgren Farms

January 26, 2024

Date

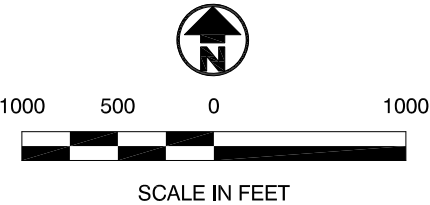
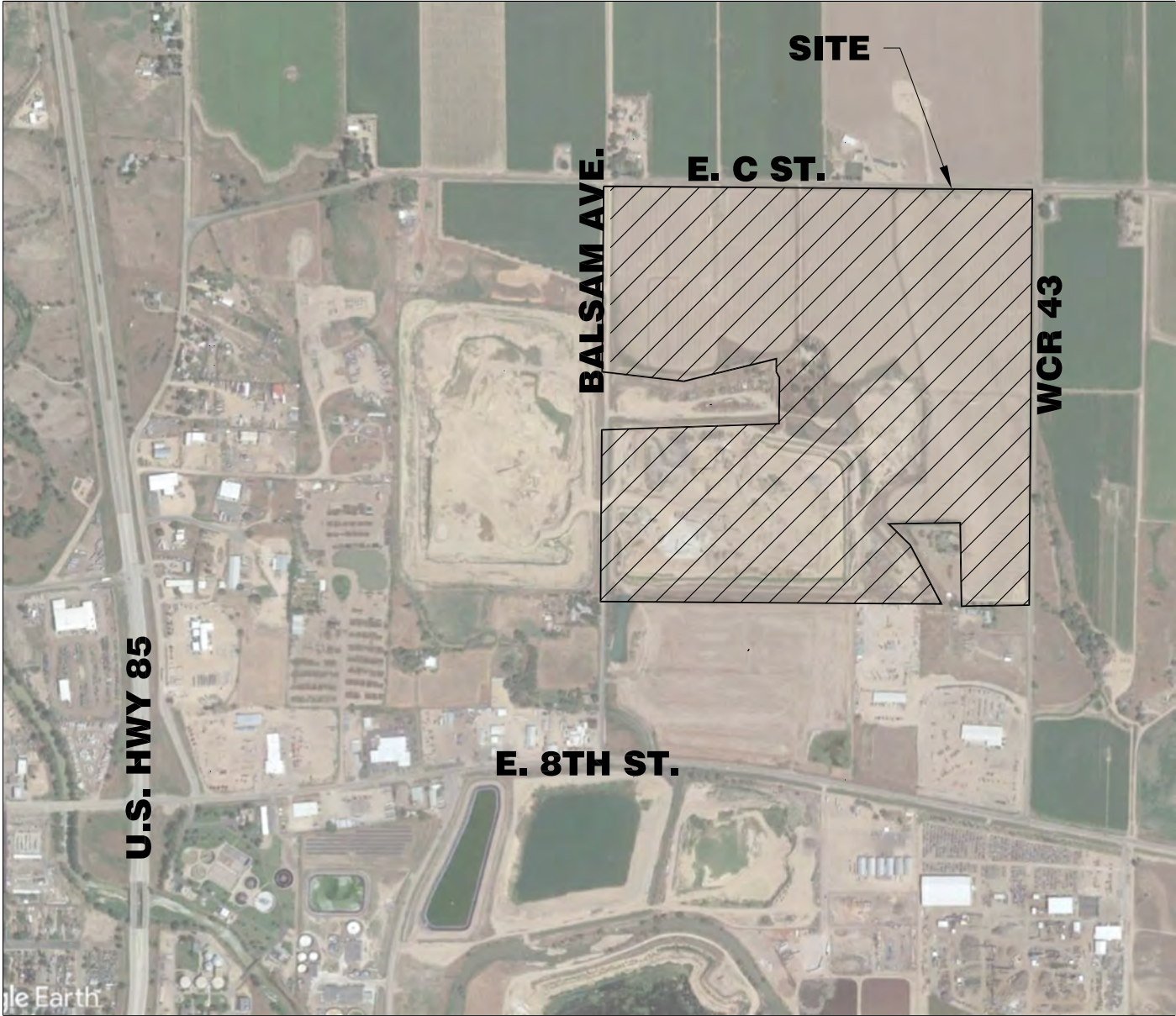
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM

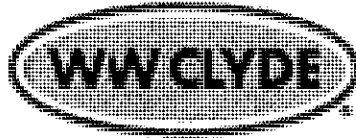


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Noble Energy
Chevron Rockies Business Unit
2115 117th Avenue
Greeley, CO 80634

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Oil/Gas pipelines
2. Oil/Gas wells (abandoned)

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,

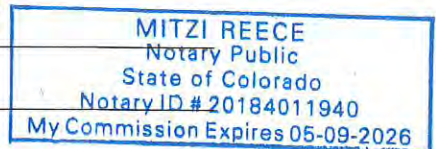


Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24
Date

The foregoing instrument was acknowledged before me this 26th day of January, 2024 by,
Andy Carpenter, as AREA MANAGER

Mitzi Reece
Notary Public



My Commission Expires: May 9, 2026

Noble Energy

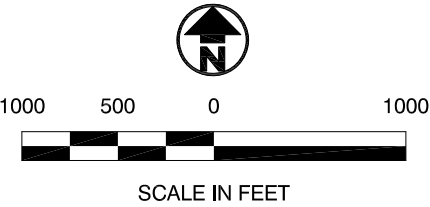
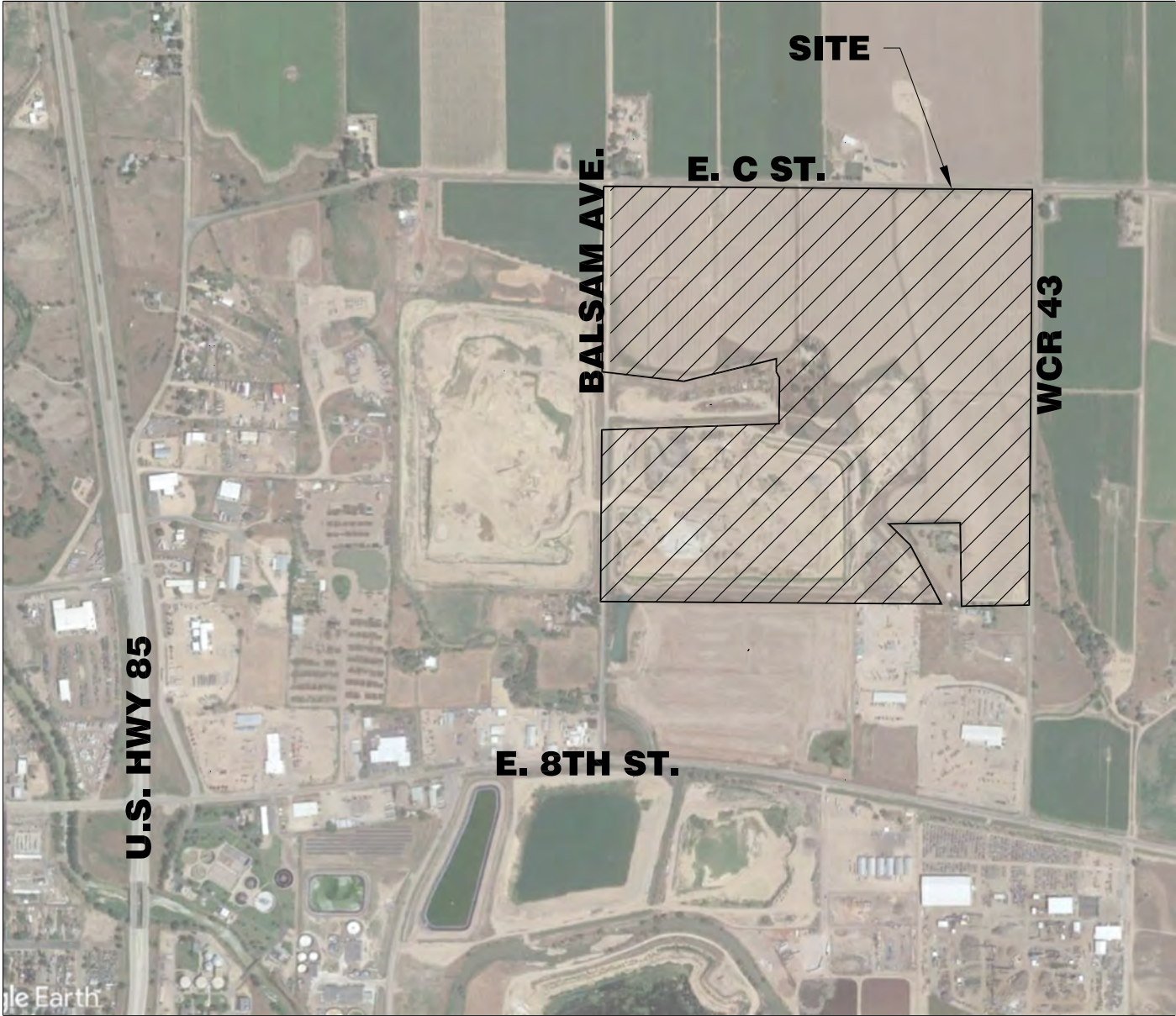
January 26, 2024
Date

The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,
_____, as _____

Notary Public

My Commission Expires: _____

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J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



North Weld County Water District
PO Box 56
Lucerne, CO 80646

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Water pipelines

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,

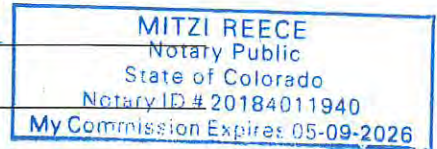

Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager


Notary Public



My Commission Expires: May 9, 2026

North Weld County Water District

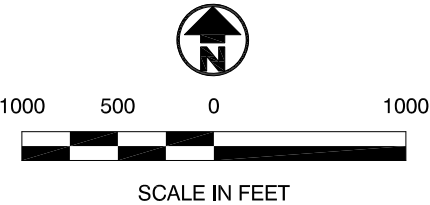
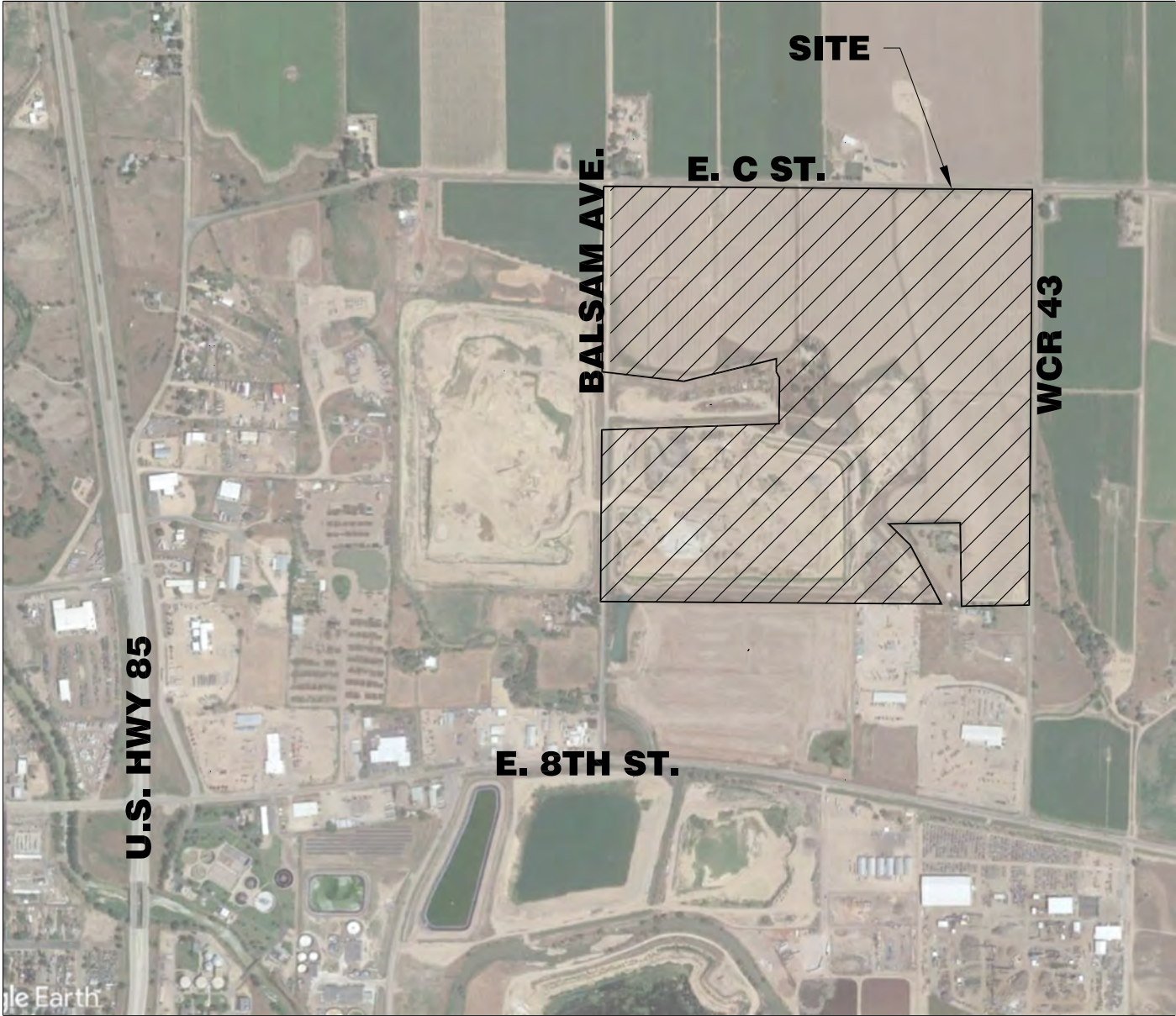
January 26, 2024
Date

The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

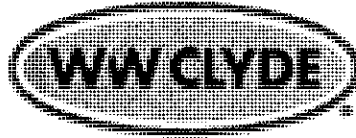


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Ogilvy Irrigating and Land
Company/ Ogilvy
Augmentation Company

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

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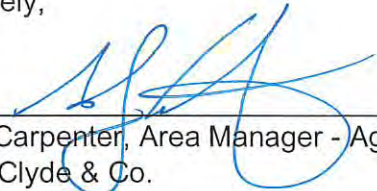
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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Fence
2. Slurry Wall
3. Pipelines

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

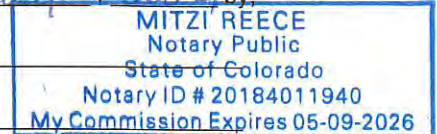
Date

1/26/24

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as Area Manager

Mitzi Reece
Notary Public



My Commission Expires: May 9, 2026

Ogilvy Irrigating and Land Company
Ogilvy Augmentation Company

Date

January 26, 2024

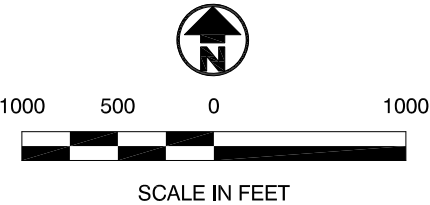
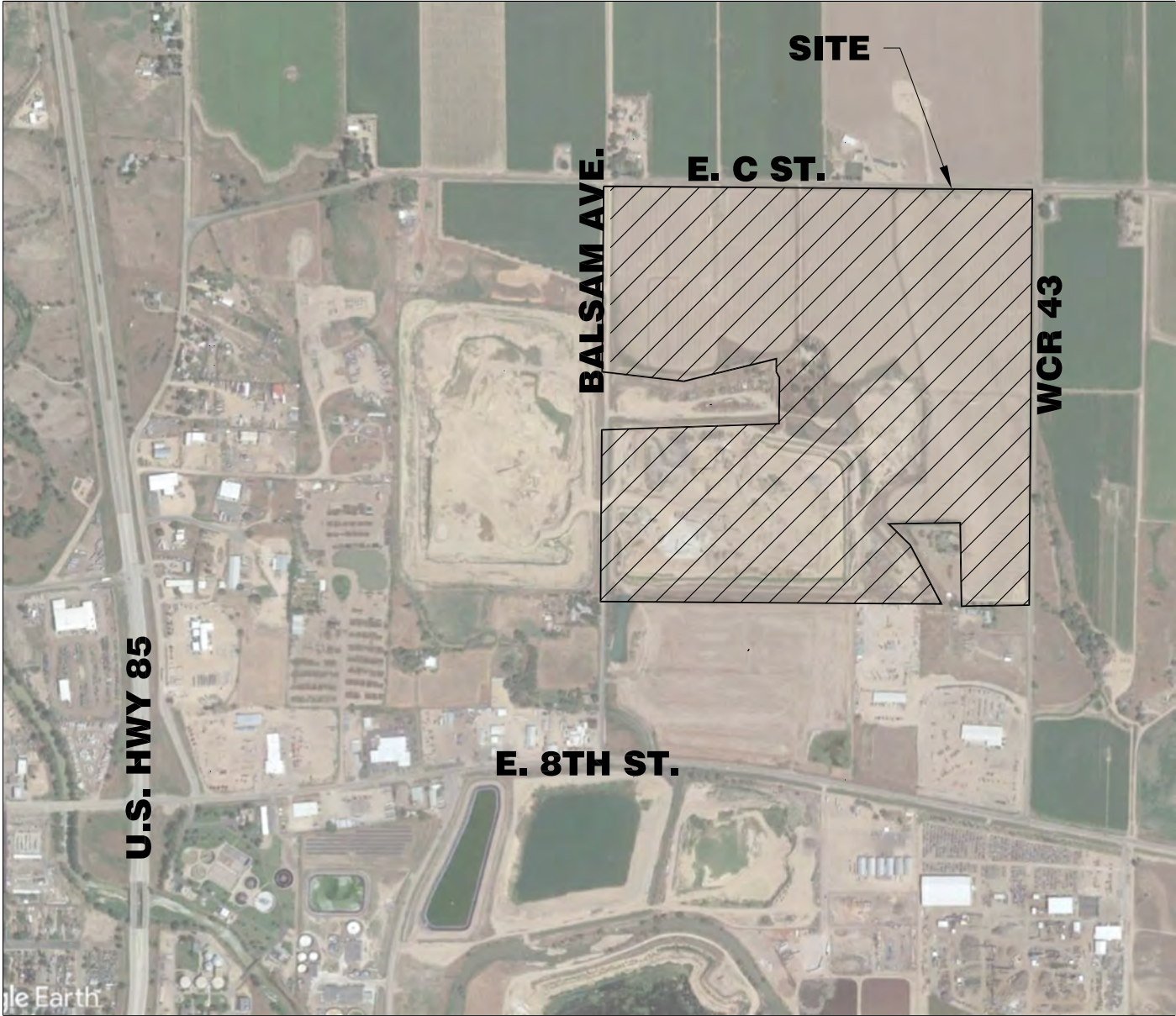
The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM



J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Sylvia Parker
211 N. Balsam Ave.
Greeley, CO 80631

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

Ms. Parker:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Buildings

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,

[Signature]
Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as AREA MANAGER

[Signature]
Notary Public

MITZI REECE Notary Public State of Colorado Notary ID # 20184011940 My Commission Expires 05-09-2026
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My Commission Expires: May 9, 2026

Sylvia Parker

January 26, 2024
Date

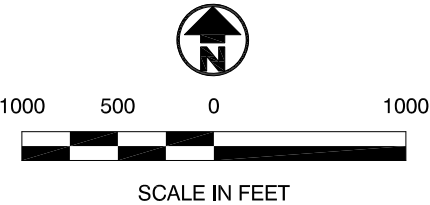
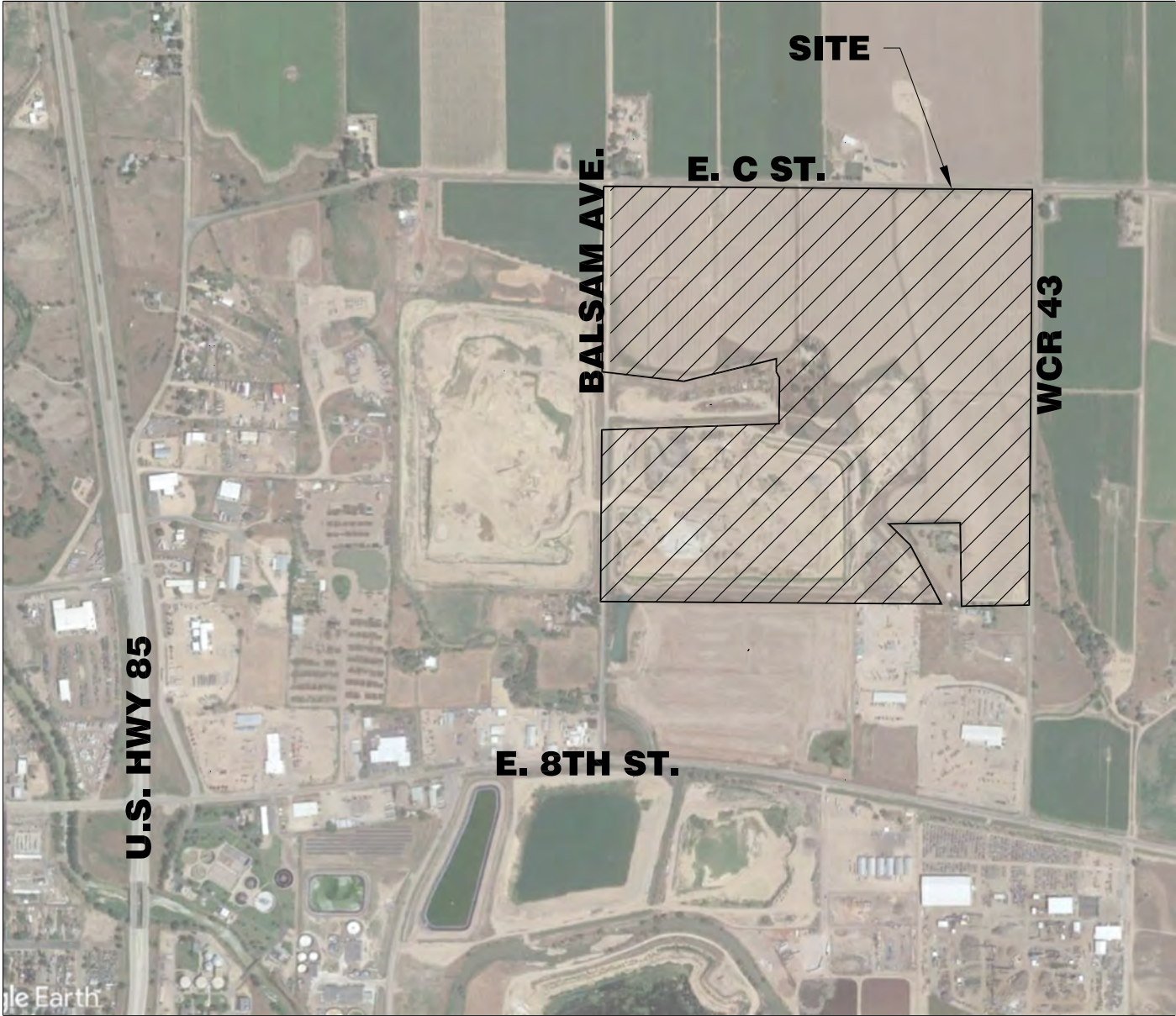
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_____, as _____

Notary Public

My Commission Expires: _____

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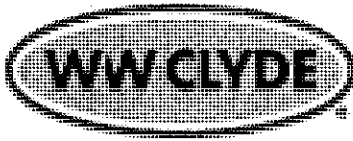


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Weld County Planning & Zoning
1402 N. 17th Ave.
Greeley, CO 80631

January 26, 2024

Re: Agreement for Compensation for Damage to Structures within 200 feet of mining activities

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

DRMS approval requires a notarized agreement between the applicant and owners of structures within 200 feet of the mining activities, providing compensation for any damage to the structure; or preparation of an engineering evaluation acceptable to the DRMS, demonstrating that such structure(s) shall not be damaged by the mining activities if an agreement cannot be reached.

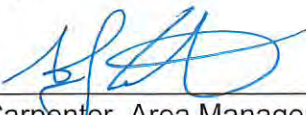
W.W. Clyde & Co. has had an engineering evaluation performed to determine acceptable setbacks from their mining permit boundary and mining limit to structures adjacent to the mining. The proposed mining slopes and setbacks were analyzed using the Galena v7.1 computer program. Galena was designed to analyze the slope stability of earth embankments subjected to several critical situations that may occur during the life of the embankment. The procedure searches for circular shear failures and automatically searches for the lowest safety factor. 5,000 separate failure surfaces were analyzed for each case. The required minimum safety factors are based on the current standards used by the Colorado State Engineer's Office (SEO) for high hazard embankment dams, and industry accepted standards for the evaluation of embankments during construction. The safety factors attained using the setbacks shown on the Mining Plan are greater than the required safety factors specified by the SEO for an earth embankment during construction, and an earth embankment subjected to earthquake loading, based on the United States Geological Survey earthquake peak acceleration factors for the area. This evaluation indicated that damage to structures adjacent to the mining should not occur, even during earthquake conditions, which are very unlikely to be present.

With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Fence
2. ROW/Roadway
3. Borrow ditch and culverts

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,



Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24

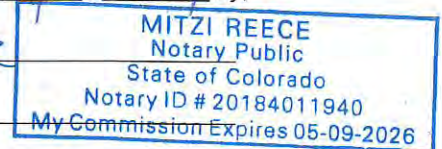
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,

Andy Carpenter, as AREA MANAGER

Mitzi Reece

Notary Public



My Commission Expires: May 9, 2026

Weld County Planning & Zoning

January 26, 2024

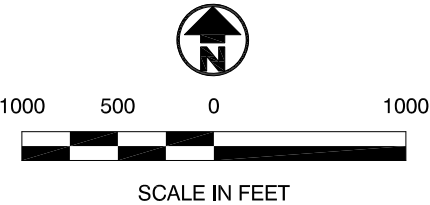
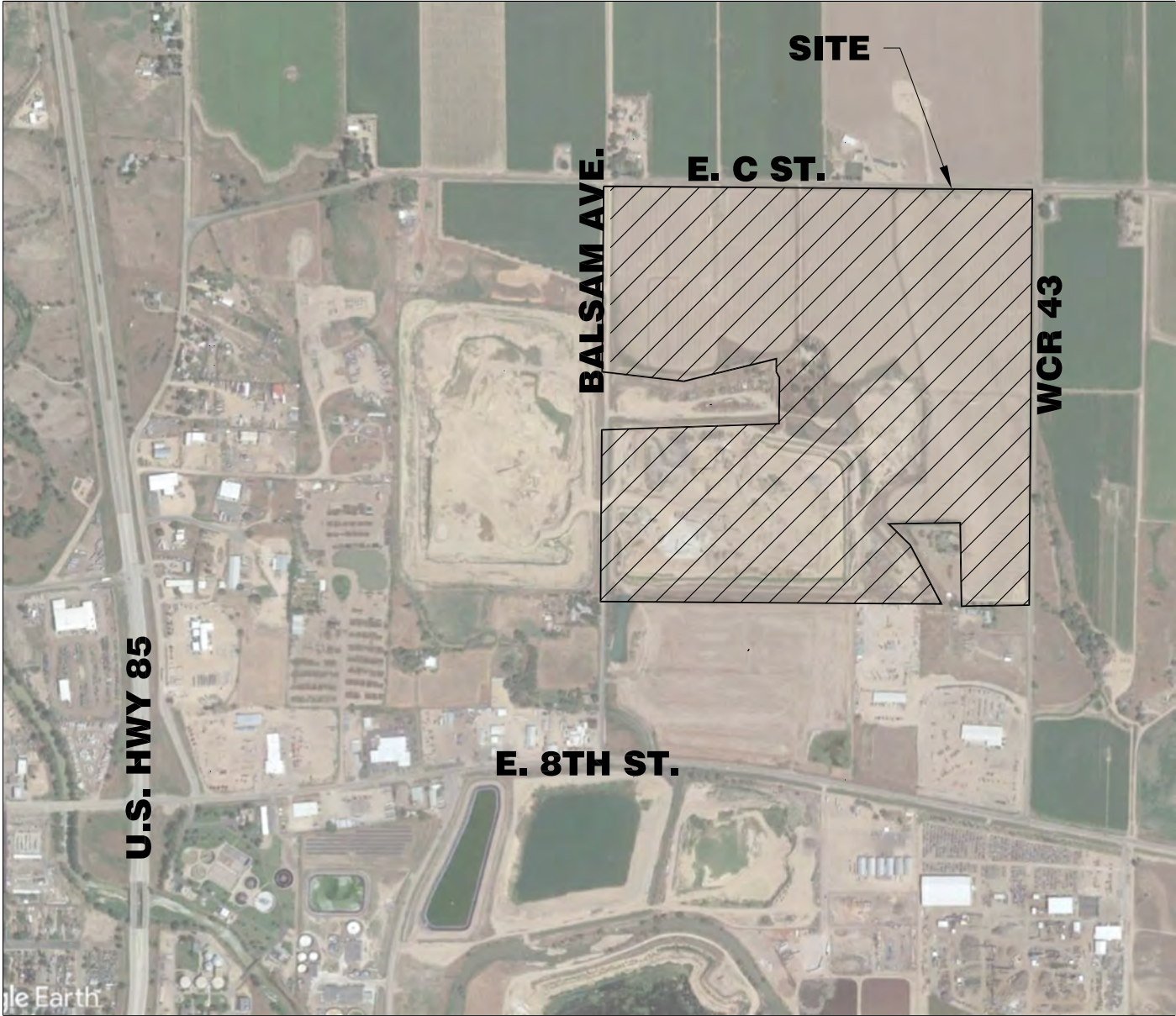
Date

The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,

_____, as _____

Notary Public

My Commission Expires: _____

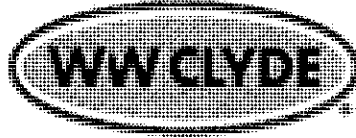


J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1



Xcel Energy
1500 6th Ave.
Greeley, CO 80631-1430

January 26, 2024

Re: *Agreement for Compensation for Damage to Structures within 200 feet of mining activities*

To Whom It May Concern:

W.W. Clyde & Co. (formerly IHC Scott) is the new operator of the former Broken Arrow Investments, LLC Derr Pit. W.W. Clyde & Co. are in the process of doing a succession of operator with the State of Colorado Division of Reclamation, Mining and Safety. One of the requirements for the succession of operator is to send out structure agreements for structure owners that are within 200 feet of the mining permit boundary. The State of Colorado Division of Reclamation, Mining, and Safety (DRMS) Reclamation Permit for the Derr Pit is M2008-078. The Colorado Mined Land Reclamation Act provides protection for your property, and specific protection for your structures located within 200 feet of the mining activities. Your property is adjacent to the mine property and within 200 feet of the mining activities.

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With this letter, W.W. Clyde & Co. requests your authorization to conduct mining and reclamation activities within 200 feet of your structure(s). Please see the attached vicinity map showing the location of the existing mine. The structures on your property are listed below:

1. Power Poles/Lines
2. Electric lines (buried)

In return for this authorization, W.W. Clyde & Co. agrees to provide fair compensation for any damage to your structure(s) resulting from its mining and reclamation activities. Your notarized signature below grants permission for W.W. Clyde & Co. to conduct mining and reclamation activities within 200 feet of your structure(s), and acknowledges W.W. Clyde & Co.'s commitment to provide fair compensation for any damages to said structure(s) caused by W.W. Clyde & Co.'s mining and reclamation activities.

Sincerely,


Andy Carpenter, Area Manager - Aggregates
W.W. Clyde & Co.

1/26/24
Date

The foregoing instrument was acknowledged before me this 26 day of January, 2024 by,
Andy Carpenter, as Area Manager


Notary Public

My Commission Expires: January 26, 2024

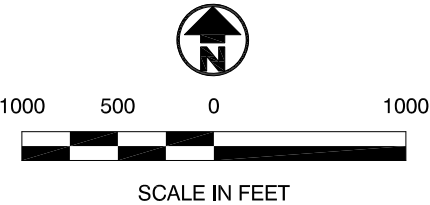
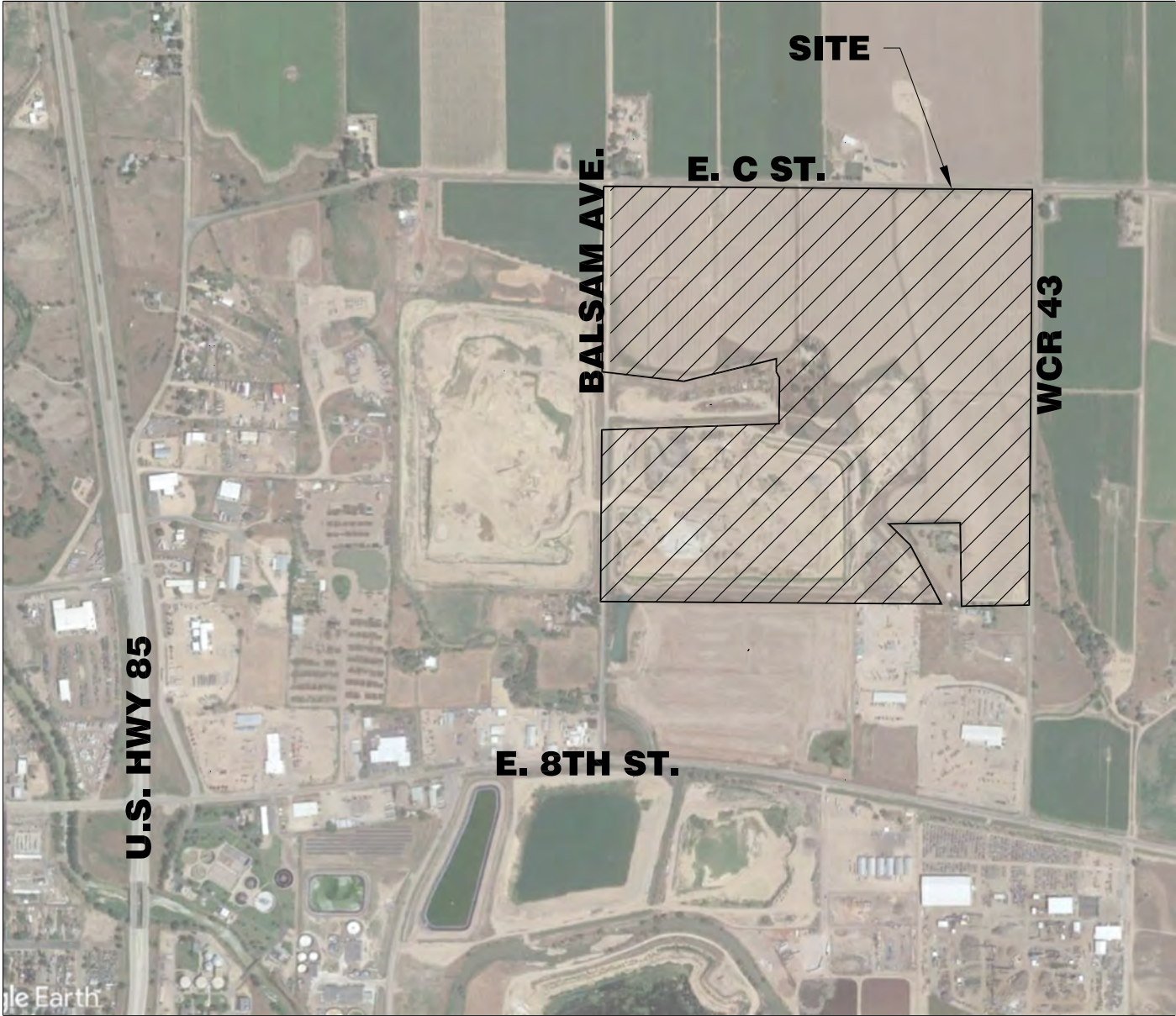

Xcel Energy
Date January 26, 2024

The foregoing instrument was acknowledged before me this _____ day of _____, _____ by,
_____, as _____

Notary Public

My Commission Expires: _____

P:\07123 Derr Gravel Pit\Drawings\Mining Plan\JT-Derr-North-Vicinity Map.dwg, Vicinity Map, 1/29/2024 4:15:35 PM



J&T Consulting, Inc.

305 Denver Avenue - Suite D
Fort Lupton, CO 80621
303-857-6222

W.W. Clyde & Co.
Derr Pit
Vicinity Map

Date:	01.29.24
Job No:	07123
Drawn:	TWT
Scale:	1" = 1000'
Sheet: 1	Of: 1

SLOPE STABILITY REPORT

FOR THE
DERR PIT – TECHNICAL REVISION 8
M-2008-017
WELD COUNTY, COLORADO

APRIL 2023
UPDATED JUNE 2023



10303 EAST DRY CREEK ROAD, #300
ENGLEWOOD, CO 80112
(303) 790-9100

PREPARED BY:

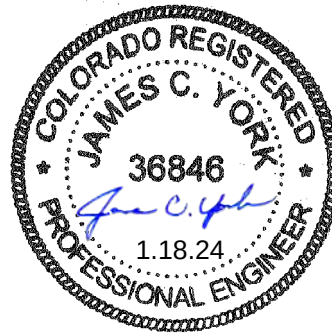


J&T Consulting, Inc.

305 DENVER AVENUE – SUITE D
FORT LUPTON, CO 80621
(303) 857-6222

CERTIFICATION:

I hereby certify this slope stability analysis for W.W. Clyde & Co., the Derr Pit Technical Revision 8, located in Weld County, Colorado was prepared by me or under my direct supervision.



James C. York
Registered Professional Engineer
State of Colorado No. 36846



Table of Contents

- I. Introduction
- II. Overview
- III. Geotechnical Data
- IV. Design Analysis and Criteria
- V. Methodology
- VI. Slope Stability Results
- VII. Conclusions and Recommendations

Appendices

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| Appendix A | Slope Stability Case Location Map |
| Appendix B | Slope Stability Case Cross-Sections |
| Appendix C | Slope Stability Case Galena Output |
| Appendix D | Geotechnical Boring Logs, Investigation Report, and Monitor Well Data |
| Appendix E | USGS Map, Oct. 2002 revision – “Peak Acceleration (%g) with a 2% Probability of Exceedance in 50 yrs” |



INTRODUCTION

IHC Scott, Inc. (Now W.W. Clyde & Co.) proposed a technical revision to their current Derr Pit reclamation permit located in the Northeast $\frac{1}{4}$ of Section 4, Township 5 North, Range 65 West, Sixth P.M. in Weld County, to include property to the north and west of the current permit area. The overall property is bounded by Balsam Avenue on the west, East C Street / WCR 62 to the north, WCR 43 to the east, and private property on the south. State Highway 263 (8th Street) is less than a quarter of a mile south of the subject property. The proposed mining operation will extract gravel reserves from locations adjacent to man-made structures. The rules and regulations of the Division of Reclamation, Mining, and Safety (DRMS) require that any mining within a 200-foot setback of a man-made structure show thorough engineering analysis that the proposed mining will not cause damage. The accepted method of demonstrating this is through a slope stability analysis. This report contains an overview of the prior geotechnical results from investigations done by Two Rivers Testing and Cesare, Inc. and the methodology used in the analysis of the mining slopes and their estimated affects on all man-made structures. Recommendations regarding acceptable setbacks from man-made structures have also been included.

OVERVIEW

The DRMS mining plan proposes that the property will be mined in 5 phases in 2 cells, phases 1-4 in the south cell, and phase 5 in the north cell. The reclamation plan, Exhibits E and F, propose the future use for this property to be slurry wall lined water storage reservoirs (2 cells). The mining in the north cell will occur at 2H:1V slopes. The slopes will be reclaimed to 3H:1V slopes above the slurry wall bench, and 4.5H:1V slopes below the slurry wall bench, using excess overburden/clay materials found on site. The reservoir cells will cover an estimated 79 surface acres when full. The actual surface area will depend on the final configuration of the reservoir after reclamation is complete.

GEOTECHNICAL DATA

Preliminary geotechnical investigations have been performed by Two Rivers Testing and Cesare, Inc. J&T Consulting, Inc. (JT) estimated soil strength parameters based on the information from the geotechnical investigations, and other stability analyses that have been performed on gravel mining operations along the front range. Table 1, on the following page, represents a summary of the soil strength parameters that were used in this stability analysis.

Table 1 - Soil Properties

Description	Max dry density (pcf)	Saturated Density (pcf)	Cohesion (psf)	Internal Friction Angle
Clay	110	131	150	22
Sand and Gravel	110	125	0	35
Weathered Bedrock	125	141	100	18
Stable Bedrock	125	141	2000	20
Slurry Wall	100	110	0	45

DESIGN ANALYSIS AND CRITERIA

The proposed mining slopes were analyzed using Clover Technologies Galena Slope Stability Analysis System, version 7.2. Galena was designed to analyze the slope stability of earth embankments subjected to various critical situations that may occur during the life of the embankment. For this project, six cases were identified as critical during the mining operation. Static and pseudo-static conditions were analyzed for each case.

Pseudo-static peak acceleration factors (peak horizontal acceleration, or PHA) were taken from USGS information for the western United States. The 2% probability of exceedance in 50 years (the most conservative) was used. A peak acceleration factor of 0.10 x gravity was taken from this data. A conservative earthquake loading coefficient of 0.50 x PHA is often used for slope stability analyses (50% of PHA). We used an even more conservative approach and used 70% of the PHA for this area for our earthquake loading coefficient. Hence, $0.70 \times 0.10 = 0.07$.

All mining side slopes in the north cell will be 2H:1V, and reclaimed slopes will be 3H:1V above the slurry wall bench, and 4.5H:1V below the slurry wall bench.

Case SS-1 – Oil/Gas Tanks South of North Cell. The mining operation is adjacent to oil/gas tanks on the south side of the cell. The mining depth was assumed to be 113 feet in this area based on bore log information in the geotechnical reports. The proposed mining setback was set 160 feet from the oil/gas wells.

Case SS-2 – Roadway and Gas Line West of North Cell. The north cell mining operation is adjacent to a roadway (Balsam Avenue/WCR 41.5) and gas line west of the cell. The mining depth was assumed to be 114 feet in this area based on bore log information in the geotechnical reports. The proposed mining setback was set 73 feet from the roadway and gas line.



Case SS-3 – Oil/Gas Wells Northwest of North Cell. The north cell mining operation is adjacent to proposed future oil/gas wells on the northwest side of the cell. The mining depth was assumed to be 115 feet in this area based on bore log information in the geotechnical reports. The proposed mining setback was set 105 feet from the proposed future oil/gas wells.

Case SS-4 – Concrete Irrigation Structure North of North Cell. The north cell mining operation is adjacent to a concrete irrigation structure on the north side of the cell. The mining depth was assumed to be 115 feet in this area based on bore log information in the geotechnical reports. The proposed mining setback was set 175 feet from the structure.

Case SS-5 – Fiber Optic Line and Roadway East of North Cell. The north cell mining operation is adjacent to a fiber optic line and a roadway (Cherry Avenue / WCR 43) on the east side of the cell. The mining depth was assumed to be 115 feet in this area based on bore log information in the geotechnical reports. The proposed mining setback was set 63 feet from the fiber optic line and roadway.

Case SS-6 – House South of North Cell. The north cell mining operation is adjacent to a house located on private property on the south side of the cell. The mining depth was assumed to be 114 feet in this area based on bore log information in the geotechnical reports. The proposed mining setback was set 112 feet from the house.

The cross-sections located in Appendix B show the estimated phreatic surface associated with each case as well as the geometry used in the mining and reclamation.

METHODOLOGY

The mining and reclamation embankment configurations shown in the computer analyses represents the estimated conditions for this site. If mining conditions differ from the estimated conditions, the slope stability will need to be re-evaluated on a case-by-case basis. The Bishop Method was used in the computer analysis for determining safety factors. The procedure searches for circular shear failures and automatically searches for the lowest safety factor. 20,000 separate failure surfaces were analyzed for each case. The required minimum safety factors are based on the policy of the Mined Land Reclamation Board (MLRD) for Factors of Safety for Slope Stability / Geotechnical Analyses.

All cases were analyzed using mining condition geometry to determine the factor of safety for each case with the steeper mining slopes. Case SS-5, which is the location that is closest to a critical structure (63 feet from the fiber optic line), and is the highest reclaimed slope (115 feet), was analyzed to determine the minimum factor of safety for all reclaimed slopes.



SLOPE STABILITY RESULTS

When estimated soil strength parameters are used, the MLRB requires minimum safety factors of 1.50 for static condition analyses and 1.30 for pseudo-static (earthquake loading) condition analyses for embankments adjacent to critical structures. The calculated factors of safety are within the design criteria specified for this project and can be considered indicators of the borrow material extraction slope performance under the various conditions. The results of the static condition and pseudo-static condition slope stability analyses are shown in Tables 2, 3, & 4 below.

Table 2: Mining Conditions
Static Condition Slope Stability Analysis Results

Description	Calculated Factor Of Safety	Required Minimum Factor Of Safety
Case SS-1 – Oil/Gas Tanks – Static	2.14	1.5
Case SS-2 – Roadway and Gas Line – Static	1.68	1.5
Case SS-3 – Proposed Oil/Gas Wells – Static	1.92	1.5
Case SS-4 – Concrete Irrigation Structure – Static	2.08	1.5
Case SS-5 – Fiber Optic Line and Roadway – Static	1.76	1.5
Case SS-6 – House – Static	1.90	1.5

Table 3: Mining Conditions
Pseudo-Static Condition Slope Stability Analysis Results

Description	Calculated Factor Of Safety	Required Minimum Factor Of Safety
Case SS-1 – Oil/Gas Tanks – EQ	1.59	1.3
Case SS-2 – Roadway and Gas Line – EQ	1.32	1.3
Case SS-3 – Proposed Oil/Gas Wells – EQ	1.47	1.3
Case SS-4 – Concrete Irrigation Structure – EQ	1.57	1.3
Case SS-5 – Fiber Optic Line and Roadway – EQ	1.40	1.3
Case SS-6 – House – EQ	1.47	1.3

Table 3: Reclaimed Conditions
Static & Pseudo-Static Condition Slope Stability Analysis Results

Description	Calculated Factor Of Safety	Required Minimum Factor Of Safety
Case SS-5 – Fiber Optic Line and Roadway – Static		1.5
Case SS-5 – Fiber Optic Line and Roadway – EQ		1.3



CONCLUSIONS AND RECOMMENDATIONS

Mining Conditions:

Case SS-1 – At a setback of 160 feet, the lowest resulting static condition safety factor of 2.14 exceeds the MLRB minimum requirement of 1.50 for an embankment adjacent to a critical structure. The lowest resulting pseudo-static condition safety factor of 1.59 exceeds the MLRB minimum requirement of 1.30 for an embankment adjacent to a critical structure subject to earthquake loading. The proposed setback of 160 feet from the oil/gas tanks is satisfactory.

Case SS-2 – At a setback of 73 feet, the lowest resulting static condition safety factor of 1.68 exceeds the MLRB minimum requirement of 1.50 for an embankment adjacent to a critical structure. The lowest resulting pseudo-static condition safety factor of 1.32 exceeds the MLRB minimum requirement of 1.30 for an embankment adjacent to a critical structure subject to earthquake loading. The proposed setback of 73 feet from the roadway and gas line is satisfactory.

Case SS-3 – At a setback of 105 feet, the lowest resulting static condition safety factor of 1.92 exceeds the MLRB minimum requirement of 1.50 for an embankment adjacent to a critical structure. The lowest resulting pseudo-static condition safety factor of 1.47 exceeds the MLRB minimum requirement of 1.30 for an embankment adjacent to a critical structure subject to earthquake loading. The proposed setback of 105 feet from the proposed oil/gas wells is satisfactory.

Case SS-4 – At a setback of 175 feet, the lowest resulting static condition safety factor of 2.08 exceeds the MLRB minimum requirement of 1.50 for an embankment adjacent to a critical structure. The lowest resulting pseudo-static condition safety factor of 1.57 exceeds the MLRB minimum requirement of 1.30 for an embankment adjacent to a critical structure subject to earthquake loading. The proposed setback of 175 feet from the concrete irrigation structure is satisfactory.

Case SS-5 – At a setback of 63 feet, the lowest resulting static condition safety factor of 1.76 exceeds the MLRB minimum requirement of 1.50 for an embankment adjacent to a critical structure. The lowest resulting pseudo-static condition safety factor of 1.40 exceeds the MLRB minimum requirement of 1.30 for an embankment adjacent to a critical structure subject to earthquake loading. The proposed setback of 63 feet from the fiber optic line and roadway is satisfactory.

Case SS-6 – At a setback of 112 feet, the lowest resulting static condition safety factor of 1.90 exceeds the MLRB minimum requirement of 1.50 for an embankment adjacent to a critical structure. The lowest resulting pseudo-static condition safety factor of 1.47 exceeds the MLRB minimum requirement of 1.30 for an embankment adjacent to a critical structure subject to earthquake loading. The proposed setback of 112 feet from the house is satisfactory.

CONCLUSIONS AND RECOMMENDATIONS (Continued)

Reclaimed Conditions:

Case SS-5 – At a setback of 63 feet, the lowest resulting static condition safety factor of 2.15 exceeds the MLRB minimum requirement of 1.50 for an embankment adjacent to a critical structure. The lowest resulting pseudo-static condition safety factor of 1.58 exceeds the MLRB minimum requirement of 1.30 for an embankment adjacent to a critical structure subject to earthquake loading. The proposed setback of 63 feet from the fiber optic line and roadway is satisfactory.



The following recommendations for monitoring of slope stability should be followed:

1. A visual inspection of the excavated slopes should be done on a weekly basis for the first 6 months of mining. This inspection should consist of walking the existing ground and looking for any signs of stress cracks or other potential signs of slope failure. Some minor sloughing of slopes is expected on any mine site. The intent of this inspection is to locate potential major slope failures that could potentially extend back into a structure.
2. A visual inspection should be done after a major precipitation event that has saturated the ground using the same procedures. A major precipitation event would be defined as a storm that produces an intensity level reached once in 50 years on the average.
3. If a visual inspection detects signs of a potential slope failure, qualified personnel should be contacted to evaluate and recommend remediation work to stabilize the area.
4. If no visible signs of slope failure are detected within the first 6 months, then the inspection period could be reduced to once per month or after every major precipitation event.

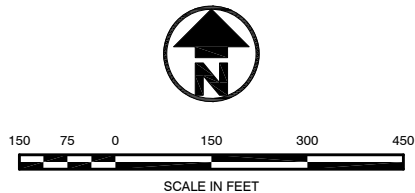


APPENDIX A





CHERRY AVENUE



	UTILITY POLE
	GUY WIRE
	GAS LINE MARKER
	GAS VALVE
	WELL
	WATER METER
	WATER FAUCET
	WATER LINE MARKER
	ELECTRIC TRANSFORMER
	TREE
	TELEPHONE PEDESTAL
	TELEPHONE LINE MARKER
	PROPERTY LINE
	FENCE LINE
	OVERHEAD ELECTRIC LINE
	UNDERGROUND WATER LINE
	EXISTING CHAIN LINK FENCE
	EXISTING CONTOURS (2' INTERVALS)
	GRAVEL ROAD
	PROPOSED PERMIT BOUNDARY
	PROPOSED FINAL MINING LIMIT
	PROPOSED SLURRY WALL
	SLOPE STABILITY CASE LOCATION

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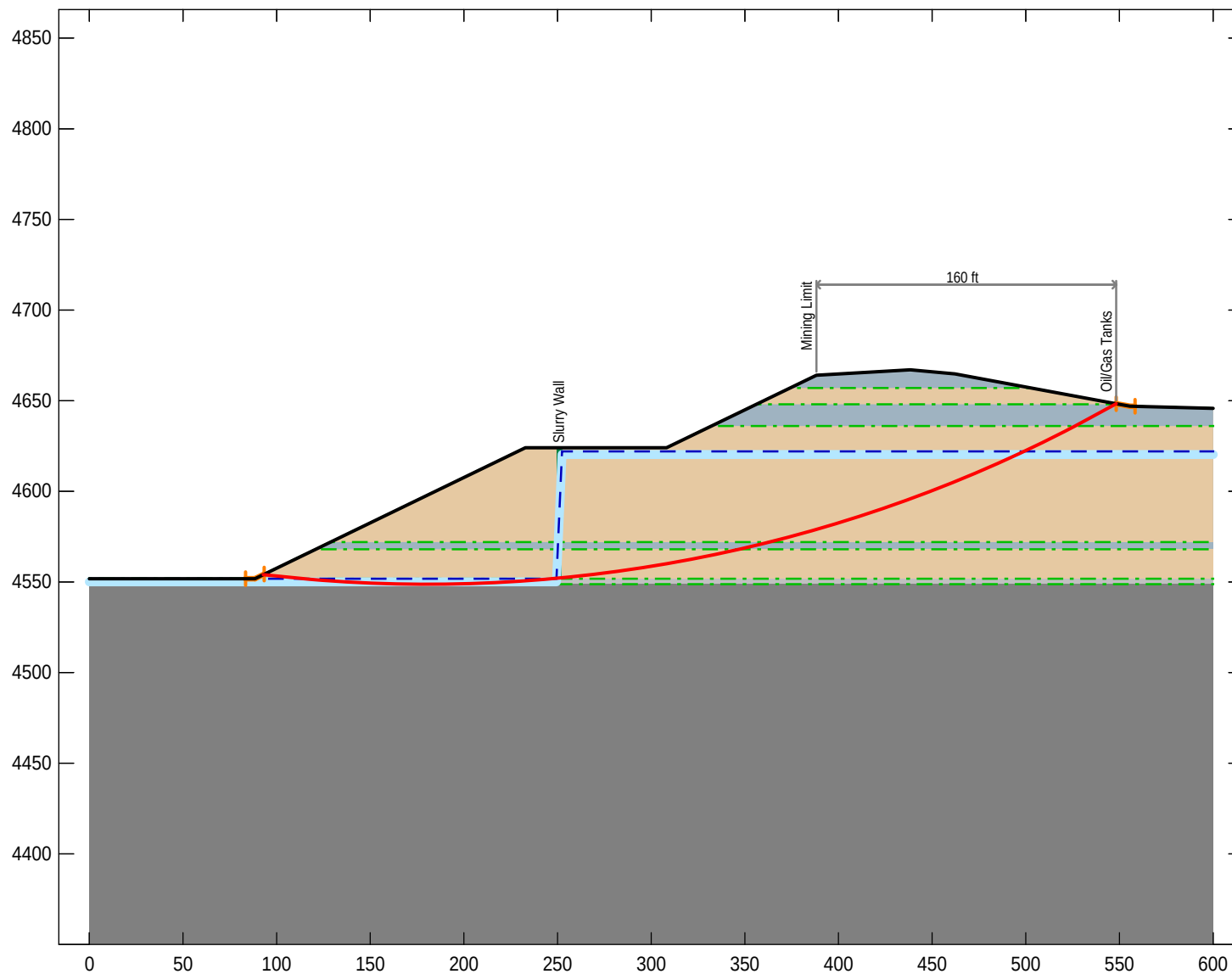
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Date	4.12.23
Drawn By	TPY
Designed By	TPY
Checked By	JCY
File	JT-IHC North Mining
Scale	As Shown

APPENDIX B



Mining Conditions





Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 2.14

GALENA Version 7.2

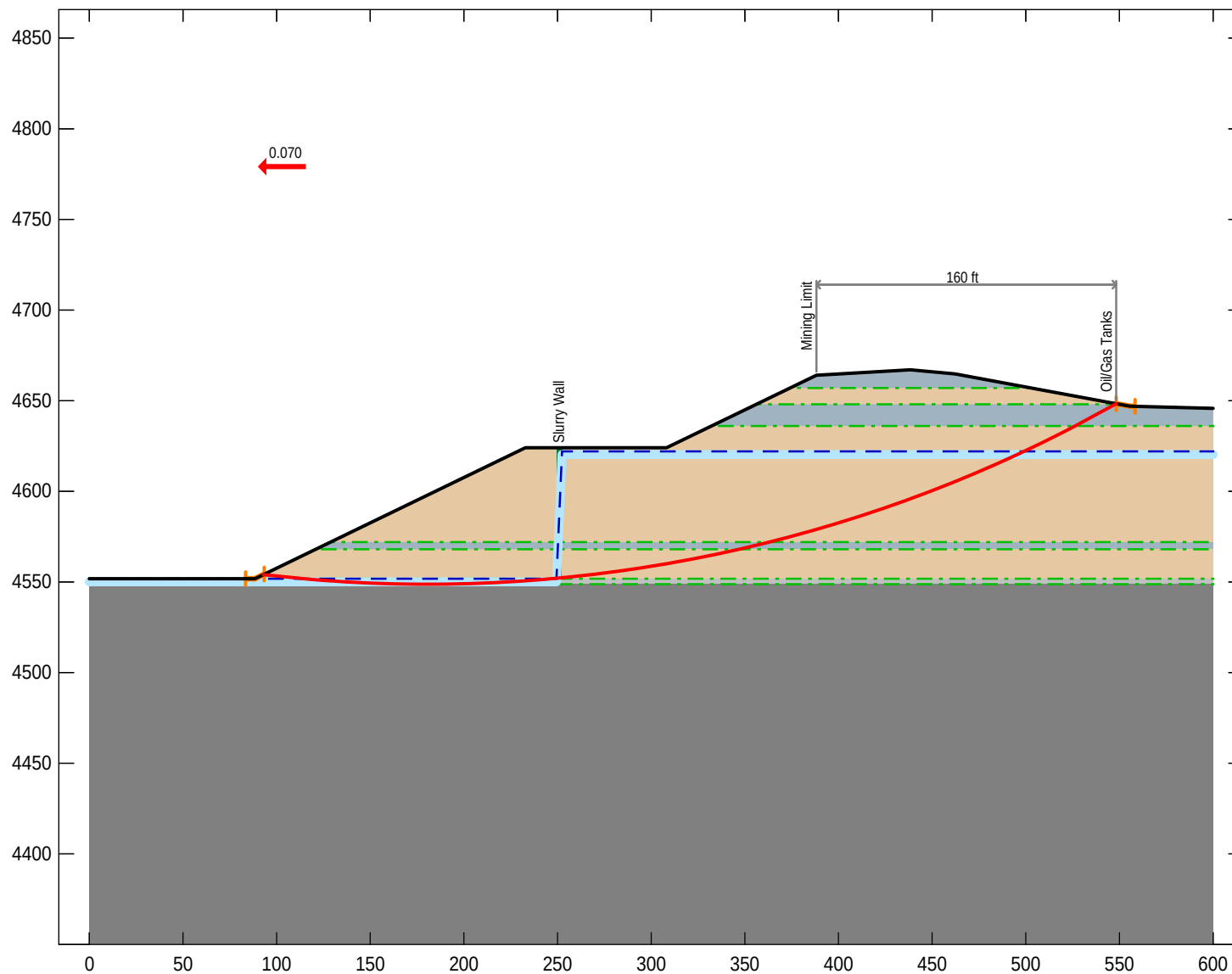
Licensed to: J & T Consulting

Project Derr Pit Technical Revision 8
Case SS-1 - Static

File: C:\Galena Models\Derr TR8 SS1.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

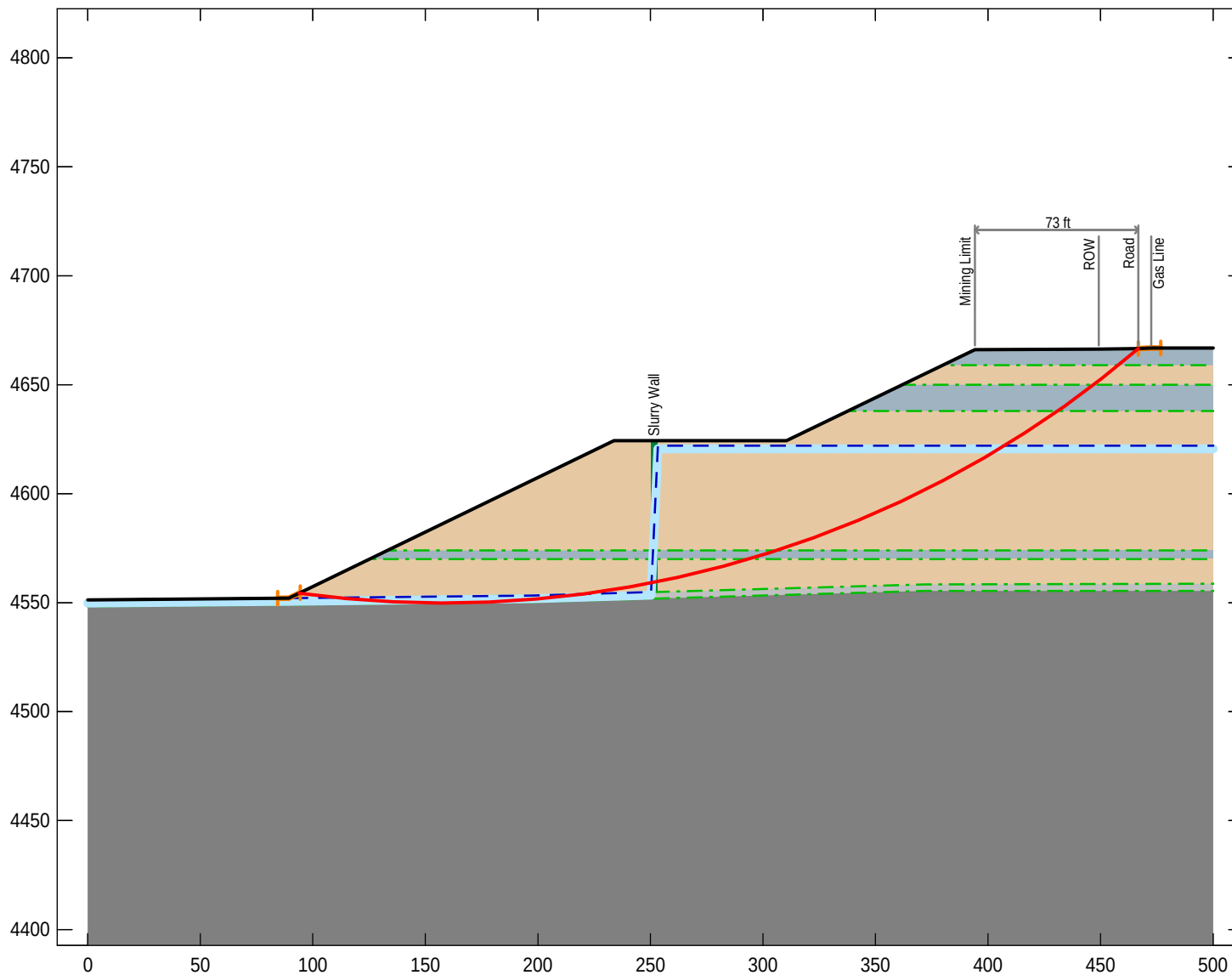
Critical Factor of Safety: 1.59

Project Derr Pit Technical Revision 8
Case SS-1 - Pseudo-Static

File: C:\Galena Models\Derr TR8 SS1-EQ.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.68

GALENA Version 7.2

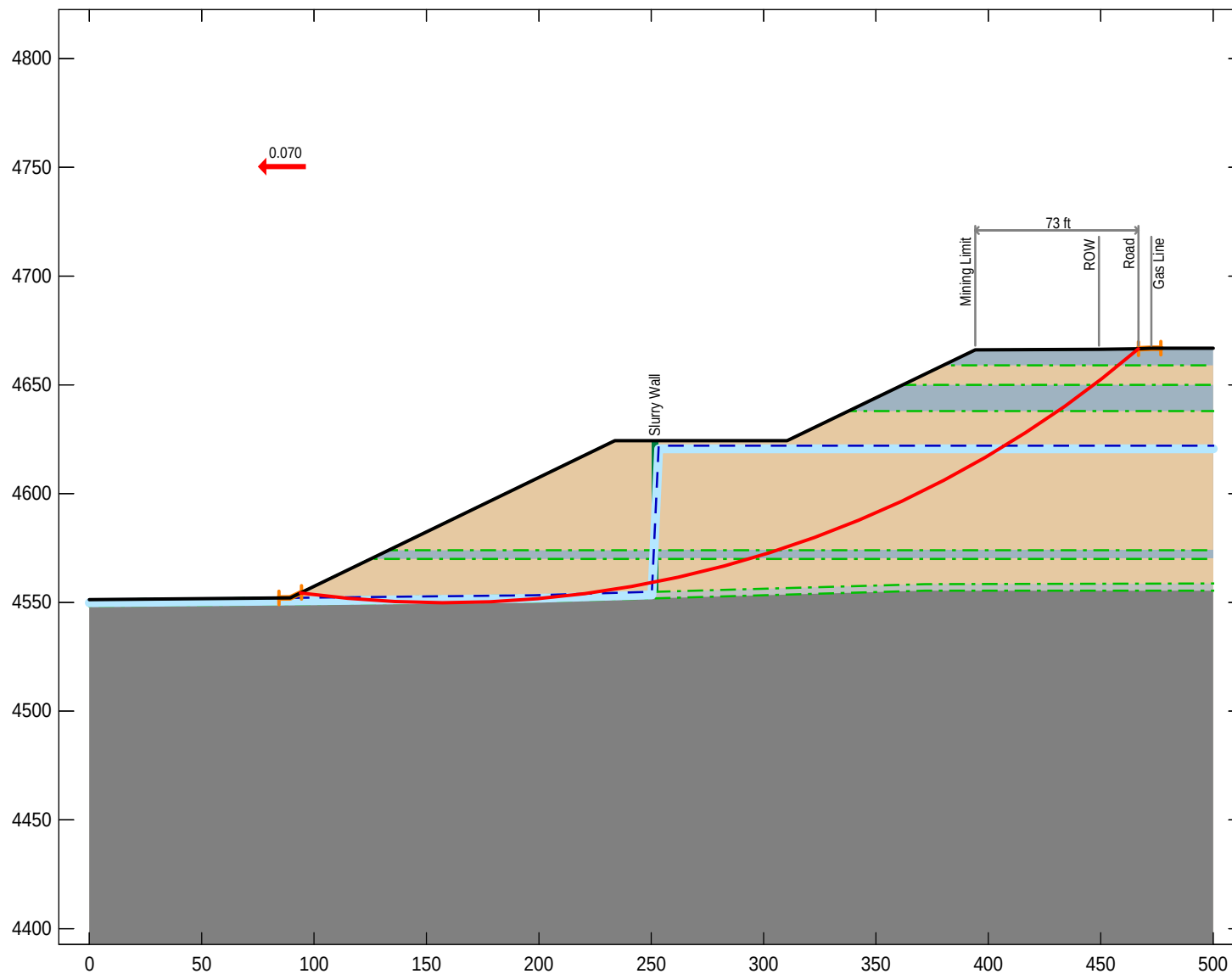
Licensed to: J & T Consulting

Project Derr Pit Technical Revision 8
Case SS-2 - Static

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Edited: 7 Apr 2023
Processed: 7 Apr 2023





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

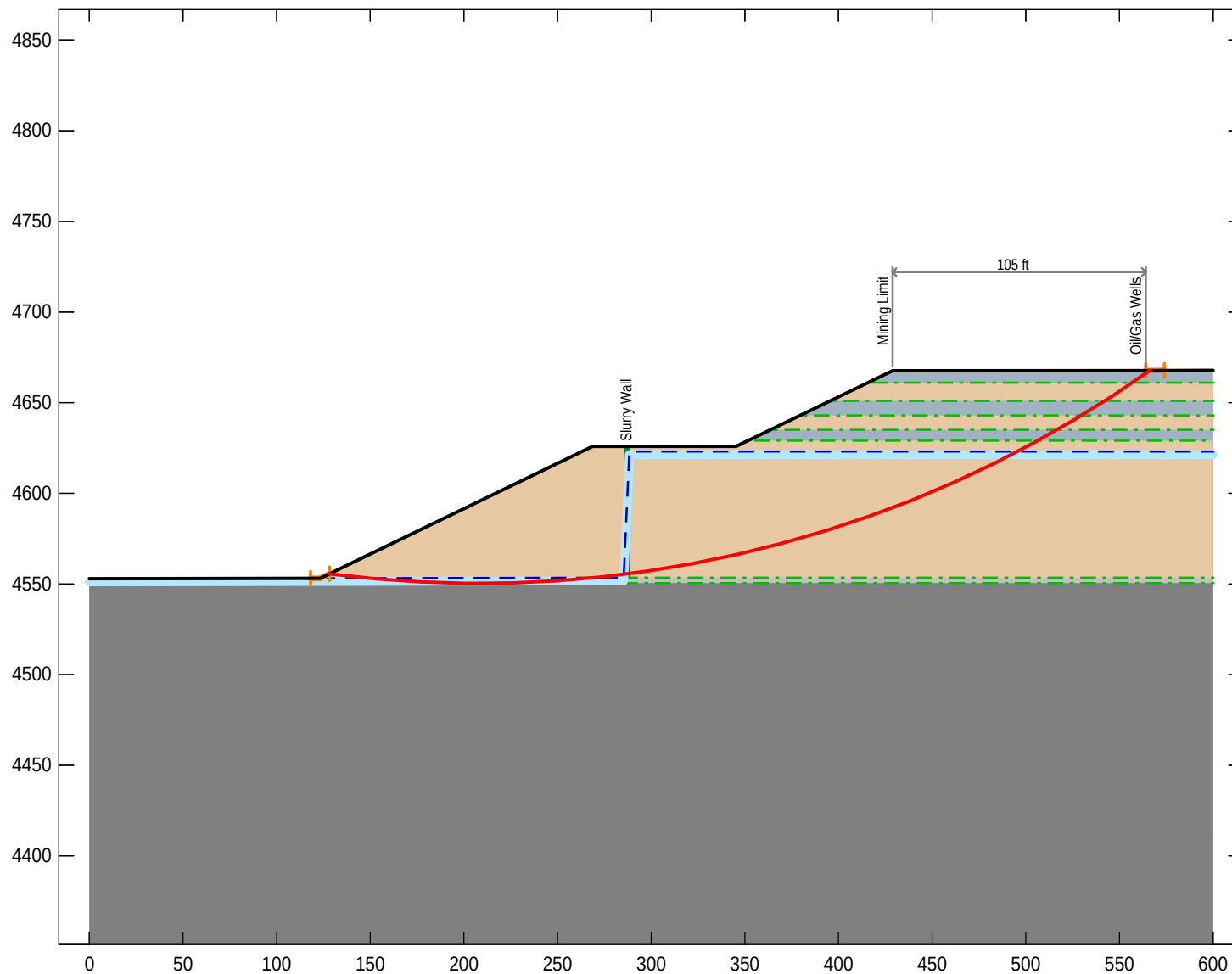
Critical Factor of Safety: 1.32

Project Derr Pit Technical Revision 8
Case SS-2 - Pseudo-Static

File: C:\Galena Models\Derr TR8 SS2-EQ.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.92

GALENA Version 7.2

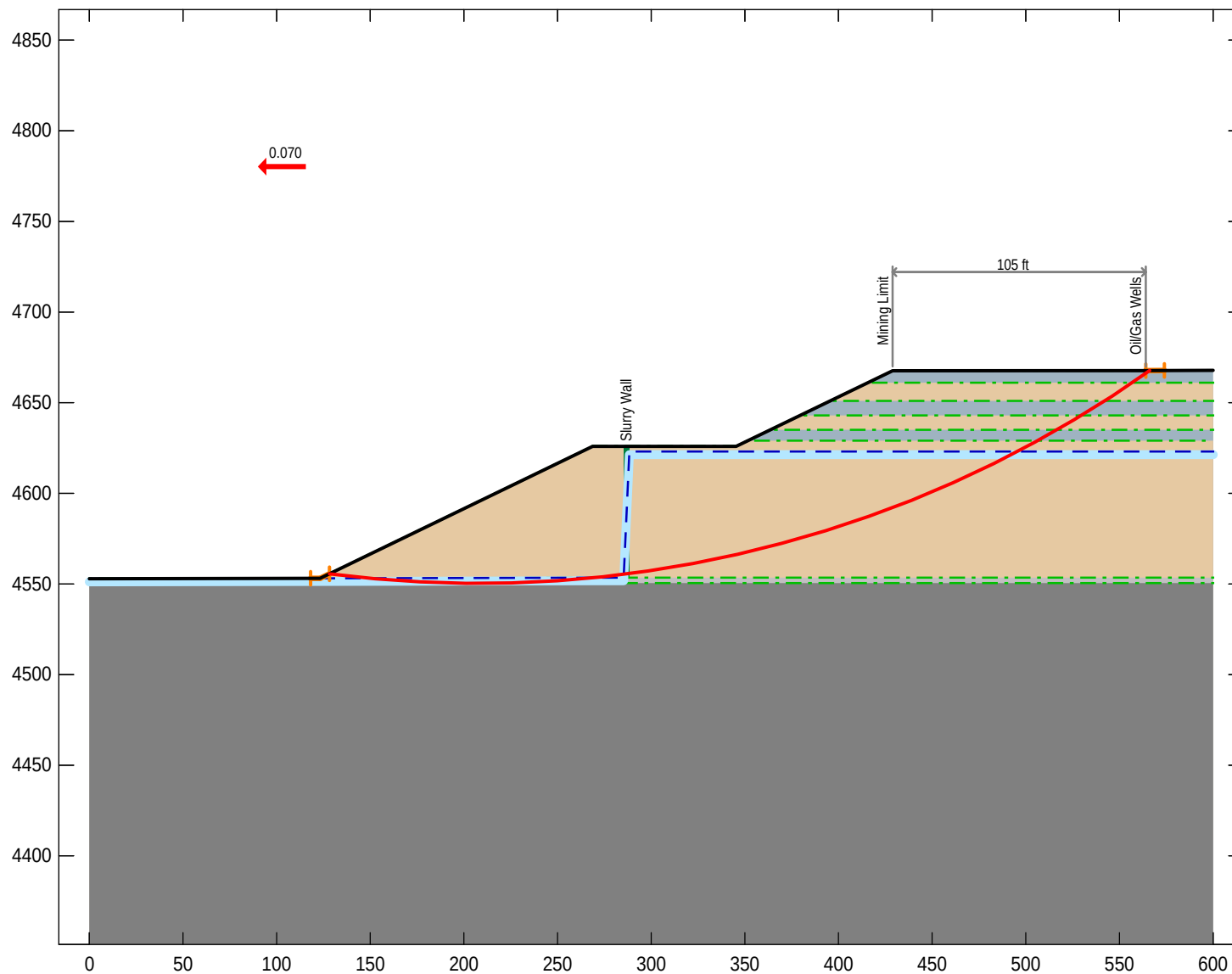
Licensed to: J & T Consulting

Project Derr Pit Technical Revision 8
Case SS-3 - Static

File: C:\Galena Models\Derr TR8 SS3.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





GALENA Version 7.2

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Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

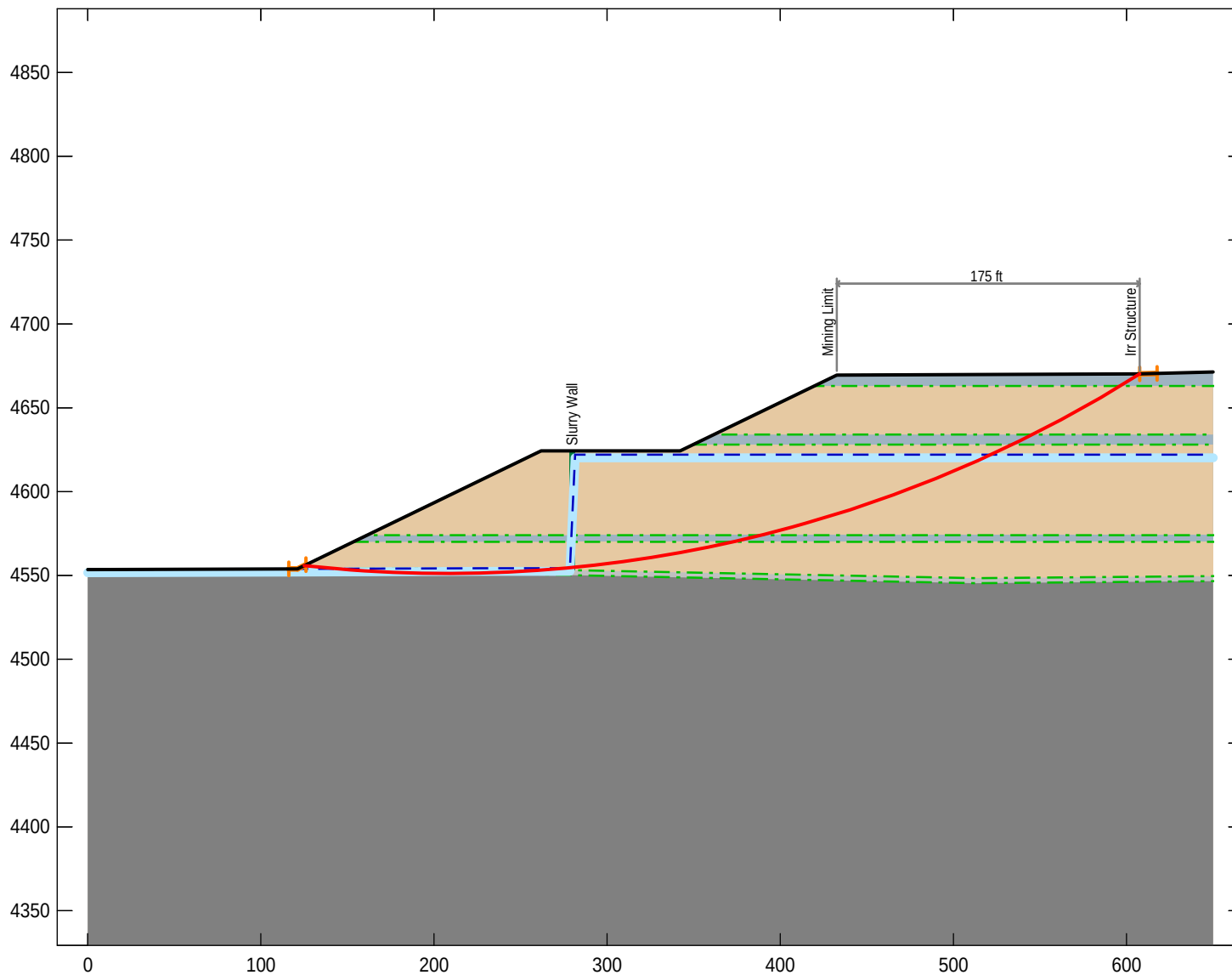
Critical Factor of Safety: 1.47

Project Derr Pit Technical Revision 8
Case SS-3 - Pseudo-Static

File: C:\Galena Models\Derr TR8 SS3-EQ.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 2.08

GALENA Version 7.2

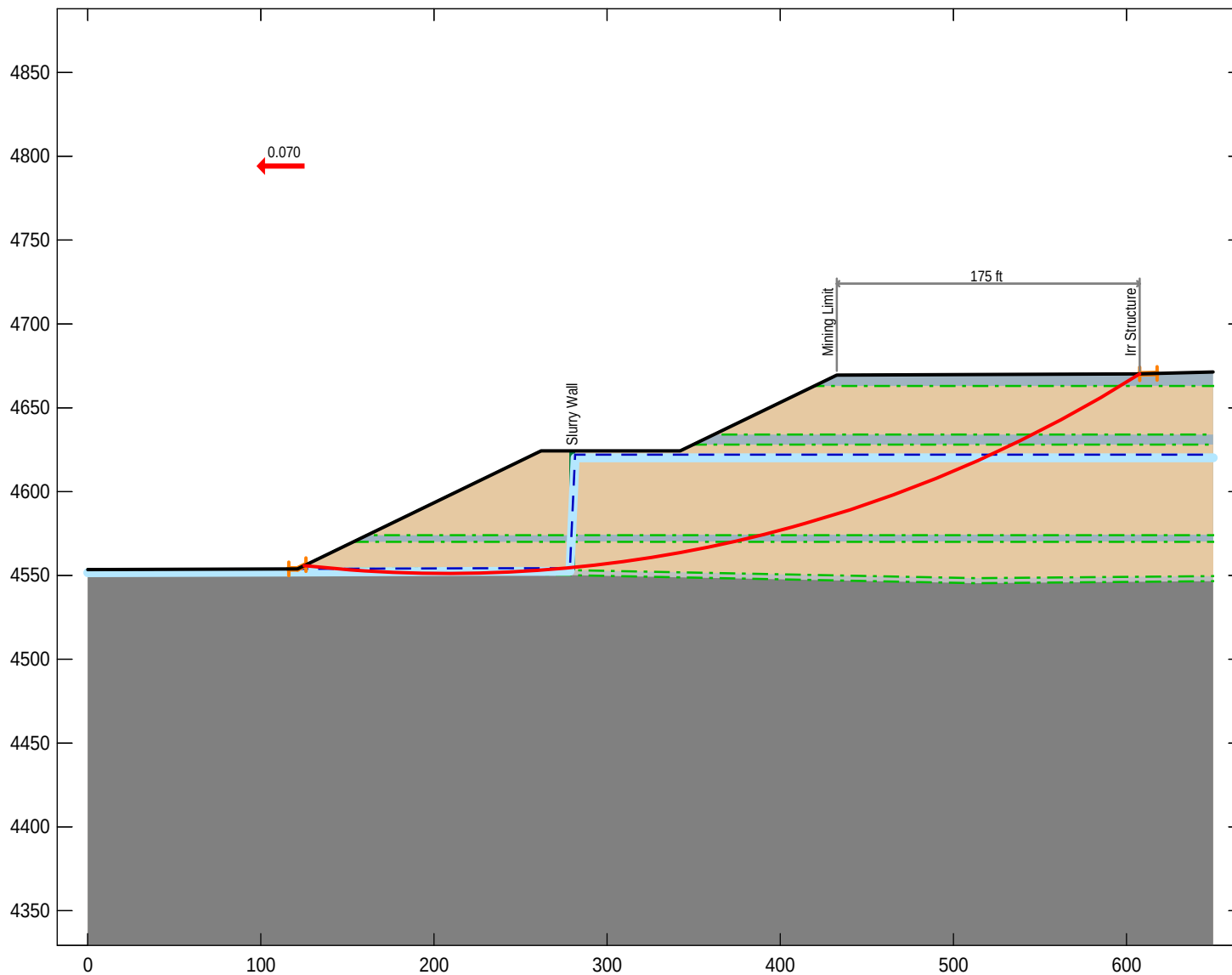
Licensed to: J & T Consulting

Project Derr Pit Technical Revision 8
Case SS-4 - Static

File: C:\Galena Models\Derr TR8 SS4.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





GALENA Version 7.2

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Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.57

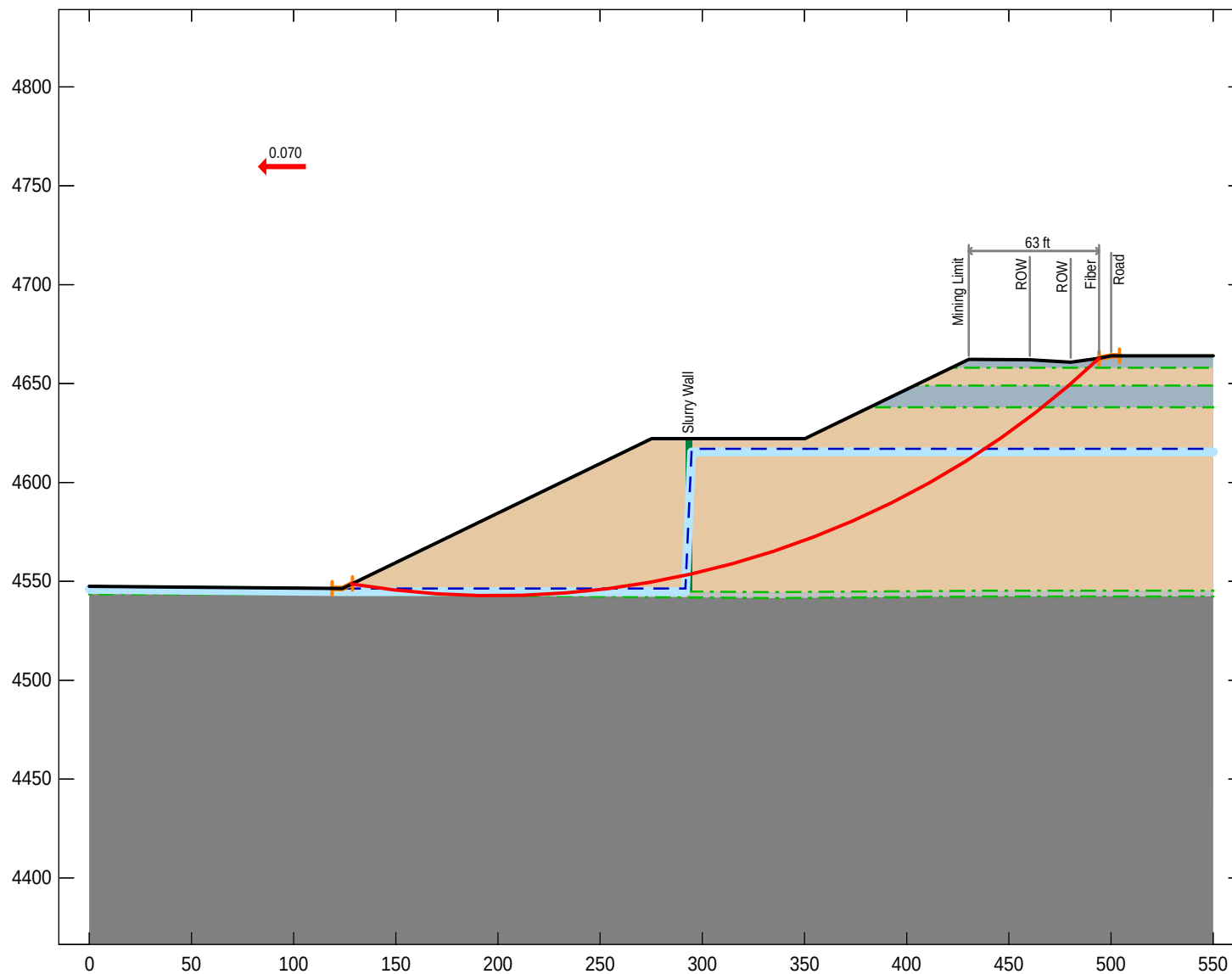
Project Derr Pit Technical Revision 8
Case SS-4 - Pseudo-Static

File: C:\Galena Models\Derr TR8 SS4-EQ.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023




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**GALENA** Version 7.2

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Material Keys

- 1: Sand and Gravel (c:0 σ :35 g:125)
- 2: Weathered Bedrock (c:100 σ :18 g:141)
- 3: Stable Bedrock (c:2000 σ :20 g:141)
- 4: Slurry Wall (c:0 σ :45 g:110)
- 5: Clay (c:150 σ :22 g:131)

<u>Analysis</u>	1
-----------------	---

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

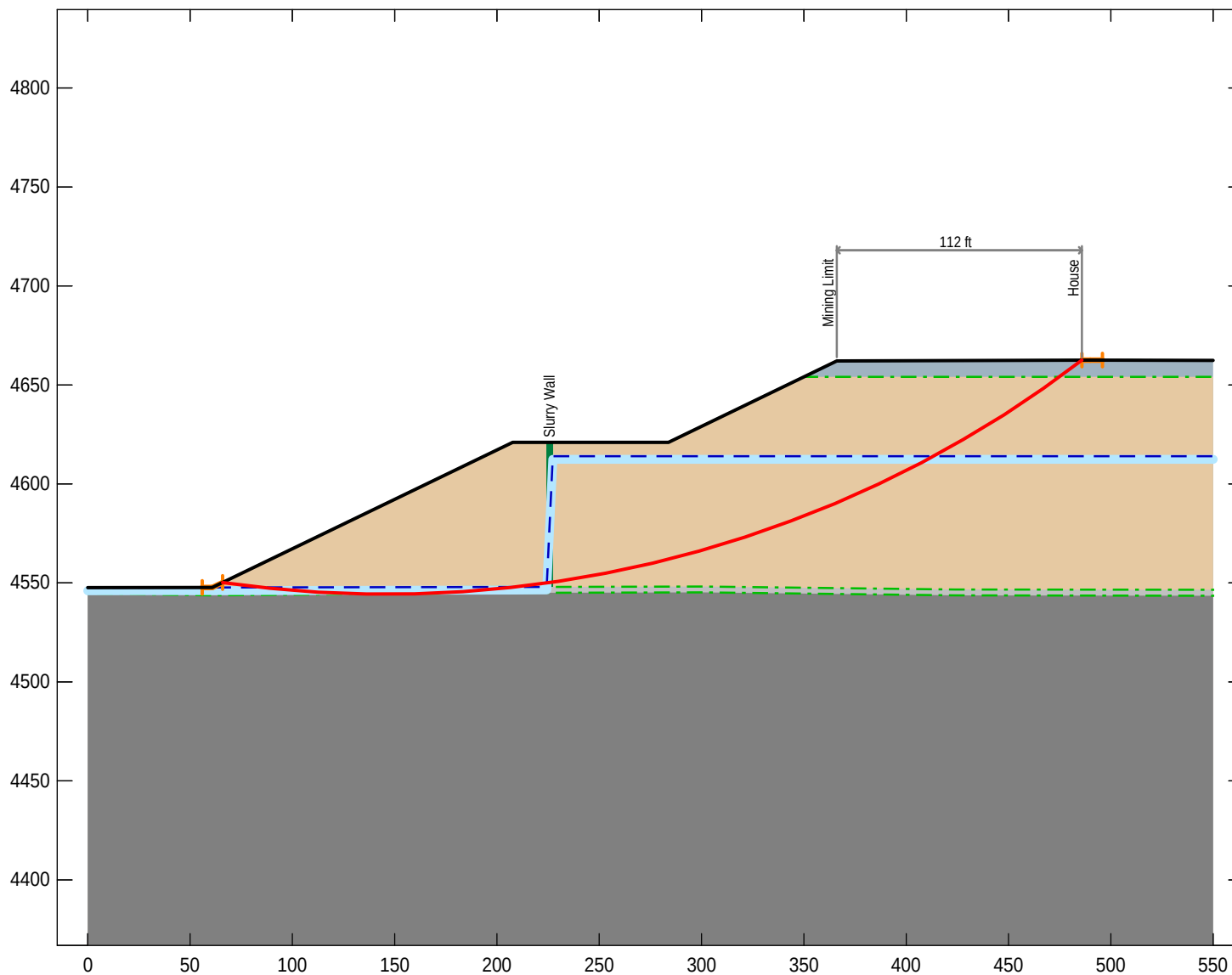
Critical Factor of Safety:	1.40
----------------------------	------

Project Derr Pit Technical Revision 8
Case SS-5 - Pseudo-Static

File: C:\Galena Models\Derr TR8 SS5-EQ.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.90

GALENA Version 7.2

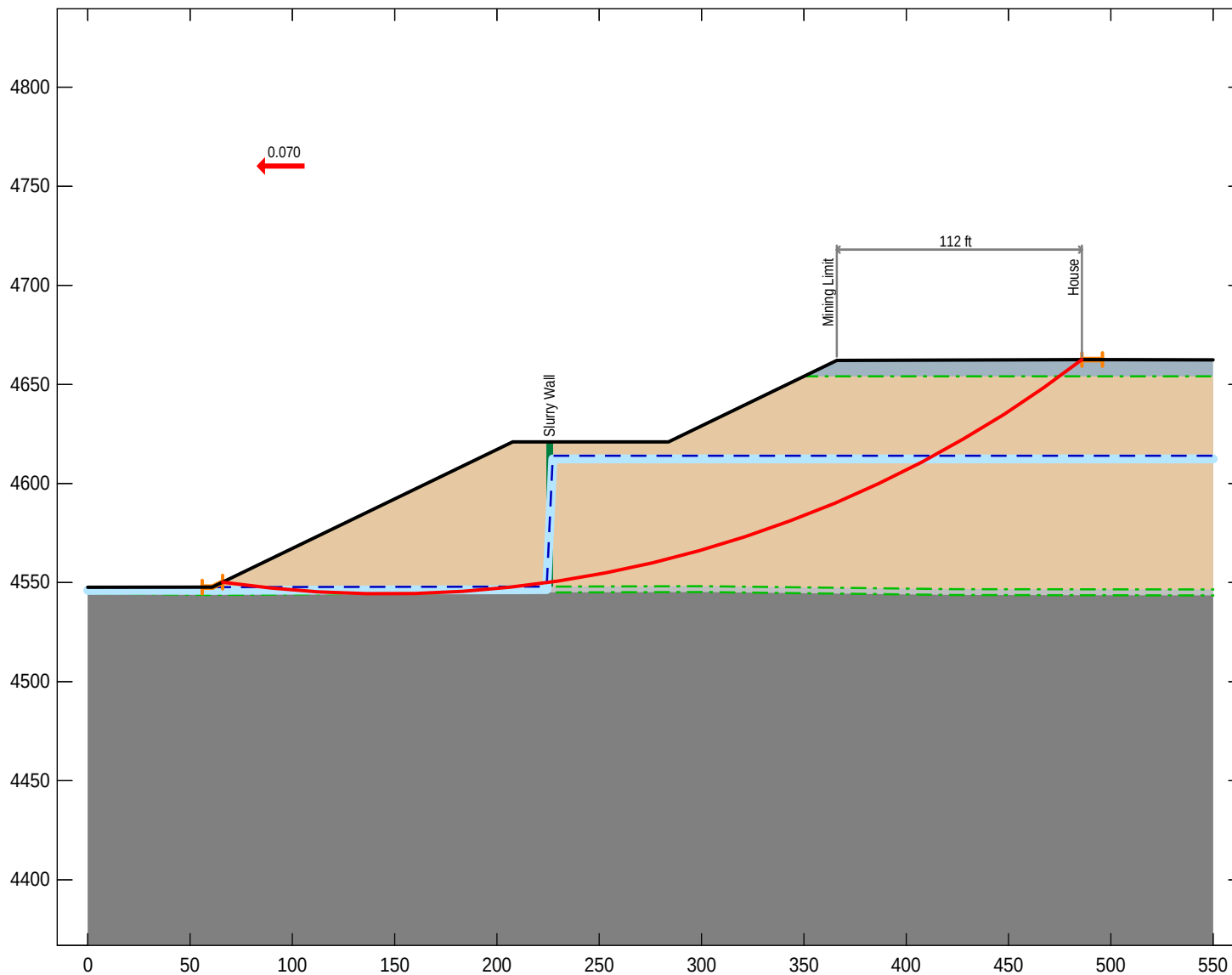
Licensed to: J & T Consulting

Project Derr Pit Technical Revision 8
Case SS-6 - Static

File: C:\Galena Models\Derr TR8 SS6.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023





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Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.47

Project Derr Pit Technical Revision 8
Case SS-6 - Pseudo-Static

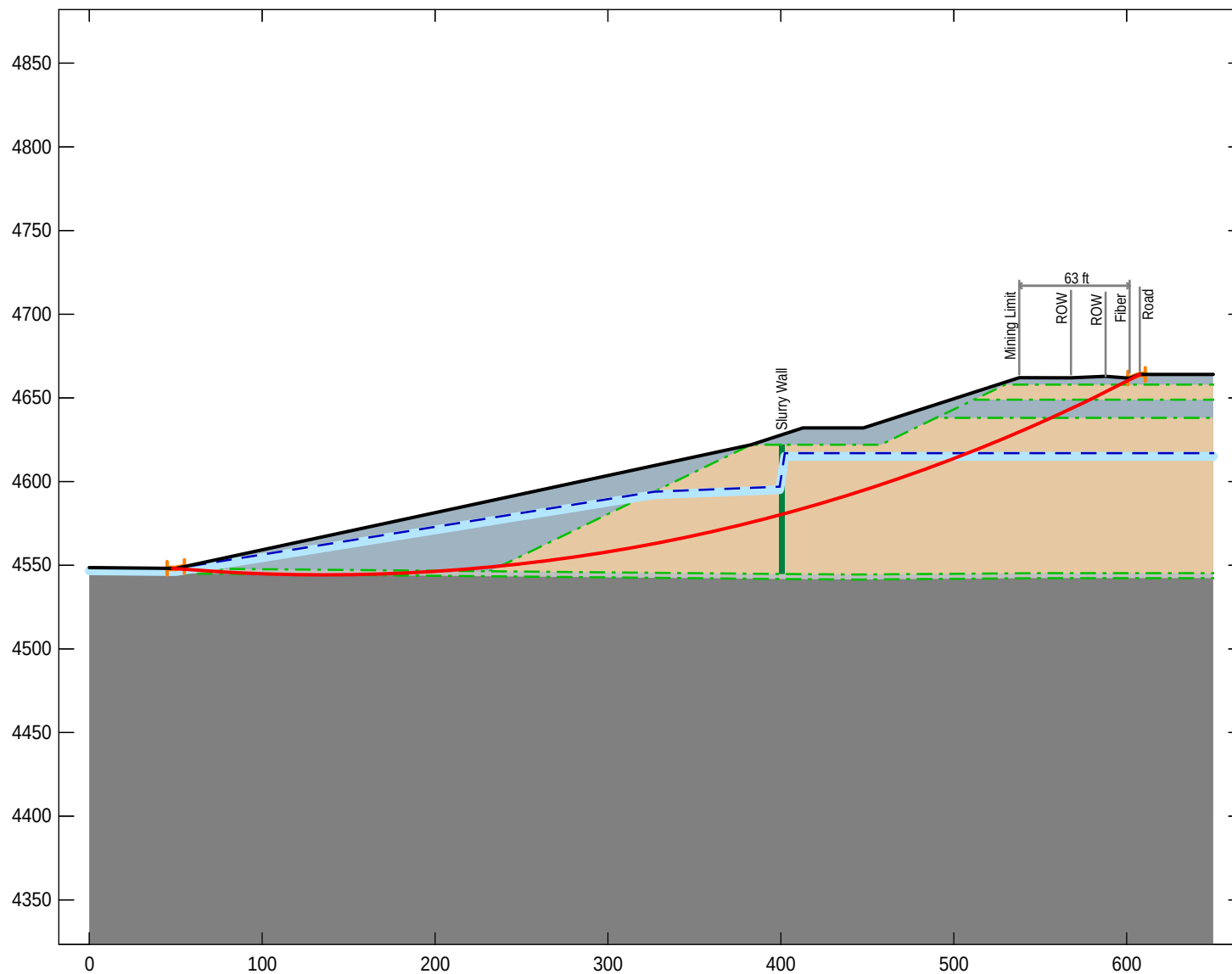
File: C:\Galena Models\Derr TR8 SS6-EQ.gmf

Edited: 7 Apr 2023
Processed: 7 Apr 2023



Reclamation Conditions





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Material Keys

- 1: Sand and Gravel (c:0 ø:35 g:125)
- 2: Weathered Bedrock (c:100 ø:18 g:141)
- 3: Stable Bedrock (c:2000 ø:20 g:141)
- 4: Slurry Wall (c:0 ø:45 g:110)
- 5: Clay (c:150 ø:22 g:131)

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 2.15

Project Derr Pit Technical Revision 8
Case SS-5 - Reclamation - Static

File: C:\Galena Models\Derr TR8 SS5-REC.gmf

Edited: 11 Apr 2023
Processed: 11 Apr 2023



APPENDIX C



Mining Conditions



Project: Derr Pit Technical Revision 8
File: C:\Galena Models\Derr TR8 SS1.gmf

Processed: 07 Apr 2023 09:50:08

DATA: Analysis 1 - Case SS-1 - Static

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0  125.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0  141.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0  141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0  110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion  Phi  UnitWeight  Ru
150.00    22.0  131.00    Auto

```

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (11 profiles)

```

-----
Profile: 1 (2 points)  Material beneath: 5 - Clay
0.00      4667.00      600.00    4667.00
Profile: 2 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4657.00      600.00    4657.00
Profile: 3 (2 points)  Material beneath: 5 - Clay
0.00      4648.00      600.00    4648.00
Profile: 4 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4636.00      600.00    4636.00
Profile: 5 (2 points)  Material beneath: 4 - Slurry Wall
249.40    4624.00      252.40    4624.00
Profile: 6 (2 points)  Material beneath: 5 - Clay
0.00      4572.00      249.40    4572.00
Profile: 7 (2 points)  Material beneath: 5 - Clay
252.40    4572.00      600.00    4572.00
Profile: 8 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4568.00      249.40    4568.00
Profile: 9 (2 points)  Material beneath: 1 - Sand and Gravel
252.40    4568.00      600.00    4568.00
Profile: 10 (2 points) Material beneath: 2 - Weathered Bedrock
0.00      4551.80      600.00    4551.80
Profile: 11 (2 points) Material beneath: 3 - Stable Bedrock
0.00      4548.80      600.00    4548.80

```

Slope Surface (10 points)

```

-----
0.00      4551.80      88.40    4551.80      232.80    4624.00      308.20    4624.00      388.20    4664.00
438.30    4667.00      462.10    4664.80      548.30    4648.30      555.60    4647.00      600.00    4645.80

```

Phreatic Surface (5 points)

```

-----
      0.00      4551.80      88.40      4551.80      249.40      4551.80      252.40      4622.00      600.00      4622.00

```

Failure Surface

```

-----
Initial circular surface for critical search defined by: XL, XR, R
Intersects: XL:      88.40      YL:      4551.80      XR:      553.30      YR:      4647.41
Centre:      XC:      166.95      YC:      5347.93      Radius:      R:      800.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00      10.00      300.00
Trial positions within range:      20      20      50

```

RESULTS: Analysis 1 - Case SS-1 - Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.394

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 2.14

Results Summary - Lowest 99 Factor of Safety circles

```

-----
Circle  X-Left  Y-Left  X-Right  Y-Right  X-Centre  Y-Centre  Radius  FoS
1       92.87   4554.04  548.30   4648.30  180.42    5278.36  729.59  2.144  <-- Critical Surface
2       93.40   4554.30  548.30   4648.30  182.20    5272.30  723.47  2.147
3       93.40   4554.30  548.83   4648.21  182.76    5272.23  723.47  2.149
4       91.82   4553.51  548.83   4648.21  176.14    5296.70  747.96  2.153
5       92.35   4553.77  549.35   4648.11  178.49    5290.59  741.84  2.154
6       92.87   4554.04  549.88   4648.02  180.83    5284.47  735.71  2.154
7       93.40   4554.30  550.41   4647.92  183.16    5278.35  729.59  2.156
8       92.35   4553.77  548.83   4648.21  177.91    5290.66  741.84  2.156
9       92.87   4554.04  549.35   4648.11  180.26    5284.54  735.71  2.157
10      92.87   4554.04  548.83   4648.21  179.69    5284.61  735.71  2.159
11      93.40   4554.30  549.35   4648.11  182.02    5278.49  729.59  2.160
12      91.82   4553.51  548.30   4648.30  175.56    5296.77  747.96  2.160
13      93.40   4554.30  548.83   4648.21  181.46    5278.56  729.59  2.162
14      91.82   4553.51  550.41   4647.92  176.56    5302.82  754.08  2.163
15      92.35   4553.77  550.93   4647.83  178.91    5296.71  747.96  2.164
16      92.35   4553.77  548.30   4648.30  177.34    5290.73  741.84  2.165
17      91.29   4553.25  549.35   4648.11  173.63    5308.98  760.20  2.165
18      93.40   4554.30  551.98   4647.64  183.57    5284.47  735.71  2.166
19      93.40   4554.30  549.88   4648.02  182.59    5278.42  729.59  2.166
20      92.35   4553.77  550.41   4647.92  178.33    5296.77  747.96  2.166
21      92.87   4554.04  550.93   4647.83  180.67    5290.66  741.84  2.167
22      90.77   4552.98  548.30   4648.30  170.69    5315.13  766.33  2.168

```

Derr TR8 SS1.gar

23	91.29	4553.25	548.83	4648.21	173.05	5309.04	760.20	2.168
24	91.82	4553.51	549.35	4648.11	175.41	5302.94	754.08	2.169
25	92.87	4554.04	548.30	4648.30	179.12	5284.68	735.71	2.169
26	92.87	4554.04	550.41	4647.92	180.10	5290.73	741.84	2.169
27	93.40	4554.30	550.93	4647.83	182.43	5284.61	735.71	2.170
28	91.82	4553.51	548.83	4648.21	174.83	5303.01	754.08	2.171
29	93.40	4554.30	551.46	4647.74	183.00	5284.54	735.71	2.171
30	91.82	4553.51	549.88	4648.02	175.99	5302.88	754.08	2.172
31	91.29	4553.25	548.30	4648.30	172.47	5309.10	760.20	2.172
32	93.40	4554.30	550.41	4647.92	181.86	5284.68	735.71	2.172
33	92.87	4554.04	551.46	4647.74	181.24	5290.59	741.84	2.173
34	92.35	4553.77	549.35	4648.11	177.18	5296.91	747.96	2.173
35	93.40	4554.30	548.30	4648.30	180.89	5278.63	729.59	2.173
36	92.35	4553.77	552.51	4647.55	179.34	5302.82	754.08	2.174
37	92.35	4553.77	548.83	4648.21	176.61	5296.97	747.96	2.174
38	93.40	4554.30	549.88	4648.02	181.29	5284.75	735.71	2.175
39	91.82	4553.51	548.30	4648.30	174.25	5303.07	754.08	2.175
40	92.35	4553.77	551.98	4647.64	178.76	5302.89	754.08	2.176
41	91.29	4553.25	550.93	4647.83	174.07	5315.09	766.33	2.176
42	92.35	4553.77	549.88	4648.02	177.76	5296.84	747.96	2.176
43	91.29	4553.25	550.41	4647.92	173.49	5315.15	766.33	2.177
44	92.87	4554.04	552.51	4647.55	181.09	5296.77	747.96	2.177
45	90.77	4552.98	549.88	4648.02	171.13	5321.24	772.45	2.177
46	92.87	4554.04	548.83	4648.21	178.38	5290.93	741.84	2.177
47	92.87	4554.04	549.35	4648.11	178.95	5290.86	741.84	2.178
48	92.87	4554.04	553.04	4647.46	181.67	5296.71	747.96	2.178
49	93.40	4554.30	553.04	4647.46	183.42	5290.65	741.84	2.178
50	92.35	4553.77	548.30	4648.30	176.03	5297.04	747.96	2.179
51	92.87	4554.04	548.83	4648.21	180.99	5278.29	729.59	2.179
52	93.40	4554.30	555.14	4647.08	184.42	5296.70	747.96	2.179
53	92.87	4554.04	551.98	4647.64	180.52	5296.84	747.96	2.179
54	90.24	4552.72	548.83	4648.21	168.18	5327.38	778.57	2.180
55	91.82	4553.51	550.93	4647.83	175.84	5309.06	760.20	2.180
56	91.82	4553.51	550.41	4647.92	175.27	5309.12	760.20	2.180
57	93.40	4554.30	548.83	4648.21	180.15	5284.88	735.71	2.180
58	92.87	4554.04	549.88	4648.02	179.53	5290.79	741.84	2.181
59	93.40	4554.30	553.56	4647.36	183.99	5290.58	741.84	2.181
60	91.29	4553.25	549.88	4648.02	172.91	5315.21	766.33	2.181
61	92.87	4554.04	551.46	4647.74	179.95	5296.91	747.96	2.182
62	90.77	4552.98	549.35	4648.11	170.55	5321.30	772.45	2.182
63	93.40	4554.30	549.35	4648.11	180.72	5284.81	735.71	2.182
64	92.87	4554.04	548.30	4648.30	177.81	5291.00	741.84	2.182
65	93.40	4554.30	551.98	4647.64	182.28	5290.79	741.84	2.183
66	91.29	4553.25	548.30	4648.30	173.78	5302.80	754.08	2.183
67	92.35	4553.77	554.09	4647.27	179.78	5308.93	760.20	2.183
68	91.82	4553.51	551.46	4647.74	176.42	5308.99	760.20	2.183
69	92.35	4553.77	550.41	4647.92	177.04	5303.08	754.08	2.184
70	90.77	4552.98	548.83	4648.21	171.27	5315.07	766.33	2.184
71	91.82	4553.51	553.04	4647.46	176.87	5315.10	766.33	2.184
72	92.35	4553.77	550.93	4647.83	177.61	5303.02	754.08	2.184
73	92.87	4554.04	554.62	4647.18	182.10	5302.82	754.08	2.185
74	90.77	4552.98	548.83	4648.21	169.96	5321.36	772.45	2.185
75	91.82	4553.51	549.88	4648.02	174.69	5309.18	760.20	2.185
76	93.40	4554.30	549.35	4648.11	183.33	5272.16	723.47	2.185
77	93.40	4554.30	551.46	4647.74	181.71	5290.86	741.84	2.185
78	91.29	4553.25	549.35	4648.11	172.33	5315.28	766.33	2.185
79	91.29	4553.25	551.98	4647.64	173.94	5321.26	772.45	2.185
80	93.40	4554.30	548.30	4648.30	179.58	5284.95	735.71	2.185
81	92.35	4553.77	553.56	4647.36	179.20	5309.00	760.20	2.186

Derr TR8 SS1.gar

82	91.82	4553.51	551.98	4647.64	177.00	5308.93	760.20	2.186
83	90.77	4552.98	551.46	4647.74	171.59	5327.35	778.57	2.186
84	92.35	4553.77	548.30	4648.30	178.65	5284.41	735.71	2.187
85	92.87	4554.04	550.41	4647.92	178.80	5297.04	747.96	2.187
86	93.40	4554.30	552.51	4647.55	182.85	5290.72	741.84	2.187
87	92.35	4553.77	551.46	4647.74	178.19	5302.95	754.08	2.187
88	92.35	4553.77	553.04	4647.46	178.63	5309.07	760.20	2.188
89	92.35	4553.77	549.88	4648.02	176.46	5303.15	754.08	2.188
90	91.82	4553.51	551.98	4647.64	175.71	5315.23	766.33	2.189
91	92.87	4554.04	550.93	4647.83	179.38	5296.98	747.96	2.189
92	92.87	4554.04	553.56	4647.36	180.96	5302.96	754.08	2.189
93	91.82	4553.51	549.35	4648.11	174.11	5309.25	760.20	2.189
94	91.29	4553.25	551.46	4647.74	173.36	5321.32	772.45	2.190
95	91.29	4553.25	548.83	4648.21	171.75	5315.34	766.33	2.190
96	90.77	4552.98	550.93	4647.83	171.00	5327.41	778.57	2.190
97	90.77	4552.98	550.41	4647.92	170.42	5327.47	778.57	2.190
98	93.40	4554.30	554.62	4647.18	183.85	5296.77	747.96	2.190
99	93.40	4554.30	550.41	4647.92	180.57	5291.00	741.84	2.191

Critical Failure Surface (circle 1)

Intersects: XL: 92.87 YL: 4554.04 XR: 548.30 YR: 4648.30
 Centre: XC: 180.42 YC: 5278.36 Radius: R: 729.59

Generated failure surface: (20 points)

92.87	4554.04	117.65	4551.47	142.50	4549.75	167.40	4548.88	192.31	4548.86
217.21	4549.69	242.06	4551.37	266.85	4553.90	291.53	4557.27	316.08	4561.49
340.47	4566.54	364.68	4572.42	388.68	4579.12	412.43	4586.63	435.91	4594.96
459.09	4604.08	481.94	4613.98	504.45	4624.67	526.58	4636.11	548.30	4648.30

Slice Geometry and Properties - Critical Failure Surface (circle 1, 49 slices)

Slice	X-Left	X-S Area	Angle	Width	Base Length	Matl	Cohesion	Phi	Weight	Porewater Force	Normal Stress	Test Factor
1	92.87	35.18	-5.9	10.80	10.85	1	0.00	35.0	4397.21	0.00	421.55	1.04
2	103.67	105.53	-5.9	10.80	10.85	1	0.00	35.0	13191.62	0.00	1264.66	1.04
3	114.47	44.59	-5.9	3.19	3.20	2	100.00	18.0	5582.37	32.99	1784.65	1.02
4	117.65	49.90	-4.0	3.15	3.16	2	100.00	18.0	6259.18	86.42	2012.57	1.01
5	120.80	152.20	-4.0	8.00	8.02	2	100.00	18.0	19226.39	412.68	2431.47	1.01
6	128.80	345.37	-4.0	13.70	13.74	2	100.00	18.0	43845.68	1350.25	3235.53	1.01
7	142.50	403.70	-2.0	12.45	12.46	2	100.00	18.0	51213.30	1761.68	4136.95	1.01
8	154.95	486.60	-2.0	12.45	12.46	2	100.00	18.0	61661.69	2099.82	4980.60	1.01
9	167.40	567.21	-0.0	12.46	12.46	2	100.00	18.0	71782.48	2272.50	5763.74	1.00
10	179.86	644.90	-0.0	12.46	12.46	2	100.00	18.0	81496.30	2280.08	6543.71	1.00
11	192.31	719.53	1.9	12.45	12.46	2	100.00	18.0	90783.62	2122.59	7255.22	1.00
12	204.76	791.84	1.9	12.45	12.46	2	100.00	18.0	99739.67	1799.63	7970.89	1.00
13	217.21	531.62	3.9	7.80	7.81	2	100.00	18.0	66869.22	898.90	8489.16	0.99
14	225.00	557.89	3.9	7.80	7.81	2	100.00	18.0	70088.20	642.03	8897.68	0.99
15	232.80	675.69	3.9	9.26	9.28	2	100.00	18.0	84793.30	428.59	9057.82	0.99
16	242.06	302.91	5.8	4.18	4.20	2	100.00	18.0	37978.74	55.99	8936.40	0.99
17	246.25	227.16	5.8	3.15	3.17	1	0.00	35.0	28470.46	0.00	8737.76	0.97
18	249.40	215.18	5.8	3.00	3.02	4	0.00	45.0	23669.44	6515.56	7629.52	0.96
19	252.40	1023.31	5.8	14.45	14.52	1	0.00	35.0	128260.92	62373.88	8730.68	0.97
20	266.85	854.68	7.8	12.34	12.46	1	0.00	35.0	107131.02	52273.19	8489.35	0.97
21	279.19	833.87	7.8	12.34	12.46	1	0.00	35.0	104530.10	50962.48	8283.15	0.97
22	291.53	550.26	9.7	8.34	8.46	1	0.00	35.0	68981.98	33782.45	8048.13	0.96
23	299.86	538.34	9.7	8.34	8.46	1	0.00	35.0	67492.02	33027.45	7874.18	0.96
24	308.20	513.50	9.7	7.88	8.00	1	0.00	35.0	64376.43	30529.88	7937.99	0.96
25	316.08	545.11	11.7	8.06	8.23	1	0.00	35.0	68331.62	30649.79	8177.25	0.96
26	324.14	564.14	11.7	8.06	8.23	1	0.00	35.0	70711.05	29793.15	8447.20	0.96

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27	332.20	599.02	11.7	8.27	8.45	1	0.00	35.0	75178.52	29697.93	8732.33	0.96
28	340.47	448.33	13.7	6.03	6.20	1	0.00	35.0	56389.63	21184.96	8918.48	0.95
29	346.50	740.85	13.7	9.70	9.98	5	150.00	22.0	93327.47	32892.18	9330.98	0.98
30	356.20	531.84	13.7	6.77	6.97	5	150.00	22.0	67000.50	22105.65	9581.07	0.98
31	362.97	905.83	15.3	11.23	11.64	1	0.00	35.0	114036.85	35221.71	9572.59	0.95
32	374.20	1168.60	15.6	14.00	14.54	1	0.00	35.0	147376.59	40790.75	9881.49	0.95
33	388.20	1011.16	17.5	12.11	12.70	1	0.00	35.0	127802.71	32582.87	9806.15	0.95
34	400.31	973.51	17.6	12.11	12.71	1	0.00	35.0	123148.68	29557.57	9432.34	0.95
35	412.43	904.98	19.5	11.74	12.46	1	0.00	35.0	114588.17	25869.78	8963.46	0.95
36	424.17	864.38	19.5	11.74	12.46	1	0.00	35.0	109561.98	22635.60	8552.70	0.95
37	435.91	171.23	21.5	2.39	2.57	1	0.00	35.0	21718.64	4267.05	8225.04	0.95
38	438.30	712.72	21.5	10.39	11.17	1	0.00	35.0	90431.73	16764.69	7881.25	0.95
39	448.69	660.23	21.5	10.39	11.17	1	0.00	35.0	83811.29	13915.05	7287.73	0.95
40	459.09	181.43	23.4	3.01	3.28	1	0.00	35.0	23039.33	3539.12	6831.20	0.95
41	462.10	558.75	23.4	9.92	10.81	1	0.00	35.0	70966.02	9760.87	6377.73	0.95
42	472.02	497.25	23.4	9.92	10.81	1	0.00	35.0	63164.80	6859.37	5655.58	0.95
43	481.94	373.29	25.4	8.44	9.35	1	0.00	35.0	47431.13	3506.47	4913.40	0.96
44	490.39	325.80	25.4	8.44	9.35	1	0.00	35.0	41412.33	1168.83	4262.73	0.96
45	498.83	138.26	25.4	4.02	4.44	1	0.00	35.0	17580.67	0.00	3790.68	0.96
46	502.85	340.98	27.1	11.76	13.21	1	0.00	35.0	43468.87	0.00	3167.56	0.96
47	514.61	243.00	27.3	11.76	13.24	1	0.00	35.0	31221.30	0.00	2271.42	0.96
48	526.37	133.54	29.3	10.70	12.26	5	150.00	22.0	17270.55	0.00	1424.55	1.04
49	537.07	47.49	29.3	11.23	12.88	5	150.00	22.0	6128.63	0.00	457.87	1.04

X-S Area: 24812.63 Path Length: 473.31

X-S Weight: 3126920.50

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS1-EQ.gmf

Processed: 07 Apr 2023 09:50:53

DATA: Analysis 1 - Case SS-1 - Pseudo-Static

Material Properties (5 materials)

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-----
Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0  125.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0  141.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0  141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0  110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion  Phi  UnitWeight  Ru
150.00    22.0  131.00    Auto

```

Water Properties

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Unit weight of water: 62.400          Unit weight of water/medium above ground: 62.400

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Material Profiles (11 profiles)

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-----
Profile: 1 (2 points)  Material beneath: 5 - Clay
0.00      4667.00      600.00    4667.00
Profile: 2 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4657.00      600.00    4657.00
Profile: 3 (2 points)  Material beneath: 5 - Clay
0.00      4648.00      600.00    4648.00
Profile: 4 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4636.00      600.00    4636.00
Profile: 5 (2 points)  Material beneath: 4 - Slurry Wall
249.40    4624.00      252.40    4624.00
Profile: 6 (2 points)  Material beneath: 5 - Clay
0.00      4572.00      249.40    4572.00
Profile: 7 (2 points)  Material beneath: 5 - Clay
252.40    4572.00      600.00    4572.00
Profile: 8 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4568.00      249.40    4568.00
Profile: 9 (2 points)  Material beneath: 1 - Sand and Gravel
252.40    4568.00      600.00    4568.00
Profile: 10 (2 points) Material beneath: 2 - Weathered Bedrock
0.00      4551.80      600.00    4551.80
Profile: 11 (2 points) Material beneath: 3 - Stable Bedrock
0.00      4548.80      600.00    4548.80

```

Slope Surface (10 points)

```

-----
0.00      4551.80      88.40    4551.80      232.80    4624.00      308.20    4624.00      388.20    4664.00
438.30    4667.00      462.10    4664.80      548.30    4648.30      555.60    4647.00      600.00    4645.80

```

Derr TR8 SS1-EQ.gar

Phreatic Surface (5 points)

0.00 4551.80 88.40 4551.80 249.40 4551.80 252.40 4622.00 600.00 4622.00

Failure Surface

Initial circular surface for critical search defined by: XL, XR, R
Intersects: XL: 88.40 YL: 4551.80 XR: 553.30 YR: 4647.41
Centre: XC: 166.95 YC: 5347.93 Radius: R: 800.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.070

Variable Restraints

Parameter descriptor: XL XR R
Range of variation: 10.00 10.00 300.00
Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case SS-1 - Pseudo-Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.777

Analysis Summary

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There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.59

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	92.87	4554.04	548.30	4648.30	180.42	5278.36	729.59	1.588	<-- Critical Surface
2	93.40	4554.30	548.30	4648.30	182.20	5272.30	723.47	1.589	
3	93.40	4554.30	548.83	4648.21	182.76	5272.23	723.47	1.590	
4	93.40	4554.30	550.41	4647.92	183.16	5278.35	729.59	1.593	
5	92.87	4554.04	549.88	4648.02	180.83	5284.47	735.71	1.593	
6	92.35	4553.77	549.35	4648.11	178.49	5290.59	741.84	1.594	
7	91.82	4553.51	548.83	4648.21	176.14	5296.70	747.96	1.595	
8	92.87	4554.04	549.35	4648.11	180.26	5284.54	735.71	1.596	
9	92.35	4553.77	548.83	4648.21	177.91	5290.66	741.84	1.597	
10	93.40	4554.30	549.35	4648.11	182.02	5278.49	729.59	1.597	
11	93.40	4554.30	551.98	4647.64	183.57	5284.47	735.71	1.597	
12	92.87	4554.04	548.83	4648.21	179.69	5284.61	735.71	1.599	
13	92.35	4553.77	550.93	4647.83	178.91	5296.71	747.96	1.599	
14	91.82	4553.51	550.41	4647.92	176.56	5302.82	754.08	1.600	
15	93.40	4554.30	548.83	4648.21	181.46	5278.56	729.59	1.600	
16	92.87	4554.04	550.93	4647.83	180.67	5290.66	741.84	1.601	
17	93.40	4554.30	549.88	4648.02	182.59	5278.42	729.59	1.601	
18	91.82	4553.51	548.30	4648.30	175.56	5296.77	747.96	1.601	

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19	92.35	4553.77	550.41	4647.92	178.33	5296.77	747.96	1.602
20	93.40	4554.30	555.14	4647.08	184.42	5296.70	747.96	1.602
21	93.40	4554.30	550.93	4647.83	182.43	5284.61	735.71	1.602
22	93.40	4554.30	551.46	4647.74	183.00	5284.54	735.71	1.603
23	91.29	4553.25	549.35	4648.11	173.63	5308.98	760.20	1.603
24	92.87	4554.04	550.41	4647.92	180.10	5290.73	741.84	1.603
25	92.35	4553.77	552.51	4647.55	179.34	5302.82	754.08	1.603
26	92.35	4553.77	548.30	4648.30	177.34	5290.73	741.84	1.604
27	92.87	4554.04	551.46	4647.74	181.24	5290.59	741.84	1.604
28	93.40	4554.30	553.04	4647.46	183.42	5290.65	741.84	1.605
29	93.40	4554.30	550.41	4647.92	181.86	5284.68	735.71	1.605
30	92.87	4554.04	552.51	4647.55	181.09	5296.77	747.96	1.605
31	92.87	4554.04	553.04	4647.46	181.67	5296.71	747.96	1.606
32	91.82	4553.51	549.35	4648.11	175.41	5302.94	754.08	1.606
33	93.40	4554.30	553.56	4647.36	183.99	5290.58	741.84	1.606
34	92.35	4553.77	551.98	4647.64	178.76	5302.89	754.08	1.606
35	91.29	4553.25	548.83	4648.21	173.05	5309.04	760.20	1.606
36	92.87	4554.04	548.30	4648.30	179.12	5284.68	735.71	1.607
37	91.82	4553.51	549.88	4648.02	175.99	5302.88	754.08	1.607
38	92.87	4554.04	554.62	4647.18	182.10	5302.82	754.08	1.608
39	90.77	4552.98	548.30	4648.30	170.69	5315.13	766.33	1.608
40	92.35	4553.77	554.09	4647.27	179.78	5308.93	760.20	1.608
41	93.40	4554.30	549.88	4648.02	181.29	5284.75	735.71	1.608
42	92.87	4554.04	551.98	4647.64	180.52	5296.84	747.96	1.608
43	91.82	4553.51	548.83	4648.21	174.83	5303.01	754.08	1.608
44	92.35	4553.77	549.35	4648.11	177.18	5296.91	747.96	1.609
45	91.29	4553.25	550.93	4647.83	174.07	5315.09	766.33	1.609
46	93.40	4554.30	548.30	4648.30	180.89	5278.63	729.59	1.610
47	92.35	4553.77	549.88	4648.02	177.76	5296.84	747.96	1.610
48	93.40	4554.30	551.98	4647.64	182.28	5290.79	741.84	1.610
49	92.35	4553.77	548.83	4648.21	176.61	5296.97	747.96	1.610
50	91.29	4553.25	550.41	4647.92	173.49	5315.15	766.33	1.611
51	91.29	4553.25	548.30	4648.30	172.47	5309.10	760.20	1.611
52	92.35	4553.77	553.56	4647.36	179.20	5309.00	760.20	1.611
53	92.87	4554.04	551.46	4647.74	179.95	5296.91	747.96	1.611
54	93.40	4554.30	556.72	4646.97	184.61	5302.85	754.08	1.611
55	91.82	4553.51	553.04	4647.46	176.87	5315.10	766.33	1.611
56	92.87	4554.04	549.35	4648.11	178.95	5290.86	741.84	1.611
57	93.40	4554.30	554.62	4647.18	183.85	5296.77	747.96	1.612
58	91.82	4553.51	550.93	4647.83	175.84	5309.06	760.20	1.612
59	92.87	4554.04	548.83	4648.21	178.38	5290.93	741.84	1.612
60	90.77	4552.98	549.88	4648.02	171.13	5321.24	772.45	1.612
61	91.82	4553.51	550.41	4647.92	175.27	5309.12	760.20	1.613
62	91.82	4553.51	548.30	4648.30	174.25	5303.07	754.08	1.613
63	92.87	4554.04	549.88	4648.02	179.53	5290.79	741.84	1.613
64	92.87	4554.04	553.56	4647.36	180.96	5302.96	754.08	1.613
65	93.40	4554.30	552.51	4647.55	182.85	5290.72	741.84	1.613
66	93.40	4554.30	551.46	4647.74	181.71	5290.86	741.84	1.613
67	91.82	4553.51	551.46	4647.74	176.42	5308.99	760.20	1.613
68	92.35	4553.77	553.04	4647.46	178.63	5309.07	760.20	1.613
69	93.40	4554.30	548.83	4648.21	180.15	5284.88	735.71	1.614
70	92.87	4554.04	548.83	4648.21	180.99	5278.29	729.59	1.614
71	91.29	4553.25	551.98	4647.64	173.94	5321.26	772.45	1.614
72	91.82	4553.51	551.98	4647.64	177.00	5308.93	760.20	1.614
73	93.40	4554.30	554.09	4647.27	183.28	5296.84	747.96	1.614
74	93.40	4554.30	549.35	4648.11	180.72	5284.81	735.71	1.614
75	92.35	4553.77	550.93	4647.83	177.61	5303.02	754.08	1.614
76	92.35	4553.77	550.41	4647.92	177.04	5303.08	754.08	1.615
77	91.29	4553.25	549.88	4648.02	172.91	5315.21	766.33	1.615

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78	92.87	4554.04	556.19	4646.98	182.41	5308.95	760.20	1.615
79	92.35	4553.77	548.30	4648.30	176.03	5297.04	747.96	1.615
80	93.40	4554.30	553.56	4647.36	182.71	5296.91	747.96	1.615
81	92.87	4554.04	554.09	4647.27	181.53	5302.89	754.08	1.615
82	92.35	4553.77	555.14	4647.08	179.65	5315.11	766.33	1.615
83	91.82	4553.51	554.62	4647.18	177.32	5321.21	772.45	1.616
84	92.87	4554.04	553.04	4647.46	180.38	5303.02	754.08	1.616
85	92.35	4553.77	551.46	4647.74	178.19	5302.95	754.08	1.616
86	90.77	4552.98	551.46	4647.74	171.59	5327.35	778.57	1.616
87	91.82	4553.51	551.98	4647.64	175.71	5315.23	766.33	1.617
88	92.87	4554.04	550.41	4647.92	178.80	5297.04	747.96	1.617
89	90.24	4552.72	548.83	4648.21	168.18	5327.38	778.57	1.617
90	92.87	4554.04	548.30	4648.30	177.81	5291.00	741.84	1.617
91	90.77	4552.98	549.35	4648.11	170.55	5321.30	772.45	1.617
92	93.40	4554.30	549.35	4648.11	183.33	5272.16	723.47	1.617
93	91.82	4553.51	549.88	4648.02	174.69	5309.18	760.20	1.617
94	92.87	4554.04	550.93	4647.83	179.38	5296.98	747.96	1.617
95	92.87	4554.04	555.67	4647.00	181.96	5309.00	760.20	1.618
96	92.35	4553.77	555.67	4647.00	180.21	5315.05	766.33	1.618
97	92.87	4554.04	555.14	4647.08	181.40	5309.07	760.20	1.618
98	91.82	4553.51	552.51	4647.55	176.29	5315.17	766.33	1.618
99	93.40	4554.30	558.30	4646.93	184.71	5309.00	760.20	1.618

Critical Failure Surface (circle 1)

Intersects: XL: 92.87 YL: 4554.04 XR: 548.30 YR: 4648.30
Centre: XC: 180.42 YC: 5278.36 Radius: R: 729.59

Generated failure surface: (20 points)

92.87	4554.04	117.65	4551.47	142.50	4549.75	167.40	4548.88	192.31	4548.86
217.21	4549.69	242.06	4551.37	266.85	4553.90	291.53	4557.27	316.08	4561.49
340.47	4566.54	364.68	4572.42	388.68	4579.12	412.43	4586.63	435.91	4594.96
459.09	4604.08	481.94	4613.98	504.45	4624.67	526.58	4636.11	548.30	4648.30

Slice Geometry and Properties - Critical Failure Surface (circle 1, 49 slices)

Slice	X-Left	X-S	Angle	Width	Length	Matl	Cohesion	Phi	Weight	PoreWater	Normal	Test
		Area								Force	Stress	Factor
1	92.87	35.18	-5.9	10.80	10.85	1	0.00	35.0	4397.21	0.00	426.78	1.05
2	103.67	105.53	-5.9	10.80	10.85	1	0.00	35.0	13191.62	0.00	1280.37	1.05
3	114.47	44.59	-5.9	3.19	3.20	2	100.00	18.0	5582.37	32.99	1796.36	1.03
4	117.65	49.90	-4.0	3.15	3.16	2	100.00	18.0	6259.18	86.42	2021.11	1.02
5	120.80	152.20	-4.0	8.00	8.02	2	100.00	18.0	19226.39	412.68	2441.48	1.02
6	128.80	345.37	-4.0	13.70	13.74	2	100.00	18.0	43845.68	1350.25	3248.37	1.02
7	142.50	403.70	-2.0	12.45	12.46	2	100.00	18.0	51213.30	1761.68	4144.99	1.01
8	154.95	486.60	-2.0	12.45	12.46	2	100.00	18.0	61661.69	2099.82	4990.16	1.01
9	167.40	567.21	-0.0	12.46	12.46	2	100.00	18.0	71782.48	2272.50	5763.99	1.00
10	179.86	644.90	-0.0	12.46	12.46	2	100.00	18.0	81496.30	2280.08	6543.99	1.00
11	192.31	719.53	1.9	12.45	12.46	2	100.00	18.0	90783.62	2122.59	7242.20	0.99
12	204.76	791.84	1.9	12.45	12.46	2	100.00	18.0	99739.67	1799.63	7956.57	0.99
13	217.21	531.62	3.9	7.80	7.81	2	100.00	18.0	66869.22	898.90	8458.40	0.99
14	225.00	557.89	3.9	7.80	7.81	2	100.00	18.0	70088.20	642.03	8865.38	0.99
15	232.80	675.69	3.9	9.26	9.28	2	100.00	18.0	84793.30	428.59	9024.82	0.99
16	242.06	302.91	5.8	4.18	4.20	2	100.00	18.0	37978.74	55.99	8887.42	0.98
17	246.25	227.16	5.8	3.15	3.17	1	0.00	35.0	28470.46	0.00	8640.13	0.96
18	249.40	215.18	5.8	3.00	3.02	4	0.00	45.0	23669.44	6515.56	7543.83	0.94
19	252.40	1023.31	5.8	14.45	14.52	1	0.00	35.0	128260.92	62373.88	8681.14	0.96
20	266.85	854.68	7.8	12.34	12.46	1	0.00	35.0	107131.02	52273.19	8426.04	0.95
21	279.19	833.87	7.8	12.34	12.46	1	0.00	35.0	104530.10	50962.48	8221.35	0.95
22	291.53	550.26	9.7	8.34	8.46	1	0.00	35.0	68981.98	33782.45	7974.12	0.94

Derr TR8 SS1-EQ.gar

23	299.86	538.34	9.7	8.34	8.46	1	0.00	35.0	67492.02	33027.45	7801.75	0.94
24	308.20	513.50	9.7	7.88	8.00	1	0.00	35.0	64376.43	30529.88	7862.78	0.94
25	316.08	545.11	11.7	8.06	8.23	1	0.00	35.0	68331.62	30649.79	8080.62	0.94
26	324.14	564.14	11.7	8.06	8.23	1	0.00	35.0	70711.05	29793.15	8342.45	0.94
27	332.20	599.02	11.7	8.27	8.45	1	0.00	35.0	75178.52	29697.93	8619.08	0.94
28	340.47	448.33	13.7	6.03	6.20	1	0.00	35.0	56389.63	21184.96	8780.35	0.93
29	346.50	740.85	13.7	9.70	9.98	5	150.00	22.0	93327.47	32892.18	9234.25	0.97
30	356.20	531.84	13.7	6.77	6.97	5	150.00	22.0	67000.50	22105.65	9478.67	0.97
31	362.97	905.83	15.3	11.23	11.64	1	0.00	35.0	114036.85	35221.71	9389.60	0.93
32	374.20	1168.60	15.6	14.00	14.54	1	0.00	35.0	147376.59	40790.75	9680.15	0.92
33	388.20	1011.16	17.5	12.11	12.70	1	0.00	35.0	127802.71	32582.87	9577.00	0.92
34	400.31	973.51	17.6	12.11	12.71	1	0.00	35.0	123148.68	29557.57	9206.51	0.92
35	412.43	904.98	19.5	11.74	12.46	1	0.00	35.0	114588.17	25869.78	8721.90	0.92
36	424.17	864.38	19.5	11.74	12.46	1	0.00	35.0	109561.98	22635.60	8316.42	0.92
37	435.91	171.23	21.5	2.39	2.57	1	0.00	35.0	21718.64	4267.05	7973.08	0.92
38	438.30	712.72	21.5	10.39	11.17	1	0.00	35.0	90431.73	16764.69	7636.51	0.92
39	448.69	660.23	21.5	10.39	11.17	1	0.00	35.0	83811.29	13915.05	7055.97	0.92
40	459.09	181.43	23.4	3.01	3.28	1	0.00	35.0	23039.33	3539.12	6591.65	0.91
41	462.10	558.75	23.4	9.92	10.81	1	0.00	35.0	70966.02	9760.87	6149.80	0.91
42	472.02	497.25	23.4	9.92	10.81	1	0.00	35.0	63164.80	6859.37	5446.52	0.91
43	481.94	373.29	25.4	8.44	9.35	1	0.00	35.0	47431.13	3506.47	4709.61	0.92
44	490.39	325.80	25.4	8.44	9.35	1	0.00	35.0	41412.33	1168.83	4076.92	0.92
45	498.83	138.26	25.4	4.02	4.44	1	0.00	35.0	17580.67	0.00	3620.46	0.92
46	502.85	340.98	27.1	11.76	13.21	1	0.00	35.0	43468.87	0.00	3016.33	0.92
47	514.61	243.00	27.3	11.76	13.24	1	0.00	35.0	31221.30	0.00	2161.98	0.92
48	526.37	133.54	29.3	10.70	12.26	5	150.00	22.0	17270.55	0.00	1366.41	1.00
49	537.07	47.49	29.3	11.23	12.88	5	150.00	22.0	6128.63	0.00	430.99	1.00

X-S Area:

24812.63

Path Length:

473.31

X-S Weight:

3126920.50

Project: Derr Pit Technical Revision 8
File: C:\Galena Models\Derr TR8 SS2.gmf

Processed: 07 Apr 2023 09:58:06

DATA: Analysis 1 - Case SS-2 - Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion Phi UnitWeight Ru
0.00 35.0 125.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion Phi UnitWeight Ru
100.00 18.0 141.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion Phi UnitWeight Ru
2000.00 20.0 141.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion Phi UnitWeight Ru
0.00 45.0 110.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion Phi UnitWeight Ru
150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (11 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
0.00 4667.00 500.00 4667.00
Profile: 2 (2 points) Material beneath: 1 - Sand and Gravel
0.00 4659.00 500.00 4659.00
Profile: 3 (2 points) Material beneath: 5 - Clay
0.00 4650.00 500.00 4650.00
Profile: 4 (2 points) Material beneath: 1 - Sand and Gravel
0.00 4638.00 500.00 4638.00
Profile: 5 (2 points) Material beneath: 4 - Slurry Wall
250.30 4624.30 253.30 4624.30
Profile: 6 (2 points) Material beneath: 5 - Clay
0.00 4574.00 250.30 4574.00
Profile: 7 (2 points) Material beneath: 5 - Clay
253.30 4574.00 500.00 4574.00
Profile: 8 (2 points) Material beneath: 1 - Sand and Gravel
0.00 4570.00 250.30 4570.00
Profile: 9 (2 points) Material beneath: 1 - Sand and Gravel
253.30 4570.00 500.00 4570.00
Profile: 10 (5 points) Material beneath: 2 - Weathered Bedrock
0.00 4551.30 89.40 4552.10 197.30 4553.30 371.80 4558.40 500.00 4558.70
Profile: 11 (5 points) Material beneath: 3 - Stable Bedrock
0.00 4548.30 89.40 4549.10 197.30 4550.30 371.80 4555.40 500.00 4555.40

Slope Surface (9 points)

0.00 4551.30 89.40 4552.10 233.80 4624.30 310.50 4624.30 394.20 4666.10
449.20 4666.30 466.80 4666.60 472.50 4666.80 500.00 4666.80

Phreatic Surface (6 points)

```

-----
      0.00    4551.30      89.40    4552.10      197.30    4553.30      250.30    4554.90      253.30    4622.00
    500.00    4622.00

```

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

```

Intersects: XL:      89.40    YL:    4552.10    XR:    471.80    YR:    4666.78
Centre:  XC:    148.92    YC:    5048.54    Radius:  R:    500.00

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Variable Restraints

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Parameter descriptor:      XL      XR      R
Range of variation:    10.00    10.00    300.00
Trial positions within range:  20      20      50

```

RESULTS: Analysis 1 - Case SS-2 - Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.918

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.68

Results Summary - Lowest 99 Factor of Safety circles

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Circle  X-Left  Y-Left  X-Right  Y-Right  X-Centre  Y-Centre  Radius  FoS
1       93.87   4554.34   466.80   4666.60   158.20    5016.21   466.33   1.679  <-- Critical Surface
2       94.40   4554.60   468.91   4666.67   160.27    5016.25   466.33   1.683
3       94.40   4554.60   466.80   4666.60   160.47    5010.04   460.20   1.683
4       94.40   4554.60   469.43   4666.69   160.70    5016.19   466.33   1.684
5       94.40   4554.60   468.38   4666.66   159.83    5016.31   466.33   1.685
6       93.35   4554.07   467.33   4666.62   156.36    5022.30   472.45   1.686
7       93.87   4554.34   469.43   4666.69   158.44    5022.35   472.45   1.686
8       93.87   4554.34   472.59   4666.80   159.14    5028.44   478.57   1.688
9       94.40   4554.60   471.54   4666.77   160.52    5022.40   472.45   1.689
10      93.87   4554.34   469.96   4666.71   158.88    5022.29   472.45   1.690
11      94.40   4554.60   472.06   4666.78   160.95    5022.34   472.45   1.690
12      94.40   4554.60   467.85   4666.64   159.40    5016.37   466.33   1.690
13      93.35   4554.07   466.80   4666.60   155.93    5022.36   472.45   1.691
14      93.87   4554.34   468.91   4666.67   158.01    5022.41   472.45   1.692
15      93.35   4554.07   469.96   4666.71   156.62    5028.44   478.57   1.692
16      94.40   4554.60   471.01   4666.75   160.08    5022.46   472.45   1.693
17      93.87   4554.34   472.06   4666.78   158.70    5028.50   478.57   1.693
18      93.87   4554.34   475.22   4666.80   159.51    5034.57   484.69   1.694
19      94.40   4554.60   474.17   4666.80   160.84    5028.54   478.57   1.695
20      92.82   4553.81   467.33   4666.62   154.10    5028.44   478.57   1.696
21      93.87   4554.34   467.33   4666.62   158.63    5016.15   466.33   1.696

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Derr TR8 SS2.gar

22	94.40	4554.60	467.33	4666.62	158.96	5016.44	466.33	1.696
23	93.87	4554.34	468.38	4666.66	157.57	5022.47	472.45	1.697
24	94.40	4554.60	474.69	4666.80	161.29	5028.47	478.57	1.697
25	93.35	4554.07	469.43	4666.69	156.18	5028.50	478.57	1.697
26	92.82	4553.81	470.48	4666.73	154.80	5034.52	484.69	1.698
27	94.40	4554.60	470.48	4666.73	159.65	5022.52	472.45	1.698
28	93.87	4554.34	471.54	4666.77	158.27	5028.56	478.57	1.699
29	94.40	4554.60	473.64	4666.80	160.38	5028.60	478.57	1.699
30	93.35	4554.07	472.59	4666.80	156.89	5034.58	484.69	1.699
31	93.87	4554.34	474.69	4666.80	159.05	5034.63	484.69	1.699
32	94.40	4554.60	466.80	4666.60	158.53	5016.50	466.33	1.701
33	92.29	4553.55	467.85	4666.64	152.27	5034.52	484.69	1.702
34	93.87	4554.34	467.85	4666.64	157.13	5022.53	472.45	1.702
35	92.82	4553.81	469.96	4666.71	154.36	5034.58	484.69	1.702
36	93.35	4554.07	468.91	4666.67	155.75	5028.56	478.57	1.702
37	92.82	4553.81	467.85	4666.64	154.53	5028.39	478.57	1.702
38	92.82	4553.81	466.80	4666.60	153.66	5028.50	478.57	1.703
39	94.40	4554.60	476.80	4666.80	161.20	5034.67	484.69	1.703
40	94.40	4554.60	469.96	4666.71	159.21	5022.58	472.45	1.703
41	92.82	4553.81	473.12	4666.80	155.11	5040.66	490.82	1.704
42	93.35	4554.07	472.06	4666.78	156.45	5034.64	484.69	1.704
43	93.35	4554.07	475.22	4666.80	157.27	5040.71	490.82	1.704
44	94.40	4554.60	473.12	4666.80	159.93	5028.66	478.57	1.704
45	93.87	4554.34	474.17	4666.80	158.60	5034.69	484.69	1.704
46	93.87	4554.34	471.01	4666.75	157.83	5028.62	478.57	1.705
47	94.40	4554.60	476.27	4666.80	160.75	5034.73	484.69	1.705
48	92.29	4553.55	467.33	4666.62	151.83	5034.57	484.69	1.706
49	93.35	4554.07	468.38	4666.66	155.31	5028.62	478.57	1.707
50	93.87	4554.34	467.33	4666.62	156.69	5022.59	472.45	1.707
51	93.35	4554.07	470.48	4666.73	157.06	5028.39	478.57	1.707
52	93.35	4554.07	473.12	4666.80	157.35	5034.52	484.69	1.708
53	92.29	4553.55	470.48	4666.73	152.55	5040.65	490.82	1.708
54	93.35	4554.07	467.85	4666.64	156.80	5022.24	472.45	1.708
55	91.77	4553.28	467.85	4666.64	150.00	5040.63	490.82	1.708
56	92.82	4553.81	472.59	4666.80	154.65	5040.72	490.82	1.708
57	94.40	4554.60	469.43	4666.69	158.78	5022.64	472.45	1.709
58	92.82	4553.81	475.75	4666.80	155.49	5046.78	496.94	1.709
59	92.82	4553.81	469.43	4666.69	153.92	5034.64	484.69	1.709
60	94.40	4554.60	472.59	4666.80	161.39	5022.28	472.45	1.709
61	93.35	4554.07	471.54	4666.77	156.02	5034.70	484.69	1.709
62	93.87	4554.34	470.48	4666.73	157.39	5028.67	478.57	1.709
63	93.35	4554.07	474.69	4666.80	156.81	5040.77	490.82	1.709
64	92.29	4553.55	466.80	4666.60	151.39	5034.63	484.69	1.710
65	93.87	4554.34	476.80	4666.80	158.98	5040.82	490.82	1.710
66	93.87	4554.34	473.64	4666.80	158.14	5034.75	484.69	1.710
67	94.40	4554.60	475.75	4666.80	160.30	5034.79	484.69	1.710
68	94.40	4554.60	475.22	4666.80	161.74	5028.41	478.57	1.710
69	94.40	4554.60	472.59	4666.80	159.48	5028.73	478.57	1.710
70	92.29	4553.55	469.96	4666.71	152.11	5040.71	490.82	1.712
71	93.87	4554.34	466.80	4666.60	156.26	5022.65	472.45	1.712
72	91.77	4553.28	467.33	4666.62	149.56	5040.69	490.82	1.712
73	92.82	4553.81	468.91	4666.67	153.48	5034.69	484.69	1.713
74	93.35	4554.07	475.75	4666.80	157.73	5040.65	490.82	1.713
75	92.29	4553.55	473.12	4666.80	152.86	5046.78	496.94	1.714
76	92.82	4553.81	475.22	4666.80	155.04	5046.84	496.94	1.714
77	93.35	4554.07	467.85	4666.64	154.87	5028.67	478.57	1.714
78	94.40	4554.60	468.91	4666.67	158.34	5022.70	472.45	1.714
79	93.87	4554.34	469.96	4666.71	156.95	5028.73	478.57	1.714
80	93.35	4554.07	471.01	4666.75	155.58	5034.76	484.69	1.714

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81	91.77	4553.28	470.48	4666.73	150.29	5046.76	496.94	1.714
82	93.35	4554.07	474.17	4666.80	156.36	5040.83	490.82	1.715
83	91.24	4553.02	467.85	4666.64	147.74	5046.74	496.94	1.715
84	92.82	4553.81	472.06	4666.78	154.21	5040.77	490.82	1.715
85	93.87	4554.34	473.12	4666.80	157.69	5034.81	484.69	1.715
86	92.29	4553.55	469.43	4666.69	151.67	5040.76	490.82	1.715
87	93.87	4554.34	476.27	4666.80	158.52	5040.88	490.82	1.715
88	94.40	4554.60	472.06	4666.78	159.04	5028.79	478.57	1.716
89	91.77	4553.28	466.80	4666.60	149.12	5040.74	490.82	1.716
90	94.40	4554.60	475.22	4666.80	159.84	5034.86	484.69	1.716
91	92.82	4553.81	468.38	4666.66	153.04	5034.75	484.69	1.717
92	92.29	4553.55	472.59	4666.80	152.40	5046.84	496.94	1.718
93	91.77	4553.28	469.96	4666.71	149.85	5046.82	496.94	1.718
94	93.35	4554.07	467.33	4666.62	154.43	5028.73	478.57	1.718
95	91.24	4553.02	467.33	4666.62	147.30	5046.79	496.94	1.718
96	93.87	4554.34	469.43	4666.69	156.52	5028.79	478.57	1.719
97	92.29	4553.55	475.75	4666.80	153.26	5052.90	503.06	1.719
98	91.24	4553.02	468.38	4666.66	148.18	5046.69	496.94	1.719
99	94.40	4554.60	468.38	4666.66	157.90	5022.76	472.45	1.719

Critical Failure Surface (circle 1)

Intersects:	XL:	93.87	YL:	4554.34	XR:	466.80	YR:	4666.60						
Centre:	XC:	158.20	YC:	5016.21			Radius:	R:	466.33					
Generated failure surface: (20 points)														
	93.87	4554.34		114.88	4551.90		135.97	4550.41		157.11	4549.88		178.24	4550.31
	199.34	4551.70		220.36	4554.04		241.24	4557.33		261.96	4561.57		282.46	4566.74
	302.71	4572.84		322.66	4579.84		342.27	4587.75		361.50	4596.53		380.31	4606.18
	398.67	4616.67		416.54	4627.98		433.87	4640.09		450.64	4652.97		466.80	4666.60

Slice Geometry and Properties - Critical Failure Surface (circle 1, 48 slices)

Slice	X-S			Base					PoreWater		Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	93.87	22.72	-6.6	8.59	8.65	1	0.00	35.0	2840.37	0.00	347.60	1.06
2	102.46	68.17	-6.6	8.59	8.65	1	0.00	35.0	8521.10	0.00	1042.79	1.06
3	111.05	45.02	-6.6	3.83	3.85	2	100.00	18.0	5642.69	58.70	1514.96	1.03
4	114.88	164.01	-4.0	10.32	10.35	2	100.00	18.0	20651.07	586.82	2031.51	1.02
5	125.20	168.91	-4.0	8.00	8.02	2	100.00	18.0	21421.36	828.61	2717.52	1.02
6	133.20	66.94	-4.0	2.77	2.77	2	100.00	18.0	8527.03	362.78	3125.58	1.02
7	135.97	293.27	-1.4	10.57	10.57	2	100.00	18.0	37318.10	1582.87	3548.95	1.01
8	146.54	351.91	-1.4	10.57	10.57	2	100.00	18.0	44712.39	1834.44	4251.92	1.01
9	157.11	408.07	1.2	10.57	10.57	2	100.00	18.0	51756.41	1928.50	4876.97	1.00
10	167.68	461.65	1.2	10.57	10.57	2	100.00	18.0	58438.41	1864.40	5506.64	1.00
11	178.24	460.00	3.8	9.53	9.55	2	100.00	18.0	58111.78	1499.70	6020.78	0.99
12	187.77	499.41	3.8	9.53	9.55	2	100.00	18.0	62959.64	1189.58	6522.74	0.99
13	197.30	112.23	3.8	2.04	2.05	2	100.00	18.0	14133.08	217.16	6827.99	0.99
14	199.34	578.94	6.4	10.10	10.16	2	100.00	18.0	72811.38	794.04	7053.59	0.98
15	209.44	618.56	6.4	10.10	10.16	2	100.00	18.0	77629.09	273.97	7519.62	0.98
16	219.54	459.78	8.7	7.13	7.21	1	0.00	35.0	57643.43	0.00	7600.77	0.95
17	226.67	477.19	9.0	7.13	7.22	1	0.00	35.0	59819.59	0.00	7871.23	0.95
18	233.80	502.78	9.0	7.44	7.53	1	0.00	35.0	63026.27	0.00	7945.72	0.95
19	241.24	598.14	11.6	9.06	9.24	1	0.00	35.0	74984.65	0.00	7628.49	0.94
20	250.30	194.42	11.6	3.00	3.06	4	0.00	45.0	21386.35	5532.96	6551.17	0.91
21	253.30	550.78	11.6	8.66	8.84	1	0.00	35.0	69055.42	33811.78	7649.82	0.94
22	261.96	629.80	14.2	10.25	10.57	1	0.00	35.0	78970.78	39012.91	7321.73	0.93
23	272.21	603.29	14.2	10.25	10.57	1	0.00	35.0	75657.22	37306.97	7013.89	0.93
24	282.46	605.51	16.8	10.83	11.31	1	0.00	35.0	75948.95	37836.55	6606.00	0.93
25	293.29	498.15	16.8	9.42	9.84	5	150.00	22.0	62415.00	31051.01	6366.29	0.97

Derr TR8 SS2.gar

26	302.71	168.65	19.4	3.31	3.51	5	150.00	22.0	21092.26	10649.50	6075.13	0.98
27	306.02	221.77	19.4	4.48	4.75	1	0.00	35.0	27721.40	13986.09	5774.81	0.92
28	310.50	603.26	19.4	12.16	12.88	1	0.00	35.0	75407.80	35608.52	5764.04	0.92
29	322.66	388.78	21.9	7.64	8.24	1	0.00	35.0	48597.11	20873.62	5811.40	0.92
30	330.29	394.40	22.0	7.64	8.24	1	0.00	35.0	49300.17	19291.97	5862.48	0.92
31	337.93	226.28	21.9	4.33	4.67	1	0.00	35.0	28313.38	10242.63	5908.21	0.92
32	342.27	506.06	24.5	9.62	10.57	1	0.00	35.0	63520.90	21148.72	5868.69	0.92
33	351.88	510.00	24.5	9.62	10.57	1	0.00	35.0	64290.23	18250.93	5892.06	0.92
34	361.50	491.45	27.1	9.24	10.39	1	0.00	35.0	62096.31	14970.65	5789.59	0.93
35	370.74	490.31	27.1	9.24	10.39	1	0.00	35.0	61954.38	11900.30	5724.76	0.93
36	379.98	375.02	29.6	7.11	8.18	1	0.00	35.0	47465.60	7134.73	5564.52	0.93
37	387.09	371.39	29.7	7.11	8.19	1	0.00	35.0	47162.12	5067.93	5476.95	0.93
38	394.20	226.86	29.7	4.47	5.15	1	0.00	35.0	28870.58	2125.09	5291.92	0.93
39	398.67	394.15	32.3	8.42	9.97	1	0.00	35.0	50234.98	1658.69	4753.34	0.94
40	407.10	388.76	32.3	9.44	11.18	1	0.00	35.0	49680.25	0.00	4162.64	0.94
41	416.54	256.12	34.9	7.17	8.75	1	0.00	35.0	32840.93	0.00	3545.88	0.94
42	423.71	220.37	34.9	7.17	8.75	1	0.00	35.0	28372.92	0.00	3063.47	0.94
43	430.88	81.27	34.9	2.99	3.65	5	150.00	22.0	10485.20	0.00	2950.15	1.04
44	433.87	152.80	37.5	6.45	8.13	5	150.00	22.0	19668.18	0.00	2515.61	1.06
45	440.32	120.98	37.5	6.45	8.13	5	150.00	22.0	15500.51	0.00	1970.27	1.06
46	446.77	37.34	37.5	2.43	3.07	1	0.00	35.0	4773.85	0.00	1487.36	0.96
47	449.20	94.39	39.7	8.59	11.16	1	0.00	35.0	12177.98	0.00	1053.41	0.97
48	457.79	33.56	40.1	9.01	11.79	5	150.00	22.0	4396.89	0.00	342.90	1.09

X-S Area: 16193.60 Path Length: 401.73

X-S Weight: 2038305.38

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS2-EQ.gmf

Processed: 07 Apr 2023 09:58:34

DATA: Analysis 1 - Case SS-2 - Pseudo-Static

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0  125.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0  141.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0  141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0  110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion  Phi  UnitWeight  Ru
150.00    22.0  131.00    Auto

```

Water Properties

```

-----
Unit weight of water: 62.400          Unit weight of water/medium above ground: 62.400

```

Material Profiles (11 profiles)

```

-----
Profile: 1 (2 points)  Material beneath: 5 - Clay
0.00  4667.00          500.00  4667.00
Profile: 2 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4659.00          500.00  4659.00
Profile: 3 (2 points)  Material beneath: 5 - Clay
0.00  4650.00          500.00  4650.00
Profile: 4 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4638.00          500.00  4638.00
Profile: 5 (2 points)  Material beneath: 4 - Slurry Wall
250.30  4624.30        253.30  4624.30
Profile: 6 (2 points)  Material beneath: 5 - Clay
0.00  4574.00          250.30  4574.00
Profile: 7 (2 points)  Material beneath: 5 - Clay
253.30  4574.00          500.00  4574.00
Profile: 8 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4570.00          250.30  4570.00
Profile: 9 (2 points)  Material beneath: 1 - Sand and Gravel
253.30  4570.00          500.00  4570.00
Profile: 10 (5 points) Material beneath: 2 - Weathered Bedrock
0.00  4551.30          89.40  4552.10          197.30  4553.30          371.80  4558.40          500.00  4558.70
Profile: 11 (5 points) Material beneath: 3 - Stable Bedrock
0.00  4548.30          89.40  4549.10          197.30  4550.30          371.80  4555.40          500.00  4555.40

```

Slope Surface (9 points)

```

-----
0.00  4551.30          89.40  4552.10          233.80  4624.30          310.50  4624.30          394.20  4666.10
449.20  4666.30          466.80  4666.60          472.50  4666.80          500.00  4666.80

```


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Phreatic Surface (6 points)

```
-----
      0.00    4551.30      89.40    4552.10      197.30    4553.30      250.30    4554.90      253.30    4622.00
    500.00    4622.00
```

Failure Surface

```
-----
Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL:      89.40    YL:    4552.10    XR:    471.80    YR:    4666.78
Centre: XC:    148.92    YC:    5048.54    Radius: R:    500.00
```

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.070

Variable Restraints

```
-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    300.00
Trial positions within range: 20      20      50
```

RESULTS: Analysis 1 - Case SS-2 - Pseudo-Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.523

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.32

Results Summary - Lowest 99 Factor of Safety circles

```
-----
Circle  X-Left  Y-Left  X-Right  Y-Right  X-Centre  Y-Centre  Radius  FoS  <-- Critical Surface
1       93.87   4554.34   466.80   4666.60   158.20    5016.21   466.33   1.325
2       94.40   4554.60   468.91   4666.67   160.27    5016.25   466.33   1.327
3       94.40   4554.60   469.43   4666.69   160.70    5016.19   466.33   1.327
4       94.40   4554.60   466.80   4666.60   160.47    5010.04   460.20   1.328
5       94.40   4554.60   468.38   4666.66   159.83    5016.31   466.33   1.329
6       93.87   4554.34   472.59   4666.80   159.14    5028.44   478.57   1.329
7       93.87   4554.34   469.43   4666.69   158.44    5022.35   472.45   1.329
8       94.40   4554.60   471.54   4666.77   160.52    5022.40   472.45   1.330
9       93.35   4554.07   467.33   4666.62   156.36    5022.30   472.45   1.330
10      94.40   4554.60   472.06   4666.78   160.95    5022.34   472.45   1.331
11      93.87   4554.34   469.96   4666.71   158.88    5022.29   472.45   1.332
12      93.87   4554.34   475.22   4666.80   159.51    5034.57   484.69   1.333
13      94.40   4554.60   467.85   4666.64   159.40    5016.37   466.33   1.334
14      93.87   4554.34   472.06   4666.78   158.70    5028.50   478.57   1.334
15      94.40   4554.60   474.17   4666.80   160.84    5028.54   478.57   1.334
16      94.40   4554.60   471.01   4666.75   160.08    5022.46   472.45   1.334
17      93.87   4554.34   468.91   4666.67   158.01    5022.41   472.45   1.334
```

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18	93.35	4554.07	469.96	4666.71	156.62	5028.44	478.57	1.334
19	93.35	4554.07	466.80	4666.60	155.93	5022.36	472.45	1.335
20	94.40	4554.60	474.69	4666.80	161.29	5028.47	478.57	1.335
21	93.87	4554.34	474.69	4666.80	159.05	5034.63	484.69	1.337
22	94.40	4554.60	473.64	4666.80	160.38	5028.60	478.57	1.337
23	93.35	4554.07	472.59	4666.80	156.89	5034.58	484.69	1.338
24	93.87	4554.34	471.54	4666.77	158.27	5028.56	478.57	1.338
25	94.40	4554.60	467.33	4666.62	158.96	5016.44	466.33	1.338
26	94.40	4554.60	470.48	4666.73	159.65	5022.52	472.45	1.338
27	93.87	4554.34	468.38	4666.66	157.57	5022.47	472.45	1.339
28	93.35	4554.07	469.43	4666.69	156.18	5028.50	478.57	1.339
29	93.87	4554.34	467.33	4666.62	158.63	5016.15	466.33	1.339
30	92.82	4553.81	470.48	4666.73	154.80	5034.52	484.69	1.339
31	94.40	4554.60	476.80	4666.80	161.20	5034.67	484.69	1.339
32	92.82	4553.81	467.33	4666.62	154.10	5028.44	478.57	1.339
33	94.40	4554.60	476.27	4666.80	160.75	5034.73	484.69	1.341
34	93.35	4554.07	475.22	4666.80	157.27	5040.71	490.82	1.341
35	93.87	4554.34	474.17	4666.80	158.60	5034.69	484.69	1.342
36	92.82	4553.81	473.12	4666.80	155.11	5040.66	490.82	1.342
37	94.40	4554.60	473.12	4666.80	159.93	5028.66	478.57	1.342
38	93.35	4554.07	472.06	4666.78	156.45	5034.64	484.69	1.343
39	92.82	4553.81	469.96	4666.71	154.36	5034.58	484.69	1.343
40	94.40	4554.60	469.96	4666.71	159.21	5022.58	472.45	1.343
41	93.35	4554.07	468.91	4666.67	155.75	5028.56	478.57	1.343
42	94.40	4554.60	466.80	4666.60	158.53	5016.50	466.33	1.343
43	93.87	4554.34	467.85	4666.64	157.13	5022.53	472.45	1.343
44	93.87	4554.34	471.01	4666.75	157.83	5028.62	478.57	1.344
45	92.29	4553.55	467.85	4666.64	152.27	5034.52	484.69	1.344
46	92.82	4553.81	467.85	4666.64	154.53	5028.39	478.57	1.344
47	93.87	4554.34	476.80	4666.80	158.98	5040.82	490.82	1.345
48	92.82	4553.81	466.80	4666.60	153.66	5028.50	478.57	1.345
49	92.82	4553.81	475.75	4666.80	155.49	5046.78	496.94	1.345
50	94.40	4554.60	475.75	4666.80	160.30	5034.79	484.69	1.345
51	93.35	4554.07	473.12	4666.80	157.35	5034.52	484.69	1.345
52	94.40	4554.60	475.22	4666.80	161.74	5028.41	478.57	1.346
53	93.35	4554.07	474.69	4666.80	156.81	5040.77	490.82	1.346
54	94.40	4554.60	472.59	4666.80	161.39	5022.28	472.45	1.346
55	92.82	4553.81	472.59	4666.80	154.65	5040.72	490.82	1.346
56	93.87	4554.34	473.64	4666.80	158.14	5034.75	484.69	1.346
57	93.35	4554.07	470.48	4666.73	157.06	5028.39	478.57	1.347
58	93.35	4554.07	471.54	4666.77	156.02	5034.70	484.69	1.347
59	94.40	4554.60	472.59	4666.80	159.48	5028.73	478.57	1.347
60	93.35	4554.07	468.38	4666.66	155.31	5028.62	478.57	1.347
61	92.29	4553.55	467.33	4666.62	151.83	5034.57	484.69	1.347
62	92.29	4553.55	470.48	4666.73	152.55	5040.65	490.82	1.347
63	94.40	4554.60	469.43	4666.69	158.78	5022.64	472.45	1.347
64	93.87	4554.34	467.33	4666.62	156.69	5022.59	472.45	1.348
65	93.87	4554.34	470.48	4666.73	157.39	5028.67	478.57	1.348
66	92.82	4553.81	469.43	4666.69	153.92	5034.64	484.69	1.348
67	93.35	4554.07	475.75	4666.80	157.73	5040.65	490.82	1.348
68	93.35	4554.07	467.85	4666.64	156.80	5022.24	472.45	1.349
69	92.82	4553.81	475.22	4666.80	155.04	5046.84	496.94	1.349
70	93.87	4554.34	476.27	4666.80	158.52	5040.88	490.82	1.349
71	91.77	4553.28	467.85	4666.64	150.00	5040.63	490.82	1.349
72	94.40	4554.60	475.22	4666.80	159.84	5034.86	484.69	1.350
73	93.35	4554.07	474.17	4666.80	156.36	5040.83	490.82	1.350
74	92.29	4553.55	473.12	4666.80	152.86	5046.78	496.94	1.350
75	92.29	4553.55	466.80	4666.60	151.39	5034.63	484.69	1.351
76	92.29	4553.55	469.96	4666.71	152.11	5040.71	490.82	1.351

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77	93.87	4554.34	473.12	4666.80	157.69	5034.81	484.69	1.351
78	93.35	4554.07	471.01	4666.75	155.58	5034.76	484.69	1.352
79	94.40	4554.60	472.06	4666.78	159.04	5028.79	478.57	1.352
80	92.82	4553.81	472.06	4666.78	154.21	5040.77	490.82	1.352
81	93.87	4554.34	469.96	4666.71	156.95	5028.73	478.57	1.352
82	92.82	4553.81	468.91	4666.67	153.48	5034.69	484.69	1.352
83	93.87	4554.34	466.80	4666.60	156.26	5022.65	472.45	1.352
84	94.40	4554.60	468.91	4666.67	158.34	5022.70	472.45	1.352
85	91.77	4553.28	467.33	4666.62	149.56	5040.69	490.82	1.353
86	91.77	4553.28	470.48	4666.73	150.29	5046.76	496.94	1.353
87	93.35	4554.07	476.80	4666.80	156.75	5046.95	496.94	1.353
88	93.35	4554.07	467.85	4666.64	154.87	5028.67	478.57	1.353
89	92.29	4553.55	475.75	4666.80	153.26	5052.90	503.06	1.353
90	92.29	4553.55	472.59	4666.80	152.40	5046.84	496.94	1.354
91	92.29	4553.55	469.43	4666.69	151.67	5040.76	490.82	1.354
92	93.87	4554.34	475.75	4666.80	158.07	5040.94	490.82	1.354
93	93.35	4554.07	473.64	4666.80	155.90	5040.89	490.82	1.355
94	92.82	4553.81	474.69	4666.80	154.58	5046.90	496.94	1.355
95	91.24	4553.02	467.85	4666.64	147.74	5046.74	496.94	1.355
96	94.40	4554.60	474.69	4666.80	159.39	5034.92	484.69	1.355
97	92.82	4553.81	468.38	4666.66	153.04	5034.75	484.69	1.355
98	93.87	4554.34	472.59	4666.80	157.23	5034.87	484.69	1.356
99	91.77	4553.28	473.12	4666.80	150.62	5052.89	503.06	1.356

Critical Failure Surface (circle 1)

Intersects: XL: 93.87 YL: 4554.34 XR: 466.80 YR: 4666.60
Centre: XC: 158.20 YC: 5016.21 Radius: R: 466.33

Generated failure surface: (20 points)

93.87	4554.34	114.88	4551.90	135.97	4550.41	157.11	4549.88	178.24	4550.31
199.34	4551.70	220.36	4554.04	241.24	4557.33	261.96	4561.57	282.46	4566.74
302.71	4572.84	322.66	4579.84	342.27	4587.75	361.50	4596.53	380.31	4606.18
398.67	4616.67	416.54	4627.98	433.87	4640.09	450.64	4652.97	466.80	4666.60

Slice Geometry and Properties - Critical Failure Surface (circle 1, 48 slices)

Slice	X-S		Base						PoreWater	Normal	Test	
	X-Left	Area	Angle	Width	Length	Mat'l	Cohesion	Phi	Weight	Force	Stress	Factor
1	93.87	22.72	-6.6	8.59	8.65	1	0.00	35.0	2840.37	0.00	352.39	1.07
2	102.46	68.17	-6.6	8.59	8.65	1	0.00	35.0	8521.10	0.00	1057.18	1.07
3	111.05	45.02	-6.6	3.83	3.85	2	100.00	18.0	5642.69	58.70	1526.15	1.04
4	114.88	164.01	-4.0	10.32	10.35	2	100.00	18.0	20651.07	586.82	2039.97	1.02
5	125.20	168.91	-4.0	8.00	8.02	2	100.00	18.0	21421.36	828.61	2728.36	1.02
6	133.20	66.94	-4.0	2.77	2.77	2	100.00	18.0	8527.03	362.78	3137.82	1.02
7	135.97	293.27	-1.4	10.57	10.57	2	100.00	18.0	37318.10	1582.87	3553.77	1.01
8	146.54	351.91	-1.4	10.57	10.57	2	100.00	18.0	44712.39	1834.44	4257.63	1.01
9	157.11	408.07	1.2	10.57	10.57	2	100.00	18.0	51756.41	1928.50	4871.74	1.00
10	167.68	461.65	1.2	10.57	10.57	2	100.00	18.0	58438.41	1864.40	5500.75	1.00
11	178.24	460.00	3.8	9.53	9.55	2	100.00	18.0	58111.78	1499.70	6000.13	0.99
12	187.77	499.41	3.8	9.53	9.55	2	100.00	18.0	62959.64	1189.58	6500.28	0.99
13	197.30	112.23	3.8	2.04	2.05	2	100.00	18.0	14133.08	217.16	6804.48	0.99
14	199.34	578.94	6.4	10.10	10.16	2	100.00	18.0	72811.38	794.04	7012.71	0.98
15	209.44	618.56	6.4	10.10	10.16	2	100.00	18.0	77629.09	273.97	7475.85	0.98
16	219.54	459.78	8.7	7.13	7.21	1	0.00	35.0	57643.43	0.00	7481.32	0.94
17	226.67	477.19	9.0	7.13	7.22	1	0.00	35.0	59819.59	0.00	7743.52	0.93
18	233.80	502.78	9.0	7.44	7.53	1	0.00	35.0	63026.27	0.00	7816.84	0.93
19	241.24	598.14	11.6	9.06	9.24	1	0.00	35.0	74984.65	0.00	7471.58	0.92
20	250.30	194.42	11.6	3.00	3.06	4	0.00	45.0	21386.35	5532.96	6417.43	0.88
21	253.30	550.78	11.6	8.66	8.84	1	0.00	35.0	69055.42	33811.78	7571.17	0.92

Derr TR8 SS2-EQ.gar

22	261.96	629.80	14.2	10.25	10.57	1	0.00	35.0	78970.78	39012.91	7231.65	0.91
23	272.21	603.29	14.2	10.25	10.57	1	0.00	35.0	75657.22	37306.97	6927.44	0.91
24	282.46	605.51	16.8	10.83	11.31	1	0.00	35.0	75948.95	37836.55	6511.64	0.90
25	293.29	498.15	16.8	9.42	9.84	5	150.00	22.0	62415.00	31051.01	6302.79	0.96
26	302.71	168.65	19.4	3.31	3.51	5	150.00	22.0	21092.26	10649.50	6005.46	0.96
27	306.02	221.77	19.4	4.48	4.75	1	0.00	35.0	27721.40	13986.09	5681.40	0.89
28	310.50	603.26	19.4	12.16	12.88	1	0.00	35.0	75407.80	35608.52	5664.98	0.89
29	322.66	388.78	21.9	7.64	8.24	1	0.00	35.0	48597.11	20873.62	5690.07	0.89
30	330.29	394.40	22.0	7.64	8.24	1	0.00	35.0	49300.17	19291.97	5732.12	0.89
31	337.93	226.28	21.9	4.33	4.67	1	0.00	35.0	28313.38	10242.63	5770.59	0.89
32	342.27	506.06	24.5	9.62	10.57	1	0.00	35.0	63520.90	21148.72	5710.06	0.89
33	351.88	510.00	24.5	9.62	10.57	1	0.00	35.0	64290.23	18250.93	5721.23	0.89
34	361.50	491.45	27.1	9.24	10.39	1	0.00	35.0	62096.31	14970.65	5594.09	0.88
35	370.74	490.31	27.1	9.24	10.39	1	0.00	35.0	61954.38	11900.30	5518.86	0.88
36	379.98	375.02	29.6	7.11	8.18	1	0.00	35.0	47465.60	7134.73	5335.85	0.88
37	387.09	371.39	29.7	7.11	8.19	1	0.00	35.0	47162.12	5067.93	5239.31	0.88
38	394.20	226.86	29.7	4.47	5.15	1	0.00	35.0	28870.58	2125.09	5053.26	0.88
39	398.67	394.15	32.3	8.42	9.97	1	0.00	35.0	50234.98	1658.69	4510.78	0.89
40	407.10	388.76	32.3	9.44	11.18	1	0.00	35.0	49680.25	0.00	3942.52	0.89
41	416.54	256.12	34.9	7.17	8.75	1	0.00	35.0	32840.93	0.00	3344.22	0.89
42	423.71	220.37	34.9	7.17	8.75	1	0.00	35.0	28372.92	0.00	2889.25	0.89
43	430.88	81.27	34.9	2.99	3.65	5	150.00	22.0	10485.20	0.00	2827.13	1.01
44	433.87	152.80	37.5	6.45	8.13	5	150.00	22.0	19668.18	0.00	2400.03	1.02
45	440.32	120.98	37.5	6.45	8.13	5	150.00	22.0	15500.51	0.00	1876.53	1.02
46	446.77	37.34	37.5	2.43	3.07	1	0.00	35.0	4773.85	0.00	1396.77	0.90
47	449.20	94.39	39.7	8.59	11.16	1	0.00	35.0	12177.98	0.00	985.63	0.90
48	457.79	33.56	40.1	9.01	11.79	5	150.00	22.0	4396.89	0.00	312.10	1.04

X-S Area:

16193.60

Path Length:

401.73

X-S Weight:

2038305.38

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS3.gmf

Processed: 07 Apr 2023 10:01:39

DATA: Analysis 1 - Case SS-3 - Static

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0  125.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0  141.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0  141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0  110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion  Phi  UnitWeight  Ru
150.00    22.0  131.00    Auto

```

Water Properties

```

-----
Unit weight of water: 62.400          Unit weight of water/medium above ground: 62.400

```

Material Profiles (9 profiles)

```

-----
Profile: 1 (2 points)  Material beneath: 5 - Clay
0.00      4668.00      600.00    4668.00
Profile: 2 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4661.00      600.00    4661.00
Profile: 3 (2 points)  Material beneath: 5 - Clay
0.00      4651.00      600.00    4651.00
Profile: 4 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4643.00      600.00    4643.00
Profile: 5 (2 points)  Material beneath: 5 - Clay
0.00      4635.00      600.00    4635.00
Profile: 6 (2 points)  Material beneath: 1 - Sand and Gravel
0.00      4629.00      600.00    4629.00
Profile: 7 (2 points)  Material beneath: 4 - Slurry Wall
285.30    4625.90      288.30    4625.90
Profile: 8 (4 points)  Material beneath: 2 - Weathered Bedrock
0.00      4552.90      123.20    4553.00      285.30    4553.50      600.00    4553.50
Profile: 9 (3 points)  Material beneath: 3 - Stable Bedrock
0.00      4550.00      285.30    4550.50      600.00    4550.50

```

Slope Surface (7 points)

```

-----
0.00      4552.90      123.20    4553.10      268.70    4625.90      345.30    4625.90      428.90    4667.60
564.00    4667.70      600.00    4667.80

```

Phreatic Surface (5 points)

```

-----
0.00      4552.90      123.10    4553.10      285.30    4553.50      288.30    4623.00      600.00    4623.00

```

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 123.20 YL: 4553.10 XR: 569.00 YR: 4667.71
 Centre: XC: 181.49 YC: 5250.67 Radius: R: 700.00

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 300.00
 Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case SS-3 - Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.015

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.92

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	128.20	4555.60	566.11	4667.71	207.95	5155.43	605.10	1.919	<-- Critical Surface
2	128.20	4555.60	564.00	4667.70	207.81	5149.27	598.98	1.923	
3	128.20	4555.60	565.58	4667.70	207.50	5155.48	605.10	1.923	
4	127.67	4555.34	565.58	4667.70	205.48	5161.59	611.22	1.926	
5	128.20	4555.60	565.05	4667.70	207.06	5155.54	605.10	1.927	
6	127.15	4555.08	565.58	4667.70	203.45	5167.69	617.35	1.929	
7	128.20	4555.60	568.21	4667.71	208.09	5161.58	611.22	1.930	
8	127.67	4555.34	565.05	4667.70	205.03	5161.65	611.22	1.930	
9	128.20	4555.60	564.53	4667.70	206.61	5155.60	605.10	1.930	
10	127.15	4555.08	565.05	4667.70	203.01	5167.74	617.35	1.933	
11	127.67	4555.34	566.11	4667.71	205.92	5161.53	611.22	1.933	
12	127.67	4555.34	568.21	4667.71	206.07	5167.69	617.35	1.933	
13	127.67	4555.34	564.53	4667.70	204.59	5161.70	611.22	1.933	
14	128.20	4555.60	567.68	4667.71	207.65	5161.64	611.22	1.933	
15	128.20	4555.60	564.00	4667.70	206.17	5155.66	605.10	1.934	
16	126.62	4554.81	565.05	4667.70	200.98	5173.83	623.47	1.934	
17	127.15	4555.08	564.53	4667.70	202.56	5167.80	617.35	1.936	
18	127.67	4555.34	567.68	4667.71	205.63	5167.74	617.35	1.936	
19	127.67	4555.34	564.00	4667.70	204.14	5161.76	611.22	1.937	
20	128.20	4555.60	567.16	4667.71	207.20	5161.70	611.22	1.937	
21	126.62	4554.81	564.53	4667.70	200.53	5173.88	623.47	1.937	
22	127.67	4555.34	564.00	4667.70	205.78	5155.38	605.10	1.938	
23	127.15	4555.08	564.00	4667.70	202.11	5167.85	617.35	1.939	
24	126.09	4554.55	564.53	4667.70	198.50	5179.96	629.59	1.939	
25	127.15	4555.08	567.68	4667.71	203.61	5173.84	623.47	1.939	
26	128.20	4555.60	568.74	4667.71	208.53	5161.52	611.22	1.939	

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27	127.67	4555.34	567.16	4667.71	205.18	5167.80	617.35	1.940
28	128.20	4555.60	570.32	4667.72	208.24	5167.74	617.35	1.940
29	126.62	4554.81	564.00	4667.70	200.08	5173.94	623.47	1.940
30	128.20	4555.60	566.63	4667.71	206.76	5161.76	611.22	1.941
31	126.62	4554.81	567.68	4667.71	201.59	5179.92	629.59	1.941
32	126.09	4554.55	564.00	4667.70	198.05	5180.01	629.59	1.941
33	128.20	4555.60	570.84	4667.72	208.69	5167.68	617.35	1.942
34	127.15	4555.08	567.16	4667.71	203.16	5173.89	623.47	1.942
35	125.57	4554.29	564.00	4667.70	196.02	5186.08	635.71	1.942
36	128.20	4555.60	573.47	4667.73	209.29	5173.78	623.47	1.943
37	127.67	4555.34	570.32	4667.72	206.23	5173.84	623.47	1.943
38	127.67	4555.34	566.63	4667.71	204.74	5167.86	617.35	1.943
39	128.20	4555.60	569.79	4667.72	207.80	5167.80	617.35	1.944
40	126.62	4554.81	567.16	4667.71	201.14	5179.98	629.59	1.944
41	128.20	4555.60	566.11	4667.71	206.31	5161.81	611.22	1.944
42	126.09	4554.55	567.16	4667.71	199.12	5186.05	635.71	1.945
43	127.15	4555.08	566.63	4667.71	202.72	5173.95	623.47	1.945
44	127.15	4555.08	570.32	4667.72	204.22	5179.93	629.59	1.945
45	127.67	4555.34	569.79	4667.72	205.79	5173.90	623.47	1.946
46	127.67	4555.34	566.11	4667.71	204.29	5167.91	617.35	1.947
47	126.62	4554.81	565.58	4667.70	201.43	5173.78	623.47	1.947
48	126.62	4554.81	566.63	4667.71	200.69	5180.03	629.59	1.947
49	126.09	4554.55	565.05	4667.70	198.95	5179.91	629.59	1.947
50	128.20	4555.60	569.26	4667.71	207.35	5167.85	617.35	1.947
51	127.15	4555.08	568.21	4667.71	204.06	5173.78	623.47	1.947
52	128.20	4555.60	565.58	4667.70	205.87	5161.87	611.22	1.948
53	126.09	4554.55	566.63	4667.71	198.67	5186.11	635.71	1.948
54	127.67	4555.34	570.84	4667.72	206.68	5173.78	623.47	1.948
55	127.15	4555.08	566.11	4667.71	202.27	5174.00	623.47	1.948
56	127.15	4555.08	569.79	4667.72	203.78	5179.99	629.59	1.949
57	125.57	4554.29	566.63	4667.71	196.65	5192.17	641.84	1.949
58	128.20	4555.60	566.63	4667.71	208.39	5155.37	605.10	1.949
59	127.15	4555.08	566.11	4667.71	203.90	5167.63	617.35	1.949
60	125.04	4554.02	564.00	4667.70	193.98	5192.15	641.84	1.949
61	125.57	4554.29	564.53	4667.70	196.47	5186.03	635.71	1.949
62	127.67	4555.34	572.95	4667.73	206.85	5179.93	629.59	1.949
63	126.62	4554.81	566.11	4667.71	200.24	5180.08	629.59	1.950
64	127.67	4555.34	565.58	4667.70	203.84	5167.97	617.35	1.950
65	127.67	4555.34	569.26	4667.71	205.34	5173.95	623.47	1.950
66	128.20	4555.60	572.42	4667.72	208.40	5173.89	623.47	1.950
67	126.62	4554.81	569.79	4667.72	201.76	5186.07	635.71	1.950
68	126.09	4554.55	566.11	4667.71	198.22	5186.16	635.71	1.951
69	128.20	4555.60	568.74	4667.71	206.91	5167.91	617.35	1.951
70	128.20	4555.60	565.05	4667.70	205.42	5161.93	611.22	1.951
71	125.57	4554.29	566.11	4667.71	196.19	5192.22	641.84	1.951
72	127.15	4555.08	564.00	4667.70	203.75	5161.48	611.22	1.951
73	127.15	4555.08	565.58	4667.70	201.82	5174.06	623.47	1.951
74	125.04	4554.02	566.11	4667.71	194.17	5198.28	647.96	1.951
75	127.15	4555.08	569.26	4667.71	203.33	5180.04	629.59	1.952
76	127.67	4555.34	568.74	4667.71	206.52	5167.63	617.35	1.952
77	126.62	4554.81	565.58	4667.70	199.79	5180.14	629.59	1.952
78	128.20	4555.60	572.95	4667.73	208.85	5173.83	623.47	1.953
79	127.67	4555.34	565.05	4667.70	203.39	5168.02	617.35	1.953
80	127.67	4555.34	572.42	4667.72	206.40	5179.99	629.59	1.953
81	127.67	4555.34	568.74	4667.71	204.90	5174.01	623.47	1.953
82	126.09	4554.55	565.58	4667.70	197.77	5186.21	635.71	1.953
83	126.62	4554.81	569.26	4667.71	201.32	5186.12	635.71	1.953
84	125.04	4554.02	565.58	4667.70	193.71	5198.33	647.96	1.953
85	125.57	4554.29	565.58	4667.70	195.74	5192.27	641.84	1.953

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86	128.20	4555.60	571.89	4667.72	207.96	5173.95	623.47	1.954
87	127.15	4555.08	565.05	4667.70	201.37	5174.11	623.47	1.954
88	126.09	4554.55	569.26	4667.71	199.30	5192.20	641.84	1.954
89	128.20	4555.60	564.53	4667.70	204.97	5161.99	611.22	1.954
90	128.20	4555.60	568.21	4667.71	206.46	5167.97	617.35	1.954
91	127.15	4555.08	568.74	4667.71	202.88	5180.10	629.59	1.955
92	127.15	4555.08	572.42	4667.72	204.40	5186.08	635.71	1.955
93	124.52	4553.76	565.05	4667.70	191.22	5204.43	654.08	1.955
94	126.62	4554.81	565.05	4667.70	199.34	5180.19	629.59	1.955
95	125.04	4554.02	565.05	4667.70	193.26	5198.38	647.96	1.955
96	126.09	4554.55	565.05	4667.70	197.32	5186.26	635.71	1.956
97	125.57	4554.29	565.05	4667.70	195.29	5192.32	641.84	1.956
98	127.67	4555.34	564.53	4667.70	202.95	5168.08	617.35	1.956
99	126.62	4554.81	568.74	4667.71	200.87	5186.18	635.71	1.956

Critical Failure Surface (circle 1)

Intersects: XL: 128.20 YL: 4555.60 XR: 566.11 YR: 4667.71
 Centre: XC: 207.95 YC: 5155.43 Radius: R: 605.10

Generated failure surface: (20 points)

128.20	4555.60	152.43	4552.88	176.75	4551.13	201.11	4550.36	225.49	4550.58
249.84	4551.78	274.13	4553.95	298.30	4557.11	322.33	4561.23	346.17	4566.32
369.79	4572.37	393.15	4579.36	416.20	4587.29	438.92	4596.14	461.26	4605.90
483.19	4616.55	504.68	4628.08	525.68	4640.46	546.17	4653.67	566.11	4667.71

Slice Geometry and Properties - Critical Failure Surface (circle 1, 45 slices)

Slice	X-S		Base						PoreWater		Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	128.20	35.92	-6.4	10.83	10.90	1	0.00	35.0	4489.59	0.00	432.42	1.05
2	139.03	107.76	-6.4	10.83	10.90	1	0.00	35.0	13469.46	0.00	1297.34	1.05
3	149.85	36.19	-6.4	2.57	2.59	2	100.00	18.0	4526.43	23.92	1798.30	1.03
4	152.43	222.82	-4.1	12.16	12.19	2	100.00	18.0	27983.08	569.01	2333.04	1.01
5	164.59	307.41	-4.1	12.16	12.19	2	100.00	18.0	38733.17	1255.76	3227.37	1.01
6	176.75	389.92	-1.8	12.18	12.19	2	100.00	18.0	49177.75	1757.19	4058.68	1.01
7	188.93	468.87	-1.8	12.18	12.19	2	100.00	18.0	59128.26	2071.41	4879.59	1.01
8	201.11	545.09	0.5	12.19	12.19	2	100.00	18.0	68690.32	2199.18	5626.47	1.00
9	213.30	618.11	0.5	12.19	12.19	2	100.00	18.0	77804.49	2139.38	6373.04	1.00
10	225.49	687.30	2.8	12.18	12.19	2	100.00	18.0	86390.54	1893.85	7035.64	0.99
11	237.67	754.17	2.8	12.18	12.19	2	100.00	18.0	94640.46	1460.78	7707.40	0.99
12	249.84	620.78	5.1	9.32	9.36	2	100.00	18.0	77777.92	718.23	8216.47	0.99
13	259.16	656.45	5.1	9.32	9.36	2	100.00	18.0	82116.54	243.50	8674.24	0.99
14	268.49	407.33	5.1	5.64	5.66	1	0.00	35.0	50916.49	0.00	8738.96	0.97
15	274.13	795.71	7.4	11.17	11.27	1	0.00	35.0	99464.01	0.00	8497.53	0.96
16	285.30	210.88	7.4	3.00	3.03	4	0.00	45.0	23196.52	6162.40	7369.90	0.94
17	288.30	694.61	7.4	10.00	10.09	1	0.00	35.0	86826.00	41885.65	8474.70	0.96
18	298.30	814.10	9.7	12.01	12.19	1	0.00	35.0	101762.64	49337.16	8209.35	0.95
19	310.32	789.32	9.7	12.01	12.19	1	0.00	35.0	98664.44	47768.23	7959.03	0.95
20	322.33	728.57	12.1	11.48	11.74	1	0.00	35.0	91071.47	44362.32	7630.01	0.95
21	333.82	700.42	12.1	11.48	11.74	1	0.00	35.0	87552.01	42565.81	7334.64	0.95
22	345.30	376.35	14.0	6.22	6.41	1	0.00	35.0	47043.25	22427.92	7229.22	0.94
23	351.52	755.04	14.4	12.03	12.42	1	0.00	35.0	94596.13	41660.68	7479.00	0.94
24	363.54	406.13	14.4	6.25	6.45	1	0.00	35.0	50990.62	20701.62	7736.71	0.94
25	369.79	653.16	16.7	9.79	10.22	1	0.00	35.0	81997.28	31349.05	7853.57	0.94
26	379.58	936.82	16.7	13.57	14.16	1	0.00	35.0	117866.36	40357.10	8112.84	0.94
27	393.15	174.47	19.0	2.47	2.61	1	0.00	35.0	22007.01	7047.09	8212.50	0.94
28	395.62	717.35	19.0	10.02	10.60	1	0.00	35.0	90510.66	27161.02	8308.55	0.94
29	405.64	732.91	19.0	10.02	10.60	1	0.00	35.0	92455.94	24881.17	8456.92	0.94
30	415.67	987.62	21.2	13.23	14.19	1	0.00	35.0	124826.23	29523.87	8522.57	0.94

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31	428.90	735.71	21.3	10.02	10.76	1	0.00	35.0	93203.11	19335.21	8366.71	0.94
32	438.92	771.15	23.6	11.17	12.19	1	0.00	35.0	97775.19	18574.52	7758.82	0.94
33	450.09	716.73	23.6	11.17	12.19	1	0.00	35.0	90973.52	14862.85	7191.82	0.94
34	461.26	647.67	25.9	10.97	12.19	1	0.00	35.0	82316.17	10981.68	6512.58	0.94
35	472.23	589.38	25.9	10.97	12.19	1	0.00	35.0	75029.63	6931.26	5898.16	0.94
36	483.19	575.53	28.2	12.02	13.64	1	0.00	35.0	73430.66	2745.71	5140.83	0.95
37	495.22	398.47	28.2	9.46	10.74	1	0.00	35.0	50981.53	0.00	4506.32	0.95
38	504.68	424.29	30.5	11.75	13.63	5	150.00	22.0	54313.64	0.00	4072.61	1.03
39	516.42	277.15	30.5	9.26	10.75	1	0.00	35.0	35458.11	0.00	3152.46	0.96
40	525.68	102.26	32.8	3.94	4.69	1	0.00	35.0	13130.00	0.00	2696.43	0.96
41	529.62	256.42	32.8	12.40	14.76	5	150.00	22.0	32846.87	0.00	2287.81	1.05
42	542.02	63.62	32.8	4.15	4.93	1	0.00	35.0	8118.80	0.00	1585.44	0.96
43	546.17	107.77	35.1	10.41	12.73	1	0.00	35.0	13889.01	0.00	1061.71	0.97
44	556.58	30.32	35.1	7.42	9.08	5	150.00	22.0	3972.39	0.00	418.16	1.07
45	564.00	1.55	35.1	2.11	2.57	5	150.00	22.0	203.48	0.00	36.28	1.07

X-S Area: 22029.57 Path Length: 463.23

X-S Weight: 2772317.25

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS3-EQ.gmf

Processed: 07 Apr 2023 10:02:07

DATA: Analysis 1 - Case SS-3 - Pseudo-Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 125.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto

Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 Auto

Material: 5 (Mohr-Coulomb Isotropic) - Clay
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (9 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
 0.00 4668.00 600.00 4668.00

Profile: 2 (2 points) Material beneath: 1 - Sand and Gravel
 0.00 4661.00 600.00 4661.00

Profile: 3 (2 points) Material beneath: 5 - Clay
 0.00 4651.00 600.00 4651.00

Profile: 4 (2 points) Material beneath: 1 - Sand and Gravel
 0.00 4643.00 600.00 4643.00

Profile: 5 (2 points) Material beneath: 5 - Clay
 0.00 4635.00 600.00 4635.00

Profile: 6 (2 points) Material beneath: 1 - Sand and Gravel
 0.00 4629.00 600.00 4629.00

Profile: 7 (2 points) Material beneath: 4 - Slurry Wall
 285.30 4625.90 288.30 4625.90

Profile: 8 (4 points) Material beneath: 2 - Weathered Bedrock
 0.00 4552.90 123.20 4553.00 285.30 4553.50 600.00 4553.50

Profile: 9 (3 points) Material beneath: 3 - Stable Bedrock
 0.00 4550.00 285.30 4550.50 600.00 4550.50

Slope Surface (7 points)

0.00	4552.90	123.20	4553.10	268.70	4625.90	345.30	4625.90	428.90	4667.60
564.00	4667.70	600.00	4667.80						

Phreatic Surface (5 points)

0.00	4552.90	123.10	4553.10	285.30	4553.50	288.30	4623.00	600.00	4623.00
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Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 123.20 YL: 4553.10 XR: 569.00 YR: 4667.71
 Centre: XC: 181.49 YC: 5250.67 Radius: R: 700.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.070

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 300.00
 Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case SS-3 - Pseudo-Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.552

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.47

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	128.20	4555.60	566.11	4667.71	207.95	5155.43	605.10	1.474	<-- Critical Surface
2	128.20	4555.60	565.58	4667.70	207.50	5155.48	605.10	1.478	
3	128.20	4555.60	564.00	4667.70	207.81	5149.27	598.98	1.479	
4	127.67	4555.34	565.58	4667.70	205.48	5161.59	611.22	1.481	
5	128.20	4555.60	568.21	4667.71	208.09	5161.58	611.22	1.481	
6	128.20	4555.60	565.05	4667.70	207.06	5155.54	605.10	1.481	
7	127.15	4555.08	565.58	4667.70	203.45	5167.69	617.35	1.483	
8	127.67	4555.34	568.21	4667.71	206.07	5167.69	617.35	1.484	
9	127.67	4555.34	565.05	4667.70	205.03	5161.65	611.22	1.484	
10	128.20	4555.60	567.68	4667.71	207.65	5161.64	611.22	1.484	
11	128.20	4555.60	564.53	4667.70	206.61	5155.60	605.10	1.484	
12	127.67	4555.34	566.11	4667.71	205.92	5161.53	611.22	1.485	
13	127.15	4555.08	565.05	4667.70	203.01	5167.74	617.35	1.486	
14	128.20	4555.60	573.47	4667.73	209.29	5173.78	623.47	1.487	
15	127.67	4555.34	567.68	4667.71	205.63	5167.74	617.35	1.487	
16	127.67	4555.34	564.53	4667.70	204.59	5161.70	611.22	1.487	
17	128.20	4555.60	570.32	4667.72	208.24	5167.74	617.35	1.487	
18	128.20	4555.60	567.16	4667.71	207.20	5161.70	611.22	1.488	
19	128.20	4555.60	564.00	4667.70	206.17	5155.66	605.10	1.488	
20	128.20	4555.60	568.74	4667.71	208.53	5161.52	611.22	1.488	
21	126.62	4554.81	565.05	4667.70	200.98	5173.83	623.47	1.488	
22	128.20	4555.60	570.84	4667.72	208.69	5167.68	617.35	1.488	

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23	127.15	4555.08	564.53	4667.70	202.56	5167.80	617.35	1.489
24	127.15	4555.08	567.68	4667.71	203.61	5173.84	623.47	1.489
25	127.67	4555.34	570.32	4667.72	206.23	5173.84	623.47	1.490
26	127.67	4555.34	564.00	4667.70	204.14	5161.76	611.22	1.490
27	127.67	4555.34	567.16	4667.71	205.18	5167.80	617.35	1.490
28	128.20	4555.60	569.79	4667.72	207.80	5167.80	617.35	1.491
29	128.20	4555.60	566.63	4667.71	206.76	5161.76	611.22	1.491
30	126.62	4554.81	564.53	4667.70	200.53	5173.88	623.47	1.491
31	127.67	4555.34	564.00	4667.70	205.78	5155.38	605.10	1.491
32	126.62	4554.81	567.68	4667.71	201.59	5179.92	629.59	1.491
33	127.15	4555.08	564.00	4667.70	202.11	5167.85	617.35	1.492
34	127.15	4555.08	567.16	4667.71	203.16	5173.89	623.47	1.492
35	127.15	4555.08	570.32	4667.72	204.22	5179.93	629.59	1.492
36	126.09	4554.55	564.53	4667.70	198.50	5179.96	629.59	1.492
37	127.67	4555.34	572.95	4667.73	206.85	5179.93	629.59	1.493
38	127.67	4555.34	569.79	4667.72	205.79	5173.90	623.47	1.493
39	127.67	4555.34	566.63	4667.71	204.74	5167.86	617.35	1.493
40	126.62	4554.81	564.00	4667.70	200.08	5173.94	623.47	1.494
41	127.67	4555.34	570.84	4667.72	206.68	5173.78	623.47	1.494
42	128.20	4555.60	572.42	4667.72	208.40	5173.89	623.47	1.494
43	128.20	4555.60	569.26	4667.71	207.35	5167.85	617.35	1.494
44	126.62	4554.81	567.16	4667.71	201.14	5179.98	629.59	1.494
45	128.20	4555.60	566.11	4667.71	206.31	5161.81	611.22	1.494
46	126.09	4554.55	564.00	4667.70	198.05	5180.01	629.59	1.495
47	128.20	4555.60	572.95	4667.73	208.85	5173.83	623.47	1.495
48	127.15	4555.08	566.63	4667.71	202.72	5173.95	623.47	1.495
49	127.15	4555.08	569.79	4667.72	203.78	5179.99	629.59	1.495
50	126.09	4554.55	567.16	4667.71	199.12	5186.05	635.71	1.495
51	127.15	4555.08	568.21	4667.71	204.06	5173.78	623.47	1.496
52	125.57	4554.29	564.00	4667.70	196.02	5186.08	635.71	1.496
53	127.67	4555.34	572.42	4667.72	206.40	5179.99	629.59	1.496
54	127.67	4555.34	566.11	4667.71	204.29	5167.91	617.35	1.496
55	127.67	4555.34	569.26	4667.71	205.34	5173.95	623.47	1.496
56	126.62	4554.81	566.63	4667.71	200.69	5180.03	629.59	1.497
57	126.62	4554.81	569.79	4667.72	201.76	5186.07	635.71	1.497
58	128.20	4555.60	571.89	4667.72	207.96	5173.95	623.47	1.497
59	128.20	4555.60	568.74	4667.71	206.91	5167.91	617.35	1.497
60	128.20	4555.60	565.58	4667.70	205.87	5161.87	611.22	1.497
61	126.62	4554.81	565.58	4667.70	201.43	5173.78	623.47	1.498
62	128.20	4555.60	566.63	4667.71	208.39	5155.37	605.10	1.498
63	126.09	4554.55	566.63	4667.71	198.67	5186.11	635.71	1.498
64	127.15	4555.08	566.11	4667.71	202.27	5174.00	623.47	1.498
65	127.15	4555.08	572.42	4667.72	204.40	5186.08	635.71	1.498
66	127.15	4555.08	569.26	4667.71	203.33	5180.04	629.59	1.498
67	127.67	4555.34	568.74	4667.71	206.52	5167.63	617.35	1.499
68	127.15	4555.08	566.11	4667.71	203.90	5167.63	617.35	1.499
69	126.09	4554.55	565.05	4667.70	198.95	5179.91	629.59	1.499
70	125.57	4554.29	566.63	4667.71	196.65	5192.17	641.84	1.499
71	127.67	4555.34	565.58	4667.70	203.84	5167.97	617.35	1.499
72	127.67	4555.34	571.89	4667.72	205.96	5180.04	629.59	1.499
73	127.67	4555.34	568.74	4667.71	204.90	5174.01	623.47	1.499
74	126.62	4554.81	566.11	4667.71	200.24	5180.08	629.59	1.499
75	128.20	4555.60	571.37	4667.72	209.13	5167.62	617.35	1.500
76	126.62	4554.81	569.26	4667.71	201.32	5186.12	635.71	1.500
77	128.20	4555.60	571.37	4667.72	207.51	5174.01	623.47	1.500
78	128.20	4555.60	565.05	4667.70	205.42	5161.93	611.22	1.500
79	128.20	4555.60	568.21	4667.71	206.46	5167.97	617.35	1.500
80	126.09	4554.55	566.11	4667.71	198.22	5186.16	635.71	1.500
81	127.15	4555.08	565.58	4667.70	201.82	5174.06	623.47	1.501

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82	126.09	4554.55	569.26	4667.71	199.30	5192.20	641.84	1.501
83	125.57	4554.29	564.53	4667.70	196.47	5186.03	635.71	1.501
84	127.15	4555.08	568.74	4667.71	202.88	5180.10	629.59	1.501
85	127.15	4555.08	571.89	4667.72	203.95	5186.13	635.71	1.501
86	125.57	4554.29	566.11	4667.71	196.19	5192.22	641.84	1.501
87	125.04	4554.02	564.00	4667.70	193.98	5192.15	641.84	1.502
88	125.04	4554.02	566.11	4667.71	194.17	5198.28	647.96	1.502
89	126.62	4554.81	565.58	4667.70	199.79	5180.14	629.59	1.502
90	127.67	4555.34	565.05	4667.70	203.39	5168.02	617.35	1.502
91	127.67	4555.34	568.21	4667.71	204.45	5174.06	623.47	1.502
92	127.15	4555.08	564.00	4667.70	203.75	5161.48	611.22	1.502
93	127.67	4555.34	571.37	4667.72	205.51	5180.10	629.59	1.502
94	126.62	4554.81	568.74	4667.71	200.87	5186.18	635.71	1.502
95	126.62	4554.81	571.89	4667.72	201.94	5192.21	641.84	1.503
96	126.09	4554.55	565.58	4667.70	197.77	5186.21	635.71	1.503
97	128.20	4555.60	574.00	4667.73	208.13	5180.10	629.59	1.503
98	128.20	4555.60	564.53	4667.70	204.97	5161.99	611.22	1.503
99	126.09	4554.55	568.74	4667.71	198.85	5192.25	641.84	1.503

Critical Failure Surface (circle 1)

Intersects: XL: 128.20 YL: 4555.60 XR: 566.11 YR: 4667.71
 Centre: XC: 207.95 YC: 5155.43 Radius: R: 605.10

Generated failure surface: (20 points)

128.20	4555.60	152.43	4552.88	176.75	4551.13	201.11	4550.36	225.49	4550.58
249.84	4551.78	274.13	4553.95	298.30	4557.11	322.33	4561.23	346.17	4566.32
369.79	4572.37	393.15	4579.36	416.20	4587.29	438.92	4596.14	461.26	4605.90
483.19	4616.55	504.68	4628.08	525.68	4640.46	546.17	4653.67	566.11	4667.71

Slice Geometry and Properties - Critical Failure Surface (circle 1, 45 slices)

Slice	X-Left	X-S Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Porewater Force	Normal Stress	Test Factor
1	128.20	35.92	-6.4	10.83	10.90	1	0.00	35.0	4489.59	0.00	438.08	1.06
2	139.03	107.76	-6.4	10.83	10.90	1	0.00	35.0	13469.46	0.00	1314.33	1.06
3	149.85	36.19	-6.4	2.57	2.59	2	100.00	18.0	4526.43	23.92	1810.66	1.03
4	152.43	222.82	-4.1	12.16	12.19	2	100.00	18.0	27983.08	569.01	2342.71	1.02
5	164.59	307.41	-4.1	12.16	12.19	2	100.00	18.0	38733.17	1255.76	3240.18	1.02
6	176.75	389.92	-1.8	12.18	12.19	2	100.00	18.0	49177.75	1757.19	4065.51	1.01
7	188.93	468.87	-1.8	12.18	12.19	2	100.00	18.0	59128.26	2071.41	4887.71	1.01
8	201.11	545.09	0.5	12.19	12.19	2	100.00	18.0	68690.32	2199.18	5623.87	1.00
9	213.30	618.11	0.5	12.19	12.19	2	100.00	18.0	77804.49	2139.38	6370.10	1.00
10	225.49	687.30	2.8	12.18	12.19	2	100.00	18.0	86390.54	1893.85	7017.76	0.99
11	237.67	754.17	2.8	12.18	12.19	2	100.00	18.0	94640.46	1460.78	7687.77	0.99
12	249.84	620.78	5.1	9.32	9.36	2	100.00	18.0	77777.92	718.23	8178.51	0.98
13	259.16	656.45	5.1	9.32	9.36	2	100.00	18.0	82116.54	243.50	8633.99	0.98
14	268.49	407.33	5.1	5.64	5.66	1	0.00	35.0	50916.49	0.00	8656.19	0.96
15	274.13	795.71	7.4	11.17	11.27	1	0.00	35.0	99464.01	0.00	8382.53	0.95
16	285.30	210.88	7.4	3.00	3.03	4	0.00	45.0	23196.52	6162.40	7269.42	0.93
17	288.30	694.61	7.4	10.00	10.09	1	0.00	35.0	86826.00	41885.65	8416.21	0.95
18	298.30	814.10	9.7	12.01	12.19	1	0.00	35.0	101762.64	49337.16	8136.59	0.94
19	310.32	789.32	9.7	12.01	12.19	1	0.00	35.0	98664.44	47768.23	7888.38	0.94
20	322.33	728.57	12.1	11.48	11.74	1	0.00	35.0	91071.47	44362.32	7547.77	0.93
21	333.82	700.42	12.1	11.48	11.74	1	0.00	35.0	87552.01	42565.81	7255.45	0.93
22	345.30	376.35	14.0	6.22	6.41	1	0.00	35.0	47043.25	22427.92	7137.46	0.92
23	351.52	755.04	14.4	12.03	12.42	1	0.00	35.0	94596.13	41660.68	7375.32	0.92
24	363.54	406.13	14.4	6.25	6.45	1	0.00	35.0	50990.62	20701.62	7622.91	0.92
25	369.79	653.16	16.7	9.79	10.22	1	0.00	35.0	81997.28	31349.05	7715.40	0.91
26	379.58	936.82	16.7	13.57	14.16	1	0.00	35.0	117866.36	40357.10	7960.89	0.91

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27	393.15	174.47	19.0	2.47	2.61	1	0.00	35.0	22007.01	7047.09	8032.87	0.91
28	395.62	717.35	19.0	10.02	10.60	1	0.00	35.0	90510.66	27161.02	8121.49	0.91
29	405.64	732.91	19.0	10.02	10.60	1	0.00	35.0	92455.94	24881.17	8258.01	0.91
30	415.67	987.62	21.2	13.23	14.19	1	0.00	35.0	124826.23	29523.87	8290.28	0.91
31	428.90	735.71	21.3	10.02	10.76	1	0.00	35.0	93203.11	19335.21	8128.86	0.91
32	438.92	771.15	23.6	11.17	12.19	1	0.00	35.0	97775.19	18574.52	7510.42	0.90
33	450.09	716.73	23.6	11.17	12.19	1	0.00	35.0	90973.52	14862.85	6953.87	0.90
34	461.26	647.67	25.9	10.97	12.19	1	0.00	35.0	82316.17	10981.68	6268.69	0.90
35	472.23	589.38	25.9	10.97	12.19	1	0.00	35.0	75029.63	6931.26	5666.55	0.90
36	483.19	575.53	28.2	12.02	13.64	1	0.00	35.0	73430.66	2745.71	4908.25	0.90
37	495.22	398.47	28.2	9.46	10.74	1	0.00	35.0	50981.53	0.00	4294.14	0.90
38	504.68	424.29	30.5	11.75	13.63	5	150.00	22.0	54313.64	0.00	3929.28	1.00
39	516.42	277.15	30.5	9.26	10.75	1	0.00	35.0	35458.11	0.00	2992.55	0.91
40	525.68	102.26	32.8	3.94	4.69	1	0.00	35.0	13130.00	0.00	2549.78	0.91
41	529.62	256.42	32.8	12.40	14.76	5	150.00	22.0	32846.87	0.00	2195.17	1.01
42	542.02	63.62	32.8	4.15	4.93	1	0.00	35.0	8118.80	0.00	1499.21	0.91
43	546.17	107.77	35.1	10.41	12.73	1	0.00	35.0	13889.01	0.00	1000.03	0.92
44	556.58	30.32	35.1	7.42	9.08	5	150.00	22.0	3972.39	0.00	388.56	1.03
45	564.00	1.55	35.1	2.11	2.57	5	150.00	22.0	203.48	0.00	21.00	1.03

X-S Area: 22029.57 Path Length: 463.23

X-S Weight: 2772317.25

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS4.gmf

Processed: 07 Apr 2023 10:04:47

DATA: Analysis 1 - Case SS-4 - Static

Material Properties (5 materials)

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-----
Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0  125.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0  141.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0  141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0  110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion  Phi  UnitWeight  Ru
150.00    22.0  131.00    Auto

```

Water Properties

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Unit weight of water: 62.400          Unit weight of water/medium above ground: 62.400

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Material Profiles (11 profiles)

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-----
Profile: 1 (2 points)  Material beneath: 5 - Clay
0.00  4672.00          650.00  4672.00
Profile: 2 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4663.00          650.00  4663.00
Profile: 3 (2 points)  Material beneath: 5 - Clay
0.00  4634.00          650.00  4634.00
Profile: 4 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4628.00          650.00  4628.00
Profile: 5 (2 points)  Material beneath: 4 - Slurry Wall
278.50  4624.30        281.50  4624.30
Profile: 6 (2 points)  Material beneath: 5 - Clay
0.00  4574.00          278.50  4574.00
Profile: 7 (2 points)  Material beneath: 5 - Clay
281.50  4574.00          650.00  4574.00
Profile: 8 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4570.00          278.50  4570.00
Profile: 9 (2 points)  Material beneath: 1 - Sand and Gravel
281.50  4570.00          650.00  4570.00
Profile: 10 (6 points) Material beneath: 2 - Weathered Bedrock
0.00  4553.50          121.10  4553.90          227.90  4554.30          278.50  4553.20          513.00  4548.40
650.00  4549.60
Profile: 11 (6 points) Material beneath: 3 - Stable Bedrock
0.00  4550.50          121.10  4550.90          227.90  4551.30          278.50  4550.20          513.00  4545.40
650.00  4546.60

```

Slope Surface (7 points)

0.00	4553.50	121.10	4553.90	261.90	Derr TR8 SS4.gar 4624.30	342.20	4624.30	432.70	4669.50
607.60	4670.20	650.00	4671.40						

Phreatic Surface (6 points)

0.00	4553.50	121.10	4553.90	227.90	4554.30	278.50	4554.30	281.50	4622.00
650.00	4622.00								

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	121.10	YL:	4553.90	XR:	612.60	YR:	4670.34
	Centre:	XC:	241.38	YC:	5141.72	Radius:	R:	600.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	300.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case SS-4 - Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.387

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 2.08

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	125.05	4555.87	607.60	4670.20	207.64	5282.83	731.63	2.082	<-- Critical Surface
2	125.57	4556.14	608.13	4670.21	209.98	5276.72	725.51	2.084	
3	125.57	4556.14	607.60	4670.20	209.56	5276.77	725.51	2.085	
4	126.10	4556.40	607.60	4670.20	211.48	5270.70	719.39	2.089	
5	123.99	4555.35	608.13	4670.21	202.72	5301.20	750.00	2.090	
6	126.10	4556.40	608.65	4670.23	212.33	5270.60	719.39	2.090	
7	123.99	4555.35	607.60	4670.20	202.29	5301.25	750.00	2.091	
8	125.05	4555.87	609.71	4670.26	207.85	5288.97	737.76	2.091	
9	125.05	4555.87	609.18	4670.24	207.43	5289.02	737.76	2.092	
10	124.52	4555.61	608.13	4670.21	204.65	5295.16	743.88	2.093	
11	125.57	4556.14	610.23	4670.27	210.20	5282.86	731.63	2.093	
12	125.57	4556.14	609.71	4670.26	209.77	5282.91	731.63	2.094	
13	124.52	4555.61	607.60	4670.20	204.21	5295.21	743.88	2.094	
14	124.52	4555.61	608.65	4670.23	205.08	5295.11	743.88	2.095	
15	125.57	4556.14	609.18	4670.24	209.34	5282.96	731.63	2.095	
16	126.10	4556.40	611.28	4670.30	212.96	5276.69	725.51	2.095	
17	126.10	4556.40	608.13	4670.21	211.90	5270.65	719.39	2.096	
18	125.57	4556.14	608.65	4670.23	208.91	5283.01	731.63	2.097	
19	125.05	4555.87	607.60	4670.20	206.14	5289.16	737.76	2.097	

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20	126.10	4556.40	610.76	4670.29	212.54	5276.74	725.51	2.098
21	126.10	4556.40	609.71	4670.26	211.68	5276.84	725.51	2.098
22	125.05	4555.87	608.13	4670.21	206.57	5289.11	737.76	2.098
23	126.10	4556.40	609.18	4670.24	211.26	5276.90	725.51	2.099
24	126.10	4556.40	608.65	4670.23	210.83	5276.95	725.51	2.100
25	125.05	4555.87	611.81	4670.32	208.08	5295.10	743.88	2.100
26	125.05	4555.87	608.65	4670.23	207.00	5289.06	737.76	2.101
27	125.05	4555.87	611.28	4670.30	207.65	5295.15	743.88	2.101
28	125.57	4556.14	612.34	4670.33	210.42	5289.00	737.76	2.102
29	125.57	4556.14	607.60	4670.20	208.06	5283.10	731.63	2.102
30	124.52	4555.61	609.71	4670.26	204.44	5301.34	750.00	2.103
31	125.57	4556.14	611.81	4670.32	209.99	5289.05	737.76	2.103
32	126.10	4556.40	609.18	4670.24	212.75	5270.55	719.39	2.103
33	124.52	4555.61	610.23	4670.27	204.87	5301.29	750.00	2.103
34	126.10	4556.40	610.23	4670.27	212.11	5276.79	725.51	2.103
35	124.52	4555.61	609.18	4670.24	204.01	5301.39	750.00	2.104
36	125.57	4556.14	608.13	4670.21	208.49	5283.06	731.63	2.104
37	125.57	4556.14	611.28	4670.30	209.56	5289.10	737.76	2.104
38	126.10	4556.40	613.39	4670.36	213.18	5282.83	731.63	2.104
39	124.52	4555.61	610.76	4670.29	205.30	5301.25	750.00	2.105
40	124.52	4555.61	608.65	4670.23	203.58	5301.43	750.00	2.105
41	125.57	4556.14	612.86	4670.35	210.84	5288.95	737.76	2.106
42	125.57	4556.14	610.76	4670.29	209.13	5289.14	737.76	2.106
43	125.57	4556.14	608.13	4670.21	206.99	5289.39	737.76	2.106
44	126.10	4556.40	612.86	4670.35	212.75	5282.88	731.63	2.106
45	124.52	4555.61	609.18	4670.24	205.51	5295.07	743.88	2.106
46	125.05	4555.87	609.71	4670.26	206.36	5295.29	743.88	2.106
47	125.05	4555.87	608.13	4670.21	208.06	5282.78	731.63	2.106
48	126.10	4556.40	611.81	4670.32	211.90	5282.98	731.63	2.107
49	125.05	4555.87	609.18	4670.24	205.93	5295.34	743.88	2.107
50	124.52	4555.61	611.28	4670.30	205.73	5301.20	750.00	2.107
51	126.10	4556.40	611.28	4670.30	211.47	5283.03	731.63	2.108
52	126.10	4556.40	607.60	4670.20	209.98	5277.05	725.51	2.108
53	125.05	4555.87	610.23	4670.27	206.79	5295.25	743.88	2.109
54	125.05	4555.87	608.65	4670.23	205.50	5295.39	743.88	2.109
55	126.10	4556.40	610.76	4670.29	211.05	5283.08	731.63	2.109
56	125.05	4555.87	613.92	4670.38	208.31	5301.24	750.00	2.109
57	123.99	4555.35	608.65	4670.23	203.15	5301.16	750.00	2.109
58	125.05	4555.87	610.23	4670.27	208.28	5288.92	737.76	2.110
59	126.10	4556.40	608.13	4670.21	210.40	5277.00	725.51	2.110
60	125.05	4555.87	613.39	4670.36	207.88	5301.29	750.00	2.110
61	126.10	4556.40	610.23	4670.27	210.62	5283.13	731.63	2.110
62	125.57	4556.14	609.18	4670.24	207.85	5289.29	737.76	2.110
63	125.05	4555.87	610.76	4670.29	207.22	5295.20	743.88	2.111
64	126.10	4556.40	612.34	4670.33	212.33	5282.93	731.63	2.111
65	125.57	4556.14	610.76	4670.29	210.63	5282.81	731.63	2.111
66	125.57	4556.14	613.92	4670.38	210.22	5295.18	743.88	2.112
67	125.57	4556.14	608.65	4670.23	207.42	5289.34	737.76	2.112
68	125.57	4556.14	609.71	4670.26	208.28	5289.24	737.76	2.112
69	124.52	4555.61	607.60	4670.20	205.71	5288.88	737.76	2.112
70	125.57	4556.14	608.65	4670.23	210.41	5276.67	725.51	2.112
71	125.57	4556.14	614.97	4670.41	211.07	5295.08	743.88	2.113
72	124.52	4555.61	607.60	4670.20	202.72	5301.52	750.00	2.113
73	125.05	4555.87	612.34	4670.33	208.51	5295.05	743.88	2.113
74	125.57	4556.14	613.39	4670.36	209.79	5295.23	743.88	2.113
75	126.10	4556.40	615.49	4670.42	213.40	5288.97	737.76	2.113
76	126.10	4556.40	614.97	4670.41	212.97	5289.02	737.76	2.114
77	125.57	4556.14	610.23	4670.27	208.71	5289.19	737.76	2.114
78	124.52	4555.61	608.13	4670.21	203.15	5301.48	750.00	2.115

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79	125.57	4556.14	612.86	4670.35	209.36	5295.28	743.88	2.115
80	126.10	4556.40	608.65	4670.23	209.34	5283.28	731.63	2.115
81	126.10	4556.40	613.92	4670.38	212.12	5289.12	737.76	2.116
82	125.05	4555.87	611.28	4670.30	206.16	5301.47	750.00	2.116
83	126.10	4556.40	609.18	4670.24	209.77	5283.23	731.63	2.116
84	125.57	4556.14	610.23	4670.27	207.22	5295.52	743.88	2.116
85	126.10	4556.40	613.39	4670.36	211.70	5289.17	737.76	2.116
86	124.52	4555.61	609.71	4670.26	205.94	5295.02	743.88	2.116
87	125.05	4555.87	611.81	4670.32	206.59	5301.43	750.00	2.116
88	126.10	4556.40	608.13	4670.21	208.91	5283.33	731.63	2.117
89	125.05	4555.87	614.44	4670.39	208.74	5301.19	750.00	2.117
90	125.05	4555.87	607.60	4670.20	204.64	5295.48	743.88	2.117
91	125.05	4555.87	610.76	4670.29	205.73	5301.52	750.00	2.117
92	126.10	4556.40	612.86	4670.35	211.27	5289.22	737.76	2.118
93	126.10	4556.40	609.71	4670.26	210.19	5283.18	731.63	2.118
94	126.10	4556.40	614.44	4670.39	212.55	5289.07	737.76	2.118
95	125.05	4555.87	608.13	4670.21	205.07	5295.43	743.88	2.118
96	125.05	4555.87	612.34	4670.33	207.02	5301.38	750.00	2.119
97	125.57	4556.14	614.44	4670.39	210.64	5295.13	743.88	2.119
98	126.10	4556.40	612.34	4670.33	210.84	5289.27	737.76	2.119
99	125.57	4556.14	611.28	4670.30	208.07	5295.43	743.88	2.120

Critical Failure Surface (circle 1)

Intersects: XL: 125.05 YL: 4555.87 XR: 607.60 YR: 4670.20
 Centre: XC: 207.64 YC: 5282.83 Radius: R: 731.63

Generated failure surface: (20 points)

125.05	4555.87	151.55	4553.35	178.14	4551.79	204.75	4551.20	231.38	4551.58
257.97	4552.93	284.50	4555.25	310.92	4558.52	337.21	4562.76	363.32	4567.95
389.23	4574.09	414.90	4581.17	440.30	4589.18	465.38	4598.10	490.13	4607.93
514.50	4618.66	538.46	4630.27	561.99	4642.73	585.04	4656.05	607.60	4670.20

Slice Geometry and Properties - Critical Failure Surface (circle 1, 50 slices)

Slice	X-S		Base						PoreWater	Normal	Test	
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	125.05	29.16	-5.4	9.90	9.94	1	0.00	35.0	3644.96	0.00	380.40	1.04
2	134.95	87.48	-5.4	9.90	9.94	1	0.00	35.0	10935.48	0.00	1141.28	1.04
3	144.84	92.45	-5.4	6.71	6.74	2	100.00	18.0	11592.49	139.63	1758.24	1.02
4	151.55	180.30	-3.4	9.75	9.76	2	100.00	18.0	22779.31	589.58	2361.10	1.01
5	161.30	198.42	-3.4	8.42	8.43	2	100.00	18.0	25210.96	807.21	3024.68	1.01
6	169.72	237.99	-3.4	8.42	8.43	2	100.00	18.0	30228.57	1083.13	3625.98	1.01
7	178.14	446.60	-1.3	13.12	13.12	2	100.00	18.0	56662.43	2039.07	4335.47	1.00
8	191.25	536.44	-1.3	13.12	13.12	2	100.00	18.0	67963.23	2316.89	5199.92	1.00
9	204.37	555.28	0.7	11.77	11.77	2	100.00	18.0	70248.44	2167.65	5958.06	1.00
10	216.13	622.53	0.8	11.77	11.77	2	100.00	18.0	78631.00	2076.97	6667.80	1.00
11	227.90	196.95	0.8	3.48	3.48	2	100.00	18.0	24852.46	595.25	7127.45	1.00
12	231.38	803.66	2.9	13.30	13.31	2	100.00	18.0	101236.24	1977.07	7552.99	0.99
13	244.68	883.09	2.9	13.30	13.31	2	100.00	18.0	110960.46	1417.29	8278.28	0.99
14	257.97	275.87	5.0	3.93	3.94	2	100.00	18.0	34609.15	294.76	8687.49	0.99
15	261.90	186.89	5.0	2.64	2.65	2	100.00	18.0	23430.07	150.41	8767.12	0.99
16	264.54	642.08	5.0	9.12	9.16	1	0.00	35.0	80478.96	227.35	8572.88	0.98
17	273.66	338.04	5.0	4.84	4.86	1	0.00	35.0	42371.32	0.00	8498.07	0.98
18	278.50	208.34	5.0	3.00	3.01	4	0.00	45.0	22917.28	6256.76	7415.43	0.96
19	281.50	207.35	5.0	3.00	3.01	1	0.00	35.0	25990.54	12556.08	8543.72	0.98
20	284.50	901.50	7.1	13.21	13.31	1	0.00	35.0	113005.16	54774.64	8375.50	0.97
21	297.71	879.84	7.1	13.21	13.31	1	0.00	35.0	110297.05	53412.39	8174.65	0.97
22	310.92	850.59	9.2	13.14	13.31	1	0.00	35.0	106639.19	51851.73	7896.49	0.96
23	324.06	822.74	9.2	13.14	13.31	1	0.00	35.0	103158.38	50091.38	7638.52	0.96

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24	337.21	304.74	11.2	4.99	5.09	1	0.00	35.0	38212.08	18657.47	7404.17	0.96
25	342.20	456.80	11.2	7.41	7.55	1	0.00	35.0	57277.91	27106.05	7471.74	0.96
26	349.61	775.79	11.2	12.01	12.25	1	0.00	35.0	97478.41	42478.01	7823.10	0.96
27	361.62	700.93	13.0	10.34	10.61	1	0.00	35.0	88236.63	35233.72	8160.39	0.95
28	371.96	593.22	13.3	8.44	8.68	5	150.00	22.0	74608.94	27609.33	8572.98	0.98
29	380.40	611.93	13.3	8.44	8.68	5	150.00	22.0	76846.38	26526.62	8820.88	0.98
30	388.84	978.08	15.4	13.03	13.51	1	0.00	35.0	122728.68	38967.45	8867.05	0.95
31	401.87	1016.06	15.4	13.03	13.52	1	0.00	35.0	127477.06	35949.45	9179.40	0.95
32	414.90	382.17	17.5	4.78	5.02	1	0.00	35.0	47943.99	12544.77	9300.24	0.95
33	419.69	1060.93	17.5	13.01	13.65	1	0.00	35.0	133338.97	31736.04	9486.24	0.95
34	432.70	619.31	17.5	7.60	7.96	1	0.00	35.0	77984.48	16907.15	9486.45	0.95
35	440.30	980.21	19.6	12.54	13.31	1	0.00	35.0	123471.59	25414.91	8995.85	0.95
36	452.84	924.87	19.6	12.54	13.31	1	0.00	35.0	116557.47	21707.46	8473.87	0.95
37	465.38	854.90	21.7	12.37	13.31	1	0.00	35.0	107801.55	17812.34	7843.58	0.95
38	477.75	794.68	21.7	12.37	13.31	1	0.00	35.0	100277.57	13727.67	7271.08	0.95
39	490.13	720.63	23.8	12.19	13.31	1	0.00	35.0	91011.13	9458.16	6597.60	0.95
40	502.31	655.87	23.8	12.19	13.31	1	0.00	35.0	82919.98	5002.68	5976.05	0.95
41	514.50	341.54	25.8	6.90	7.66	1	0.00	35.0	43224.17	798.91	5402.97	0.96
42	521.39	556.02	25.8	12.39	13.77	1	0.00	35.0	70459.39	0.00	4890.68	0.96
43	533.78	190.74	25.8	4.68	5.20	5	150.00	22.0	24173.29	0.00	4692.51	1.02
44	538.46	266.38	27.9	7.05	7.97	5	150.00	22.0	33670.26	0.00	4298.13	1.03
45	545.51	278.38	27.9	8.24	9.33	1	0.00	35.0	35141.89	0.00	3619.62	0.96
46	553.75	242.66	27.9	8.24	9.33	1	0.00	35.0	30678.38	0.00	3159.95	0.96
47	561.99	276.41	30.0	11.53	13.31	1	0.00	35.0	35037.66	0.00	2544.90	0.97
48	573.52	200.18	30.0	11.53	13.31	1	0.00	35.0	25512.22	0.00	1853.01	0.97
49	585.04	117.47	32.1	11.08	13.07	1	0.00	35.0	15157.88	0.00	1130.09	0.97
50	596.12	41.06	32.1	11.48	13.55	5	150.00	22.0	5379.51	0.00	377.48	1.05

X-S Area:

25125.57

Path Length:

505.90

X-S Weight:

3160451.00

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS4-EQ.gmf

Processed: 07 Apr 2023 10:05:14

DATA: Analysis 1 - Case SS-4 - Pseudo-Static

Material Properties (5 materials)

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-----
Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0  125.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0  141.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0  141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0  110.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion  Phi  UnitWeight  Ru
150.00    22.0  131.00    Auto

```

Water Properties

```

-----
Unit weight of water: 62.400          Unit weight of water/medium above ground: 62.400

```

Material Profiles (11 profiles)

```

-----
Profile: 1 (2 points)  Material beneath: 5 - Clay
0.00  4672.00          650.00  4672.00
Profile: 2 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4663.00          650.00  4663.00
Profile: 3 (2 points)  Material beneath: 5 - Clay
0.00  4634.00          650.00  4634.00
Profile: 4 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4628.00          650.00  4628.00
Profile: 5 (2 points)  Material beneath: 4 - Slurry Wall
278.50  4624.30        281.50  4624.30
Profile: 6 (2 points)  Material beneath: 5 - Clay
0.00  4574.00          278.50  4574.00
Profile: 7 (2 points)  Material beneath: 5 - Clay
281.50  4574.00          650.00  4574.00
Profile: 8 (2 points)  Material beneath: 1 - Sand and Gravel
0.00  4570.00          278.50  4570.00
Profile: 9 (2 points)  Material beneath: 1 - Sand and Gravel
281.50  4570.00          650.00  4570.00
Profile: 10 (6 points) Material beneath: 2 - Weathered Bedrock
0.00  4553.50          121.10  4553.90          227.90  4554.30          278.50  4553.20          513.00  4548.40
650.00  4549.60
Profile: 11 (6 points) Material beneath: 3 - Stable Bedrock
0.00  4550.50          121.10  4550.90          227.90  4551.30          278.50  4550.20          513.00  4545.40
650.00  4546.60

```

Slope Surface (7 points)

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0.00	4553.50	121.10	4553.90	261.90	4624.30	342.20	4624.30	432.70	4669.50
607.60	4670.20	650.00	4671.40						

Phreatic Surface (6 points)

0.00	4553.50	121.10	4553.90	227.90	4554.30	278.50	4554.30	281.50	4622.00
650.00	4622.00								

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects:	XL:	121.10	YL:	4553.90	XR:	612.60	YR:	4670.34
	Centre:	XC:	241.38	YC:	5141.72	Radius:	R:	600.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.070

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	300.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case SS-4 - Pseudo-Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.811

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.57

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	125.05	4555.87	607.60	4670.20	207.64	5282.83	731.63	1.572	<-- Critical Surface
2	125.57	4556.14	608.13	4670.21	209.98	5276.72	725.51	1.572	
3	125.57	4556.14	607.60	4670.20	209.56	5276.77	725.51	1.574	
4	126.10	4556.40	608.65	4670.23	212.33	5270.60	719.39	1.576	
5	126.10	4556.40	607.60	4670.20	211.48	5270.70	719.39	1.576	
6	125.05	4555.87	609.71	4670.26	207.85	5288.97	737.76	1.577	
7	125.57	4556.14	610.23	4670.27	210.20	5282.86	731.63	1.578	
8	123.99	4555.35	608.13	4670.21	202.72	5301.20	750.00	1.578	
9	126.10	4556.40	611.28	4670.30	212.96	5276.69	725.51	1.578	
10	125.05	4555.87	609.18	4670.24	207.43	5289.02	737.76	1.579	
11	125.57	4556.14	609.71	4670.26	209.77	5282.91	731.63	1.579	
12	123.99	4555.35	607.60	4670.20	202.29	5301.25	750.00	1.579	
13	124.52	4555.61	608.13	4670.21	204.65	5295.16	743.88	1.580	
14	125.57	4556.14	609.18	4670.24	209.34	5282.96	731.63	1.580	
15	126.10	4556.40	610.76	4670.29	212.54	5276.74	725.51	1.580	

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16	126.10	4556.40	608.13	4670.21	211.90	5270.65	719.39	1.581
17	124.52	4555.61	608.65	4670.23	205.08	5295.11	743.88	1.581
18	126.10	4556.40	609.71	4670.26	211.68	5276.84	725.51	1.581
19	124.52	4555.61	607.60	4670.20	204.21	5295.21	743.88	1.581
20	125.57	4556.14	608.65	4670.23	208.91	5283.01	731.63	1.582
21	125.05	4555.87	611.81	4670.32	208.08	5295.10	743.88	1.582
22	126.10	4556.40	609.18	4670.24	211.26	5276.90	725.51	1.582
23	125.57	4556.14	612.34	4670.33	210.42	5289.00	737.76	1.583
24	125.05	4555.87	607.60	4670.20	206.14	5289.16	737.76	1.583
25	126.10	4556.40	613.39	4670.36	213.18	5282.83	731.63	1.583
26	126.10	4556.40	608.65	4670.23	210.83	5276.95	725.51	1.584
27	125.05	4555.87	611.28	4670.30	207.65	5295.15	743.88	1.584
28	125.57	4556.14	611.81	4670.32	209.99	5289.05	737.76	1.584
29	125.05	4555.87	608.13	4670.21	206.57	5289.11	737.76	1.584
30	126.10	4556.40	612.86	4670.35	212.75	5282.88	731.63	1.585
31	125.05	4555.87	608.65	4670.23	207.00	5289.06	737.76	1.585
32	126.10	4556.40	610.23	4670.27	212.11	5276.79	725.51	1.585
33	125.57	4556.14	612.86	4670.35	210.84	5288.95	737.76	1.585
34	125.57	4556.14	611.28	4670.30	209.56	5289.10	737.76	1.586
35	126.10	4556.40	609.18	4670.24	212.75	5270.55	719.39	1.586
36	124.52	4555.61	610.23	4670.27	204.87	5301.29	750.00	1.586
37	124.52	4555.61	609.71	4670.26	204.44	5301.34	750.00	1.586
38	126.10	4556.40	611.81	4670.32	211.90	5282.98	731.63	1.587
39	125.57	4556.14	607.60	4670.20	208.06	5283.10	731.63	1.587
40	125.57	4556.14	610.76	4670.29	209.13	5289.14	737.76	1.587
41	125.05	4555.87	613.92	4670.38	208.31	5301.24	750.00	1.587
42	124.52	4555.61	610.76	4670.29	205.30	5301.25	750.00	1.587
43	126.10	4556.40	611.28	4670.30	211.47	5283.03	731.63	1.588
44	124.52	4555.61	609.18	4670.24	204.01	5301.39	750.00	1.588
45	125.57	4556.14	608.13	4670.21	208.49	5283.06	731.63	1.588
46	126.10	4556.40	615.49	4670.42	213.40	5288.97	737.76	1.589
47	124.52	4555.61	611.28	4670.30	205.73	5301.20	750.00	1.589
48	125.05	4555.87	613.39	4670.36	207.88	5301.29	750.00	1.589
49	126.10	4556.40	610.76	4670.29	211.05	5283.08	731.63	1.589
50	125.05	4555.87	609.71	4670.26	206.36	5295.29	743.88	1.589
51	125.57	4556.14	613.92	4670.38	210.22	5295.18	743.88	1.589
52	125.57	4556.14	614.97	4670.41	211.07	5295.08	743.88	1.589
53	126.10	4556.40	612.34	4670.33	212.33	5282.93	731.63	1.589
54	124.52	4555.61	608.65	4670.23	203.58	5301.43	750.00	1.589
55	125.57	4556.14	608.13	4670.21	206.99	5289.39	737.76	1.589
56	126.10	4556.40	614.97	4670.41	212.97	5289.02	737.76	1.590
57	124.52	4555.61	609.18	4670.24	205.51	5295.07	743.88	1.590
58	125.05	4555.87	609.18	4670.24	205.93	5295.34	743.88	1.590
59	125.05	4555.87	610.23	4670.27	206.79	5295.25	743.88	1.590
60	125.05	4555.87	608.13	4670.21	208.06	5282.78	731.63	1.591
61	126.10	4556.40	610.23	4670.27	210.62	5283.13	731.63	1.591
62	125.57	4556.14	613.39	4670.36	209.79	5295.23	743.88	1.591
63	126.10	4556.40	607.60	4670.20	209.98	5277.05	725.51	1.591
64	125.05	4555.87	610.23	4670.27	208.28	5288.92	737.76	1.591
65	125.05	4555.87	610.76	4670.29	207.22	5295.20	743.88	1.591
66	125.05	4555.87	608.65	4670.23	205.50	5295.39	743.88	1.592
67	125.57	4556.14	610.76	4670.29	210.63	5282.81	731.63	1.592
68	126.10	4556.40	613.92	4670.38	212.12	5289.12	737.76	1.592
69	125.57	4556.14	609.18	4670.24	207.85	5289.29	737.76	1.592
70	126.10	4556.40	608.13	4670.21	210.40	5277.00	725.51	1.592
71	125.05	4555.87	612.34	4670.33	208.51	5295.05	743.88	1.592
72	125.57	4556.14	612.86	4670.35	209.36	5295.28	743.88	1.592
73	126.10	4556.40	613.39	4670.36	211.70	5289.17	737.76	1.593
74	123.99	4555.35	608.65	4670.23	203.15	5301.16	750.00	1.593

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75	125.57	4556.14	609.71	4670.26	208.28	5289.24	737.76	1.593
76	125.57	4556.14	617.07	4670.47	211.30	5301.22	750.00	1.593
77	125.05	4555.87	614.44	4670.39	208.74	5301.19	750.00	1.593
78	126.10	4556.40	614.44	4670.39	212.55	5289.07	737.76	1.593
79	125.57	4556.14	608.65	4670.23	207.42	5289.34	737.76	1.594
80	126.10	4556.40	617.60	4670.48	213.63	5295.11	743.88	1.594
81	125.57	4556.14	608.65	4670.23	210.41	5276.67	725.51	1.594
82	125.57	4556.14	610.23	4670.27	208.71	5289.19	737.76	1.594
83	126.10	4556.40	612.86	4670.35	211.27	5289.22	737.76	1.594
84	125.57	4556.14	616.02	4670.44	210.45	5301.32	750.00	1.594
85	125.57	4556.14	614.44	4670.39	210.64	5295.13	743.88	1.595
86	126.10	4556.40	617.07	4670.47	213.20	5295.16	743.88	1.595
87	125.05	4555.87	611.81	4670.32	206.59	5301.43	750.00	1.595
88	125.05	4555.87	611.28	4670.30	206.16	5301.47	750.00	1.595
89	125.57	4556.14	610.23	4670.27	207.22	5295.52	743.88	1.596
90	126.10	4556.40	608.65	4670.23	209.34	5283.28	731.63	1.596
91	124.52	4555.61	607.60	4670.20	205.71	5288.88	737.76	1.596
92	126.10	4556.40	609.18	4670.24	209.77	5283.23	731.63	1.596
93	125.57	4556.14	615.49	4670.42	210.02	5301.37	750.00	1.596
94	126.10	4556.40	612.34	4670.33	210.84	5289.27	737.76	1.596
95	125.05	4555.87	612.34	4670.33	207.02	5301.38	750.00	1.596
96	124.52	4555.61	607.60	4670.20	202.72	5301.52	750.00	1.596
97	125.05	4555.87	610.76	4670.29	205.73	5301.52	750.00	1.597
98	124.52	4555.61	608.13	4670.21	203.15	5301.48	750.00	1.597
99	126.10	4556.40	609.71	4670.26	210.19	5283.18	731.63	1.597

Critical Failure Surface (circle 1)

Intersects: XL: 125.05 YL: 4555.87 XR: 607.60 YR: 4670.20
 Centre: XC: 207.64 YC: 5282.83 Radius: R: 731.63

Generated failure surface: (20 points)

125.05	4555.87	151.55	4553.35	178.14	4551.79	204.75	4551.20	231.38	4551.58
257.97	4552.93	284.50	4555.25	310.92	4558.52	337.21	4562.76	363.32	4567.95
389.23	4574.09	414.90	4581.17	440.30	4589.18	465.38	4598.10	490.13	4607.93
514.50	4618.66	538.46	4630.27	561.99	4642.73	585.04	4656.05	607.60	4670.20

Slice Geometry and Properties - Critical Failure Surface (circle 1, 50 slices)

Slice	X-S		Base							Porewater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	125.05	29.16	-5.4	9.90	9.94	1	0.00	35.0	3644.96	0.00	384.54	1.05
2	134.95	87.48	-5.4	9.90	9.94	1	0.00	35.0	10935.48	0.00	1153.67	1.05
3	144.84	92.45	-5.4	6.71	6.74	2	100.00	18.0	11592.49	139.63	1768.31	1.02
4	151.55	180.30	-3.4	9.75	9.76	2	100.00	18.0	22779.31	589.58	2368.95	1.01
5	161.30	198.42	-3.4	8.42	8.43	2	100.00	18.0	25210.96	807.21	3034.41	1.01
6	169.72	237.99	-3.4	8.42	8.43	2	100.00	18.0	30228.57	1083.13	3637.42	1.01
7	178.14	446.60	-1.3	13.12	13.12	2	100.00	18.0	56662.43	2039.07	4340.53	1.00
8	191.25	536.44	-1.3	13.12	13.12	2	100.00	18.0	67963.23	2316.89	5205.92	1.00
9	204.37	555.28	0.7	11.77	11.77	2	100.00	18.0	70248.44	2167.65	5954.04	1.00
10	216.13	622.53	0.8	11.77	11.77	2	100.00	18.0	78631.00	2076.97	6662.91	1.00
11	227.90	196.95	0.8	3.48	3.48	2	100.00	18.0	24852.46	595.25	7122.20	1.00
12	231.38	803.66	2.9	13.30	13.31	2	100.00	18.0	101236.24	1977.07	7533.38	0.99
13	244.68	883.09	2.9	13.30	13.31	2	100.00	18.0	110960.46	1417.29	8256.72	0.99
14	257.97	275.87	5.0	3.93	3.94	2	100.00	18.0	34609.15	294.76	8648.74	0.99
15	261.90	186.89	5.0	2.64	2.65	2	100.00	18.0	23430.07	150.41	8727.86	0.99
16	264.54	642.08	5.0	9.12	9.16	1	0.00	35.0	80478.96	227.35	8494.46	0.97
17	273.66	338.04	5.0	4.84	4.86	1	0.00	35.0	42371.32	0.00	8420.08	0.97
18	278.50	208.34	5.0	3.00	3.01	4	0.00	45.0	22917.28	6256.76	7346.61	0.95
19	281.50	207.35	5.0	3.00	3.01	1	0.00	35.0	25990.54	12556.08	8503.60	0.97

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20	284.50	901.50	7.1	13.21	13.31	1	0.00	35.0	113005.16	54774.64	8320.78	0.95
21	297.71	879.84	7.1	13.21	13.31	1	0.00	35.0	110297.05	53412.39	8121.20	0.95
22	310.92	850.59	9.2	13.14	13.31	1	0.00	35.0	106639.19	51851.73	7830.74	0.95
23	324.06	822.74	9.2	13.14	13.31	1	0.00	35.0	103158.38	50091.38	7574.85	0.95
24	337.21	304.74	11.2	4.99	5.09	1	0.00	35.0	38212.08	18657.47	7329.58	0.94
25	342.20	456.80	11.2	7.41	7.55	1	0.00	35.0	57277.91	27106.05	7394.29	0.94
26	349.61	775.79	11.2	12.01	12.25	1	0.00	35.0	97478.41	42478.01	7736.23	0.94
27	361.62	700.93	13.0	10.34	10.61	1	0.00	35.0	88236.63	35233.72	8049.84	0.93
28	371.96	593.22	13.3	8.44	8.68	5	150.00	22.0	74608.94	27609.33	8491.89	0.97
29	380.40	611.93	13.3	8.44	8.68	5	150.00	22.0	76846.38	26526.62	8734.55	0.97
30	388.84	978.08	15.4	13.03	13.51	1	0.00	35.0	122728.68	38967.45	8707.19	0.92
31	401.87	1016.06	15.4	13.03	13.52	1	0.00	35.0	127477.06	35949.45	9004.56	0.92
32	414.90	382.17	17.5	4.78	5.02	1	0.00	35.0	47943.99	12544.77	9094.94	0.92
33	419.69	1060.93	17.5	13.01	13.65	1	0.00	35.0	133338.97	31736.04	9270.01	0.92
34	432.70	619.31	17.5	7.60	7.96	1	0.00	35.0	77984.48	16907.15	9264.13	0.92
35	440.30	980.21	19.6	12.54	13.31	1	0.00	35.0	123471.59	25414.91	8758.12	0.92
36	452.84	924.87	19.6	12.54	13.31	1	0.00	35.0	116557.47	21707.46	8244.33	0.92
37	465.38	854.90	21.7	12.37	13.31	1	0.00	35.0	107801.55	17812.34	7603.70	0.91
38	477.75	794.68	21.7	12.37	13.31	1	0.00	35.0	100277.57	13727.67	7041.00	0.91
39	490.13	720.63	23.8	12.19	13.31	1	0.00	35.0	91011.13	9458.16	6361.00	0.91
40	502.31	655.87	23.8	12.19	13.31	1	0.00	35.0	82919.98	5002.68	5750.98	0.91
41	514.50	341.54	25.8	6.90	7.66	1	0.00	35.0	43224.17	798.91	5172.42	0.91
42	521.39	556.02	25.8	12.39	13.77	1	0.00	35.0	70459.39	0.00	4677.90	0.91
43	533.78	190.74	25.8	4.68	5.20	5	150.00	22.0	24173.29	0.00	4555.06	0.99
44	538.46	266.38	27.9	7.05	7.97	5	150.00	22.0	33670.26	0.00	4160.85	1.00
45	545.51	278.38	27.9	8.24	9.33	1	0.00	35.0	35141.89	0.00	3450.10	0.92
46	553.75	242.66	27.9	8.24	9.33	1	0.00	35.0	30678.38	0.00	3011.97	0.92
47	561.99	276.41	30.0	11.53	13.31	1	0.00	35.0	35037.66	0.00	2417.21	0.92
48	573.52	200.18	30.0	11.53	13.31	1	0.00	35.0	25512.22	0.00	1760.04	0.92
49	585.04	117.47	32.1	11.08	13.07	1	0.00	35.0	15157.88	0.00	1069.59	0.92
50	596.12	41.06	32.1	11.48	13.55	5	150.00	22.0	5379.51	0.00	351.99	1.02

X-S Area: 25125.57 Path Length: 505.90

X-S Weight: 3160451.00

Project: Derr Pit Technical Revision 8
File: C:\Galena Models\Derr TR8 SS5.gmf

Processed: 07 Apr 2023 10:10:35

DATA: Analysis 1 - Case SS-5 - Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion Phi UnitWeight Ru
0.00 35.0 125.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion Phi UnitWeight Ru
100.00 18.0 141.00 Auto

Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion Phi UnitWeight Ru
2000.00 20.0 141.00 Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion Phi UnitWeight Ru
0.00 45.0 110.00 Auto

Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion Phi UnitWeight Ru
150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
0.00 4664.00 550.00 4664.00

Profile: 2 (2 points) Material beneath: 1 - Sand and Gravel
0.00 4658.00 550.00 4658.00

Profile: 3 (2 points) Material beneath: 5 - Clay
0.00 4649.00 550.00 4649.00

Profile: 4 (2 points) Material beneath: 1 - Sand and Gravel
0.00 4638.00 550.00 4638.00

Profile: 5 (2 points) Material beneath: 4 - Slurry Wall
291.80 4622.10 294.80 4622.10

Profile: 6 (6 points) Material beneath: 2 - Weathered Bedrock
0.00 4547.50 123.80 4546.40 291.80 4544.90 332.60 4544.50 441.30 4545.30
550.00 4545.30

Profile: 7 (6 points) Material beneath: 3 - Stable Bedrock
0.00 4543.50 123.80 4543.40 291.80 4541.90 332.60 4541.50 441.30 4542.30
550.00 4542.30

Slope Surface (10 points)

0.00	4547.50	123.80	4546.40	275.20	4622.10	350.20	4622.10	430.40	4662.20
460.30	4662.00	480.30	4660.80	494.20	4662.80	500.10	4664.00	550.00	4664.00

Phreatic Surface (5 points)

0.00	4547.50	123.80	4546.40	291.80	4546.40	294.80	4617.00	550.00	4617.00
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Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 123.80 YL: 4546.40 XR: 499.20 YR: 4663.82
Centre: XC: 174.27 YC: 5043.85 Radius: R: 500.00

Variable Restraints

Parameter descriptor: XL XR R
Range of variation: 10.00 10.00 300.00
Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case SS-5 - Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.861

Analysis Summary

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There were: 19162 successful analyses from a total of 20001 trial failure surfaces
839 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.76

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	128.27	4548.64	494.20	4662.80	198.77	4966.20	423.47	1.760	<-- Critical Surface
2	128.80	4548.90	496.83	4663.33	200.85	4966.19	423.47	1.763	
3	128.80	4548.90	499.99	4663.98	200.94	4972.39	429.59	1.765	
4	127.75	4548.37	494.73	4662.91	196.78	4972.38	429.59	1.766	
5	128.80	4548.90	496.31	4663.23	200.50	4966.26	423.47	1.766	
6	128.27	4548.64	497.88	4663.55	199.22	4972.33	429.59	1.767	
7	127.75	4548.37	494.20	4662.80	196.42	4972.44	429.59	1.768	
8	127.22	4548.11	495.78	4663.12	195.14	4978.50	435.71	1.769	
9	128.80	4548.90	495.78	4663.12	200.15	4966.32	423.47	1.769	
10	128.80	4548.90	500.52	4664.00	201.37	4972.32	429.59	1.770	
11	128.27	4548.64	497.36	4663.44	198.86	4972.39	429.59	1.770	
12	127.75	4548.37	498.94	4663.76	197.58	4978.46	435.71	1.770	
13	127.22	4548.11	495.25	4663.01	194.78	4978.55	435.71	1.771	
14	127.75	4548.37	495.25	4663.01	197.13	4972.33	429.59	1.771	
15	128.80	4548.90	497.36	4663.44	201.21	4966.13	423.47	1.771	
16	128.27	4548.64	501.57	4664.00	199.93	4978.42	435.71	1.772	
17	126.69	4547.85	499.99	4663.98	193.61	4990.78	447.96	1.772	
18	127.22	4548.11	494.73	4662.91	194.43	4978.61	435.71	1.772	
19	128.80	4548.90	495.25	4663.01	199.79	4966.38	423.47	1.772	
20	126.69	4547.85	496.31	4663.23	193.15	4984.66	441.84	1.773	
21	128.27	4548.64	496.83	4663.33	198.51	4972.45	429.59	1.773	
22	127.75	4548.37	498.41	4663.66	197.23	4978.51	435.71	1.773	
23	125.64	4547.32	494.20	4662.80	189.07	4990.77	447.96	1.773	
24	127.22	4548.11	494.20	4662.80	194.07	4978.67	435.71	1.774	
25	128.27	4548.64	499.99	4663.98	198.60	4978.64	435.71	1.774	
26	126.69	4547.85	495.78	4663.12	192.79	4984.71	441.84	1.774	
27	128.80	4548.90	503.67	4664.00	202.03	4978.42	435.71	1.774	

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28	128.27	4548.64	501.04	4664.00	199.48	4978.49	435.71	1.775
29	127.75	4548.37	497.88	4663.55	196.87	4978.57	435.71	1.775
30	127.22	4548.11	499.46	4663.87	195.59	4984.62	441.84	1.775
31	128.27	4548.64	496.31	4663.23	198.15	4972.51	429.59	1.776
32	126.69	4547.85	495.25	4663.01	192.44	4984.77	441.84	1.776
33	128.80	4548.90	499.46	4663.87	200.59	4972.45	429.59	1.776
34	126.17	4547.58	496.83	4663.33	191.16	4990.80	447.96	1.776
35	127.75	4548.37	502.09	4664.00	198.04	4984.58	441.84	1.777
36	128.80	4548.90	494.73	4662.91	199.44	4966.44	423.47	1.777
37	126.69	4547.85	494.73	4662.91	192.08	4984.82	441.84	1.777
38	126.17	4547.58	499.99	4663.98	191.28	4996.97	454.08	1.777
39	126.17	4547.58	496.31	4663.23	190.81	4990.85	447.96	1.777
40	125.64	4547.32	497.88	4663.55	189.54	4996.88	454.08	1.777
41	127.22	4548.11	498.94	4663.76	195.24	4984.68	441.84	1.778
42	125.12	4547.06	494.20	4662.80	186.73	4996.94	454.08	1.778
43	128.27	4548.64	495.78	4663.12	197.80	4972.57	429.59	1.778
44	128.80	4548.90	503.15	4664.00	201.58	4978.49	435.71	1.778
45	126.17	4547.58	495.78	4663.12	190.45	4990.91	447.96	1.778
46	127.75	4548.37	497.36	4663.44	196.52	4978.63	435.71	1.778
47	127.22	4548.11	499.99	4663.98	195.95	4984.57	441.84	1.779
48	128.27	4548.64	500.52	4664.00	199.03	4978.57	435.71	1.779
49	125.64	4547.32	497.36	4663.44	189.18	4996.94	454.08	1.779
50	126.17	4547.58	495.25	4663.01	190.10	4990.96	447.96	1.779
51	128.27	4548.64	494.73	4662.91	199.13	4966.14	423.47	1.779
52	128.80	4548.90	494.20	4662.80	199.08	4966.50	423.47	1.779
53	125.64	4547.32	496.83	4663.33	188.83	4996.99	454.08	1.780
54	127.75	4548.37	501.57	4664.00	197.59	4984.65	441.84	1.780
55	128.27	4548.64	504.20	4664.00	200.15	4984.59	441.84	1.780
56	128.27	4548.64	498.41	4663.66	199.57	4972.27	429.59	1.780
57	127.22	4548.11	498.41	4663.66	194.88	4984.74	441.84	1.780
58	125.64	4547.32	496.31	4663.23	188.47	4997.04	454.08	1.780
59	128.80	4548.90	498.94	4663.76	200.23	4972.51	429.59	1.780
60	124.59	4546.79	494.73	4662.91	184.74	5003.05	460.20	1.781
61	128.27	4548.64	495.25	4663.01	197.44	4972.62	429.59	1.781
62	125.12	4547.06	497.88	4663.55	187.20	5003.05	460.20	1.781
63	127.22	4548.11	502.62	4664.00	196.17	4990.73	447.96	1.781
64	127.75	4548.37	496.83	4663.33	196.16	4978.68	435.71	1.781
65	128.80	4548.90	501.04	4664.00	201.82	4972.24	429.59	1.781
66	126.69	4547.85	496.83	4663.33	193.51	4984.60	441.84	1.781
67	127.75	4548.37	499.99	4663.98	196.26	4984.87	441.84	1.781
68	126.17	4547.58	497.36	4663.44	191.52	4990.75	447.96	1.781
69	125.12	4547.06	497.36	4663.44	186.84	5003.10	460.20	1.782
70	125.64	4547.32	499.99	4663.98	188.94	5003.15	460.20	1.782
71	128.80	4548.90	502.62	4664.00	201.13	4978.57	435.71	1.782
72	126.69	4547.85	499.46	4663.87	193.26	4990.83	447.96	1.782
73	124.59	4546.79	494.20	4662.80	184.38	5003.10	460.20	1.782
74	127.22	4548.11	497.88	4663.55	194.53	4984.79	441.84	1.782
75	124.59	4546.79	498.41	4663.66	185.22	5009.16	466.33	1.782
76	126.69	4547.85	494.20	4662.80	191.73	4984.87	441.84	1.783
77	127.22	4548.11	496.31	4663.23	195.49	4978.44	435.71	1.783
78	126.17	4547.58	500.52	4664.00	191.71	4996.91	454.08	1.783
79	128.27	4548.64	494.73	4662.91	197.09	4972.68	429.59	1.783
80	127.75	4548.37	496.31	4663.23	195.81	4978.74	435.71	1.783
81	127.75	4548.37	501.04	4664.00	197.14	4984.73	441.84	1.783
82	126.69	4547.85	500.52	4664.00	194.04	4990.71	447.96	1.783
83	125.12	4547.06	494.73	4662.91	187.08	4996.89	454.08	1.783
84	124.06	4546.53	495.25	4663.01	182.76	5009.15	466.33	1.783
85	128.80	4548.90	498.41	4663.66	199.88	4972.57	429.59	1.783
86	128.27	4548.64	503.67	4664.00	199.71	4984.66	441.84	1.783

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87	124.59	4546.79	497.88	4663.55	184.87	5009.21	466.33	1.784
88	127.22	4548.11	502.09	4664.00	195.72	4990.80	447.96	1.784
89	126.69	4547.85	498.94	4663.76	192.90	4990.89	447.96	1.784
90	124.06	4546.53	498.94	4663.76	183.25	5015.26	472.45	1.784
91	126.69	4547.85	503.15	4664.00	194.30	4996.87	454.08	1.784
92	123.54	4546.40	499.99	4663.98	181.77	5021.42	478.57	1.785
93	128.27	4548.64	499.46	4663.87	198.25	4978.70	435.71	1.785
94	127.22	4548.11	497.36	4663.44	194.17	4984.84	441.84	1.785
95	128.27	4548.64	494.20	4662.80	196.73	4972.74	429.59	1.785
96	127.75	4548.37	495.78	4663.12	195.45	4978.80	435.71	1.785
97	125.64	4547.32	501.04	4664.00	189.84	5003.03	460.20	1.785
98	125.12	4547.06	499.99	4663.98	186.61	5009.31	466.33	1.786
99	126.17	4547.58	494.73	4662.91	189.74	4991.01	447.96	1.786

Critical Failure Surface (circle 1)

Intersects: XL: 128.27 YL: 4548.64 XR: 494.20 YR: 4662.80
Centre: XC: 198.77 YC: 4966.20 Radius: R: 423.47

Generated failure surface: (20 points)

128.27	4548.64	149.00	4545.66	169.84	4543.72	190.75	4542.80	211.69	4542.92
232.59	4544.08	253.41	4546.27	274.09	4549.48	294.60	4553.71	314.86	4558.95
334.85	4565.18	354.50	4572.40	373.77	4580.58	392.61	4589.70	410.98	4599.74
428.83	4610.67	446.12	4622.47	462.81	4635.12	478.85	4648.57	494.20	4662.80

Slice Geometry and Properties - Critical Failure Surface (circle 1, 44 slices)

Slice	X-S		Base						Porewater		Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	128.27	19.54	-8.2	7.79	7.87	1	0.00	35.0	2442.24	0.00	332.40	1.07
2	136.07	58.61	-8.2	7.79	7.87	1	0.00	35.0	7326.70	0.00	997.17	1.07
3	143.86	60.01	-8.2	5.14	5.19	2	100.00	18.0	7515.17	119.38	1510.50	1.04
4	149.00	171.19	-5.3	10.42	10.47	2	100.00	18.0	21558.08	799.20	2108.93	1.02
5	159.42	235.64	-5.3	10.42	10.47	2	100.00	18.0	29760.76	1434.80	2908.72	1.02
6	169.84	298.50	-2.5	10.46	10.47	2	100.00	18.0	37723.10	1901.70	3637.82	1.01
7	180.30	357.95	-2.5	10.46	10.47	2	100.00	18.0	45215.61	2200.20	4359.92	1.01
8	190.75	415.11	0.3	10.47	10.47	2	100.00	18.0	52378.84	2329.68	4998.86	1.00
9	201.22	469.26	0.3	10.47	10.47	2	100.00	18.0	59120.98	2290.14	5642.30	1.00
10	211.69	519.87	3.2	10.45	10.47	2	100.00	18.0	65378.11	2081.88	6191.38	0.99
11	222.14	568.44	3.2	10.45	10.47	2	100.00	18.0	71337.02	1704.28	6755.44	0.99
12	232.59	699.20	6.0	11.84	11.91	2	100.00	18.0	87527.93	1261.97	7248.00	0.99
13	244.43	567.18	6.0	8.98	9.03	1	0.00	35.0	70897.72	341.12	7580.34	0.97
14	253.41	690.08	8.8	10.34	10.47	1	0.00	35.0	86260.28	0.00	7854.70	0.95
15	263.75	726.96	8.8	10.34	10.47	1	0.00	35.0	90870.17	0.00	8274.44	0.95
16	274.09	634.83	11.7	8.85	9.04	1	0.00	35.0	79354.12	0.00	8283.35	0.94
17	282.95	618.66	11.7	8.85	9.04	1	0.00	35.0	77332.13	0.00	8072.28	0.94
18	291.80	192.00	11.7	2.80	2.85	4	0.00	45.0	21120.06	4608.79	6931.03	0.91
19	294.60	679.77	14.5	10.13	10.47	1	0.00	35.0	84971.81	40481.68	7963.64	0.94
20	304.73	653.23	14.5	10.13	10.47	1	0.00	35.0	81653.20	38770.11	7651.55	0.94
21	314.86	615.42	17.3	9.99	10.47	1	0.00	35.0	76927.34	36896.43	7238.10	0.93
22	324.86	584.27	17.3	9.99	10.47	1	0.00	35.0	73034.20	34860.58	6870.00	0.93
23	334.85	426.09	20.2	7.68	8.18	1	0.00	35.0	53260.85	25720.75	6454.91	0.93
24	342.52	404.45	20.2	7.68	8.18	1	0.00	35.0	50556.50	24282.62	6125.10	0.93
25	350.20	221.66	20.2	4.30	4.58	1	0.00	35.0	27707.55	12969.82	5985.11	0.93
26	354.50	503.11	23.0	9.64	10.47	1	0.00	35.0	62889.11	27795.28	5967.76	0.93
27	364.13	510.14	23.0	9.64	10.47	1	0.00	35.0	63767.34	25124.76	6008.88	0.93
28	373.77	439.28	25.8	8.23	9.14	1	0.00	35.0	54909.71	19644.77	5941.58	0.93
29	382.00	568.08	25.8	10.61	11.79	1	0.00	35.0	71178.59	21978.72	5924.79	0.93
30	392.61	607.44	28.7	11.39	12.98	1	0.00	35.0	76486.72	19589.24	5787.13	0.94
31	404.00	369.52	28.7	6.98	7.96	1	0.00	35.0	46650.46	9520.40	5701.32	0.94

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32	410.98	574.39	31.5	11.02	12.92	1	0.00	35.0	72525.95	11198.40	5462.89	0.94
33	422.00	349.42	31.5	6.83	8.01	1	0.00	35.0	44199.16	4212.06	5303.41	0.94
34	428.83	79.27	34.3	1.57	1.90	1	0.00	35.0	10047.97	685.85	5121.65	0.95
35	430.40	368.30	34.3	7.70	9.33	1	0.00	35.0	46739.14	1530.91	4805.81	0.95
36	438.10	339.84	34.3	8.02	9.71	1	0.00	35.0	43206.98	0.00	4237.81	0.95
37	446.12	261.66	37.2	7.09	8.89	1	0.00	35.0	33348.29	0.00	3614.61	0.96
38	453.21	223.24	37.2	7.09	8.89	1	0.00	35.0	28543.64	0.00	3093.77	0.96
39	460.30	69.57	37.2	2.51	3.14	1	0.00	35.0	8920.97	0.00	2734.69	0.96
40	462.81	86.54	40.0	3.44	4.48	1	0.00	35.0	11121.77	0.00	2427.08	0.98
41	466.24	131.15	40.0	6.30	8.22	5	150.00	22.0	16839.76	0.00	2180.92	1.09
42	472.54	95.46	40.0	6.30	8.22	5	150.00	22.0	12164.44	0.00	1558.80	1.09
43	478.85	81.78	42.8	10.17	13.87	1	0.00	35.0	10425.66	0.00	748.64	1.00
44	489.02	10.50	42.8	5.18	7.06	5	150.00	22.0	1375.57	0.00	153.87	1.12
		-----			-----				-----			
	X-S Area:	16556.63	Path Length:	397.75				X-S Weight:	2076572.00			

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS5-EQ.gmf

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DATA: Analysis 1 - Case SS-5 - Pseudo-Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion Phi UnitWeight Ru
0.00 35.0 125.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion Phi UnitWeight Ru
100.00 18.0 141.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion Phi UnitWeight Ru
2000.00 20.0 141.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion Phi UnitWeight Ru
0.00 45.0 110.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Clay
Cohesion Phi UnitWeight Ru
150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
0.00 4664.00 550.00 4664.00
Profile: 2 (2 points) Material beneath: 1 - Sand and Gravel
0.00 4658.00 550.00 4658.00
Profile: 3 (2 points) Material beneath: 5 - Clay
0.00 4649.00 550.00 4649.00
Profile: 4 (2 points) Material beneath: 1 - Sand and Gravel
0.00 4638.00 550.00 4638.00
Profile: 5 (2 points) Material beneath: 4 - Slurry Wall
291.80 4622.10 294.80 4622.10
Profile: 6 (6 points) Material beneath: 2 - Weathered Bedrock
0.00 4547.50 123.80 4546.40 291.80 4544.90 332.60 4544.50 441.30 4545.30
550.00 4545.30
Profile: 7 (6 points) Material beneath: 3 - Stable Bedrock
0.00 4543.50 123.80 4543.40 291.80 4541.90 332.60 4541.50 441.30 4542.30
550.00 4542.30

Slope Surface (10 points)

0.00 4547.50 123.80 4546.40 275.20 4622.10 350.20 4622.10 430.40 4662.20
460.30 4662.00 480.30 4660.80 494.20 4662.80 500.10 4664.00 550.00 4664.00

Phreatic Surface (5 points)

0.00 4547.50 123.80 4546.40 291.80 4546.40 294.80 4617.00 550.00 4617.00

Failure Surface

Initial circular surface for critical search defined by: XL, XR, R

Intersects: XL: 123.80 YL: 4546.40 XR: 499.20 YR: 4663.82
Centre: XC: 174.27 YC: 5043.85 Radius: R: 500.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.070

Variable Restraints

Parameter descriptor: XL XR R
Range of variation: 10.00 10.00 300.00
Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case SS-5 - Pseudo-Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.481

Analysis Summary

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There were: 19162 successful analyses from a total of 20001 trial failure surfaces
839 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.40

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	128.27	4548.64	494.20	4662.80	198.77	4966.20	423.47	1.398	<-- Critical Surface
2	128.80	4548.90	496.83	4663.33	200.85	4966.19	423.47	1.399	
3	128.80	4548.90	499.99	4663.98	200.94	4972.39	429.59	1.400	
4	128.80	4548.90	496.31	4663.23	200.50	4966.26	423.47	1.402	
5	128.27	4548.64	497.88	4663.55	199.22	4972.33	429.59	1.402	
6	127.75	4548.37	494.73	4662.91	196.78	4972.38	429.59	1.403	
7	128.80	4548.90	500.52	4664.00	201.37	4972.32	429.59	1.403	
8	128.27	4548.64	501.57	4664.00	199.93	4978.42	435.71	1.404	
9	127.75	4548.37	494.20	4662.80	196.42	4972.44	429.59	1.405	
10	128.80	4548.90	495.78	4663.12	200.15	4966.32	423.47	1.405	
11	128.27	4548.64	497.36	4663.44	198.86	4972.39	429.59	1.405	
12	127.75	4548.37	498.94	4663.76	197.58	4978.46	435.71	1.405	
13	127.22	4548.11	495.78	4663.12	195.14	4978.50	435.71	1.405	
14	128.80	4548.90	503.67	4664.00	202.03	4978.42	435.71	1.405	
15	128.80	4548.90	497.36	4663.44	201.21	4966.13	423.47	1.405	
16	127.75	4548.37	495.25	4663.01	197.13	4972.33	429.59	1.407	
17	126.69	4547.85	499.99	4663.98	193.61	4990.78	447.96	1.407	
18	127.22	4548.11	495.25	4663.01	194.78	4978.55	435.71	1.407	
19	127.75	4548.37	498.41	4663.66	197.23	4978.51	435.71	1.407	
20	128.80	4548.90	495.25	4663.01	199.79	4966.38	423.47	1.407	
21	128.27	4548.64	501.04	4664.00	199.48	4978.49	435.71	1.407	
22	128.27	4548.64	496.83	4663.33	198.51	4972.45	429.59	1.408	
23	128.27	4548.64	499.99	4663.98	198.60	4978.64	435.71	1.408	

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24	127.75	4548.37	502.09	4664.00	198.04	4984.58	441.84	1.408
25	127.22	4548.11	494.73	4662.91	194.43	4978.61	435.71	1.408
26	126.69	4547.85	496.31	4663.23	193.15	4984.66	441.84	1.408
27	128.80	4548.90	503.15	4664.00	201.58	4978.49	435.71	1.408
28	128.80	4548.90	499.46	4663.87	200.59	4972.45	429.59	1.409
29	127.22	4548.11	499.46	4663.87	195.59	4984.62	441.84	1.409
30	127.75	4548.37	497.88	4663.55	196.87	4978.57	435.71	1.409
31	128.27	4548.64	504.20	4664.00	200.15	4984.59	441.84	1.410
32	127.22	4548.11	494.20	4662.80	194.07	4978.67	435.71	1.410
33	126.69	4547.85	495.78	4663.12	192.79	4984.71	441.84	1.410
34	128.27	4548.64	496.31	4663.23	198.15	4972.51	429.59	1.410
35	125.64	4547.32	494.20	4662.80	189.07	4990.77	447.96	1.410
36	128.27	4548.64	500.52	4664.00	199.03	4978.57	435.71	1.411
37	126.69	4547.85	495.25	4663.01	192.44	4984.77	441.84	1.411
38	128.80	4548.90	494.73	4662.91	199.44	4966.44	423.47	1.411
39	127.22	4548.11	498.94	4663.76	195.24	4984.68	441.84	1.411
40	126.17	4547.58	496.83	4663.33	191.16	4990.80	447.96	1.411
41	127.75	4548.37	501.57	4664.00	197.59	4984.65	441.84	1.411
42	126.17	4547.58	499.99	4663.98	191.28	4996.97	454.08	1.411
43	127.22	4548.11	502.62	4664.00	196.17	4990.73	447.96	1.412
44	128.80	4548.90	502.62	4664.00	201.13	4978.57	435.71	1.412
45	128.80	4548.90	501.04	4664.00	201.82	4972.24	429.59	1.412
46	127.75	4548.37	497.36	4663.44	196.52	4978.63	435.71	1.412
47	125.64	4547.32	497.88	4663.55	189.54	4996.88	454.08	1.412
48	128.27	4548.64	495.78	4663.12	197.80	4972.57	429.59	1.412
49	127.22	4548.11	499.99	4663.98	195.95	4984.57	441.84	1.412
50	126.69	4547.85	494.73	4662.91	192.08	4984.82	441.84	1.412
51	126.17	4547.58	496.31	4663.23	190.81	4990.85	447.96	1.412
52	128.80	4548.90	498.94	4663.76	200.23	4972.51	429.59	1.413
53	128.27	4548.64	498.41	4663.66	199.57	4972.27	429.59	1.413
54	128.27	4548.64	503.67	4664.00	199.71	4984.66	441.84	1.413
55	127.22	4548.11	498.41	4663.66	194.88	4984.74	441.84	1.413
56	126.17	4547.58	495.78	4663.12	190.45	4990.91	447.96	1.413
57	125.64	4547.32	497.36	4663.44	189.18	4996.94	454.08	1.414
58	128.27	4548.64	494.73	4662.91	199.13	4966.14	423.47	1.414
59	128.80	4548.90	494.20	4662.80	199.08	4966.50	423.47	1.414
60	127.75	4548.37	499.99	4663.98	196.26	4984.87	441.84	1.414
61	125.12	4547.06	494.20	4662.80	186.73	4996.94	454.08	1.414
62	127.75	4548.37	496.83	4663.33	196.16	4978.68	435.71	1.414
63	127.75	4548.37	501.04	4664.00	197.14	4984.73	441.84	1.414
64	126.17	4547.58	495.25	4663.01	190.10	4990.96	447.96	1.414
65	125.64	4547.32	496.83	4663.33	188.83	4996.99	454.08	1.414
66	127.22	4548.11	502.09	4664.00	195.72	4990.80	447.96	1.415
67	126.69	4547.85	503.15	4664.00	194.30	4996.87	454.08	1.415
68	128.27	4548.64	495.25	4663.01	197.44	4972.62	429.59	1.415
69	126.69	4547.85	499.46	4663.87	193.26	4990.83	447.96	1.415
70	126.69	4547.85	496.83	4663.33	193.51	4984.60	441.84	1.415
71	125.12	4547.06	497.88	4663.55	187.20	5003.05	460.20	1.415
72	126.17	4547.58	500.52	4664.00	191.71	4996.91	454.08	1.415
73	126.69	4547.85	500.52	4664.00	194.04	4990.71	447.96	1.415
74	128.80	4548.90	498.41	4663.66	199.88	4972.57	429.59	1.415
75	125.64	4547.32	496.31	4663.23	188.47	4997.04	454.08	1.415
76	126.17	4547.58	497.36	4663.44	191.52	4990.75	447.96	1.415
77	127.22	4548.11	497.88	4663.55	194.53	4984.79	441.84	1.415
78	125.64	4547.32	499.99	4663.98	188.94	5003.15	460.20	1.416
79	128.27	4548.64	503.15	4664.00	199.26	4984.73	441.84	1.416
80	128.27	4548.64	499.46	4663.87	198.25	4978.70	435.71	1.416
81	125.12	4547.06	497.36	4663.44	186.84	5003.10	460.20	1.416
82	127.75	4548.37	504.20	4664.00	197.84	4990.82	447.96	1.416

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83	124.59	4546.79	494.73	4662.91	184.74	5003.05	460.20	1.416
84	127.75	4548.37	496.31	4663.23	195.81	4978.74	435.71	1.416
85	128.80	4548.90	502.09	4664.00	200.69	4978.64	435.71	1.416
86	124.59	4546.79	498.41	4663.66	185.22	5009.16	466.33	1.417
87	126.69	4547.85	498.94	4663.76	192.90	4990.89	447.96	1.417
88	127.22	4548.11	496.31	4663.23	195.49	4978.44	435.71	1.417
89	128.27	4548.64	494.73	4662.91	197.09	4972.68	429.59	1.417
90	126.17	4547.58	503.67	4664.00	192.43	5002.99	460.20	1.417
91	127.75	4548.37	500.52	4664.00	196.69	4984.80	441.84	1.417
92	126.69	4547.85	502.62	4664.00	193.84	4996.94	454.08	1.417
93	125.64	4547.32	501.04	4664.00	189.84	5003.03	460.20	1.417
94	126.69	4547.85	494.20	4662.80	191.73	4984.87	441.84	1.417
95	127.22	4548.11	501.57	4664.00	195.26	4990.87	447.96	1.417
96	124.59	4546.79	497.88	4663.55	184.87	5009.21	466.33	1.418
97	128.80	4548.90	497.88	4663.55	199.52	4972.63	429.59	1.418
98	127.22	4548.11	497.36	4663.44	194.17	4984.84	441.84	1.418
99	124.59	4546.79	494.20	4662.80	184.38	5003.10	460.20	1.418

Critical Failure Surface (circle 1)

Intersects: XL: 128.27 YL: 4548.64 XR: 494.20 YR: 4662.80
Centre: XC: 198.77 YC: 4966.20 Radius: R: 423.47

Generated failure surface: (20 points)

128.27	4548.64	149.00	4545.66	169.84	4543.72	190.75	4542.80	211.69	4542.92
232.59	4544.08	253.41	4546.27	274.09	4549.48	294.60	4553.71	314.86	4558.95
334.85	4565.18	354.50	4572.40	373.77	4580.58	392.61	4589.70	410.98	4599.74
428.83	4610.67	446.12	4622.47	462.81	4635.12	478.85	4648.57	494.20	4662.80

Slice Geometry and Properties - Critical Failure Surface (circle 1, 44 slices)

Slice	X-S		Base						Porewater		Normal	Test
	X-Left	Area	Angle	Width	Length	Mat'l	Cohesion	Phi	Weight	Force	Stress	Factor
1	128.27	19.54	-8.2	7.79	7.87	1	0.00	35.0	2442.24	0.00	337.70	1.09
2	136.07	58.61	-8.2	7.79	7.87	1	0.00	35.0	7326.70	0.00	1013.06	1.09
3	143.86	60.01	-8.2	5.14	5.19	2	100.00	18.0	7515.17	119.38	1523.25	1.05
4	149.00	171.19	-5.3	10.42	10.47	2	100.00	18.0	21558.08	799.20	2119.61	1.03
5	159.42	235.64	-5.3	10.42	10.47	2	100.00	18.0	29760.76	1434.80	2922.77	1.03
6	169.84	298.50	-2.5	10.46	10.47	2	100.00	18.0	37723.10	1901.70	3645.76	1.01
7	180.30	357.95	-2.5	10.46	10.47	2	100.00	18.0	45215.61	2200.20	4369.33	1.01
8	190.75	415.11	0.3	10.47	10.47	2	100.00	18.0	52378.84	2329.68	4997.45	1.00
9	201.22	469.26	0.3	10.47	10.47	2	100.00	18.0	59120.98	2290.14	5640.72	1.00
10	211.69	519.87	3.2	10.45	10.47	2	100.00	18.0	65378.11	2081.88	6174.94	0.99
11	222.14	568.44	3.2	10.45	10.47	2	100.00	18.0	71337.02	1704.28	6737.43	0.99
12	232.59	699.20	6.0	11.84	11.91	2	100.00	18.0	87527.93	1261.97	7211.47	0.98
13	244.43	567.18	6.0	8.98	9.03	1	0.00	35.0	70897.72	341.12	7502.76	0.96
14	253.41	690.08	8.8	10.34	10.47	1	0.00	35.0	86260.28	0.00	7738.06	0.94
15	263.75	726.96	8.8	10.34	10.47	1	0.00	35.0	90870.17	0.00	8151.57	0.94
16	274.09	634.83	11.7	8.85	9.04	1	0.00	35.0	79354.12	0.00	8123.69	0.93
17	282.95	618.66	11.7	8.85	9.04	1	0.00	35.0	77332.13	0.00	7916.69	0.93
18	291.80	192.00	11.7	2.80	2.85	4	0.00	45.0	21120.06	4608.79	6790.29	0.89
19	294.60	679.77	14.5	10.13	10.47	1	0.00	35.0	84971.81	40481.68	7867.02	0.91
20	304.73	653.23	14.5	10.13	10.47	1	0.00	35.0	81653.20	38770.11	7558.45	0.91
21	314.86	615.42	17.3	9.99	10.47	1	0.00	35.0	76927.34	36896.43	7134.86	0.91
22	324.86	584.27	17.3	9.99	10.47	1	0.00	35.0	73034.20	34860.58	6771.59	0.91
23	334.85	426.09	20.2	7.68	8.18	1	0.00	35.0	53260.85	25720.75	6349.14	0.90
24	342.52	404.45	20.2	7.68	8.18	1	0.00	35.0	50556.50	24282.62	6024.25	0.90
25	350.20	221.66	20.2	4.30	4.58	1	0.00	35.0	27707.55	12969.82	5884.36	0.90
26	354.50	503.11	23.0	9.64	10.47	1	0.00	35.0	62889.11	27795.28	5848.32	0.90
27	364.13	510.14	23.0	9.64	10.47	1	0.00	35.0	63767.34	25124.76	5878.76	0.90

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28	373.77	439.28	25.8	8.23	9.14	1	0.00	35.0	54909.71	19644.77	5789.33	0.89
29	382.00	568.08	25.8	10.61	11.79	1	0.00	35.0	71178.59	21978.72	5761.78	0.89
30	392.61	607.44	28.7	11.39	12.98	1	0.00	35.0	76486.72	19589.24	5598.00	0.89
31	404.00	369.52	28.7	6.98	7.96	1	0.00	35.0	46650.46	9520.40	5502.13	0.89
32	410.98	574.39	31.5	11.02	12.92	1	0.00	35.0	72525.95	11198.40	5240.88	0.90
33	422.00	349.42	31.5	6.83	8.01	1	0.00	35.0	44199.16	4212.06	5072.63	0.90
34	428.83	79.27	34.3	1.57	1.90	1	0.00	35.0	10047.97	685.85	4872.13	0.90
35	430.40	368.30	34.3	7.70	9.33	1	0.00	35.0	46739.14	1530.91	4562.46	0.90
36	438.10	339.84	34.3	8.02	9.71	1	0.00	35.0	43206.98	0.00	4015.64	0.90
37	446.12	261.66	37.2	7.09	8.89	1	0.00	35.0	33348.29	0.00	3410.01	0.91
38	453.21	223.24	37.2	7.09	8.89	1	0.00	35.0	28543.64	0.00	2918.64	0.91
39	460.30	69.57	37.2	2.51	3.14	1	0.00	35.0	8920.97	0.00	2579.90	0.91
40	462.81	86.54	40.0	3.44	4.48	1	0.00	35.0	11121.77	0.00	2279.37	0.92
41	466.24	131.15	40.0	6.30	8.22	5	150.00	22.0	16839.76	0.00	2078.47	1.05
42	472.54	95.46	40.0	6.30	8.22	5	150.00	22.0	12164.44	0.00	1481.33	1.05
43	478.85	81.78	42.8	10.17	13.87	1	0.00	35.0	10425.66	0.00	699.82	0.93
44	489.02	10.50	42.8	5.18	7.06	5	150.00	22.0	1375.57	0.00	131.05	1.08

X-S Area: 16556.63

Path Length: 397.75

X-S Weight: 2076572.00

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS6.gmf

Processed: 07 Apr 2023 10:16:58

DATA: Analysis 1 - Case SS-6 - Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 125.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto

Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 Auto

Material: 5 (Mohr-Coulomb Isotropic) - Clay
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (5 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
 0.00 4663.00 550.00 4663.00

Profile: 2 (2 points) Material beneath: 1 - Sand and Gravel
 0.00 4654.10 550.00 4654.10

Profile: 3 (2 points) Material beneath: 4 - Slurry Wall
 224.30 4621.00 227.30 4621.00

Profile: 4 (6 points) Material beneath: 2 - Weathered Bedrock
 0.00 4547.60 60.90 4547.70 224.30 4548.00 300.30 4548.20 423.80 4546.70
 550.00 4546.50

Profile: 5 (6 points) Material beneath: 3 - Stable Bedrock
 0.00 4544.60 60.90 4543.70 224.30 4545.00 300.30 4545.20 423.90 4543.70
 550.00 4543.50

Slope Surface (7 points)

0.00 4547.60 60.90 4547.70 207.70 4621.00 283.80 4621.00 366.10 4662.10
 489.90 4662.50 550.00 4662.40

Phreatic Surface (5 points)

0.00 4547.60 60.90 4547.70 224.30 4548.00 227.30 4614.00 550.00 4614.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 60.90 YL: 4547.70 XR: 490.90 YR: 4662.50
 Centre: XC: 132.17 YC: 5143.45 Radius: R: 600.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	300.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case SS-6 - Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.115

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.90

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	65.90	4550.20	485.90	4662.49	145.98	5092.27	547.96	1.902	<-- Critical Surface
2	64.85	4549.67	486.43	4662.49	142.26	5104.50	560.20	1.909	
3	65.37	4549.93	485.90	4662.49	143.90	5098.42	554.08	1.911	
4	64.85	4549.67	485.90	4662.49	141.81	5104.56	560.20	1.911	
5	65.37	4549.93	486.43	4662.49	144.34	5098.36	554.08	1.912	
6	64.32	4549.41	486.43	4662.49	140.17	5110.63	566.33	1.914	
7	64.32	4549.41	485.90	4662.49	139.72	5110.69	566.33	1.917	
8	64.85	4549.67	489.06	4662.50	142.77	5110.61	566.33	1.918	
9	65.37	4549.93	488.01	4662.49	143.95	5104.60	560.20	1.918	
10	65.90	4550.20	486.95	4662.49	145.15	5098.58	554.08	1.918	
11	64.85	4549.67	488.53	4662.50	142.32	5110.67	566.33	1.919	
12	63.79	4549.15	486.43	4662.49	138.09	5116.75	572.45	1.919	
13	65.37	4549.93	488.53	4662.50	144.40	5104.54	560.20	1.919	
14	65.90	4550.20	487.48	4662.49	145.59	5098.52	554.08	1.920	
15	65.90	4550.20	488.53	4662.50	146.47	5098.39	554.08	1.920	
16	65.37	4549.93	487.48	4662.49	143.51	5104.66	560.20	1.920	
17	64.32	4549.41	489.06	4662.50	140.69	5116.74	572.45	1.921	
18	65.90	4550.20	490.64	4662.50	146.54	5104.57	560.20	1.921	
19	65.90	4550.20	488.01	4662.49	146.03	5098.45	554.08	1.921	
20	65.90	4550.20	486.43	4662.49	144.70	5098.65	554.08	1.922	
21	63.79	4549.15	485.90	4662.49	137.64	5116.81	572.45	1.923	
22	64.85	4549.67	488.01	4662.49	141.88	5110.73	566.33	1.923	
23	63.27	4548.88	486.43	4662.49	136.00	5122.86	578.57	1.924	
24	65.37	4549.93	486.95	4662.49	143.07	5104.72	560.20	1.925	
25	64.32	4549.41	488.53	4662.50	140.24	5116.80	572.45	1.925	
26	65.90	4550.20	485.90	4662.49	144.26	5098.71	554.08	1.926	
27	64.85	4549.67	491.16	4662.50	142.85	5116.78	572.45	1.926	
28	63.79	4549.15	489.06	4662.50	138.61	5122.86	578.57	1.926	
29	64.85	4549.67	491.69	4662.50	143.29	5116.72	572.45	1.927	
30	64.85	4549.67	487.48	4662.49	141.43	5110.80	566.33	1.927	
31	65.37	4549.93	490.64	4662.50	144.47	5110.71	566.33	1.927	
32	65.90	4550.20	489.58	4662.50	145.65	5104.70	560.20	1.927	

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33	63.27	4548.88	485.90	4662.49	135.55	5122.92	578.57	1.927
34	65.37	4549.93	490.11	4662.50	144.02	5110.77	566.33	1.928
35	62.74	4548.62	486.43	4662.49	133.91	5128.97	584.69	1.928
36	64.32	4549.41	491.69	4662.50	141.23	5122.85	578.57	1.928
37	64.32	4549.41	488.01	4662.49	139.80	5116.86	572.45	1.928
38	65.37	4549.93	486.43	4662.49	142.62	5104.79	560.20	1.929
39	65.37	4549.93	491.16	4662.50	144.91	5110.65	566.33	1.929
40	65.90	4550.20	493.27	4662.49	147.06	5110.68	566.33	1.929
41	65.90	4550.20	489.06	4662.50	145.21	5104.76	560.20	1.929
42	65.90	4550.20	490.11	4662.50	146.09	5104.63	560.20	1.930
43	63.79	4549.15	488.53	4662.50	138.16	5122.92	578.57	1.930
44	64.85	4549.67	490.64	4662.50	142.40	5116.84	572.45	1.930
45	65.37	4549.93	493.79	4662.49	145.45	5116.75	572.45	1.930
46	64.85	4549.67	486.95	4662.49	140.98	5110.86	566.33	1.930
47	63.27	4548.88	489.06	4662.50	136.54	5128.97	584.69	1.931
48	62.74	4548.62	485.90	4662.49	133.46	5129.02	584.69	1.931
49	65.90	4550.20	492.74	4662.50	146.62	5110.74	566.33	1.931
50	64.32	4549.41	486.95	4662.49	140.62	5110.57	566.33	1.932
51	64.32	4549.41	491.16	4662.50	140.78	5122.91	578.57	1.932
52	65.37	4549.93	489.58	4662.50	143.58	5110.83	566.33	1.932
53	64.32	4549.41	487.48	4662.49	139.35	5116.92	572.45	1.932
54	65.37	4549.93	485.90	4662.49	142.18	5104.85	560.20	1.932
55	63.79	4549.15	488.01	4662.49	137.72	5122.98	578.57	1.933
56	65.90	4550.20	488.53	4662.50	144.76	5104.82	560.20	1.934
57	64.85	4549.67	490.11	4662.50	141.95	5116.90	572.45	1.934
58	64.85	4549.67	486.43	4662.49	140.54	5110.92	566.33	1.934
59	63.27	4548.88	488.53	4662.50	136.09	5129.02	584.69	1.934
60	62.22	4548.36	485.90	4662.49	131.37	5135.11	590.82	1.934
61	63.79	4549.15	486.95	4662.49	138.53	5116.69	572.45	1.935
62	64.32	4549.41	486.95	4662.49	138.90	5116.98	572.45	1.935
63	64.32	4549.41	490.64	4662.50	140.33	5122.97	578.57	1.936
64	65.37	4549.93	489.06	4662.50	143.13	5110.90	566.33	1.936
65	63.79	4549.15	487.48	4662.49	137.27	5123.03	578.57	1.936
66	64.85	4549.67	493.79	4662.49	143.39	5122.89	578.57	1.937
67	61.69	4548.09	485.90	4662.49	129.28	5141.19	596.94	1.937
68	63.79	4549.15	491.16	4662.50	138.71	5129.02	584.69	1.937
69	65.90	4550.20	495.90	4662.49	147.60	5116.79	572.45	1.937
70	64.85	4549.67	493.27	4662.49	142.94	5122.95	578.57	1.937
71	63.27	4548.88	488.01	4662.49	135.64	5129.08	584.69	1.937
72	65.37	4549.93	492.74	4662.50	144.56	5116.88	572.45	1.937
73	64.85	4549.67	485.90	4662.49	140.09	5110.98	566.33	1.938
74	64.85	4549.67	489.58	4662.50	141.51	5116.96	572.45	1.938
75	62.74	4548.62	488.53	4662.50	134.01	5135.12	590.82	1.938
76	65.90	4550.20	491.69	4662.50	145.73	5110.87	566.33	1.938
77	65.90	4550.20	488.01	4662.49	144.32	5104.88	560.20	1.938
78	64.32	4549.41	486.43	4662.49	138.45	5117.04	572.45	1.939
79	64.32	4549.41	493.79	4662.49	141.33	5129.01	584.69	1.939
80	64.32	4549.41	490.11	4662.50	139.88	5123.02	578.57	1.939
81	65.37	4549.93	492.22	4662.50	144.11	5116.94	572.45	1.939
82	63.79	4549.15	486.95	4662.49	136.82	5123.09	578.57	1.940
83	65.37	4549.93	493.27	4662.49	145.00	5116.82	572.45	1.940
84	65.37	4549.93	488.53	4662.50	142.69	5110.96	566.33	1.940
85	65.90	4550.20	491.16	4662.50	146.98	5104.50	560.20	1.940
86	63.79	4549.15	490.64	4662.50	138.26	5129.08	584.69	1.940
87	63.27	4548.88	487.48	4662.49	135.19	5129.14	584.69	1.940
88	65.90	4550.20	492.22	4662.50	146.17	5110.81	566.33	1.940
89	65.37	4549.93	495.90	4662.49	145.55	5122.92	578.57	1.940
90	62.74	4548.62	488.01	4662.49	133.56	5135.18	590.82	1.941
91	63.79	4549.15	491.69	4662.50	139.16	5128.96	584.69	1.941

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92	63.27	4548.88	491.16	4662.50	136.64	5135.13	590.82	1.941
93	64.85	4549.67	492.74	4662.50	142.50	5123.01	578.57	1.941
94	62.22	4548.36	488.53	4662.50	131.93	5141.21	596.94	1.941
95	65.90	4550.20	491.16	4662.50	145.28	5110.93	566.33	1.941
96	64.85	4549.67	489.06	4662.50	141.06	5117.02	572.45	1.941
97	65.90	4550.20	494.85	4662.49	146.71	5116.91	572.45	1.942
98	65.90	4550.20	487.48	4662.49	143.88	5104.95	560.20	1.942
99	64.32	4549.41	485.90	4662.49	138.01	5117.09	572.45	1.942

Critical Failure Surface (circle 1)

Intersects: XL: 65.90 YL: 4550.20 XR: 485.90 YR: 4662.49
 Centre: XC: 145.98 YC: 5092.27 Radius: R: 547.96

Generated failure surface: (20 points)

65.90	4550.20	89.24	4547.26	112.69	4545.33	136.20	4544.40	159.73	4544.49
183.23	4545.58	206.66	4547.68	229.98	4550.79	253.15	4554.89	276.12	4559.99
298.84	4566.07	321.29	4573.11	343.42	4581.12	365.18	4590.06	386.53	4599.94
407.44	4610.71	427.87	4622.38	447.78	4634.92	467.14	4648.29	485.90	4662.49

Slice Geometry and Properties - Critical Failure Surface (circle 1, 45 slices)

Slice	X-Left	X-S	Angle	Width	Length	Matl	Cohesion	Phi	Weight	PoreWater Force	Normal Stress	Test Factor
1	65.90	29.65	-7.2	9.74	9.82	1	0.00	35.0	3706.43	0.00	399.04	1.06
2	75.64	88.96	-7.2	9.74	9.82	1	0.00	35.0	11119.89	0.00	1197.18	1.06
3	85.38	51.72	-7.2	3.86	3.89	2	100.00	18.0	6480.48	59.92	1720.44	1.03
4	89.24	211.07	-4.7	11.72	11.76	2	100.00	18.0	26569.22	725.08	2302.19	1.02
5	100.97	291.03	-4.7	11.72	11.76	2	100.00	18.0	36749.45	1450.15	3182.04	1.02
6	112.69	369.09	-2.3	11.75	11.76	2	100.00	18.0	46646.88	1990.67	3996.22	1.01
7	124.44	443.52	-2.3	11.75	11.76	2	100.00	18.0	56040.99	2345.87	4800.65	1.01
8	136.20	512.74	0.2	11.71	11.71	2	100.00	18.0	64734.52	2503.59	5526.27	1.00
9	147.91	580.67	0.2	11.71	11.71	2	100.00	18.0	73222.04	2488.26	6250.83	1.00
10	159.61	651.56	2.6	11.81	11.82	2	100.00	18.0	82037.64	2313.57	6892.63	0.99
11	171.42	714.68	2.7	11.81	11.82	2	100.00	18.0	89827.18	1923.57	7546.42	0.99
12	183.23	768.59	5.1	11.72	11.76	2	100.00	18.0	96416.60	1342.99	8102.09	0.99
13	194.94	824.81	5.1	11.72	11.76	2	100.00	18.0	103250.76	586.73	8675.62	0.99
14	206.66	158.46	7.6	2.17	2.18	2	100.00	18.0	19812.32	19.44	8938.64	0.99
15	208.83	561.04	7.6	7.74	7.81	1	0.00	35.0	70129.86	0.00	8640.44	0.96
16	216.56	553.06	7.6	7.74	7.81	1	0.00	35.0	69133.12	0.00	8517.62	0.96
17	224.30	212.30	7.6	3.00	3.03	4	0.00	45.0	23353.14	5810.42	7400.78	0.94
18	227.30	188.74	7.6	2.68	2.71	1	0.00	35.0	23592.76	10700.07	8572.07	0.96
19	229.98	801.36	10.0	11.58	11.76	1	0.00	35.0	100170.32	45645.50	8356.05	0.95
20	241.56	777.60	10.0	11.58	11.76	1	0.00	35.0	97199.59	44139.43	8107.45	0.95
21	253.15	744.54	12.5	11.48	11.76	1	0.00	35.0	93067.60	42450.70	7764.56	0.95
22	264.63	715.28	12.5	11.48	11.76	1	0.00	35.0	89409.97	40580.42	7458.12	0.95
23	276.12	460.90	15.0	7.68	7.95	1	0.00	35.0	57611.90	26295.70	7122.27	0.94
24	283.80	450.05	15.0	7.52	7.79	1	0.00	35.0	56256.84	24755.91	7093.32	0.94
25	291.32	463.18	15.0	7.52	7.79	1	0.00	35.0	57897.79	23778.68	7280.67	0.94
26	298.84	712.54	17.4	11.22	11.76	1	0.00	35.0	89067.84	33891.65	7412.30	0.94
27	310.07	735.90	17.4	11.22	11.76	1	0.00	35.0	91988.09	31305.31	7622.77	0.94
28	321.29	745.25	19.9	11.06	11.76	1	0.00	35.0	93155.77	28543.13	7716.90	0.94
29	332.35	762.09	19.9	11.06	11.76	1	0.00	35.0	95261.20	25606.35	7855.42	0.94
30	343.42	466.21	22.3	6.67	7.21	1	0.00	35.0	58276.64	14170.59	7852.78	0.94
31	350.08	532.66	22.3	7.55	8.16	1	0.00	35.0	66668.16	14558.68	7906.69	0.94
32	357.63	537.69	22.3	7.55	8.16	1	0.00	35.0	67467.17	12978.59	7973.19	0.94
33	365.18	742.99	24.8	10.68	11.76	1	0.00	35.0	93387.31	15758.93	7668.98	0.94
34	375.85	690.65	24.8	10.68	11.76	1	0.00	35.0	86846.92	12135.32	7100.73	0.94
35	386.53	622.69	27.3	10.46	11.76	1	0.00	35.0	78343.84	8345.79	6410.85	0.95
36	396.99	566.69	27.3	10.46	11.76	1	0.00	35.0	71345.60	4389.56	5794.66	0.95

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37	407.44	286.96	29.7	5.75	6.62	1	0.00	35.0	36151.27	678.98	5210.75	0.95
38	413.20	338.82	29.7	7.34	8.45	1	0.00	35.0	42712.34	0.00	4809.15	0.95
39	420.53	308.24	29.7	7.34	8.45	1	0.00	35.0	38890.31	0.00	4378.73	0.95
40	427.87	366.36	32.2	9.96	11.76	1	0.00	35.0	46285.73	0.00	3774.67	0.96
41	437.83	304.28	32.2	9.96	11.76	1	0.00	35.0	38528.24	0.00	3142.08	0.96
42	447.78	233.40	34.6	9.68	11.76	1	0.00	35.0	29656.02	0.00	2443.07	0.97
43	457.46	168.98	34.7	9.68	11.76	1	0.00	35.0	21605.62	0.00	1779.85	0.97
44	467.14	86.30	37.1	7.68	9.63	1	0.00	35.0	11171.62	0.00	1138.35	0.98
45	474.81	46.29	37.1	11.09	13.90	5	150.00	22.0	6064.19	0.00	419.90	1.08
		-----			-----							
	X-S Area:	20879.63	Path Length:	447.01				X-S Weight:	2617310.75			

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS6-EQ.gmf

Processed: 07 Apr 2023 10:17:23

DATA: Analysis 1 - Case SS-6 - Pseudo-Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 125.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto

Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 Auto

Material: 5 (Mohr-Coulomb Isotropic) - Clay
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (5 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
 0.00 4663.00 550.00 4663.00

Profile: 2 (2 points) Material beneath: 1 - Sand and Gravel
 0.00 4654.10 550.00 4654.10

Profile: 3 (2 points) Material beneath: 4 - Slurry Wall
 224.30 4621.00 227.30 4621.00

Profile: 4 (6 points) Material beneath: 2 - Weathered Bedrock
 0.00 4547.60 60.90 4547.70 224.30 4548.00 300.30 4548.20 423.80 4546.70
 550.00 4546.50

Profile: 5 (6 points) Material beneath: 3 - Stable Bedrock
 0.00 4544.60 60.90 4543.70 224.30 4545.00 300.30 4545.20 423.90 4543.70
 550.00 4543.50

Slope Surface (7 points)

0.00 4547.60 60.90 4547.70 207.70 4621.00 283.80 4621.00 366.10 4662.10
 489.90 4662.50 550.00 4662.40

Phreatic Surface (5 points)

0.00 4547.60 60.90 4547.70 224.30 4548.00 227.30 4614.00 550.00 4614.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 60.90 YL: 4547.70 XR: 490.90 YR: 4662.50
 Centre: XC: 132.17 YC: 5143.45 Radius: R: 600.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.070

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	300.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case SS-6 - Pseudo-Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.644

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.47

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	65.90	4550.20	485.90	4662.49	145.98	5092.27	547.96	1.472	<-- Critical Surface
2	64.85	4549.67	486.43	4662.49	142.26	5104.50	560.20	1.477	
3	65.37	4549.93	485.90	4662.49	143.90	5098.42	554.08	1.479	
4	65.37	4549.93	486.43	4662.49	144.34	5098.36	554.08	1.479	
5	64.85	4549.67	485.90	4662.49	141.81	5104.56	560.20	1.480	
6	64.32	4549.41	486.43	4662.49	140.17	5110.63	566.33	1.481	
7	64.85	4549.67	489.06	4662.50	142.77	5110.61	566.33	1.482	
8	65.37	4549.93	488.01	4662.49	143.95	5104.60	560.20	1.483	
9	65.90	4550.20	490.64	4662.50	146.54	5104.57	560.20	1.483	
10	64.85	4549.67	488.53	4662.50	142.32	5110.67	566.33	1.483	
11	65.37	4549.93	488.53	4662.50	144.40	5104.54	560.20	1.484	
12	65.90	4550.20	486.95	4662.49	145.15	5098.58	554.08	1.484	
13	65.90	4550.20	488.53	4662.50	146.47	5098.39	554.08	1.484	
14	65.90	4550.20	487.48	4662.49	145.59	5098.52	554.08	1.484	
15	64.32	4549.41	485.90	4662.49	139.72	5110.69	566.33	1.485	
16	65.90	4550.20	488.01	4662.49	146.03	5098.45	554.08	1.485	
17	64.32	4549.41	489.06	4662.50	140.69	5116.74	572.45	1.485	
18	65.37	4549.93	487.48	4662.49	143.51	5104.66	560.20	1.485	
19	63.79	4549.15	486.43	4662.49	138.09	5116.75	572.45	1.486	
20	65.90	4550.20	486.43	4662.49	144.70	5098.65	554.08	1.487	
21	64.85	4549.67	488.01	4662.49	141.88	5110.73	566.33	1.487	
22	64.85	4549.67	491.69	4662.50	143.29	5116.72	572.45	1.487	
23	65.90	4550.20	493.27	4662.49	147.06	5110.68	566.33	1.487	
24	64.85	4549.67	491.16	4662.50	142.85	5116.78	572.45	1.487	
25	65.37	4549.93	490.64	4662.50	144.47	5110.71	566.33	1.488	
26	65.37	4549.93	493.79	4662.49	145.45	5116.75	572.45	1.488	
27	65.90	4550.20	489.58	4662.50	145.65	5104.70	560.20	1.489	
28	64.32	4549.41	488.53	4662.50	140.24	5116.80	572.45	1.489	

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29	64.32	4549.41	491.69	4662.50	141.23	5122.85	578.57	1.489
30	65.37	4549.93	486.95	4662.49	143.07	5104.72	560.20	1.489
31	65.37	4549.93	490.11	4662.50	144.02	5110.77	566.33	1.489
32	65.37	4549.93	491.16	4662.50	144.91	5110.65	566.33	1.489
33	63.79	4549.15	485.90	4662.49	137.64	5116.81	572.45	1.489
34	65.90	4550.20	492.74	4662.50	146.62	5110.74	566.33	1.490
35	63.79	4549.15	489.06	4662.50	138.61	5122.86	578.57	1.490
36	65.90	4550.20	490.11	4662.50	146.09	5104.63	560.20	1.490
37	63.27	4548.88	486.43	4662.49	136.00	5122.86	578.57	1.490
38	64.85	4549.67	487.48	4662.49	141.43	5110.80	566.33	1.491
39	65.90	4550.20	485.90	4662.49	144.26	5098.71	554.08	1.491
40	64.85	4549.67	490.64	4662.50	142.40	5116.84	572.45	1.491
41	65.90	4550.20	489.06	4662.50	145.21	5104.76	560.20	1.491
42	65.90	4550.20	495.90	4662.49	147.60	5116.79	572.45	1.492
43	64.32	4549.41	488.01	4662.49	139.80	5116.86	572.45	1.492
44	64.32	4549.41	491.16	4662.50	140.78	5122.91	578.57	1.492
45	65.37	4549.93	486.43	4662.49	142.62	5104.79	560.20	1.493
46	65.37	4549.93	489.58	4662.50	143.58	5110.83	566.33	1.493
47	63.79	4549.15	488.53	4662.50	138.16	5122.92	578.57	1.493
48	63.27	4548.88	485.90	4662.49	135.55	5122.92	578.57	1.493
49	64.85	4549.67	493.79	4662.49	143.39	5122.89	578.57	1.494
50	63.27	4548.88	489.06	4662.50	136.54	5128.97	584.69	1.494
51	62.74	4548.62	486.43	4662.49	133.91	5128.97	584.69	1.494
52	64.85	4549.67	486.95	4662.49	140.98	5110.86	566.33	1.494
53	64.85	4549.67	490.11	4662.50	141.95	5116.90	572.45	1.494
54	64.85	4549.67	493.27	4662.49	142.94	5122.95	578.57	1.494
55	65.37	4549.93	495.90	4662.49	145.55	5122.92	578.57	1.495
56	65.37	4549.93	492.74	4662.50	144.56	5116.88	572.45	1.495
57	65.90	4550.20	488.53	4662.50	144.76	5104.82	560.20	1.495
58	64.32	4549.41	487.48	4662.49	139.35	5116.92	572.45	1.495
59	64.32	4549.41	486.95	4662.49	140.62	5110.57	566.33	1.496
60	64.32	4549.41	490.64	4662.50	140.33	5122.97	578.57	1.496
61	65.90	4550.20	491.69	4662.50	145.73	5110.87	566.33	1.496
62	64.32	4549.41	493.79	4662.49	141.33	5129.01	584.69	1.496
63	65.37	4549.93	493.27	4662.49	145.00	5116.82	572.45	1.496
64	65.37	4549.93	485.90	4662.49	142.18	5104.85	560.20	1.496
65	63.79	4549.15	488.01	4662.49	137.72	5122.98	578.57	1.496
66	65.90	4550.20	494.85	4662.49	146.71	5116.91	572.45	1.496
67	65.37	4549.93	489.06	4662.50	143.13	5110.90	566.33	1.496
68	63.79	4549.15	491.16	4662.50	138.71	5129.02	584.69	1.497
69	65.37	4549.93	492.22	4662.50	144.11	5116.94	572.45	1.497
70	62.74	4548.62	485.90	4662.49	133.46	5129.02	584.69	1.497
71	63.27	4548.88	488.53	4662.50	136.09	5129.02	584.69	1.497
72	65.90	4550.20	492.22	4662.50	146.17	5110.81	566.33	1.497
73	64.85	4549.67	486.43	4662.49	140.54	5110.92	566.33	1.497
74	64.85	4549.67	489.58	4662.50	141.51	5116.96	572.45	1.498
75	65.90	4550.20	491.16	4662.50	146.98	5104.50	560.20	1.498
76	64.85	4549.67	492.74	4662.50	142.50	5123.01	578.57	1.498
77	64.32	4549.41	486.95	4662.49	138.90	5116.98	572.45	1.498
78	63.79	4549.15	486.95	4662.49	138.53	5116.69	572.45	1.499
79	65.90	4550.20	488.01	4662.49	144.32	5104.88	560.20	1.499
80	65.90	4550.20	491.16	4662.50	145.28	5110.93	566.33	1.499
81	64.32	4549.41	490.11	4662.50	139.88	5123.02	578.57	1.499
82	63.79	4549.15	487.48	4662.49	137.27	5123.03	578.57	1.499
83	64.32	4549.41	493.27	4662.49	140.88	5129.07	584.69	1.499
84	63.79	4549.15	491.69	4662.50	139.16	5128.96	584.69	1.499
85	65.90	4550.20	495.37	4662.49	147.16	5116.85	572.45	1.499
86	63.79	4549.15	490.64	4662.50	138.26	5129.08	584.69	1.500
87	62.22	4548.36	485.90	4662.49	131.37	5135.11	590.82	1.500

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88	63.27	4548.88	488.01	4662.49	135.64	5129.08	584.69	1.500
89	63.79	4549.15	493.79	4662.49	139.27	5135.12	590.82	1.500
90	65.37	4549.93	488.53	4662.50	142.69	5110.96	566.33	1.500
91	62.74	4548.62	488.53	4662.50	134.01	5135.12	590.82	1.500
92	63.27	4548.88	491.16	4662.50	136.64	5135.13	590.82	1.500
93	65.37	4549.93	491.69	4662.50	143.66	5117.00	572.45	1.500
94	64.85	4549.67	495.90	4662.49	143.50	5129.05	584.69	1.501
95	64.85	4549.67	485.90	4662.49	140.09	5110.98	566.33	1.501
96	64.85	4549.67	489.06	4662.50	141.06	5117.02	572.45	1.501
97	64.32	4549.41	486.43	4662.49	138.45	5117.04	572.45	1.501
98	65.37	4549.93	494.85	4662.49	144.66	5123.05	578.57	1.502
99	64.85	4549.67	492.22	4662.50	142.05	5123.07	578.57	1.502

Critical Failure Surface (circle 1)

Intersects: XL: 65.90 YL: 4550.20 XR: 485.90 YR: 4662.49
Centre: XC: 145.98 YC: 5092.27 Radius: R: 547.96

Generated failure surface: (20 points)

65.90	4550.20	89.24	4547.26	112.69	4545.33	136.20	4544.40	159.73	4544.49
183.23	4545.58	206.66	4547.68	229.98	4550.79	253.15	4554.89	276.12	4559.99
298.84	4566.07	321.29	4573.11	343.42	4581.12	365.18	4590.06	386.53	4599.94
407.44	4610.71	427.87	4622.38	447.78	4634.92	467.14	4648.29	485.90	4662.49

Slice Geometry and Properties - Critical Failure Surface (circle 1, 45 slices)

Slice	X-S		Base						PoreWater	Normal	Test	
	X-Left	Area	Angle	Width	Length	Mat'l	Cohesion	Phi	Weight	Force	Stress	Factor
1	65.90	29.65	-7.2	9.74	9.82	1	0.00	35.0	3706.43	0.00	404.80	1.07
2	75.64	88.96	-7.2	9.74	9.82	1	0.00	35.0	11119.89	0.00	1214.44	1.07
3	85.38	51.72	-7.2	3.86	3.89	2	100.00	18.0	6480.48	59.92	1733.47	1.04
4	89.24	211.07	-4.7	11.72	11.76	2	100.00	18.0	26569.22	725.08	2312.89	1.02
5	100.97	291.03	-4.7	11.72	11.76	2	100.00	18.0	36749.45	1450.15	3196.17	1.02
6	112.69	369.09	-2.3	11.75	11.76	2	100.00	18.0	46646.88	1990.67	4004.43	1.01
7	124.44	443.52	-2.3	11.75	11.76	2	100.00	18.0	56040.99	2345.87	4810.40	1.01
8	136.20	512.74	0.2	11.71	11.71	2	100.00	18.0	64734.52	2503.59	5525.25	1.00
9	147.91	580.67	0.2	11.71	11.71	2	100.00	18.0	73222.04	2488.26	6249.68	1.00
10	159.61	651.56	2.6	11.81	11.82	2	100.00	18.0	82037.64	2313.57	6876.61	0.99
11	171.42	714.68	2.7	11.81	11.82	2	100.00	18.0	89827.18	1923.57	7528.69	0.99
12	183.23	768.59	5.1	11.72	11.76	2	100.00	18.0	96416.60	1342.99	8065.60	0.98
13	194.94	824.81	5.1	11.72	11.76	2	100.00	18.0	103250.76	586.73	8636.32	0.98
14	206.66	158.46	7.6	2.17	2.18	2	100.00	18.0	19812.32	19.44	8878.85	0.98
15	208.83	561.04	7.6	7.74	7.81	1	0.00	35.0	70129.86	0.00	8523.79	0.95
16	216.56	553.06	7.6	7.74	7.81	1	0.00	35.0	69133.12	0.00	8402.63	0.95
17	224.30	212.30	7.6	3.00	3.03	4	0.00	45.0	23353.14	5810.42	7297.80	0.93
18	227.30	188.74	7.6	2.68	2.71	1	0.00	35.0	23592.76	10700.07	8509.72	0.95
19	229.98	801.36	10.0	11.58	11.76	1	0.00	35.0	100170.32	45645.50	8277.25	0.94
20	241.56	777.60	10.0	11.58	11.76	1	0.00	35.0	97199.59	44139.43	8030.76	0.94
21	253.15	744.54	12.5	11.48	11.76	1	0.00	35.0	93067.60	42450.70	7674.70	0.93
22	264.63	715.28	12.5	11.48	11.76	1	0.00	35.0	89409.97	40580.42	7371.45	0.93
23	276.12	460.90	15.0	7.68	7.95	1	0.00	35.0	57611.90	26295.70	7024.75	0.92
24	283.80	450.05	15.0	7.52	7.79	1	0.00	35.0	56256.84	24755.91	6993.28	0.92
25	291.32	463.18	15.0	7.52	7.79	1	0.00	35.0	57897.79	23778.68	7172.64	0.92
26	298.84	712.54	17.4	11.22	11.76	1	0.00	35.0	89067.84	33891.65	7278.94	0.91
27	310.07	735.90	17.4	11.22	11.76	1	0.00	35.0	91988.09	31305.31	7476.74	0.91
28	321.29	745.25	19.9	11.06	11.76	1	0.00	35.0	93155.77	28543.13	7540.97	0.91
29	332.35	762.09	19.9	11.06	11.76	1	0.00	35.0	95261.20	25606.35	7666.57	0.91
30	343.42	466.21	22.3	6.67	7.21	1	0.00	35.0	58276.64	14170.59	7634.68	0.90
31	350.08	532.66	22.3	7.55	8.16	1	0.00	35.0	66668.16	14558.68	7679.84	0.90
32	357.63	537.69	22.3	7.55	8.16	1	0.00	35.0	67467.17	12978.59	7736.70	0.90

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33	365.18	742.99	24.8	10.68	11.76	1	0.00	35.0	93387.31	15758.93	7410.55	0.90
34	375.85	690.65	24.8	10.68	11.76	1	0.00	35.0	86846.92	12135.32	6852.93	0.90
35	386.53	622.69	27.3	10.46	11.76	1	0.00	35.0	78343.84	8345.79	6156.56	0.90
36	396.99	566.69	27.3	10.46	11.76	1	0.00	35.0	71345.60	4389.56	5552.85	0.90
37	407.44	286.96	29.7	5.75	6.62	1	0.00	35.0	36151.27	678.98	4963.57	0.91
38	413.20	338.82	29.7	7.34	8.45	1	0.00	35.0	42712.34	0.00	4576.46	0.91
39	420.53	308.24	29.7	7.34	8.45	1	0.00	35.0	38890.31	0.00	4166.84	0.91
40	427.87	366.36	32.2	9.96	11.76	1	0.00	35.0	46285.73	0.00	3577.64	0.91
41	437.83	304.28	32.2	9.96	11.76	1	0.00	35.0	38528.24	0.00	2978.08	0.91
42	447.78	233.40	34.6	9.68	11.76	1	0.00	35.0	29656.02	0.00	2306.16	0.91
43	457.46	168.98	34.7	9.68	11.76	1	0.00	35.0	21605.62	0.00	1680.10	0.91
44	467.14	86.30	37.1	7.68	9.63	1	0.00	35.0	11171.62	0.00	1070.11	0.92
45	474.81	46.29	37.1	11.09	13.90	5	150.00	22.0	6064.19	0.00	389.08	1.04

X-S Area:

20879.63

Path Length:

447.01

X-S Weight:

2617310.75

Reclamation Conditions



Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS5-REC.gmf

Processed: 11 Apr 2023 15:02:48

DATA: Analysis 1 - Case SS-5 - Reclamation - Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 125.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto

Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 Auto

Material: 5 (Mohr-Coulomb Isotropic) - Clay
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
 0.00 4664.00 650.00 4664.00

Profile: 2 (3 points) Material beneath: 1 - Sand and Gravel
 511.77 4649.00 529.77 4658.00 650.00 4658.00

Profile: 3 (3 points) Material beneath: 5 - Clay
 489.77 4638.00 511.77 4649.00 650.00 4649.00

Profile: 4 (5 points) Material beneath: 1 - Sand and Gravel
 231.58 4546.40 382.76 4622.00 457.80 4622.00 489.77 4638.00 650.00 4638.00

Profile: 5 (2 points) Material beneath: 4 - Slurry Wall
 399.30 4622.00 402.30 4622.00

Profile: 6 (7 points) Material beneath: 2 - Weathered Bedrock
 0.00 4548.60 50.00 4548.10 231.60 4546.40 399.30 4544.80 443.40 4544.50
 548.80 4545.30 650.00 4545.30

Profile: 7 (7 points) Material beneath: 3 - Stable Bedrock
 0.00 4545.60 50.00 4545.10 231.60 4543.40 399.30 4541.80 443.40 4541.50
 548.80 4542.30 650.00 4542.30

Slope Surface (11 points)

0.00	4548.60	50.00	4548.10	382.80	4622.00	412.70	4632.00	447.70	4632.00
537.90	4662.10	567.80	4662.00	587.80	4662.90	601.70	4661.80	607.60	4664.00
650.00	4664.00								

Phreatic Surface (6 points)

0.00	4548.60	50.00	4548.10	326.72	4594.00	399.30	4597.00	402.30	4617.00
650.00	4617.00								

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 50.00 YL: 4548.10 XR: 605.70 YR: 4663.29
 Centre: XC: 133.22 YC: 5544.63 Radius: R: 1000.00

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 300.00
 Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case SS-5 - Reclamation - Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.164

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 2.15

Negative normal stresses exist on the base of one or more slices; examine slice data and consult the GALENA Help utility
 Test Factor is less than 0.2 lower limit for one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	48.16	4548.12	607.54	4663.98	135.43	5535.08	990.82	2.147	<-- Critical Surface
2	53.95	4548.98	600.70	4661.88	148.01	5473.80	929.59	2.148	
3	53.42	4548.86	600.70	4661.88	146.45	5479.94	935.71	2.148	
4	50.26	4548.16	607.54	4663.98	137.09	5529.02	984.69	2.148	
5	52.89	4548.74	600.70	4661.88	144.90	5486.08	941.84	2.148	
6	48.68	4548.11	607.54	4663.98	135.49	5535.12	990.82	2.148	
7	50.79	4548.28	607.54	4663.98	138.65	5522.90	978.57	2.148	
8	51.32	4548.39	607.54	4663.98	140.21	5516.77	972.45	2.148	
9	51.84	4548.51	607.54	4663.98	141.77	5510.64	966.33	2.148	
10	46.58	4548.13	607.54	4663.98	133.94	5541.24	996.94	2.148	
11	52.37	4548.63	607.54	4663.98	143.33	5504.51	960.20	2.148	
12	55.00	4549.21	607.54	4663.98	151.14	5473.82	929.59	2.148	
13	54.47	4549.09	607.54	4663.98	149.58	5479.96	935.71	2.148	
14	50.26	4548.16	600.70	4661.88	137.12	5516.72	972.45	2.149	
15	50.79	4548.28	600.70	4661.88	138.68	5510.60	966.33	2.149	
16	51.32	4548.39	600.70	4661.88	140.23	5504.47	960.20	2.149	
17	51.84	4548.51	600.70	4661.88	141.79	5498.34	954.08	2.149	
18	52.37	4548.63	600.70	4661.88	143.34	5492.21	947.96	2.149	
19	53.95	4548.98	607.54	4663.98	148.01	5486.10	941.84	2.149	
20	49.21	4548.11	607.54	4663.98	135.56	5535.15	990.82	2.149	
21	45.00	4548.15	607.54	4663.98	132.45	5547.39	1003.06	2.149	
22	49.21	4548.11	600.70	4661.88	135.60	5522.86	978.57	2.149	
23	49.74	4548.10	607.54	4663.98	135.62	5535.19	990.82	2.149	
24	49.74	4548.10	600.70	4661.88	135.67	5522.89	978.57	2.150	

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25	47.11	4548.13	600.70	4661.88	134.05	5528.98	984.69	2.150
26	47.11	4548.13	607.54	4663.98	134.00	5541.27	996.94	2.150
27	47.63	4548.12	607.54	4663.98	134.07	5541.31	996.94	2.150
28	50.26	4548.16	607.54	4663.98	135.78	5535.28	990.82	2.150
29	48.16	4548.12	607.54	4663.98	134.13	5541.34	996.94	2.150
30	48.68	4548.11	607.54	4663.98	134.20	5541.38	996.94	2.150
31	54.47	4549.09	600.70	4661.88	148.27	5473.94	929.59	2.150
32	53.95	4548.98	600.70	4661.88	146.71	5480.08	935.71	2.150
33	47.63	4548.12	600.70	4661.88	134.12	5529.01	984.69	2.150
34	53.42	4548.86	607.54	4663.98	146.45	5492.24	947.96	2.150
35	50.79	4548.28	607.54	4663.98	137.34	5529.16	984.69	2.151
36	49.21	4548.11	607.54	4663.98	134.26	5541.41	996.94	2.151
37	52.37	4548.63	607.54	4663.98	142.02	5510.78	966.33	2.151
38	48.16	4548.12	600.70	4661.88	134.18	5529.05	984.69	2.151
39	45.53	4548.15	607.54	4663.98	132.52	5547.43	1003.06	2.151
40	52.89	4548.74	607.54	4663.98	143.59	5504.65	960.20	2.151
41	46.05	4548.14	607.54	4663.98	132.58	5547.46	1003.06	2.151
42	46.58	4548.13	607.54	4663.98	132.64	5547.50	1003.06	2.151
43	49.74	4548.10	601.23	4661.84	136.19	5522.85	978.57	2.151
44	55.00	4549.21	607.54	4663.98	149.83	5480.11	935.71	2.151
45	45.53	4548.15	600.70	4661.88	132.57	5535.13	990.82	2.151
46	47.11	4548.13	607.54	4663.98	132.71	5547.53	1003.06	2.151
47	51.32	4548.39	607.54	4663.98	138.90	5523.04	978.57	2.151
48	54.47	4549.09	601.23	4661.84	148.77	5473.89	929.59	2.151
49	49.74	4548.10	607.54	4663.98	134.32	5541.45	996.94	2.151
50	53.95	4548.98	601.23	4661.84	147.22	5480.03	935.71	2.152
51	50.79	4548.28	600.70	4661.88	137.38	5516.86	972.45	2.152
52	52.89	4548.74	601.23	4661.84	144.11	5492.30	947.96	2.152
53	53.42	4548.86	601.23	4661.84	145.67	5486.17	941.84	2.152
54	46.05	4548.14	600.70	4661.88	132.63	5535.17	990.82	2.152
55	51.32	4548.39	600.70	4661.88	138.94	5510.74	966.33	2.152
56	47.63	4548.12	601.23	4661.84	134.63	5528.97	984.69	2.152
57	52.89	4548.74	607.54	4663.98	144.89	5498.38	954.08	2.152
58	51.84	4548.51	600.70	4661.88	140.49	5504.61	960.20	2.152
59	52.37	4548.63	600.70	4661.88	142.05	5498.48	954.08	2.152
60	54.47	4549.09	607.54	4663.98	148.27	5486.25	941.84	2.152
61	52.89	4548.74	600.70	4661.88	143.60	5492.35	947.96	2.152
62	51.84	4548.51	607.54	4663.98	140.46	5516.91	972.45	2.152
63	53.42	4548.86	600.70	4661.88	145.16	5486.22	941.84	2.152
64	47.63	4548.12	607.54	4663.98	132.77	5547.57	1003.06	2.152
65	45.00	4548.15	607.54	4663.98	131.16	5553.65	1009.18	2.152
66	46.58	4548.13	600.70	4661.88	132.70	5535.20	990.82	2.152
67	48.16	4548.12	601.23	4661.84	134.70	5529.00	984.69	2.152
68	50.26	4548.16	600.70	4661.88	135.83	5522.98	978.57	2.152
69	45.53	4548.15	607.54	4663.98	131.23	5553.68	1009.18	2.152
70	53.95	4548.98	601.75	4661.82	147.69	5479.98	935.71	2.153
71	48.16	4548.12	607.54	4663.98	132.84	5547.60	1003.06	2.153
72	50.26	4548.16	601.23	4661.84	136.35	5522.94	978.57	2.153
73	53.42	4548.86	601.75	4661.82	146.14	5486.12	941.84	2.153
74	52.89	4548.74	601.75	4661.82	144.59	5492.26	947.96	2.153
75	52.37	4548.63	601.75	4661.82	143.04	5498.39	954.08	2.153
76	48.68	4548.11	601.23	4661.84	134.76	5529.04	984.69	2.153
77	48.68	4548.11	600.70	4661.88	134.25	5529.08	984.69	2.153
78	49.21	4548.11	600.70	4661.88	134.31	5529.12	984.69	2.153
79	50.79	4548.28	601.23	4661.84	137.90	5516.81	972.45	2.153
80	46.05	4548.14	601.23	4661.84	133.15	5535.12	990.82	2.153
81	49.74	4548.10	600.70	4661.88	134.37	5529.15	984.69	2.153
82	51.32	4548.39	601.23	4661.84	139.45	5510.69	966.33	2.153
83	51.84	4548.51	601.23	4661.84	141.01	5504.56	960.20	2.153

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84	52.37	4548.63	601.23	4661.84	142.56	5498.44	954.08	2.153
85	46.05	4548.14	607.54	4663.98	131.29	5553.72	1009.18	2.153
86	53.95	4548.98	607.54	4663.98	146.71	5492.39	947.96	2.153
87	48.68	4548.11	607.54	4663.98	132.90	5547.63	1003.06	2.153
88	50.26	4548.16	607.54	4663.98	134.48	5541.53	996.94	2.153
89	55.00	4549.21	600.70	4661.88	148.53	5474.09	929.59	2.153
90	48.16	4548.12	601.75	4661.82	135.18	5528.96	984.69	2.153
91	46.58	4548.13	601.23	4661.84	133.22	5535.16	990.82	2.153
92	50.79	4548.28	607.54	4663.98	136.04	5535.42	990.82	2.153
93	51.84	4548.51	607.54	4663.98	139.16	5523.18	978.57	2.153
94	51.32	4548.39	607.54	4663.98	137.60	5529.30	984.69	2.153
95	52.37	4548.63	607.54	4663.98	140.72	5517.05	972.45	2.154
96	47.11	4548.13	600.70	4661.88	132.76	5535.24	990.82	2.154
97	50.26	4548.16	601.75	4661.82	136.83	5522.89	978.57	2.154
98	46.58	4548.13	607.54	4663.98	131.35	5553.75	1009.18	2.154
99	47.63	4548.12	600.70	4661.88	132.83	5535.27	990.82	2.154

Critical Failure Surface (circle 1)

Intersects: XL: 48.16 YL: 4548.12 XR: 607.54 YR: 4663.98
 Centre: XC: 135.43 YC: 5535.08 Radius: R: 990.82

Generated failure surface: (20 points)

48.16	4548.12	78.58	4545.90	109.05	4544.62	139.54	4544.28	170.03	4544.87
200.49	4546.41	230.89	4548.88	261.20	4552.28	291.39	4556.62	321.43	4561.88
351.29	4568.07	380.95	4575.17	410.38	4583.18	439.54	4592.09	468.42	4601.90
496.98	4612.59	525.20	4624.15	553.05	4636.58	580.51	4649.86	607.54	4663.98

Slice Geometry and Properties - Critical Failure Surface (circle 1, 50 slices)

Slice	X-S		Base						Porewater		Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	48.16	27.61	-4.2	15.21	15.25	2	100.00	18.0	3690.38	1419.41	247.76	1.01
2	63.37	95.84	-4.2	15.21	15.25	2	100.00	18.0	12775.52	4875.24	849.26	1.01
3	78.58	160.84	-2.4	15.24	15.25	2	100.00	18.0	21401.74	8110.33	1412.29	1.01
4	93.81	222.14	-2.4	15.24	15.25	2	100.00	18.0	29508.83	11124.30	1946.55	1.01
5	109.05	280.11	-0.6	15.25	15.25	2	100.00	18.0	37143.63	13916.17	2439.09	1.00
6	124.29	334.37	-0.6	15.25	15.25	2	100.00	18.0	44255.27	16486.43	2906.00	1.00
7	139.54	384.97	1.1	15.25	15.25	2	100.00	18.0	50852.80	18831.97	3328.43	1.00
8	154.79	432.04	1.1	15.25	15.25	2	100.00	18.0	56951.73	20954.76	3727.71	1.00
9	170.03	475.00	2.9	15.23	15.25	2	100.00	18.0	62476.70	22854.00	4080.29	0.99
10	185.26	514.82	2.9	15.23	15.25	2	100.00	18.0	67553.74	24527.08	4411.96	0.99
11	200.49	111.03	4.6	3.14	3.15	2	100.00	18.0	14549.46	5270.34	4590.31	0.99
12	203.64	497.58	4.6	13.63	13.67	5	150.00	22.0	65182.93	23460.42	4731.35	0.99
13	217.26	523.72	4.6	13.63	13.67	5	150.00	22.0	68607.71	24443.95	4979.96	0.99
14	230.89	289.65	6.4	7.28	7.33	5	150.00	22.0	37943.62	13448.67	5134.90	0.99
15	238.17	470.01	6.4	11.51	11.59	1	0.00	35.0	61416.65	21635.59	5211.61	0.97
16	249.68	484.55	6.4	11.51	11.59	1	0.00	35.0	63013.52	22081.10	5346.76	0.97
17	261.20	653.68	8.2	15.09	15.25	1	0.00	35.0	84579.53	29513.72	5439.39	0.97
18	276.29	671.54	8.2	15.09	15.25	1	0.00	35.0	86431.67	29833.05	5557.51	0.97
19	291.39	682.42	9.9	15.02	15.25	1	0.00	35.0	87403.53	29925.93	5610.63	0.96
20	306.41	692.99	9.9	15.02	15.25	1	0.00	35.0	88348.25	29792.12	5669.65	0.96
21	321.43	246.33	11.7	5.29	5.41	1	0.00	35.0	31309.70	10502.54	5662.63	0.96
22	326.72	573.21	11.7	12.28	12.55	1	0.00	35.0	72672.58	23487.16	5659.90	0.96
23	339.00	575.46	11.7	12.28	12.55	1	0.00	35.0	72702.61	21892.96	5654.11	0.96
24	351.29	694.13	13.5	14.83	15.25	1	0.00	35.0	87360.52	24244.55	5579.38	0.95
25	366.12	690.31	13.5	14.83	15.25	1	0.00	35.0	86515.84	21448.96	5513.26	0.95
26	380.95	858.52	15.2	18.35	19.02	1	0.00	35.0	107584.22	22493.96	5480.91	0.95
27	399.30	142.34	15.2	3.00	3.11	4	0.00	45.0	16036.70	5127.00	4929.74	0.92
28	402.30	385.95	15.2	8.08	8.37	1	0.00	35.0	48624.76	18237.05	5707.77	0.95

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29	410.38	111.74	17.0	2.32	2.43	1	0.00	35.0	14102.03	5075.31	5706.50	0.95
30	412.70	618.15	17.0	13.42	14.03	1	0.00	35.0	78074.61	27198.01	5465.77	0.95
31	426.12	563.11	17.0	13.42	14.03	1	0.00	35.0	71194.52	23606.94	4976.37	0.95
32	439.54	314.25	18.8	8.16	8.62	1	0.00	35.0	39771.27	12645.10	4535.48	0.95
33	447.70	374.78	18.8	10.10	10.67	1	0.00	35.0	47555.50	13592.47	4366.08	0.95
34	457.80	393.45	18.8	10.62	11.22	1	0.00	35.0	49976.28	11830.61	4341.69	0.95
35	468.42	392.82	20.5	10.67	11.40	1	0.00	35.0	49788.44	9319.40	4245.65	0.95
36	479.10	388.19	20.5	10.67	11.40	1	0.00	35.0	49095.99	6477.58	4160.70	0.95
37	489.77	259.69	20.5	7.21	7.70	1	0.00	35.0	32861.32	2768.10	4099.27	0.95
38	496.98	381.43	22.3	10.76	11.63	1	0.00	35.0	48468.76	1600.14	3989.45	0.95
39	507.74	140.45	22.3	4.03	4.35	1	0.00	35.0	17911.25	0.00	3924.26	0.95
40	511.77	459.68	22.3	13.43	14.52	1	0.00	35.0	58609.58	0.00	3848.63	0.95
41	525.20	152.76	24.0	4.57	5.00	1	0.00	35.0	19444.77	0.00	3717.10	0.96
42	529.77	266.15	24.0	8.13	8.90	1	0.00	35.0	33939.72	0.00	3644.27	0.96
43	537.90	437.54	24.0	15.15	16.59	1	0.00	35.0	56063.64	0.00	3229.66	0.96
44	553.05	72.57	25.8	2.93	3.26	1	0.00	35.0	9336.03	0.00	2750.58	0.96
45	555.99	250.03	25.8	11.81	13.12	5	150.00	22.0	32115.82	0.00	2460.63	1.02
46	567.80	173.66	25.8	10.93	12.14	5	150.00	22.0	22158.73	0.00	1827.37	1.02
47	578.73	103.37	27.2	9.07	10.20	1	0.00	35.0	13176.92	0.00	1243.89	0.96
48	587.80	55.88	27.6	8.29	9.36	1	0.00	35.0	7212.63	0.00	743.04	0.96
49	596.09	14.34	27.6	5.61	6.32	5	150.00	22.0	1878.20	0.00	271.84	1.03
50	601.70	2.55	-89.9	5.90	4660.91	5	150.00	22.0	333.61	0.00	-374.16	-5.35
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	X-S Area:	18097.75		Path Length:	5233.78				X-S Weight:	2319964.25		

Project: Derr Pit Technical Revision 8

File: C:\Galena Models\Derr TR8 SS5-REC-EQ.gmf

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DATA: Analysis 1 - Case SS-5 - Reclamation - Pseudo-Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 125.00 Auto

Material: 2 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto

Material: 3 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 Auto

Material: 5 (Mohr-Coulomb Isotropic) - Clay
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Clay
 0.00 4664.00 650.00 4664.00

Profile: 2 (3 points) Material beneath: 1 - Sand and Gravel
 511.77 4649.00 529.77 4658.00 650.00 4658.00

Profile: 3 (3 points) Material beneath: 5 - Clay
 489.77 4638.00 511.77 4649.00 650.00 4649.00

Profile: 4 (5 points) Material beneath: 1 - Sand and Gravel
 231.58 4546.40 382.76 4622.00 457.80 4622.00 489.77 4638.00 650.00 4638.00

Profile: 5 (2 points) Material beneath: 4 - Slurry Wall
 399.30 4622.00 402.30 4622.00

Profile: 6 (7 points) Material beneath: 2 - Weathered Bedrock
 0.00 4548.60 50.00 4548.10 231.60 4546.40 399.30 4544.80 443.40 4544.50
 548.80 4545.30 650.00 4545.30

Profile: 7 (7 points) Material beneath: 3 - Stable Bedrock
 0.00 4545.60 50.00 4545.10 231.60 4543.40 399.30 4541.80 443.40 4541.50
 548.80 4542.30 650.00 4542.30

Slope Surface (11 points)

0.00	4548.60	50.00	4548.10	382.80	4622.00	412.70	4632.00	447.70	4632.00
537.90	4662.10	567.80	4662.00	587.80	4662.90	601.70	4661.80	607.60	4664.00
650.00	4664.00								

Phreatic Surface (6 points)

0.00	4548.60	50.00	4548.10	326.72	4594.00	399.30	4597.00	402.30	4617.00
650.00	4617.00								

Failure Surface

Initial circular surface for critical search defined by: XL, XR, R

Intersects: XL: 50.00 YL: 4548.10 XR: 605.70 YR: 4663.29
 Centre: XC: 133.22 YC: 5544.63 Radius: R: 1000.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.070

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 300.00
 Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case SS-5 - Reclamation - Pseudo-Static

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.597

Analysis Summary

There were: 20001 successful analyses from a total of 20001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.58

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	53.95	4548.98	600.70	4661.88	148.01	5473.80	929.59	1.584	<-- Critical Surface
2	53.42	4548.86	600.70	4661.88	146.45	5479.94	935.71	1.584	
3	52.89	4548.74	600.70	4661.88	144.90	5486.08	941.84	1.584	
4	48.16	4548.12	607.54	4663.98	135.43	5535.08	990.82	1.585	
5	50.26	4548.16	607.54	4663.98	137.09	5529.02	984.69	1.585	
6	55.00	4549.21	607.54	4663.98	151.14	5473.82	929.59	1.585	
7	50.26	4548.16	600.70	4661.88	137.12	5516.72	972.45	1.585	
8	48.68	4548.11	607.54	4663.98	135.49	5535.12	990.82	1.585	
9	54.47	4549.09	607.54	4663.98	149.58	5479.96	935.71	1.585	
10	50.79	4548.28	607.54	4663.98	138.65	5522.90	978.57	1.585	
11	50.79	4548.28	600.70	4661.88	138.68	5510.60	966.33	1.585	
12	52.37	4548.63	600.70	4661.88	143.34	5492.21	947.96	1.585	
13	51.32	4548.39	600.70	4661.88	140.23	5504.47	960.20	1.585	
14	51.84	4548.51	600.70	4661.88	141.79	5498.34	954.08	1.585	
15	51.32	4548.39	607.54	4663.98	140.21	5516.77	972.45	1.585	
16	51.84	4548.51	607.54	4663.98	141.77	5510.64	966.33	1.585	
17	52.37	4548.63	607.54	4663.98	143.33	5504.51	960.20	1.585	
18	49.21	4548.11	600.70	4661.88	135.60	5522.86	978.57	1.586	
19	46.58	4548.13	607.54	4663.98	133.94	5541.24	996.94	1.586	
20	53.95	4548.98	607.54	4663.98	148.01	5486.10	941.84	1.586	
21	49.74	4548.10	600.70	4661.88	135.67	5522.89	978.57	1.586	
22	47.11	4548.13	600.70	4661.88	134.05	5528.98	984.69	1.586	

						Derr TR8 SS5-REC-EQ.gar		
23	54.47	4549.09	600.70	4661.88	148.27	5473.94	929.59	1.586
24	53.95	4548.98	600.70	4661.88	146.71	5480.08	935.71	1.586
25	49.21	4548.11	607.54	4663.98	135.56	5535.15	990.82	1.587
26	49.74	4548.10	607.54	4663.98	135.62	5535.19	990.82	1.587
27	45.00	4548.15	607.54	4663.98	132.45	5547.39	1003.06	1.587
28	47.63	4548.12	600.70	4661.88	134.12	5529.01	984.69	1.587
29	49.74	4548.10	601.23	4661.84	136.19	5522.85	978.57	1.587
30	54.47	4549.09	601.23	4661.84	148.77	5473.89	929.59	1.587
31	53.95	4548.98	601.23	4661.84	147.22	5480.03	935.71	1.587
32	48.16	4548.12	600.70	4661.88	134.18	5529.05	984.69	1.587
33	53.42	4548.86	601.23	4661.84	145.67	5486.17	941.84	1.587
34	53.42	4548.86	607.54	4663.98	146.45	5492.24	947.96	1.587
35	52.89	4548.74	601.23	4661.84	144.11	5492.30	947.96	1.587
36	47.11	4548.13	607.54	4663.98	134.00	5541.27	996.94	1.587
37	50.26	4548.16	607.54	4663.98	135.78	5535.28	990.82	1.587
38	47.63	4548.12	607.54	4663.98	134.07	5541.31	996.94	1.587
39	45.53	4548.15	600.70	4661.88	132.57	5535.13	990.82	1.587
40	48.16	4548.12	607.54	4663.98	134.13	5541.34	996.94	1.587
41	47.63	4548.12	601.23	4661.84	134.63	5528.97	984.69	1.587
42	48.68	4548.11	607.54	4663.98	134.20	5541.38	996.94	1.587
43	50.79	4548.28	600.70	4661.88	137.38	5516.86	972.45	1.587
44	51.32	4548.39	600.70	4661.88	138.94	5510.74	966.33	1.588
45	51.84	4548.51	600.70	4661.88	140.49	5504.61	960.20	1.588
46	53.95	4548.98	601.75	4661.82	147.69	5479.98	935.71	1.588
47	53.42	4548.86	600.70	4661.88	145.16	5486.22	941.84	1.588
48	52.37	4548.63	600.70	4661.88	142.05	5498.48	954.08	1.588
49	52.89	4548.74	600.70	4661.88	143.60	5492.35	947.96	1.588
50	55.00	4549.21	607.54	4663.98	149.83	5480.11	935.71	1.588
51	52.37	4548.63	607.54	4663.98	142.02	5510.78	966.33	1.588
52	46.05	4548.14	600.70	4661.88	132.63	5535.17	990.82	1.588
53	53.42	4548.86	601.75	4661.82	146.14	5486.12	941.84	1.588
54	52.89	4548.74	607.54	4663.98	143.59	5504.65	960.20	1.588
55	52.89	4548.74	601.75	4661.82	144.59	5492.26	947.96	1.588
56	50.79	4548.28	607.54	4663.98	137.34	5529.16	984.69	1.588
57	48.16	4548.12	601.23	4661.84	134.70	5529.00	984.69	1.588
58	52.37	4548.63	601.75	4661.82	143.04	5498.39	954.08	1.588
59	49.21	4548.11	607.54	4663.98	134.26	5541.41	996.94	1.588
60	45.53	4548.15	607.54	4663.98	132.52	5547.43	1003.06	1.588
61	46.05	4548.14	607.54	4663.98	132.58	5547.46	1003.06	1.588
62	50.26	4548.16	601.23	4661.84	136.35	5522.94	978.57	1.588
63	46.58	4548.13	600.70	4661.88	132.70	5535.20	990.82	1.588
64	46.58	4548.13	607.54	4663.98	132.64	5547.50	1003.06	1.588
65	51.32	4548.39	607.54	4663.98	138.90	5523.04	978.57	1.588
66	48.68	4548.11	601.23	4661.84	134.76	5529.04	984.69	1.588
67	52.89	4548.74	607.54	4663.98	144.89	5498.38	954.08	1.588
68	50.79	4548.28	601.23	4661.84	137.90	5516.81	972.45	1.588
69	51.32	4548.39	601.23	4661.84	139.45	5510.69	966.33	1.588
70	54.47	4549.09	607.54	4663.98	148.27	5486.25	941.84	1.588
71	51.84	4548.51	601.23	4661.84	141.01	5504.56	960.20	1.588
72	50.26	4548.16	600.70	4661.88	135.83	5522.98	978.57	1.588
73	52.37	4548.63	601.23	4661.84	142.56	5498.44	954.08	1.588
74	47.11	4548.13	607.54	4663.98	132.71	5547.53	1003.06	1.588
75	46.05	4548.14	601.23	4661.84	133.15	5535.12	990.82	1.588
76	48.16	4548.12	601.75	4661.82	135.18	5528.96	984.69	1.588
77	49.74	4548.10	607.54	4663.98	134.32	5541.45	996.94	1.588
78	48.68	4548.11	600.70	4661.88	134.25	5529.08	984.69	1.588
79	51.84	4548.51	607.54	4663.98	140.46	5516.91	972.45	1.588
80	49.21	4548.11	600.70	4661.88	134.31	5529.12	984.69	1.589
81	49.74	4548.10	600.70	4661.88	134.37	5529.15	984.69	1.589

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82	50.26	4548.16	601.75	4661.82	136.83	5522.89	978.57	1.589
83	46.58	4548.13	601.23	4661.84	133.22	5535.16	990.82	1.589
84	55.00	4549.21	600.70	4661.88	148.53	5474.09	929.59	1.589
85	48.68	4548.11	601.75	4661.82	135.25	5529.00	984.69	1.589
86	50.26	4548.16	602.28	4662.02	136.97	5522.88	978.57	1.589
87	50.79	4548.28	601.75	4661.82	138.38	5516.77	972.45	1.589
88	47.63	4548.12	607.54	4663.98	132.77	5547.57	1003.06	1.589
89	51.32	4548.39	601.75	4661.82	139.93	5510.65	966.33	1.589
90	51.84	4548.51	601.75	4661.82	141.48	5504.52	960.20	1.589
91	53.95	4548.98	602.28	4662.02	147.84	5479.97	935.71	1.589
92	48.68	4548.11	602.28	4662.02	135.38	5528.98	984.69	1.589
93	50.26	4548.16	602.81	4662.21	137.11	5522.87	978.57	1.589
94	50.79	4548.28	602.28	4662.02	138.52	5516.76	972.45	1.589
95	45.00	4548.15	607.54	4663.98	131.16	5553.65	1009.18	1.589
96	53.42	4548.86	602.28	4662.02	146.29	5486.11	941.84	1.589
97	51.32	4548.39	602.28	4662.02	140.07	5510.63	966.33	1.589
98	52.89	4548.74	602.28	4662.02	144.73	5492.24	947.96	1.589
99	51.84	4548.51	602.28	4662.02	141.63	5504.51	960.20	1.589

Critical Failure Surface (circle 1)

Intersects: XL: 53.95 YL: 4548.98 XR: 600.70 YR: 4661.88
 Centre: XC: 148.01 YC: 5473.80 Radius: R: 929.59

Generated failure surface: (20 points)

53.95	4548.98	83.68	4546.43	113.48	4544.85	143.32	4544.22	173.16	4544.55
202.98	4545.83	232.73	4548.07	262.40	4551.27	291.96	4555.42	321.36	4560.51
350.59	4566.55	379.61	4573.52	408.39	4581.42	436.90	4590.23	465.11	4599.96
492.99	4610.59	520.52	4622.11	547.67	4634.51	574.41	4647.77	600.70	4661.88

Slice Geometry and Properties - Critical Failure Surface (circle 1, 51 slices)

Slice	X-Left	X-S Area	Angle	Width	Base Length	Matl	Cohesion	Phi	Weight	Porewater Force	Normal Stress	Test Factor
1	53.95	22.13	-4.9	12.00	12.04	5	150.00	22.0	2898.94	965.88	253.54	1.03
2	65.94	113.84	-4.9	17.74	17.80	2	100.00	18.0	15032.43	5580.63	862.47	1.02
3	83.68	166.83	-3.0	14.90	14.92	2	100.00	18.0	22104.38	8273.02	1497.14	1.01
4	98.58	227.96	-3.0	14.90	14.92	2	100.00	18.0	30209.90	11313.17	2044.89	1.01
5	113.48	277.75	-1.2	14.53	14.53	2	100.00	18.0	36783.35	13730.43	2539.90	1.00
6	128.01	329.07	-1.2	14.53	14.53	2	100.00	18.0	43532.02	16194.09	3005.67	1.00
7	142.54	398.91	0.5	15.31	15.31	2	100.00	18.0	52695.95	19514.78	3437.30	1.00
8	157.85	448.37	0.6	15.31	15.31	2	100.00	18.0	59128.08	21780.37	3856.00	1.00
9	173.16	480.56	2.5	14.91	14.92	2	100.00	18.0	63253.65	23182.36	4216.78	0.99
10	188.07	520.32	2.5	14.91	14.92	2	100.00	18.0	68345.15	24885.43	4556.32	0.99
11	202.98	364.64	4.3	9.87	9.89	2	100.00	18.0	47809.59	17341.02	4794.29	0.99
12	212.84	382.08	4.3	9.95	9.97	5	150.00	22.0	50052.04	18040.91	4964.39	0.98
13	222.79	396.59	4.3	9.95	9.97	5	150.00	22.0	51953.62	18601.30	5153.04	0.98
14	232.73	114.08	6.1	2.80	2.81	5	150.00	22.0	14943.93	5342.43	5237.96	0.98
15	235.53	560.16	6.1	13.44	13.51	1	0.00	35.0	73168.09	26047.67	5285.63	0.96
16	248.97	580.80	6.1	13.44	13.51	1	0.00	35.0	75447.67	26706.76	5449.85	0.96
17	262.40	659.02	8.0	14.78	14.92	1	0.00	35.0	85160.77	30027.85	5544.14	0.95
18	277.18	676.85	8.0	14.78	14.92	1	0.00	35.0	87026.05	30378.38	5664.37	0.95
19	291.96	687.61	9.8	14.70	14.92	1	0.00	35.0	87997.20	30503.80	5704.93	0.94
20	306.66	698.16	9.8	14.70	14.92	1	0.00	35.0	88955.77	30403.33	5765.01	0.94
21	321.36	256.55	11.7	5.36	5.47	1	0.00	35.0	32592.92	11090.75	5744.41	0.94
22	326.72	573.11	11.7	11.93	12.19	1	0.00	35.0	72635.07	23874.08	5740.92	0.94
23	338.65	575.33	11.7	11.93	12.19	1	0.00	35.0	72675.27	22375.36	5733.64	0.94
24	350.59	698.86	13.5	14.51	14.92	1	0.00	35.0	87959.96	25136.30	5642.38	0.93
25	365.10	695.04	13.5	14.51	14.92	1	0.00	35.0	87130.59	22449.41	5573.42	0.93
26	379.61	148.87	15.3	3.12	3.24	1	0.00	35.0	18616.66	4505.05	5469.56	0.92

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27	382.73	797.09	15.3	16.57	17.18	1	0.00	35.0	99908.85	21456.50	5511.64	0.92
28	399.30	146.06	15.3	3.00	3.11	4	0.00	45.0	16445.65	5370.54	4927.39	0.88
29	402.30	297.93	15.3	6.09	6.31	1	0.00	35.0	37516.71	14340.61	5744.04	0.92
30	408.39	212.26	17.2	4.31	4.52	1	0.00	35.0	26773.06	9840.32	5720.86	0.92
31	412.70	573.18	17.2	12.10	12.66	1	0.00	35.0	72373.67	25585.40	5505.88	0.92
32	424.80	527.92	17.2	12.10	12.66	1	0.00	35.0	66715.36	22628.75	5066.34	0.92
33	436.90	431.13	19.0	10.80	11.43	1	0.00	35.0	54539.95	17760.05	4585.87	0.92
34	447.70	383.65	19.0	10.10	10.68	1	0.00	35.0	48663.89	14199.71	4356.74	0.92
35	457.80	276.90	19.0	7.31	7.73	1	0.00	35.0	35171.92	8826.92	4327.11	0.92
36	465.11	463.08	20.9	12.33	13.20	1	0.00	35.0	58708.09	12094.62	4206.79	0.92
37	477.44	455.87	20.9	12.33	13.20	1	0.00	35.0	57654.26	8224.71	4091.36	0.92
38	489.77	118.01	20.9	3.22	3.45	1	0.00	35.0	14916.64	1512.31	4022.62	0.92
39	492.99	549.58	22.7	15.32	16.61	1	0.00	35.0	69770.77	3320.66	3874.83	0.91
40	508.31	121.26	22.7	3.46	3.75	1	0.00	35.0	15464.61	0.00	3775.63	0.91
41	511.77	302.60	22.7	8.75	9.49	1	0.00	35.0	38594.44	0.00	3720.32	0.91
42	520.52	310.86	24.5	9.25	10.16	1	0.00	35.0	39587.84	0.00	3562.88	0.91
43	529.77	264.68	24.5	8.13	8.94	1	0.00	35.0	33755.62	0.00	3454.70	0.91
44	537.90	291.27	24.5	9.77	10.74	1	0.00	35.0	37293.66	0.00	3175.72	0.91
45	547.67	181.79	26.4	7.05	7.86	1	0.00	35.0	23359.71	0.00	2719.48	0.92
46	554.72	271.84	26.4	13.08	14.60	5	150.00	22.0	34904.22	0.00	2326.49	0.99
47	567.80	105.82	26.4	6.61	7.37	5	150.00	22.0	13506.06	0.00	1773.30	0.99
48	574.41	32.09	28.2	2.30	2.61	5	150.00	22.0	4080.32	0.00	1517.05	1.00
49	576.70	118.43	28.2	11.10	12.59	1	0.00	35.0	15113.19	0.00	1100.85	0.92
50	587.80	35.16	28.2	5.67	6.44	1	0.00	35.0	4553.90	0.00	648.85	0.92
51	593.47	16.08	28.2	7.23	8.20	5	150.00	22.0	2107.13	0.00	211.75	1.00

X-S Area: 18338.03

Path Length: 567.01

X-S Weight: 2349589.00

APPENDIX D



LOG OF TEST BORE - 15 (Log 1 of 5)

Client:	Dust & Dirt Excavating	Project:	Slurry Wall Design
Site:	Sec 4 Township 5 North Range 65 West	Project No.:	2006-201

Description	Depth (ft.)	Sample Type	SPT-N (BLOWS/FT)	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Index	% Passing #200	Unconfined Strength (psf)	Swell (psf)	USCS/AASHTO
SILTY SAND WITH GRAVEL	0										
	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										
	10										
	11										
	12										
	13										
	14										
	15										
	16										
	17										
	18										
	19										
	20										
SANDY SILTY CLAY	21										
SILTY SAND WITH GRAVEL	22										
	23										
	24										
	25										

The stratification lines represent the approximate boundary lines between soil and rock types. Insitu, the transition may be gradual.

Water Observations

Initial WL: 35'

WL: 35'

Water Checked: 10/23/06

T.R.T.

Two Rivers Testing, Inc.

Boring Started: 10/23/2006

Boring Complete: 10/23/2006

Logged By: TM

Approved By: TMC

LOG OF TEST BORE - 15 (Log 2 of 5)

Client:	Dust & Dirt Excavating	Project:	Slurry Wall Design
Site:	Sec 4 Township 5 North Range 65 West	Project No.:	2006-201

Description	Depth (ft.)	Sample Type	SPT-N (BLOWS/FT)	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Index	% Passing #200	Unconfined Strength (psf)	Swell (psf)	USCS/AASHTO
SANDY SILTY CLAY	26										
	27										
	28										
SILTY SAND WITH GRAVEL	29										
	30										
	31										
	32										
	33										
SANDY SILTY CLAY	34										
SILTY SAND & GRAVEL	35										
WITH COBBLE	36										
GROUNDWATER	37										
	38										
	39										
	40										
	41										
	42										
	43										
	44										
	45										
	46										
	47										
	48										
	49										
	50										

The stratification lines represent the approximate boundary lines between soil and rock types. Insitu, the transition may be gradual.

Water Observations

Initial WL:	35'
WL:	35'
Water Checked:	10/23/06

T.R.T.

Two Rivers Testing, Inc.

Boring Started:	10/23/2006
Boring Complete:	10/23/2006
Logged By:	TM
Approved By:	TMC

LOG OF TEST BORE - 15 (Log 3 of 5)

Client:	Dust & Dirt Excavating	Project:	Slurry Wall Design
Site:	Sec 4 Township 5 North Range 65 West	Project No.:	2006-201

Description	Depth (ft.)	Sample Type	SPT-N (BLOWS/FT)	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Index	% Passing #200	Unconfined Strength (psf)	Swell (psf)	USCS/AASHTO
SILTY SAND & GRAVEL WITH COBBLE	51										
	52										
	53										
	54										
	55										
	56										
	57										
	58										
	59										
	60										
	61										
	62										
	63										
	64										
	65										
	66										
	67										
	68										
	69										
	70										
	71										
	72										
	73										
	74										
	75										

The stratification lines represent the approximate boundary lines between soil and rock types. Insitu, the transition may be gradual.

Water Observations

Initial WL:	35'
WL:	35'
Water Checked:	10/23/06

T.R.T.

Two Rivers Testing, Inc.

Boring Started:	10/23/2006
Boring Complete:	10/23/2006
Logged By:	TM
Approved By:	TMC

LOG OF TEST BORE - 15 (Log 4 of 5)

Client:	Dust & Dirt Excavating	Project:	Slurry Wall Design
Site:	Sec 4 Township 5 North Range-65 West	Project No.:	2006-201

Description	Depth (ft.)	Sample Type	SPT-N (BLOWS/FT)	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Index	% Passing #200	Unconfined Strength (psf)	Swell (psf)	USCS/AASHTO
SILTY SAND & GRAVEL WITH COBBLE	76										
	77										
	78										
	79										
	80										
	81										
	82										
	83										
	84										
	85										
	86										
	87										
	88										
SILTY SAND WITH GRAVEL	89										
	90										
	91										
	92										
	93										
SANDY SILTY CLAY	94										
SILTY SAND & GRAVEL WITH COBBLE	95										
	96										
	97										
	98										
	99										
	100										

The stratification lines represent the approximate boundary lines between soil and rock types. Insitu, the transition may be gradual.

Water Observations

Initial WL:	35'
WL:	35'
Water Checked:	10/23/06

T.R.T.

Two Rivers Testing, Inc.

Boring Started:	10/23/2006
Boring Complete:	10/23/2006
Logged By:	TM
Approved By:	TMC

LOG OF TEST BORE - 15 (Log 5 of 5)

Client:	Dust & Dirt Excavating	Project:	Slurry Wall Design
Site:	Sec 4 Township 5 North Range 65 West	Project No.:	2006-201

Description	Depth (ft.)	Sample Type	SPT-N (BLOWS/FT)	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Index	% Passing #200	Unconfined Strength (psf)	Swell (psf)	USCS/AASHTO
SILTY SAND & GRAVEL WITH COBBLE	101										
	102										
	103										
	104										
	105										
	106										
	107										
	108										
	109										
	110										
	111										
SILTSTONE (WEATHERED- BROWN)	112										
	113										
	114		76								
	115		122								
SILTSTONE (GREY)	116		107								
	117		137								
	118		95								
	119										
	120										
	121										
	122										
	123										
	124										
	125										

The stratification lines represent the approximate boundary lines between soil and rock types. Insitu, the transition may be gradual.

Water Observations

Initial WL: 35'

WL: 35'

Water Checked: 10/23/06

T.R.T.

Two Rivers Testing, Inc.

Boring Started: 10/23/2006

Boring Complete: 10/23/2006

Logged By: TM

Approved By: TMC

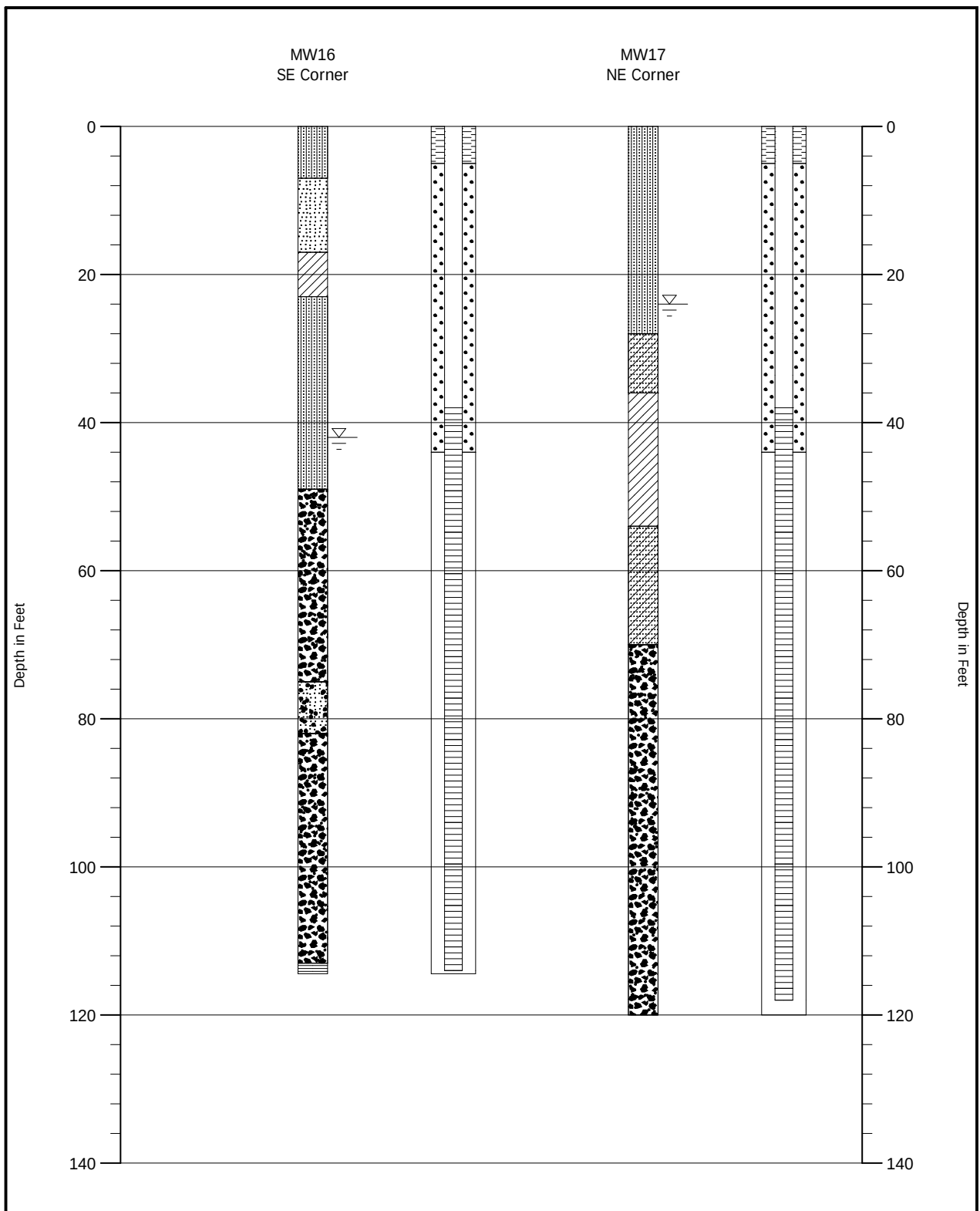


FIGURE 1
Logs of Borings

PROJECT NO:	19.3069	 CESARE, INC. <i>Geotechnical Engineers & Construction Materials Consultants</i>
PROJECT NAME:	Derr Pit Monitoring Wells	
DWG DATE:	8/12/2019	

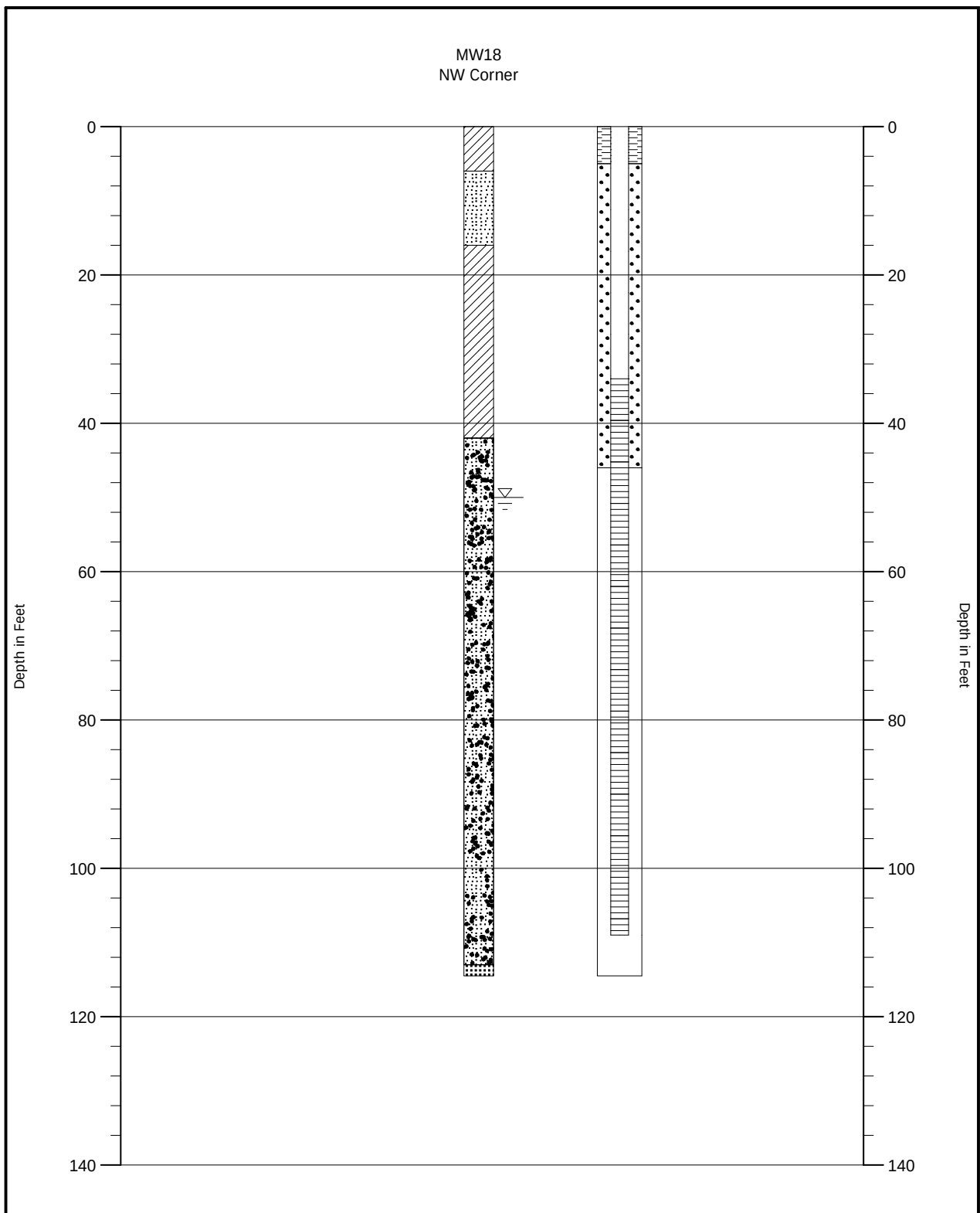


FIGURE 2
Logs of Borings

PROJECT NO:	19.3069	 CESARE, INC. <i>Geotechnical Engineers & Construction Materials Consultants</i>
PROJECT NAME:	Derr Pit Monitoring Wells	
DWG DATE:	8/12/2019	

KEY TO SYMBOLS

Symbol Description

Strata symbols



SAND, with silt to silty, locally with gravel and clay, moist to wet, tan to brown.



SAND, gravelly, very moist to wet, red brown to tan



CLAY, sandy, moist to wet, brown to tan.



GRAVEL, with sand, gravels typically 1 to 2 inch in dimension, cobbles occasionally 3 to 4 inch in dimension, moist to wet, tan.



GRAVEL and SAND, gravels typically 1 to 2 inch in dimension, cobbles occasionally 3 to 4 inch in dimension, very moist to wet, brown to tan.



CLAYSTONE, hard, moist, with lignite partings, black and grey.



SAND, clayey, medium dense, wet, tan.



SANDSTONE, fine grained with silt, very hard, wet, brown.

Misc. Symbols



Water level during drilling

Symbol Description

Monitor Well Details



Pipe riser



Bentonite pellets



Silica sand, blank PVC



Slotted pipe, backfilled with silica sand



Slotted pipe, Native sand and gravel backfill



End of well installation

Notes:

1. 50/5 indicates 50 blows with a 140-pound hammer falling 30 inches were required to drive a modified California barrel sampler 5 inches.
2. Exploratory borings MW16 through MW18 were drilled on August 8 and 9, 2019 using a CME-55 drill rig with a 4.25-inch inner diameter continuous flight hollow stem auger.
3. Groundwater was encountered at depths of 23, 44, and 50 feet below ground surface in borings MW16, MW17, and MW18, respectively, during drilling.
4. Gravel dimensions described in these logs were based on verbal input and estimates from drill operator.
5. Piezometers were constructed in all three borings.
6. Contacts between soil units are approximate and may be gradational.
7. Project No. 19.3069.



GEOTECHNICAL DATA REPORT

Mill Iron Pit
Greeley, Colorado



Report Prepared for:

**Mr. Martin Holt
IHC Scott
7135 South Tucson Way
Centennial, CO 80112**

**Project No. 22.3026
May 19, 2022**

Corporate Office: 7108 South Alton Way, Building B • Centennial, CO 80112
Locations: Centennial • Frederick • Silverthorne • Salida/Crested Butte
Phone 303-220-0300 • www.cesareinc.com



GEOTECHNICAL DATA REPORT

Mill Iron Pit
Greeley, Colorado

Report Prepared for:

**Mr. Martin Holt
IHC Scott
7135 South Tucson Way
Centennial, CO 80112**

**Project No. 22.3026
May 19, 2022**

Report Prepared by:

A handwritten signature in blue ink, appearing to read 'J. Edwards'.

**Jay B. Edwards
Engineering Field Services Coordinator**

Reviewed by:



**Craig A. Colby, P.E.
Director of Engineering**

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1. PURPOSE.....	1
2. SITE CONDITIONS	1
3. SITE EXPLORATION	1
4. SUBSURFACE CONDITIONS – NORTHERN SECTION	1
5. SUBSURFACE CONDITIONS – SOUTHERN SECTION.....	2
6. LIMITATIONS.....	2

FIGURES

VICINITY MAP.....	FIGURE 1
SITE PLAN AND BORING LOCATIONS.....	FIGURE 2

APPENDIX

FIELD EXPLORATION	APPENDIX A
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1. PURPOSE

Cesare, Inc. (Cesare) performed subsurface exploration at the Mill Iron Pit Property in Greeley, Colorado to provide subsurface information to IHC Scott (Client) regarding potential aggregate resource production. Factual data gathered during the field exploration is summarized in Figures 1 and 2 and Appendix A.

2. SITE CONDITIONS

The Mill Iron Pit property site is located at the northeastern edge of Greeley, Colorado. The portions of the site explored by Cesare were previously used for agricultural purposes but are currently unused. The site consists of two sections; a northern and a southern section. There is an active aggregate mine between the two sections. Both sections of the site are surrounded by active aggregate mining and agricultural or industrial land. Topography of both sections is considered relatively flat. There is an elevation difference of 25 to 30 feet from the southern section up to the northern section. The Cache la Poudre River is located about 1,000 feet south of the southern border of the southern section.

3. SITE EXPLORATION

Subsurface conditions were explored by drilling 17 borings between April 25 and 28, 2022 at the locations indicated in Figure 2. The boring locations were chosen by and staked in the field by the Client. The borings were advanced using either an 8 inch or 4 inch diameter, continuous flight, solid stem auger (CFSSA) powered by a Diedrich D-120 drilling rig. Borings B-1, B-4, B-7A, and B-11A were advanced to depths of 115 to 125 feet using 4 inch diameter CFSSA. The remainder of the borings were advanced to depths of 76 to 100 feet using 8 inch diameter CFSSA. The borings were backfilled immediately upon completion.

Bulk samples of sand and gravel obtained from auger cuttings were collected at various intervals, as depicted on the boring logs in Appendix A. The bulk samples provide a reasonable representation of the in-place sand and gravel units. Based on Cesare's experience, cobbles larger than 4 inches may not be brought to the surface using 8 inch solid stem augers and auger drilling tends to push gravel and cobble sized material to the side of the drill hole, creating a finer grained material when collected at the surface. Additionally, when cuttings are brought to the surface through a significant groundwater table, fines can be washed out of the cuttings collected at the surface. Fines content can sometimes be increased as the material on the auger travels through finer overburden material. Samples were returned to Cesare's laboratory for testing. Laboratory testing results are the subject of a separate report.

4. SUBSURFACE CONDITIONS – NORTHERN SECTION

Cesare's borings in the northern section (B-1 through B-11A) generally encountered overburden soil consisting of about 3 to 9 feet of clayey sand to sandy clay. The overburden soil was generally underlain by gravelly sand to sandy gravel soil, with clay and/or clay lenses. The gravelly sand to sandy gravel extended to claystone bedrock at depths ranging from 111 to 120 feet below ground surface. Bedrock was encountered in Borings B-1, B-4, B-7A, and B-11A. Groundwater was encountered at depths ranging from 35 to 45 feet below ground surface at the time of drilling. For safety purposes, borings were backfilled at the completion of the study preventing additional water level measurements. More complete descriptions of the subsoil and groundwater conditions encountered are shown in Appendix A.

5. SUBSURFACE CONDITIONS – SOUTHERN SECTION

Cesare's borings in the southern section (B-12 through B-15) generally encountered overburden soil consisting of about 3 to 9 feet of clayey sand to sandy clay. The overburden soil was generally underlain by gravelly sand to sandy gravel soil, with clay and/or clay lenses. The gravelly sand to sandy gravel soil extended to clastone bedrock at depths ranging from 75 to 90 feet below ground surface. Bedrock was encountered in Borings B-12 through B-15. Groundwater was encountered at depths of 25 feet below ground surface at the time of drilling. For safety purposes, borings were backfilled at the completion of the study preventing additional water level measurements. More complete descriptions of the subsoil and groundwater conditions encountered are shown in Appendix A.

These observations represent conditions at the time of field exploration and may not be indicative of other times or other locations. Groundwater can be expected to fluctuate with variations in seasons, drainage, site vegetation, irrigation, and weather conditions.

6. LIMITATIONS

This document has been prepared as an instrument of service for the exclusive use of IHC Scott for the specific application to the project as discussed herein and has been prepared in accordance with geotechnical engineering practices generally accepted in the state of Colorado at the date of its preparation. No warranties, either expressed or implied, are intended or made. This document should not be assumed to contain information for other parties or other purposes.

The findings of this data report are valid as of the date its preparation. Changes in the conditions of a property can occur with the passage of time, whether due to natural processes or the works of people on this or adjacent properties. Standards of practice evolve in engineering and changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this data report may be invalidated wholly or partially by changes outside of Cesare's control, therefore, this data report is subject to review and should not be relied upon without such review after a period of 3 years.

The exploration locations for this data report were selected to obtain a reasonably accurate depiction of underground conditions for design purposes and these locations are often modified based on accessibility and the presence of underground or overhead utility conflicts. Variations from the soil conditions encountered are possible.

Cesare's scope of services for this report did not include either specifically, or by implication, any environmental assessment of the site or identification of hazardous material or conditions. Additionally, none of the services performed in connection with this data report were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not, of itself, be enough to prevent mold from growing in or on the structures involved.

Cesare offers many other construction observations, materials engineering, and testing services and can be contacted to discuss further.

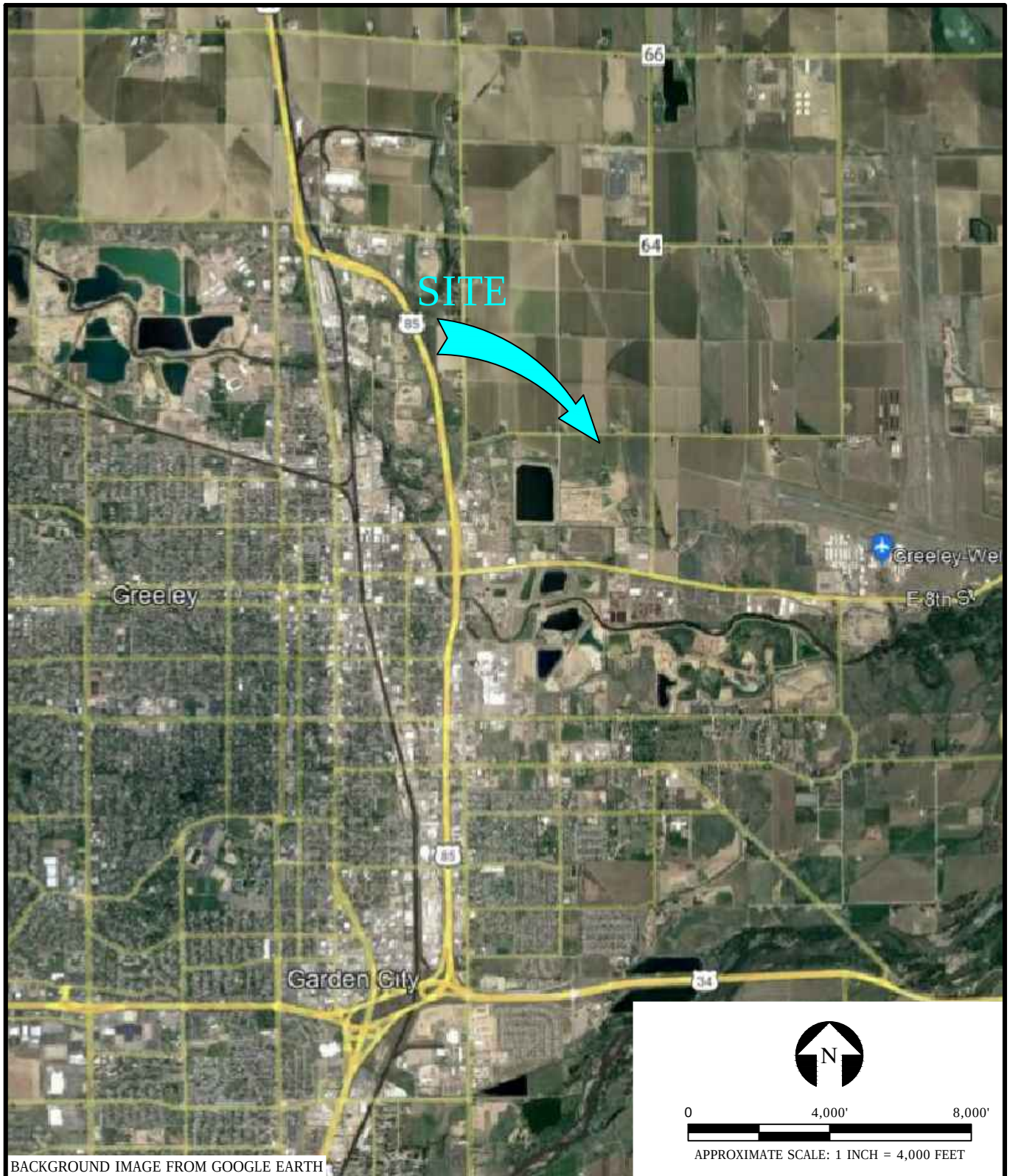


FIGURE 1
Vicinity Map

PROJECT NO:	22.3026		
PROJECT NAME:	Mill Iron Pit		
DRAWN BY:	JBE	CHECKED BY:	CAC
DWG DATE:	05.11.22	REV. DATE:	--

CESARE, INC.
Geotechnical Engineers & Construction Materials Consultants

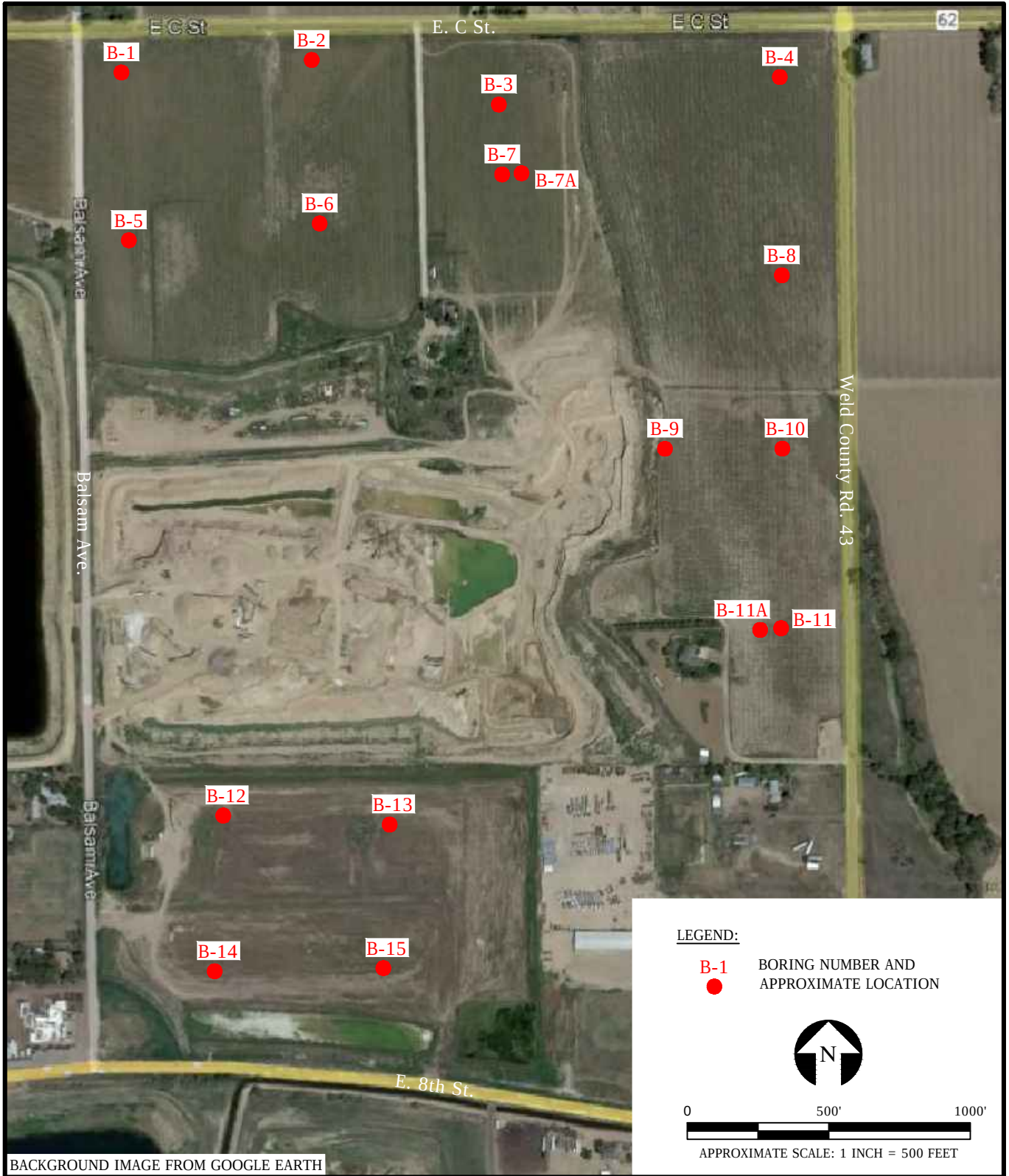


FIGURE 2
Site Plan and Boring Locations

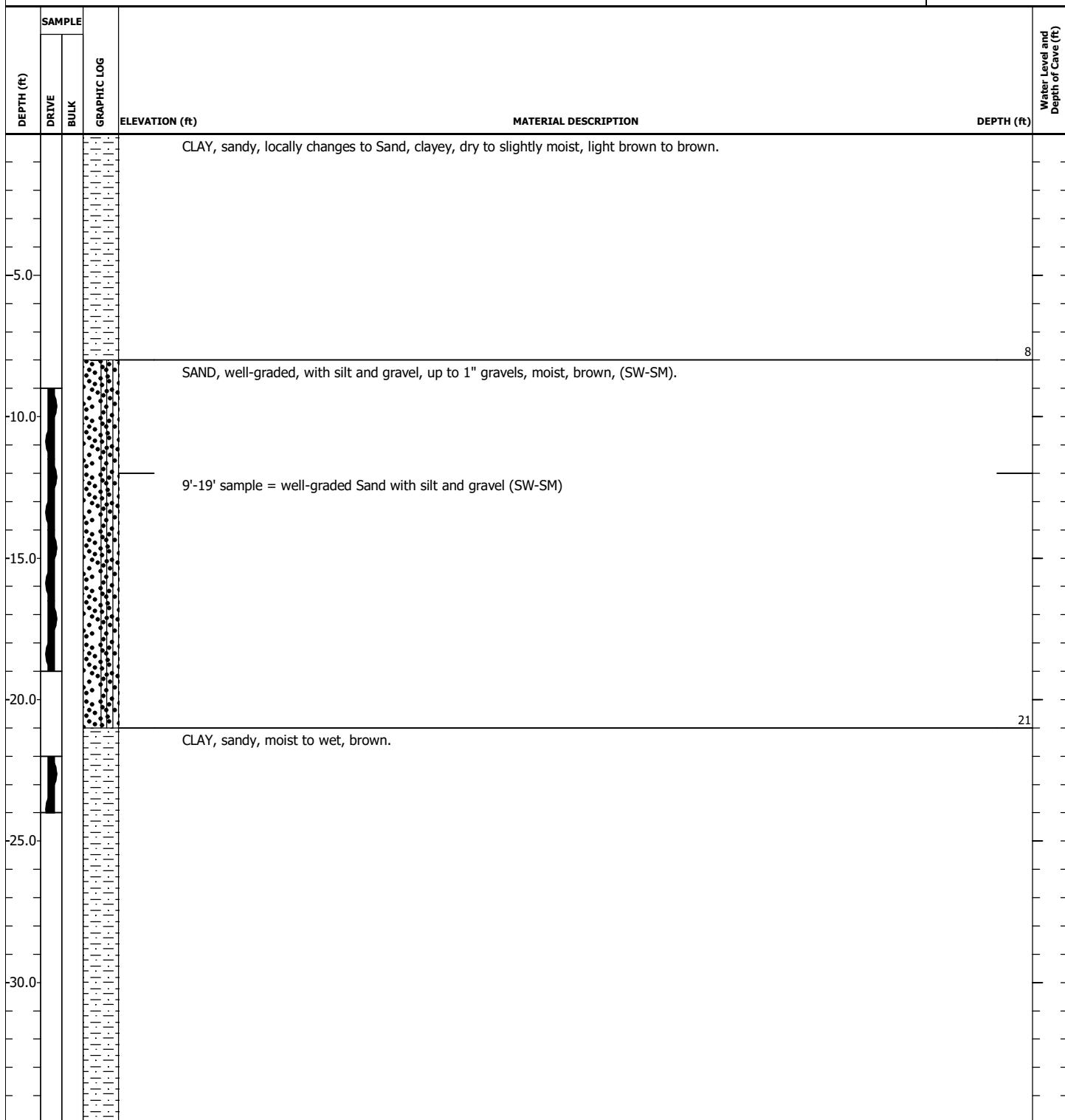
PROJECT NO:	22.3026		
PROJECT NAME:	Mill Iron Pit		
DRAWN BY:	JBE	CHECKED BY:	CAC
DWG DATE:	05.11.22	REV. DATE:	--



APPENDIX A

Field Exploration

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-1
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 1 of 4



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

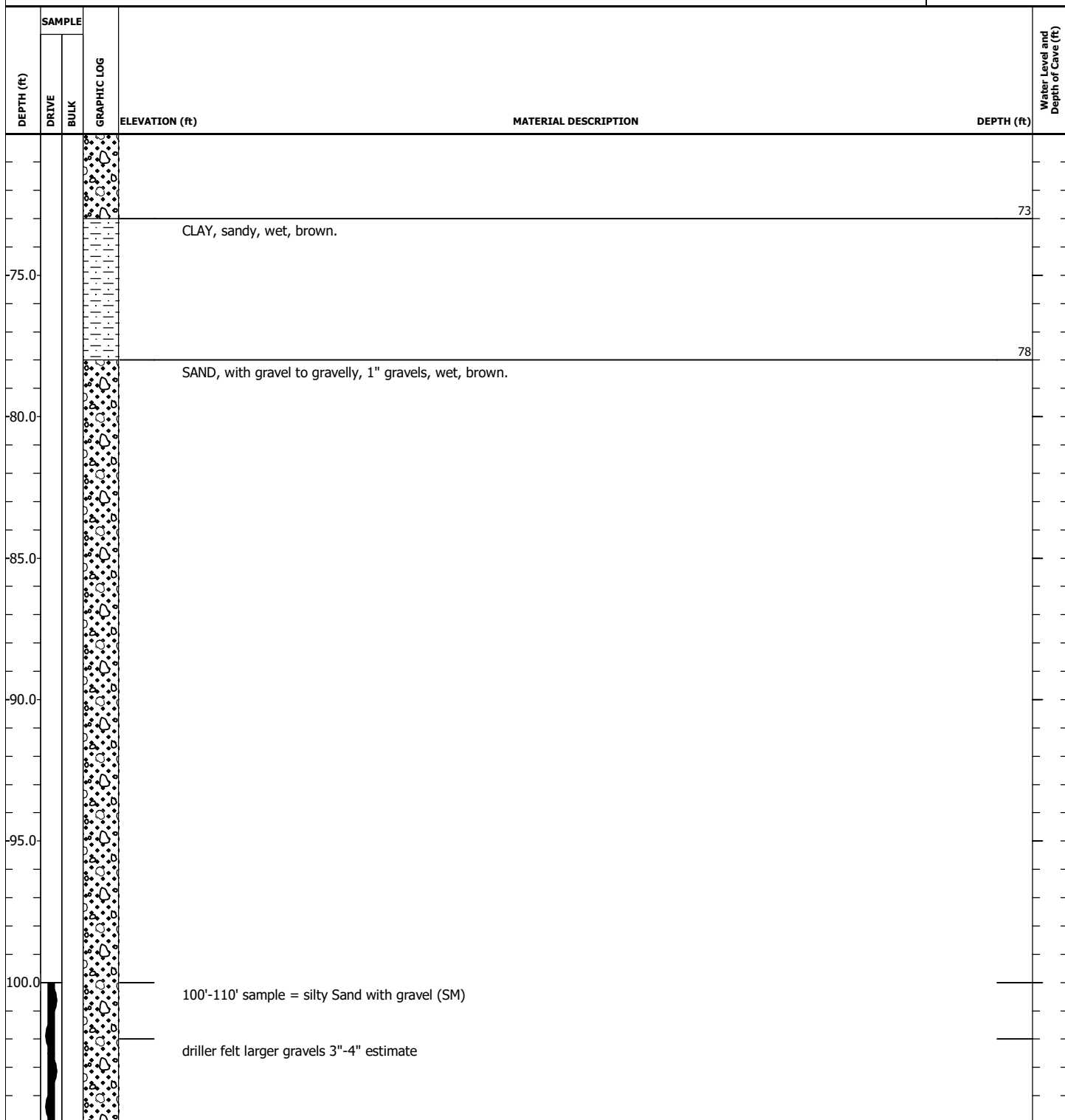
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-1
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 2 of 4

DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
40.0							
43.0						43	
45.0					SAND, with gravel to gravelly, 1"-2" gravels with occasional 2"-4", wet, brown.		
50.0							
55.0							
60.0							
65.0					driller felt larger gravels 2"-4" estimate		

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-1
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 3 of 4



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

Page 4 of 4



	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



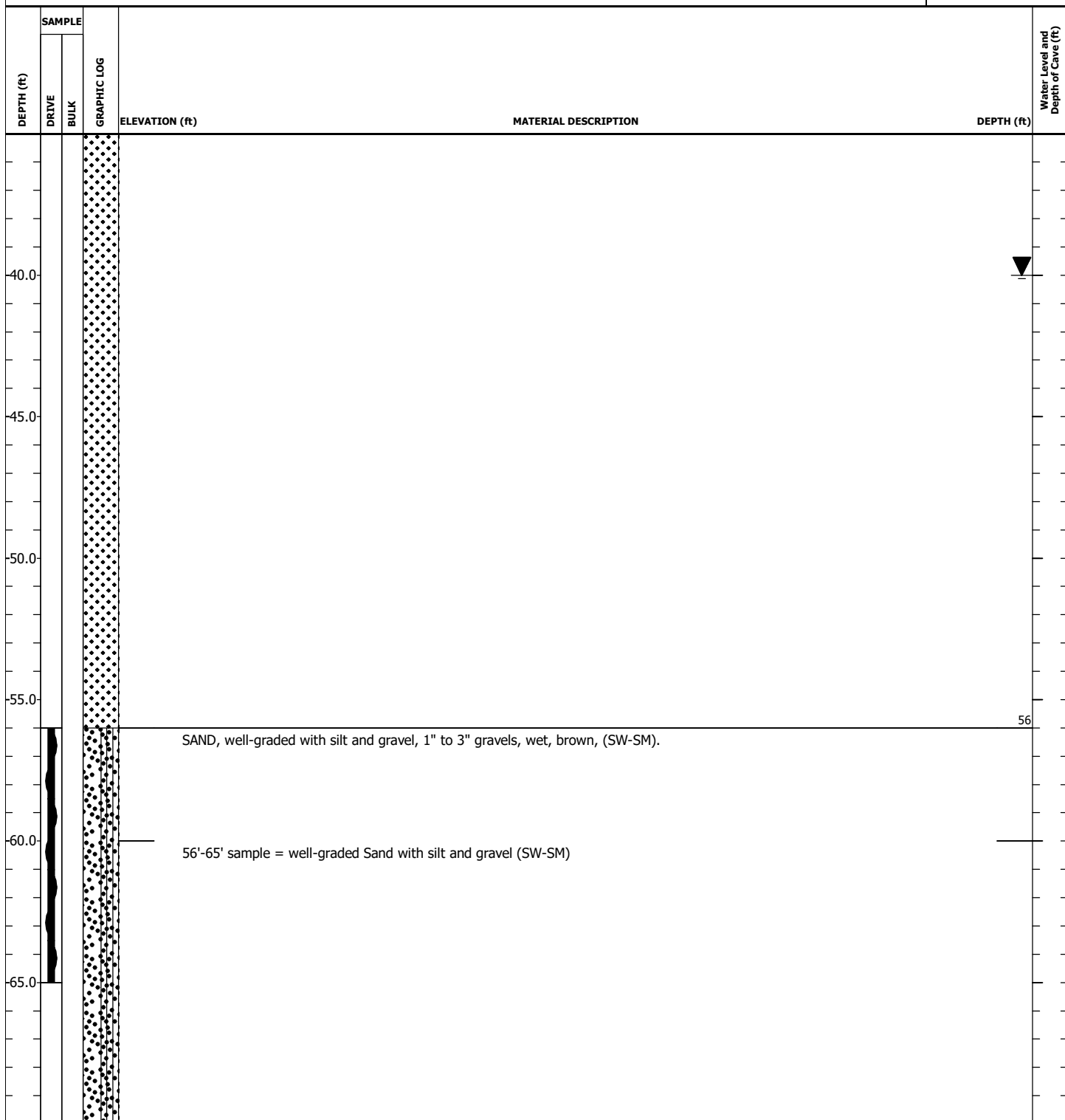
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-2
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 1 of 3

DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, to SAND, clayey, few fine gravels, dry, light brown.		
-5.0					6	
				SAND, well-graded with silt and gravel, up to 1" gravels, moist, brown (SW-SM).		
-10.0				7'-17' sample = well-graded Sand with silt and gravel (SW-SM)		
-15.0					17	
				CLAY, sandy, moist, brown.		
-20.0						
-25.0						
-30.0				SAND, occasional gravels up to 1", moist to wet, brown.	30	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

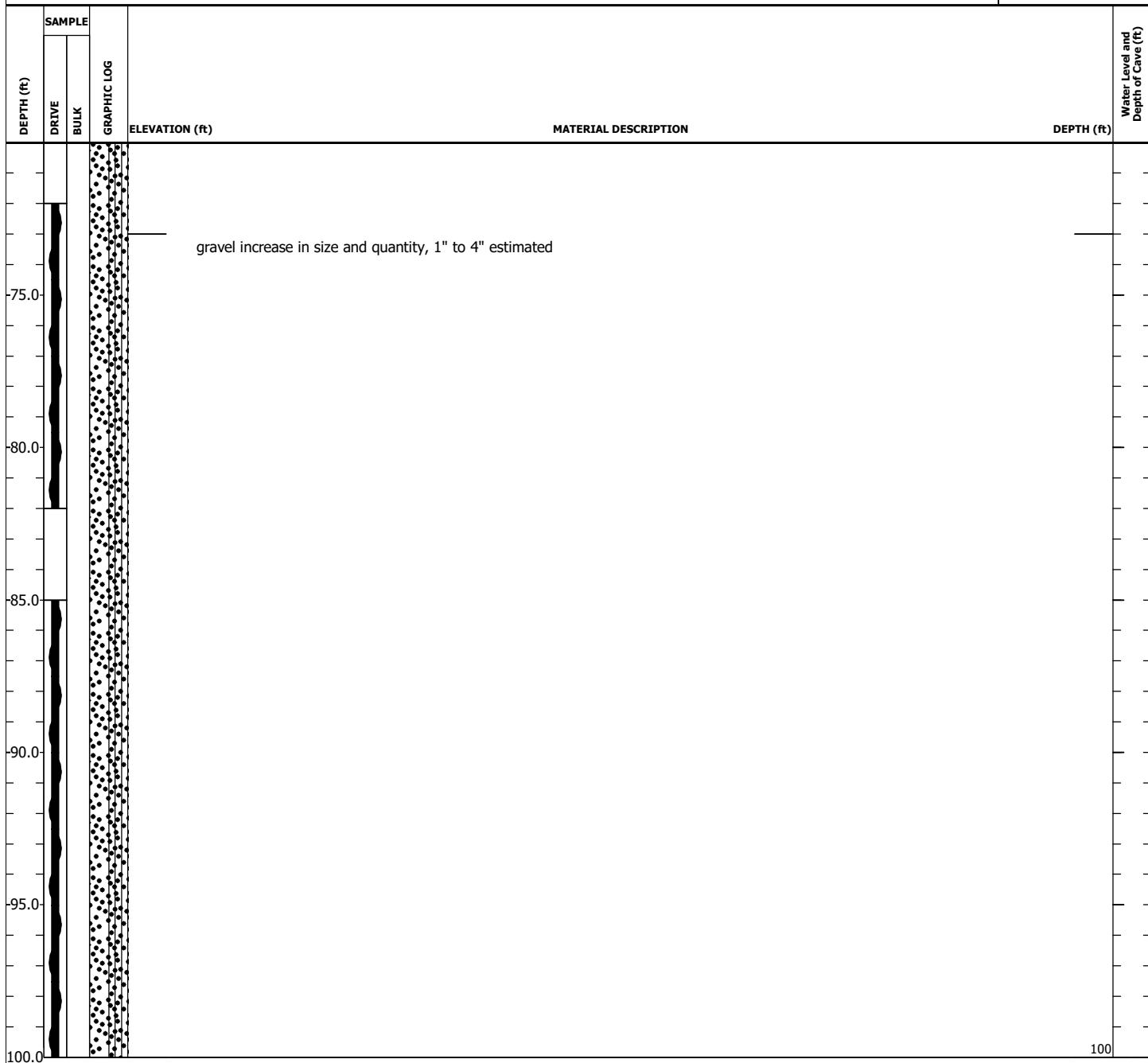
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-2
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 2 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-2
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 3 of 3



LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-3
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 1 of 3

DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, slightly moist, light brown.		
					3	
				SAND, clayey, with fine gravel, slightly moist, light brown.		
-5.0						
					9	
				SAND, well-graded with silt and gravel, 1"-2" gravels, moist, brown, (SW-SM).		
-10.0				9'-19' and 33'-35' sample = well-graded Sand with silt and gravel (SW-SM).		
					19	
				CLAY, sandy, moist, brown.	20	
-20.0				SAND, with gravel, 1"-2" gravels, moist, brown.		
					24	
				CLAY, sandy, with gravels up to 1", moist, brown.		
-25.0						
					32	
				SAND, well-graded with silt and gravel, 1"-2" gravels, moist, brown, (SW-SM).		
-30.0						
					35	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

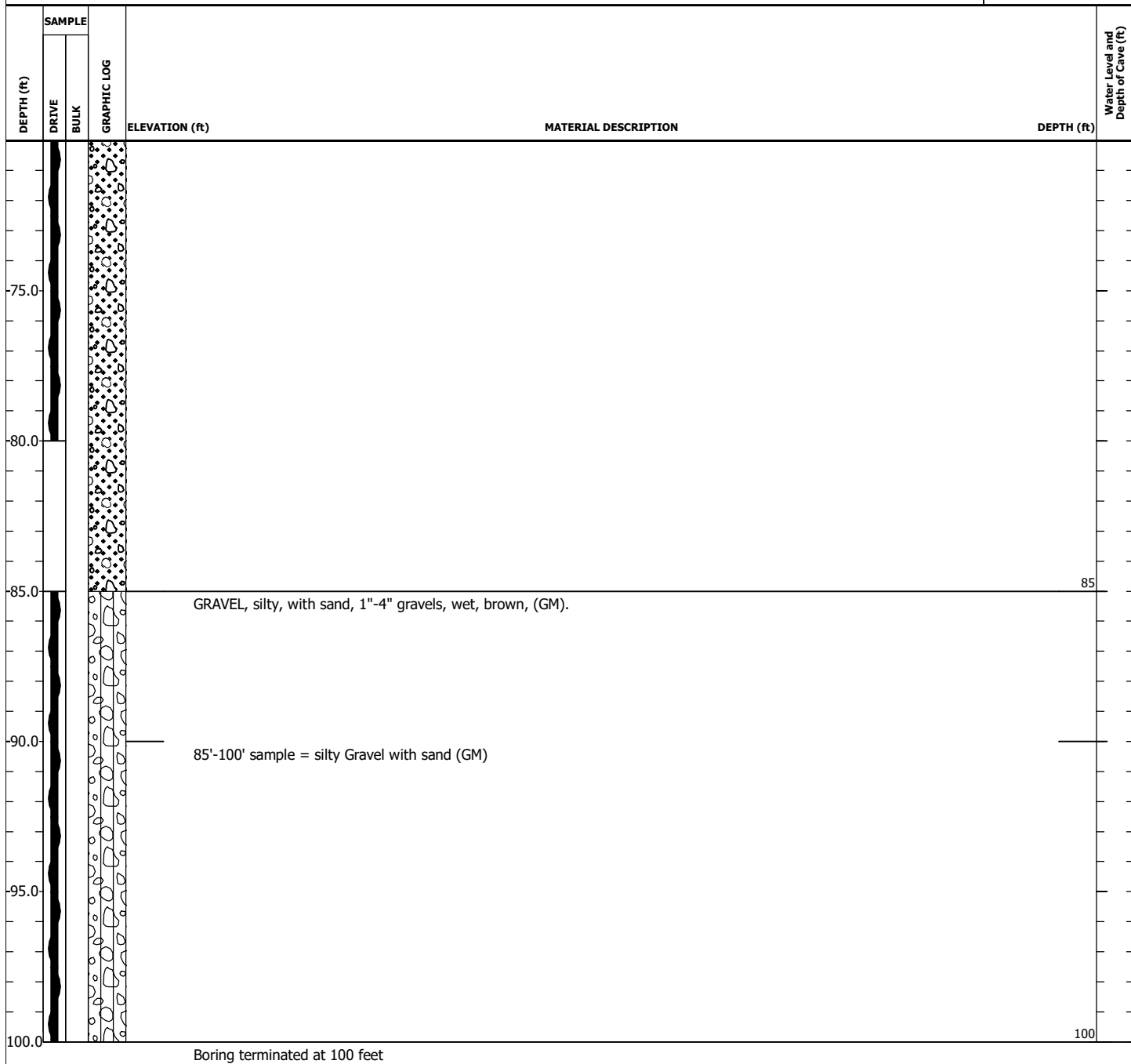
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-3
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 2 of 3

DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
40.0					CLAY, sandy, with fine gravel, moist, brown.		
						43	
45.0					SAND, with gravels up to 1", moist, brown.		▼
						46	
					CLAY, sandy, with gravels up to 1", wet, brown.		
						48	
50.0					SAND, with gravel to gravelly, 1"-2" gravels, wet, brown.		
55.0							
60.0							
65.0							
					larger gravels encountered, up to 3" estimated		

LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-3
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 3 of 3

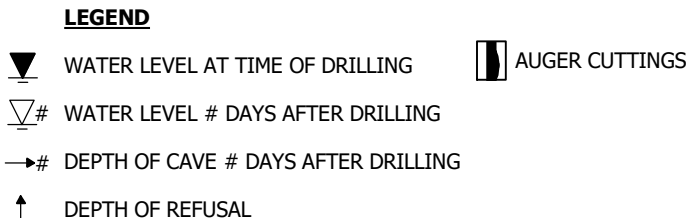


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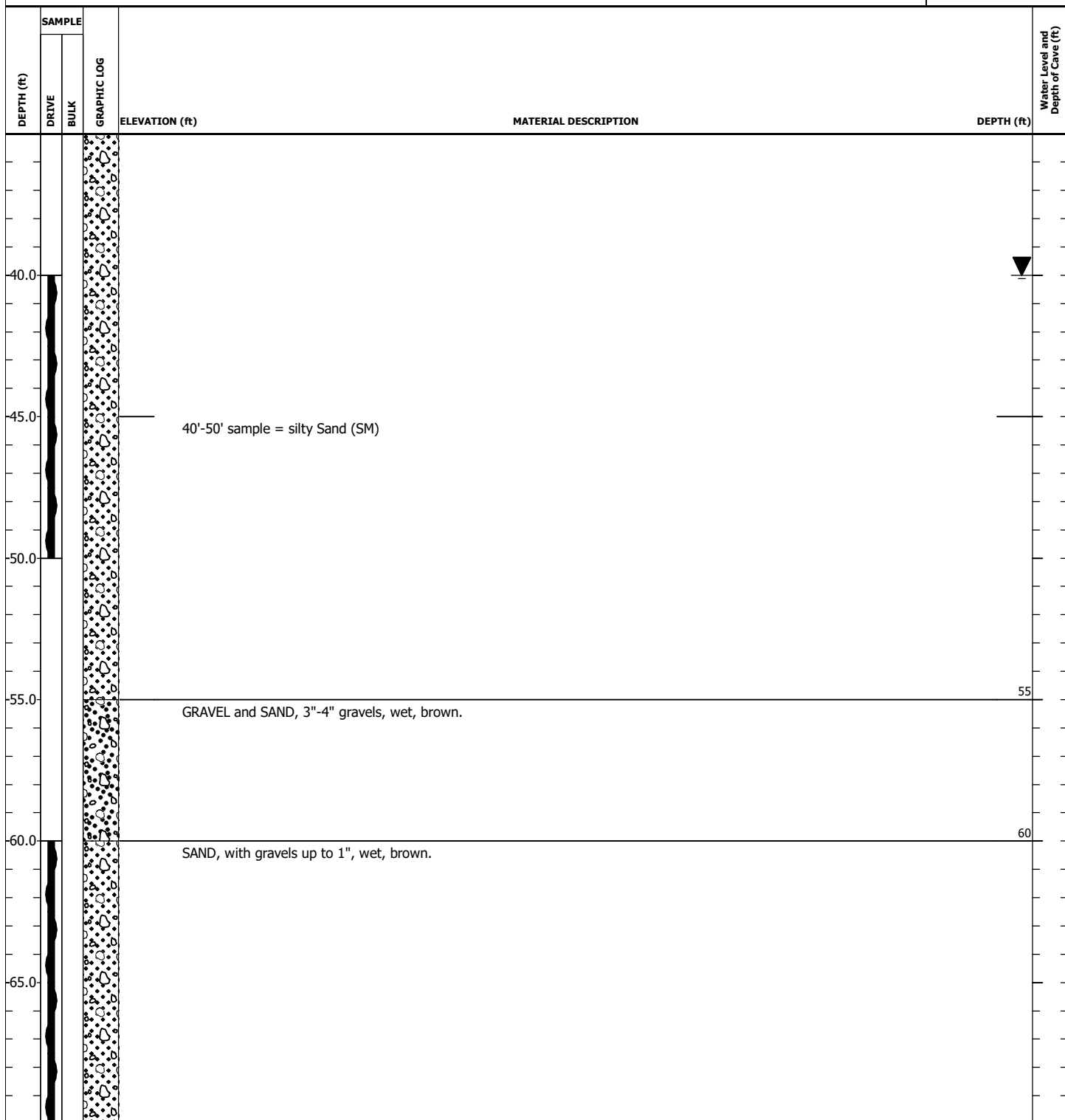
- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

Page 1 of 4



PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-4
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 2 of 4



LEGEND

- WATER LEVEL AT TIME OF DRILLING
- AUGER CUTTINGS
- WATER LEVEL # DAYS AFTER DRILLING
- DEPTH OF CAVE # DAYS AFTER DRILLING
- DEPTH OF REFUSAL

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

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LEGEND

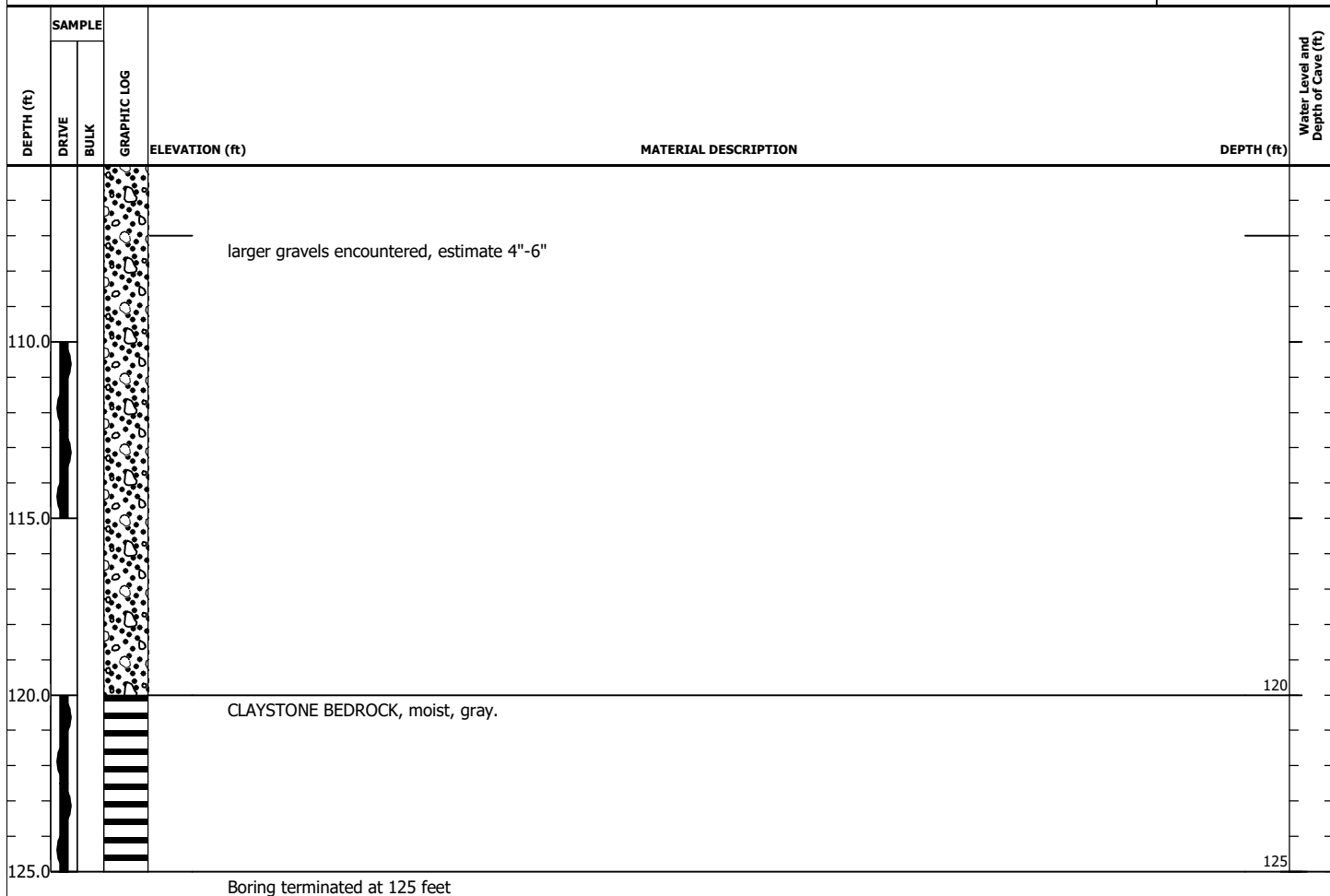
▼ WATER LEVEL AT TIME OF DRILLING  AUGER CUTTINGS

▽# WATER LEVEL # DAYS AFTER DRILLING

→# DEPTH OF CAVE # DAYS AFTER DRILLING

↑ DEPTH OF REFUSAL

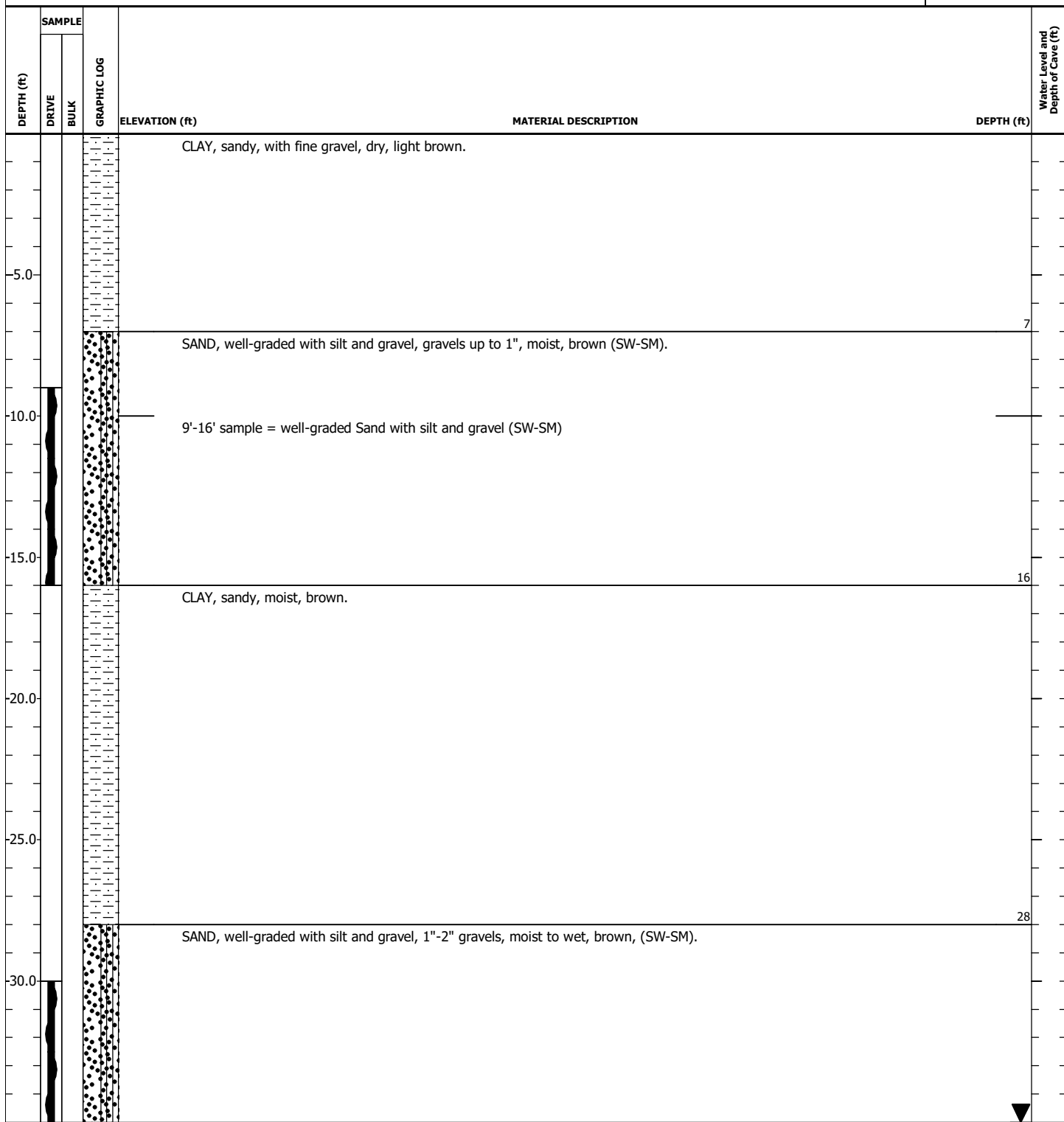
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-4
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 4 of 4



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

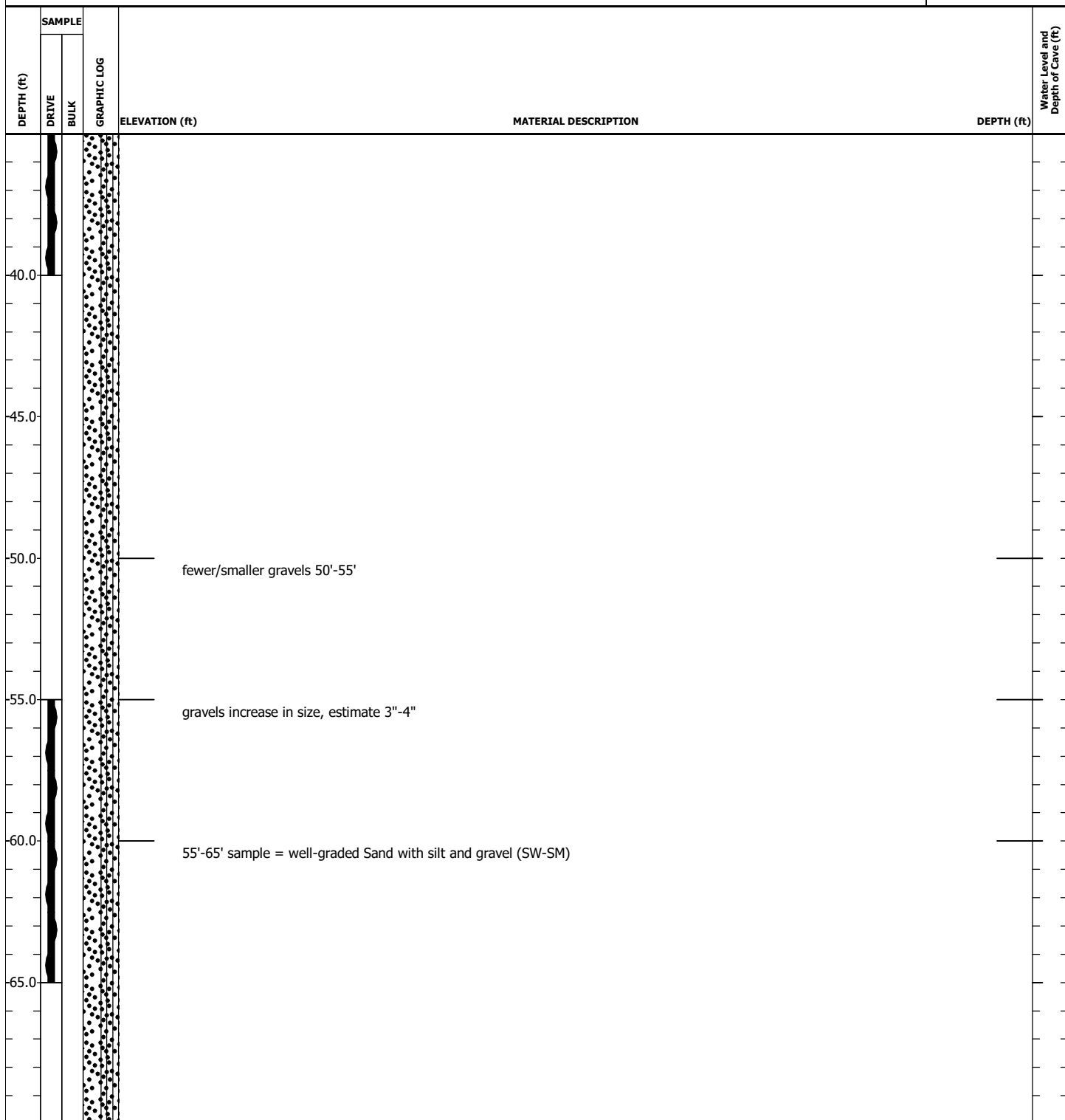
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-5
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 1 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

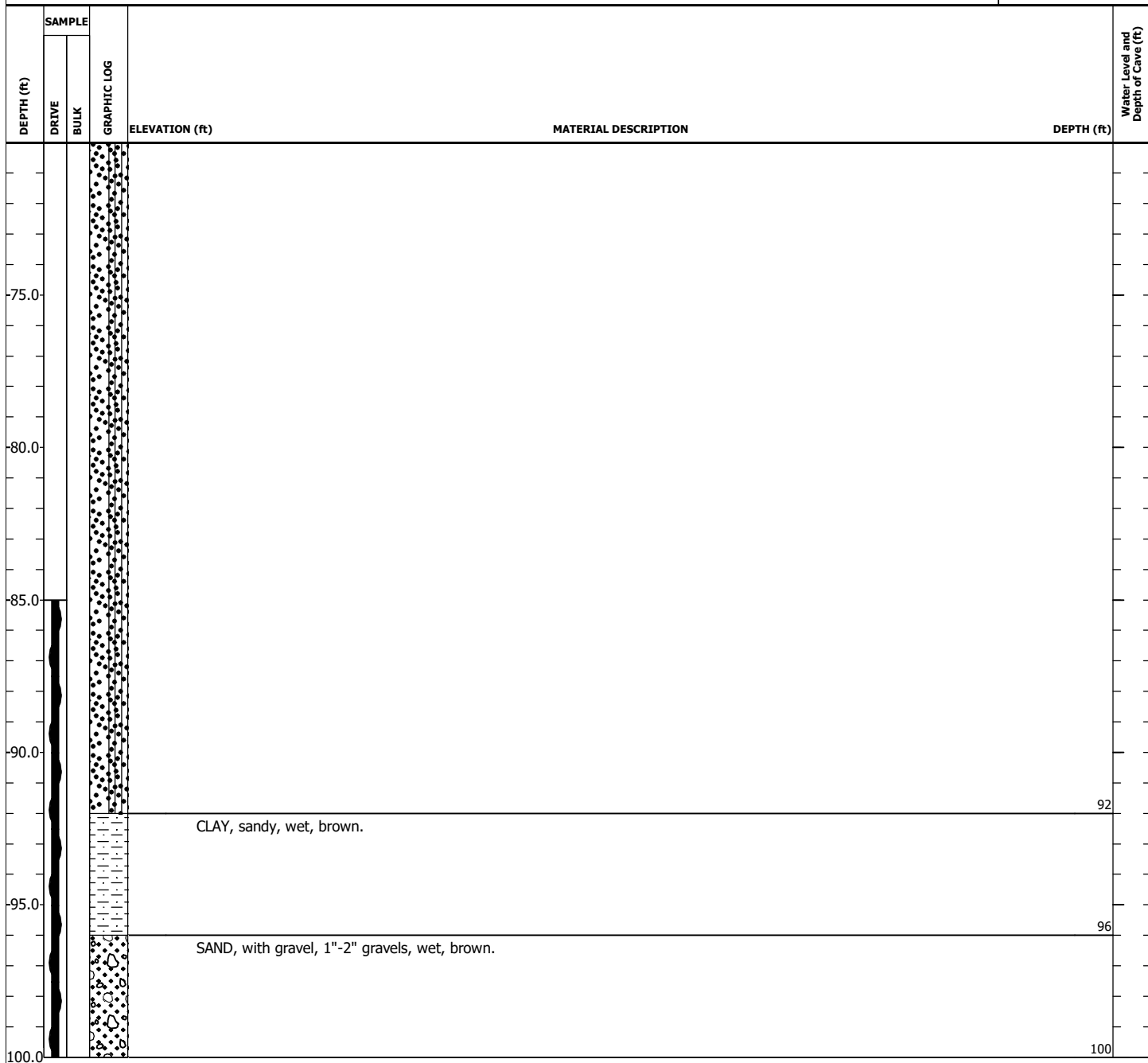
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-5
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 2 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-5
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 3 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-6
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 1 of 3

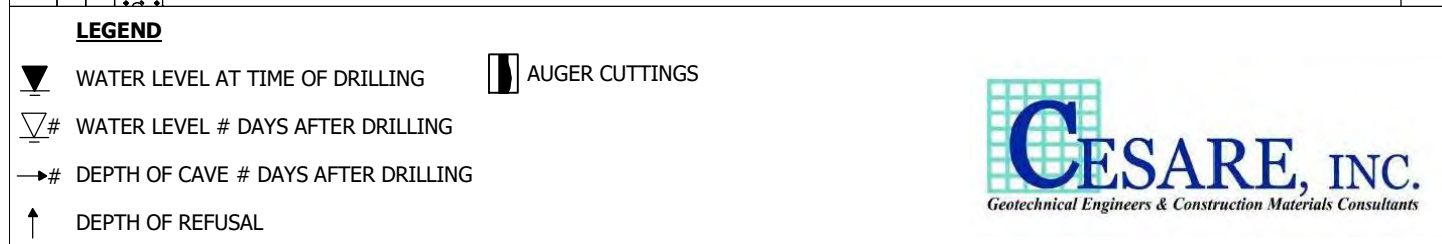
DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, to SAND, clayey, dry, light brown.		
-5.0						
				SAND, well-graded with silt and gravel, 1"-2" gravels, moist, brown, (SW-SM).	7	
-10.0				9'-17' sample = well-graded Sand with silt and gravel (SW-SM)		
-15.0						
				CLAY, sandy, few gravels up to 1", moist, brown.	17	
-20.0						
-25.0				SAND, with gravel, 1"-2" gravels, moist, brown.	25	
-30.0						
				CLAY, sandy, moist, brown.	33	

LEGEND

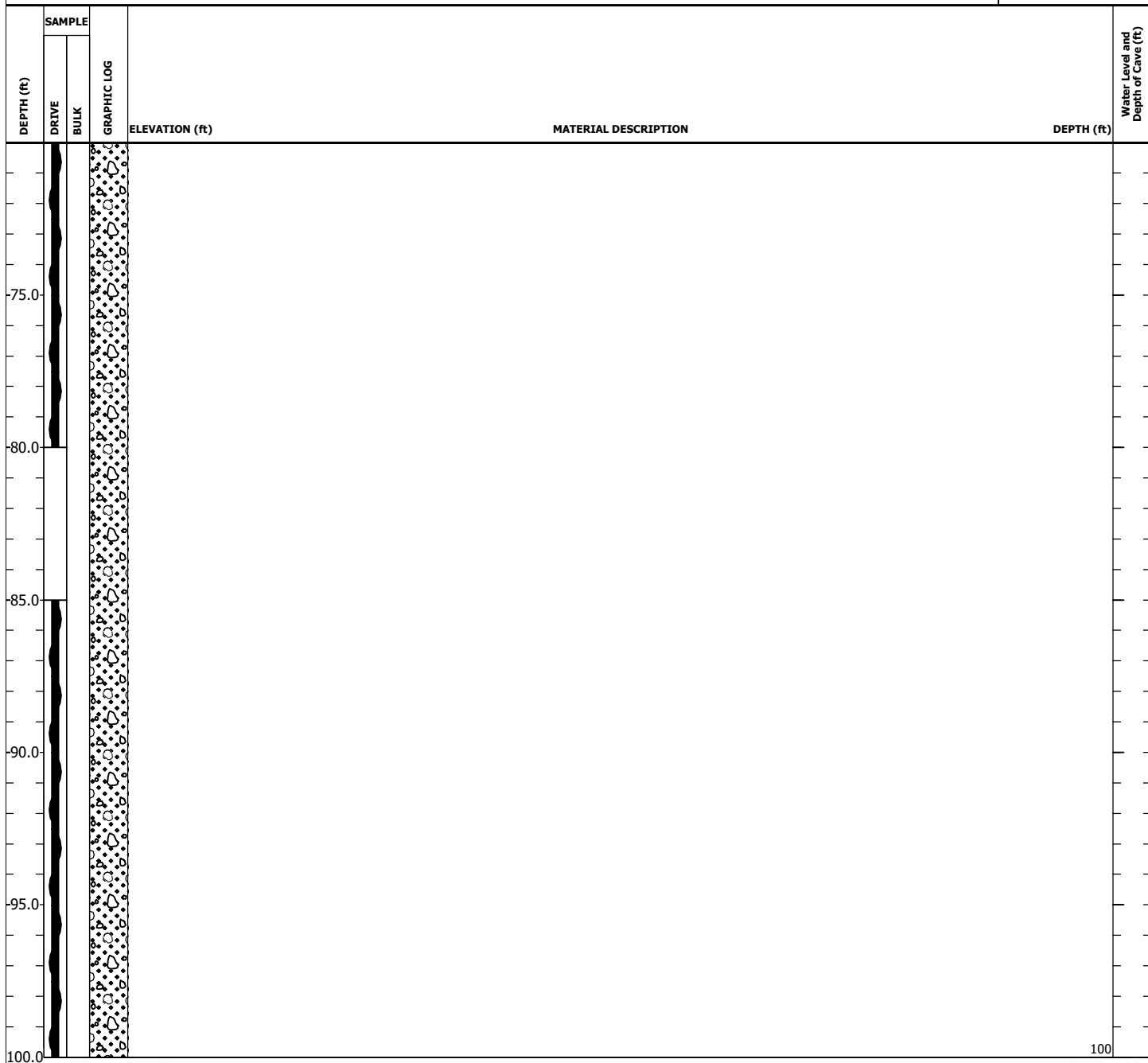
-  WATER LEVEL AT TIME OF DRILLING
  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/28/2022
DATE COMPLETED	4/28/2022

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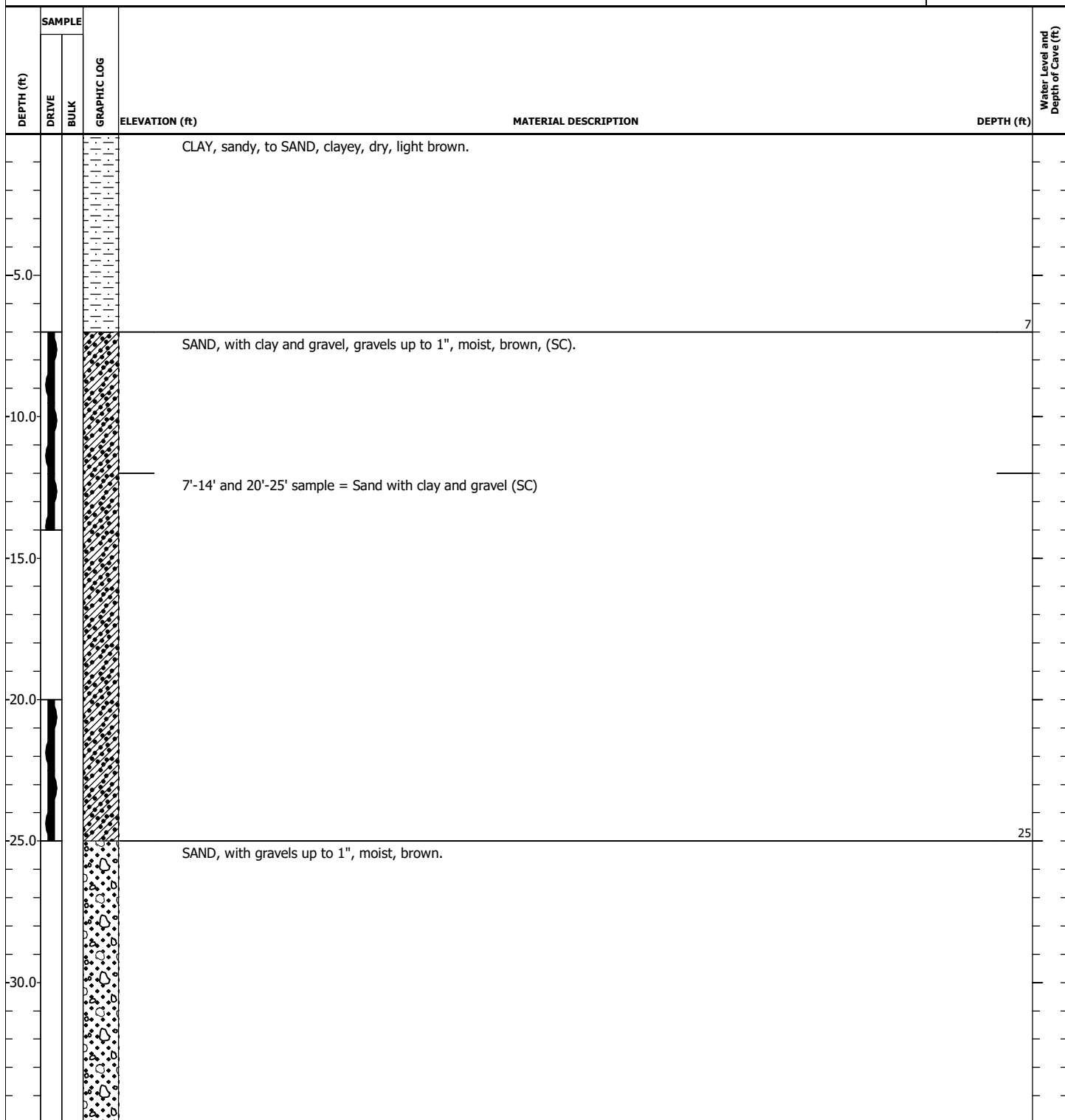
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-6
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 3 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

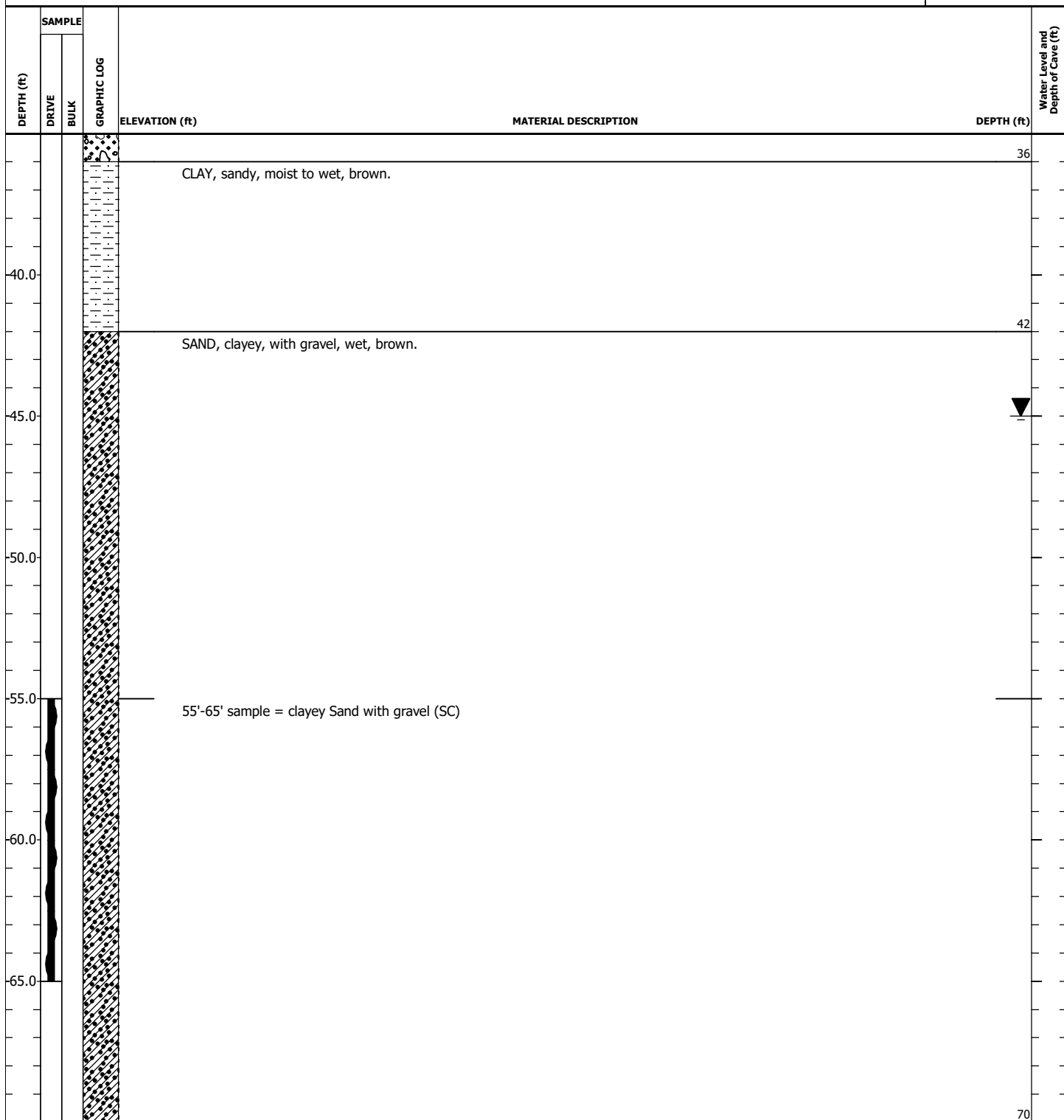
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 1 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 2 of 3



LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 3 of 3

DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
-75.0					SAND, gravelly, 1"-3" gravels, wet, brown.		
-80.0					GRAVEL, well-graded, with sand, wet, brown, (GW).	80	
-85.0					larger gravels, 4"-6" estimate		
-90.0					80'-90' sample = well-graded Gravel with sand (GW)		
-95.0					CLAY, sandy, gravels up to 1", wet, brown.	96	
						98	

Boring terminated at 98 feet

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7A
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 1 of 4

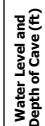
DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
5.0					CLAY, sandy, to SAND, clayey, dry, light brown.		
10.0					SAND, with gravel up to 1", moist, brown.	7	
15.0							
20.0					SAND, clayey, with gravel up to 1", moist, brown.	20	
25.0					SAND, with gravel up to 1", moist, brown.	25	
30.0							

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

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	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



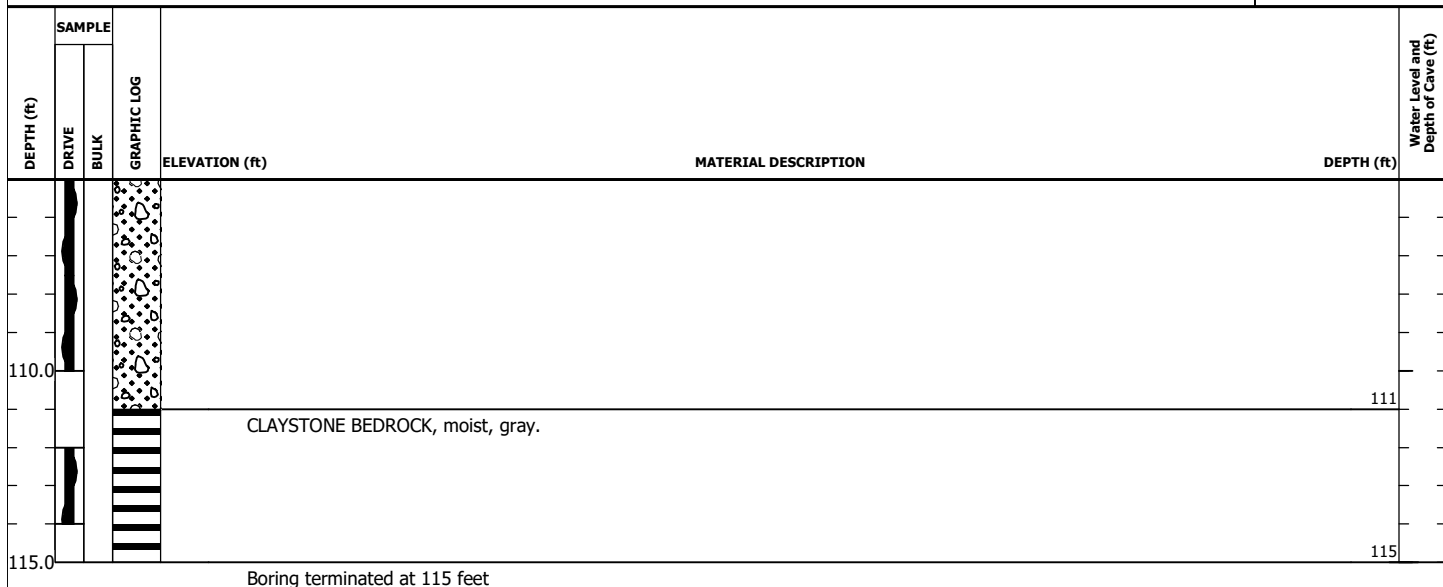
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7A
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 3 of 4

DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
75.0					SAND, gravelly, 1"-3" gravels, wet, brown.		
80.0							
85.0					larger gravels, 4"-6" estimate		
90.0							
95.0							
100.0					CLAY, sandy, with gravels up to 1", wet, brown.	96	
					SAND, gravelly, 1"-4" gravels, wet, brown.	100	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7A
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 4 of 4



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

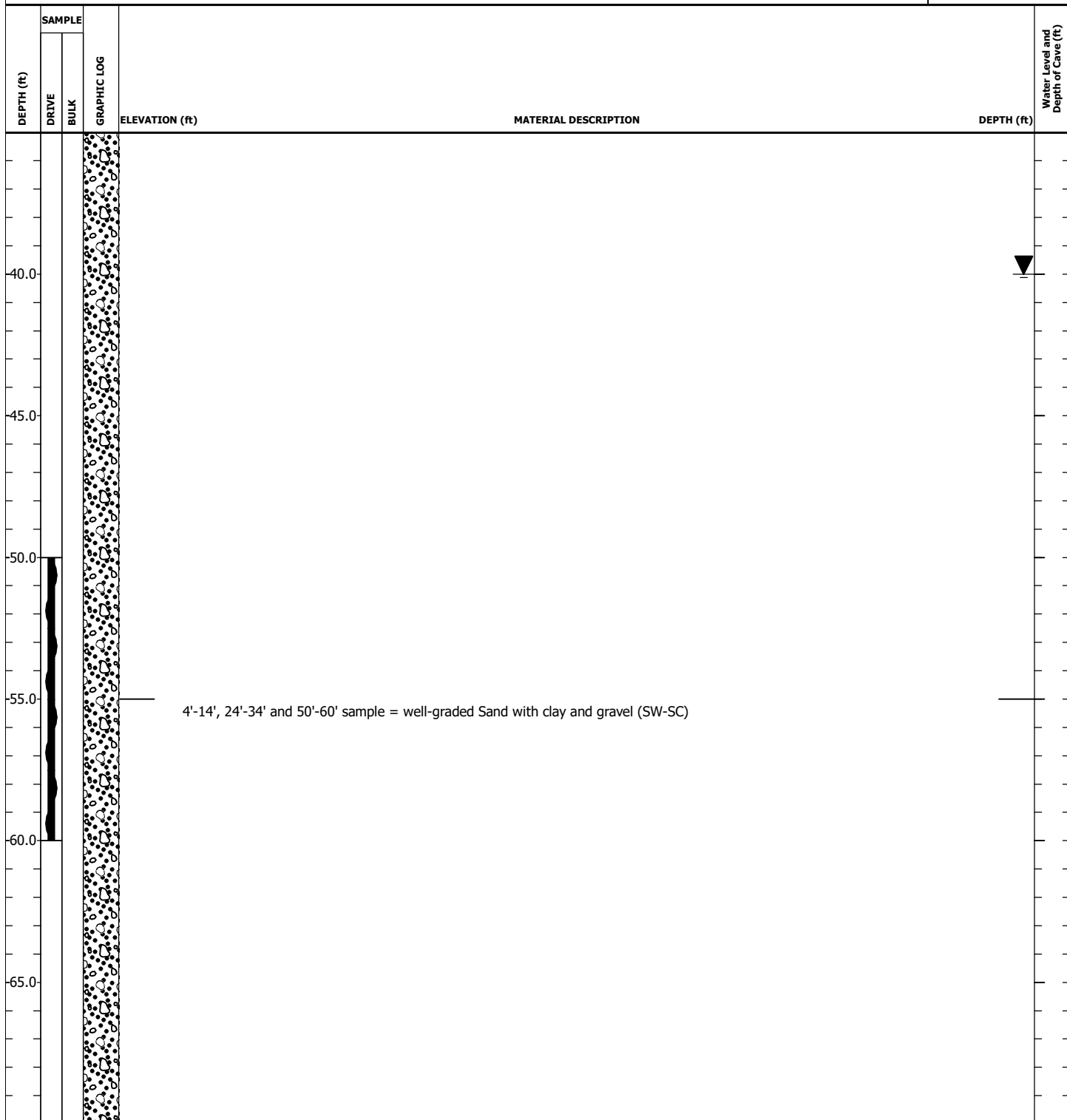
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-8
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 1 of 3

DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, moist, brown.		
					4	
-5.0				SAND, well-graded, with gravel, gravels up to 1", moist, brown, (SW).		
				4'-14', 24'-34' and 50'-60' sample = well-graded Sand with clay and gravel (SW-SC)		
-10.0					13	
				CLAY, sandy, with gravel up to 1", moist, brown.		
-15.0						
-20.0					24	
-25.0				SAND, with gravel, locally with clay, 1"-3" gravels, moist to wet, brown, (SW-SC).		
				4'-14', 24'-34' and 50'-60' sample = well-graded Sand with clay and gravel (SW-SC)		
-30.0						

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

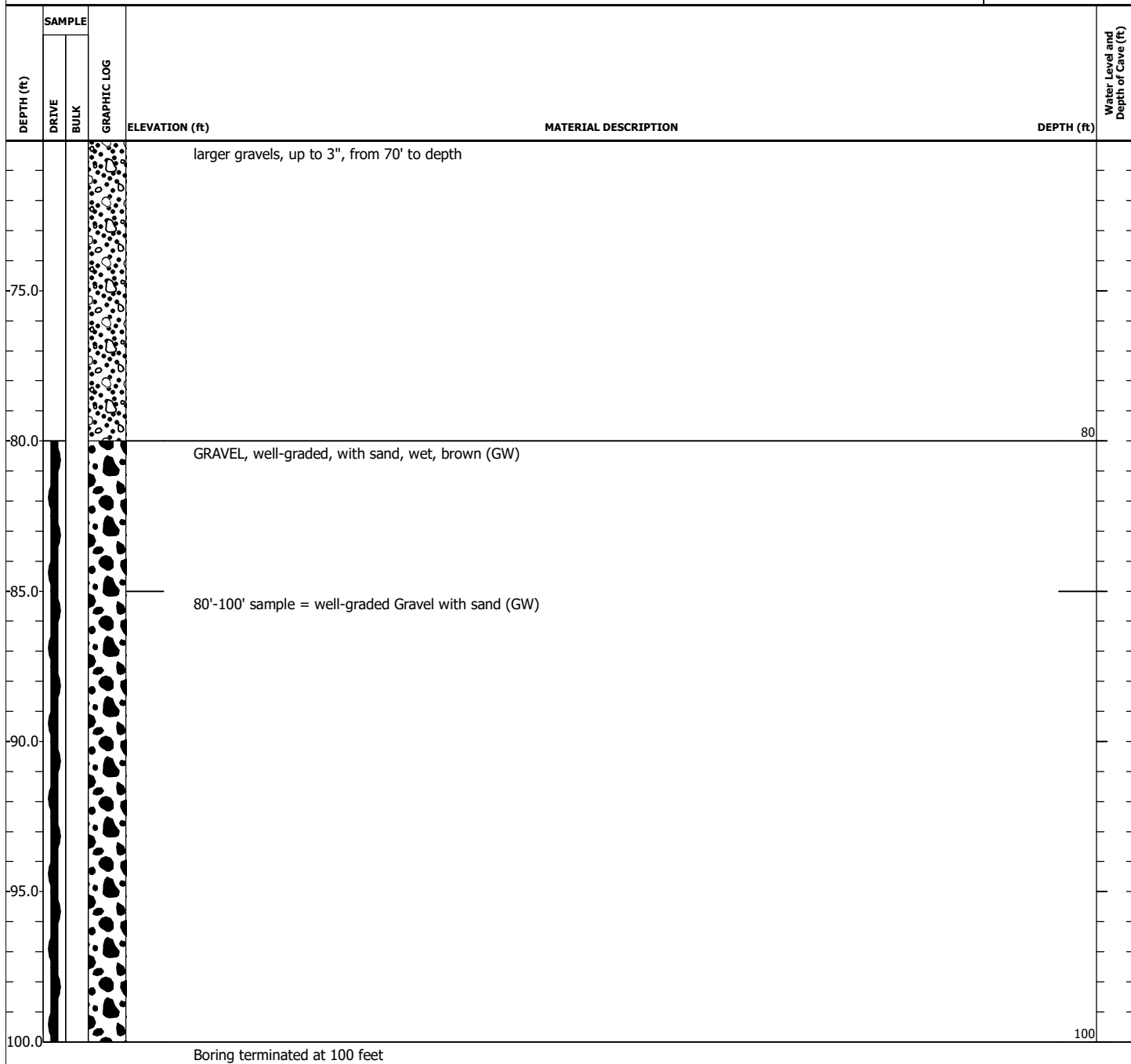
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-8
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 2 of 3



LEGEND

- WATER LEVEL AT TIME OF DRILLING
- WATER LEVEL # DAYS AFTER DRILLING
- DEPTH OF CAVE # DAYS AFTER DRILLING
- DEPTH OF REFUSAL
- AUGER CUTTINGS

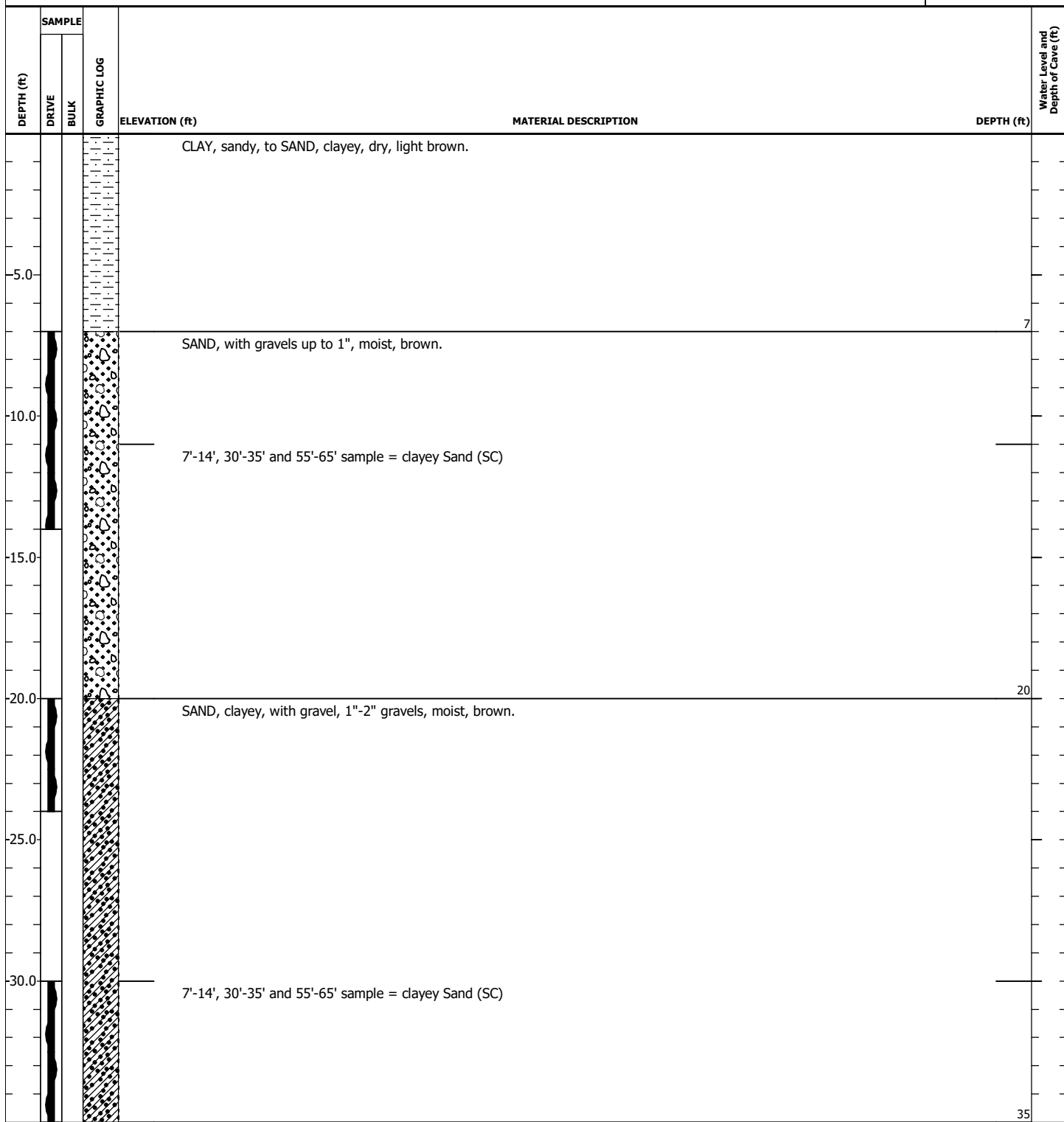
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-8
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 3 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

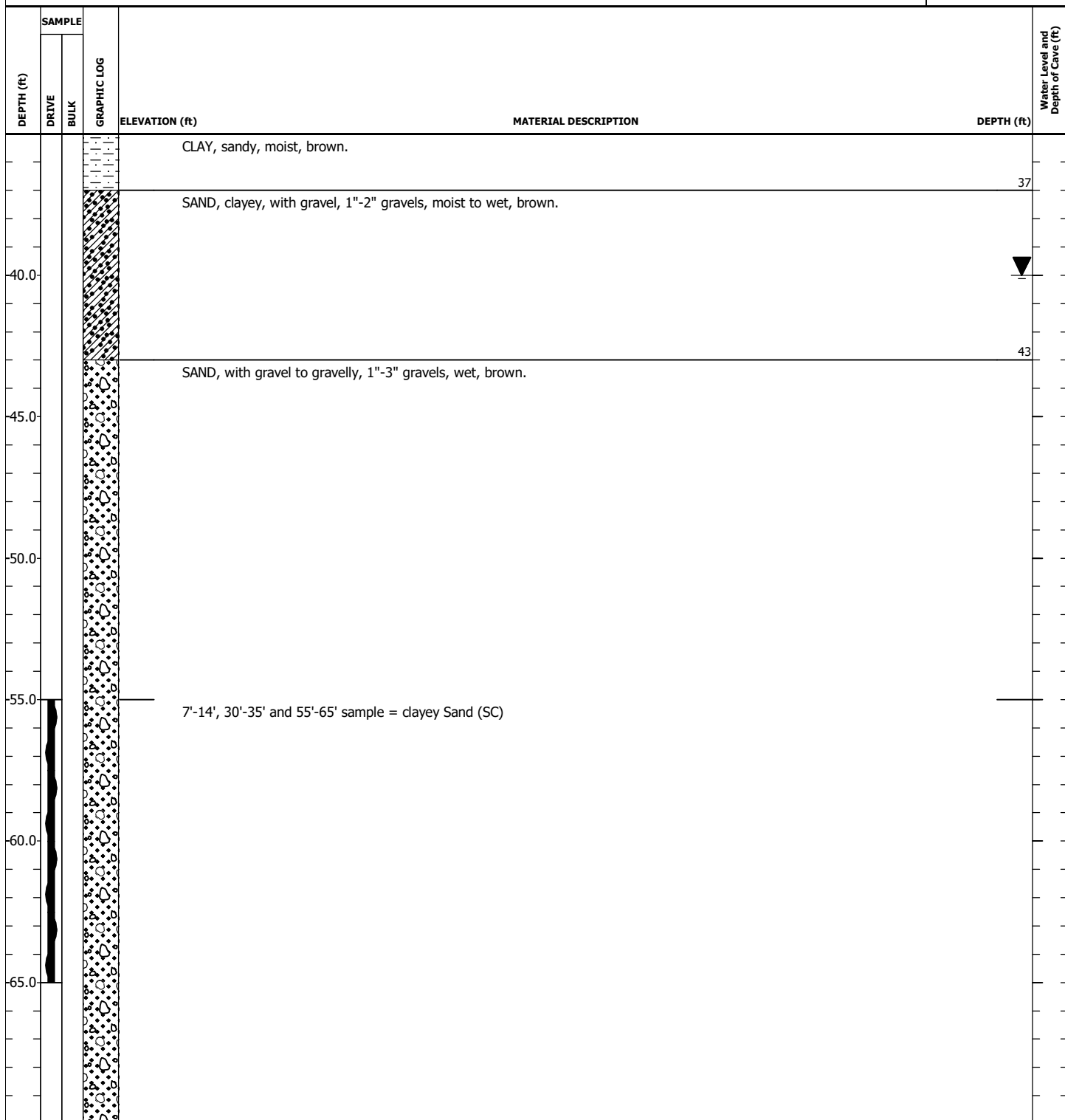
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-9
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 1 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

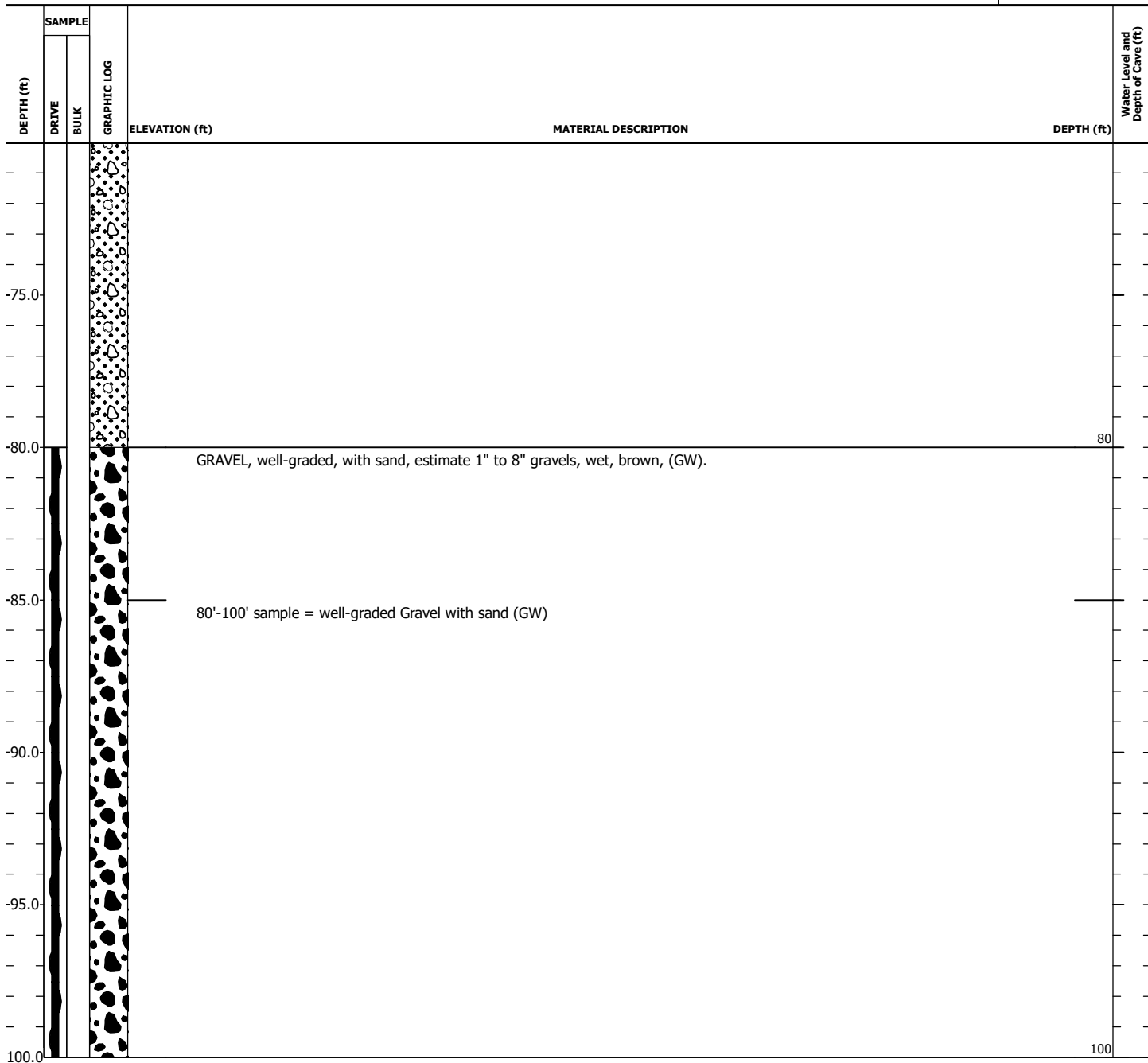
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-9
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 2 of 3



LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-9
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 3 of 3



LEGEND

- WATER LEVEL AT TIME OF DRILLING
- WATER LEVEL # DAYS AFTER DRILLING
- DEPTH OF CAVE # DAYS AFTER DRILLING
- DEPTH OF REFUSAL
- AUGER CUTTINGS

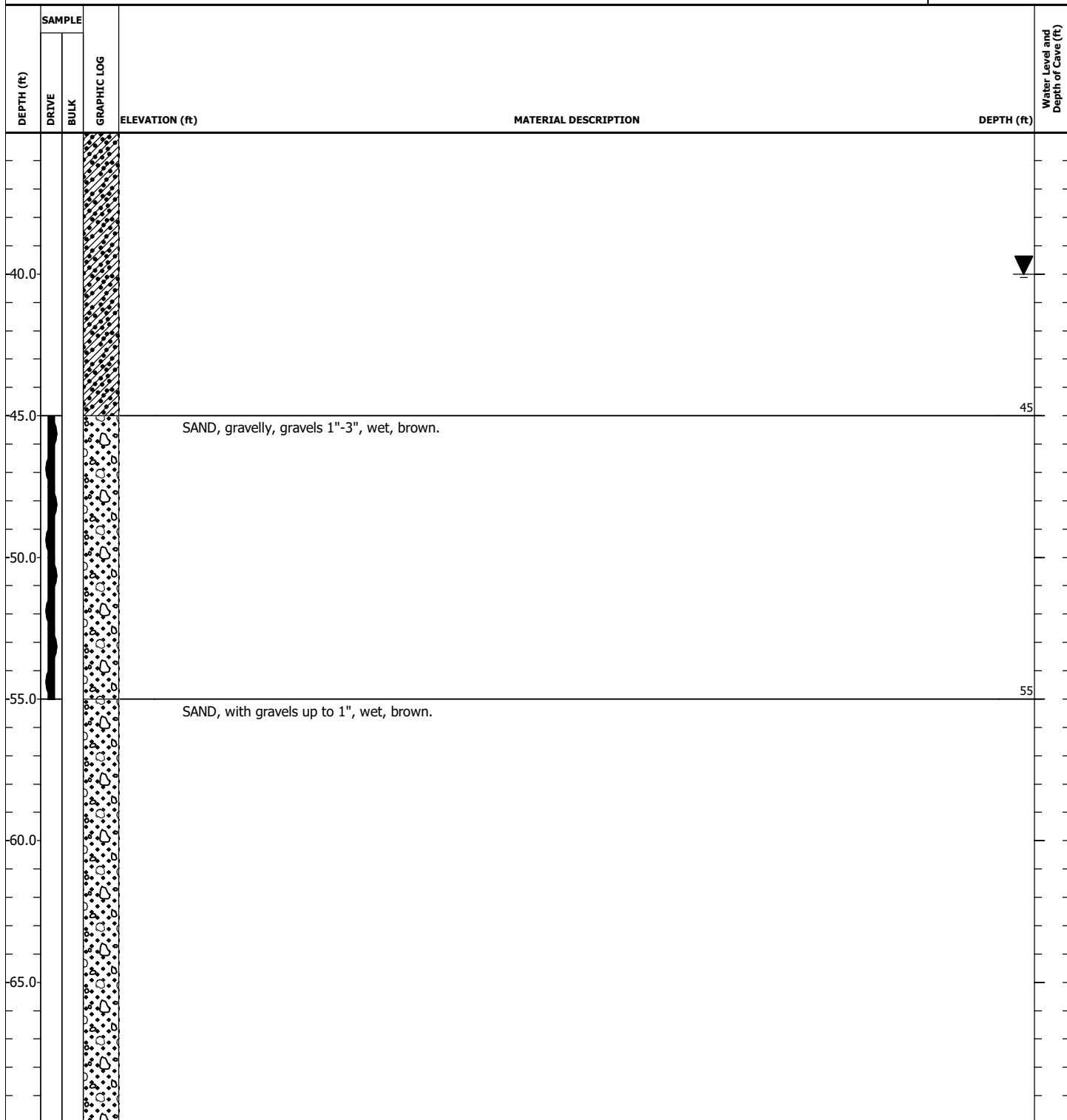
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-10
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 1 of 3

DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
					CLAY, sandy, dry, light brown.		
						4	
-5.0					SAND, with gravels up to 1", moist, brown.		
-10.0					4'-14' and 25'-30' sample = well-graded Sand with silt and gravel (SW-SM)		
-15.0							
-17.0					Clayey from 17'-18'		
-20.0					Gravels increase in quantity and size (estimate 1"-3") 20'-28'		
-25.0					4'-14' and 25'-30' sample = well-graded Sand with silt and gravel (SW-SM)		
-30.0					SAND, clayey, with gravels up to 1", moist to wet, brown.	30	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

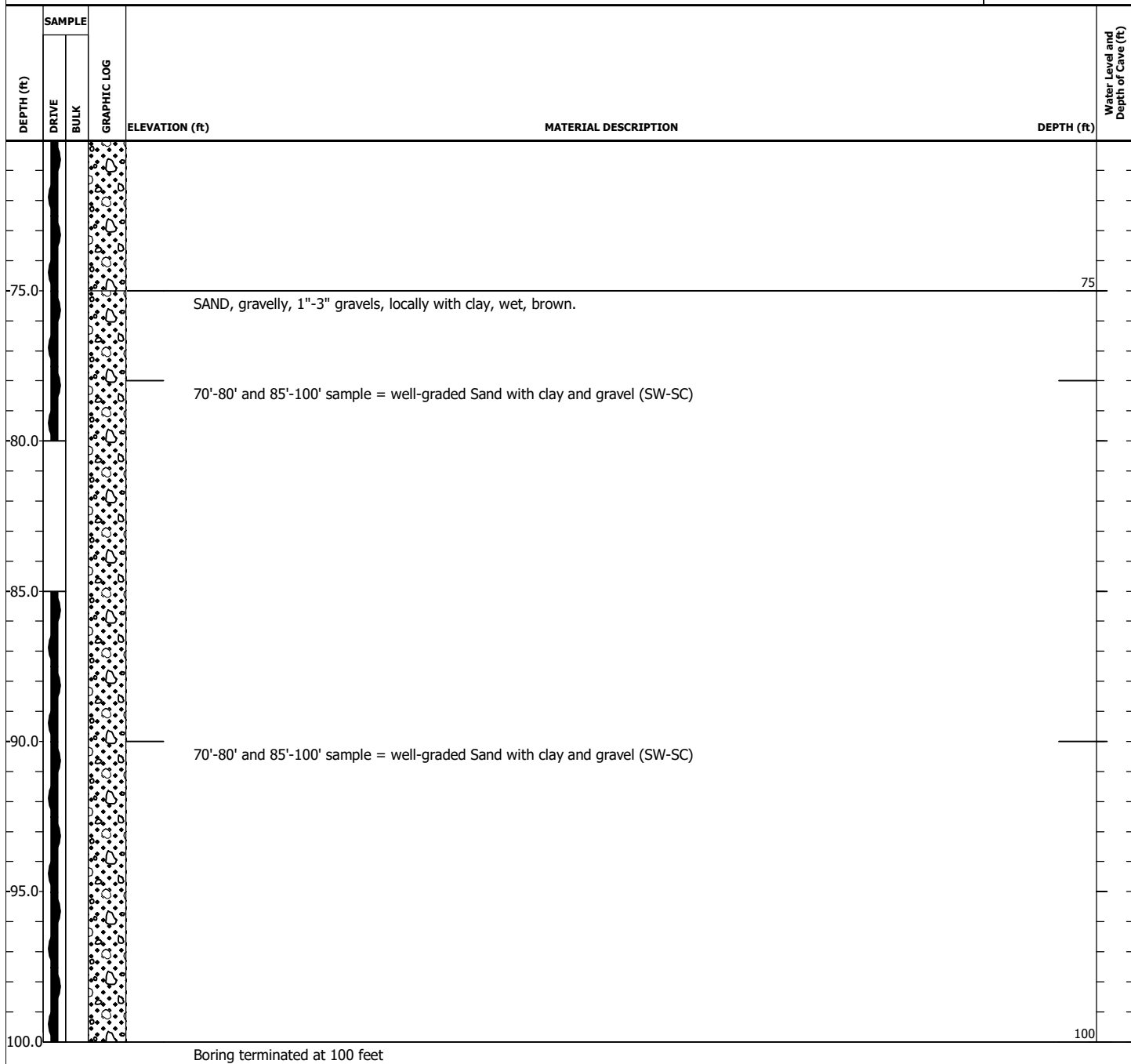
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-10
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 2 of 3



LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-10
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 3 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

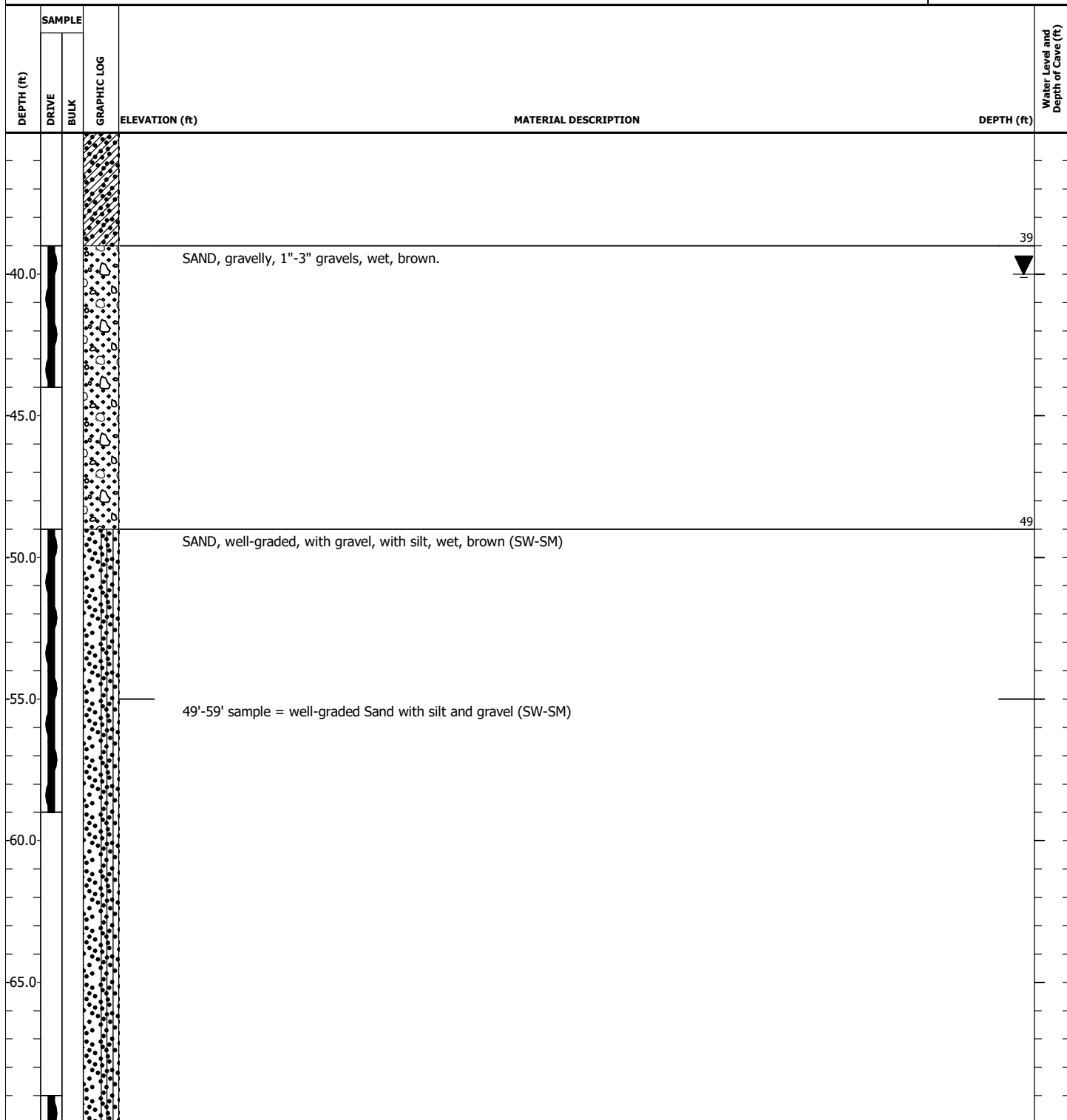
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-11
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 1 of 3

DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, dry, light brown.		
-5.0						
				SAND, with clay, with gravels up to 1", moist, brown.	8	
-10.0				8'-14' and 17.5'-24' sample = clayey Sand with gravel (SC)	12	
				SAND, with gravels up to 1", moist, brown.		
-15.0						
				SAND, clayey, with gravels up to 1", moist, brown, (SC)	17.5	
-20.0				8'-14' and 17.5'-24' sample = clayey Sand with gravel (SC)		
-25.0						
				SAND, well-graded, moist, brown.	27	
-30.0				SAND, clayey, with gravels up to 1", moist, brown.	29	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

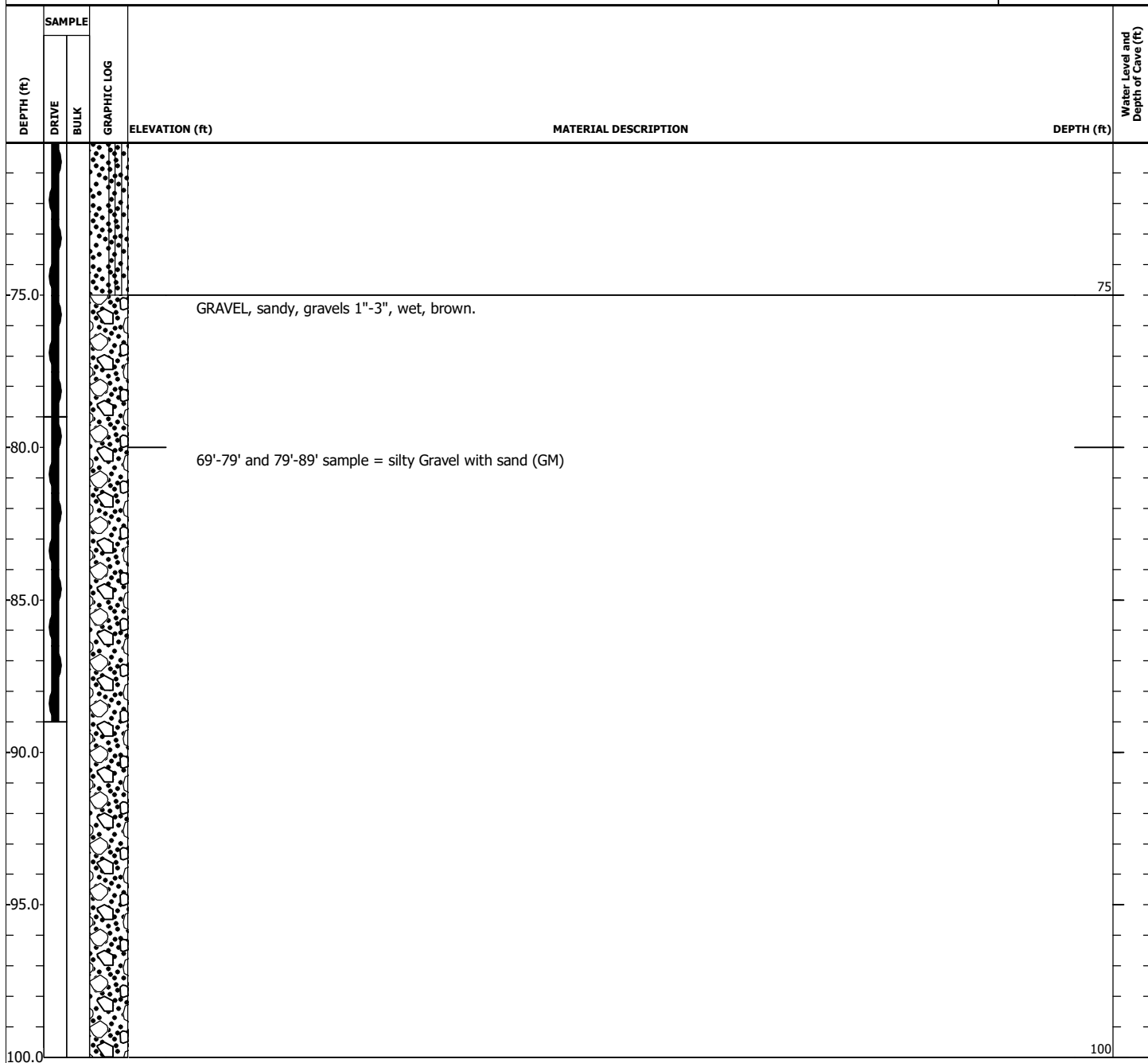
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-11
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 2 of 3



LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-11
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 3 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-11A
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 1 of 4

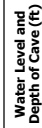
DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, dry, light brown.		
-5.0						
				SAND, with clay, with gravels up to 1", moist, brown.	8	
-10.0						
				SAND, with gravels up to 1", moist, brown.	12	
-15.0						
				SAND, clayey, gravelly, gravels up to 1", moist, brown.	17.5	
-20.0						
-25.0						
				SAND, well-graded, moist, brown.	27	
-30.0						
				SAND, clayey, with gravels up to 1", moist, brown.	29	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

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	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-11A
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 3 of 4

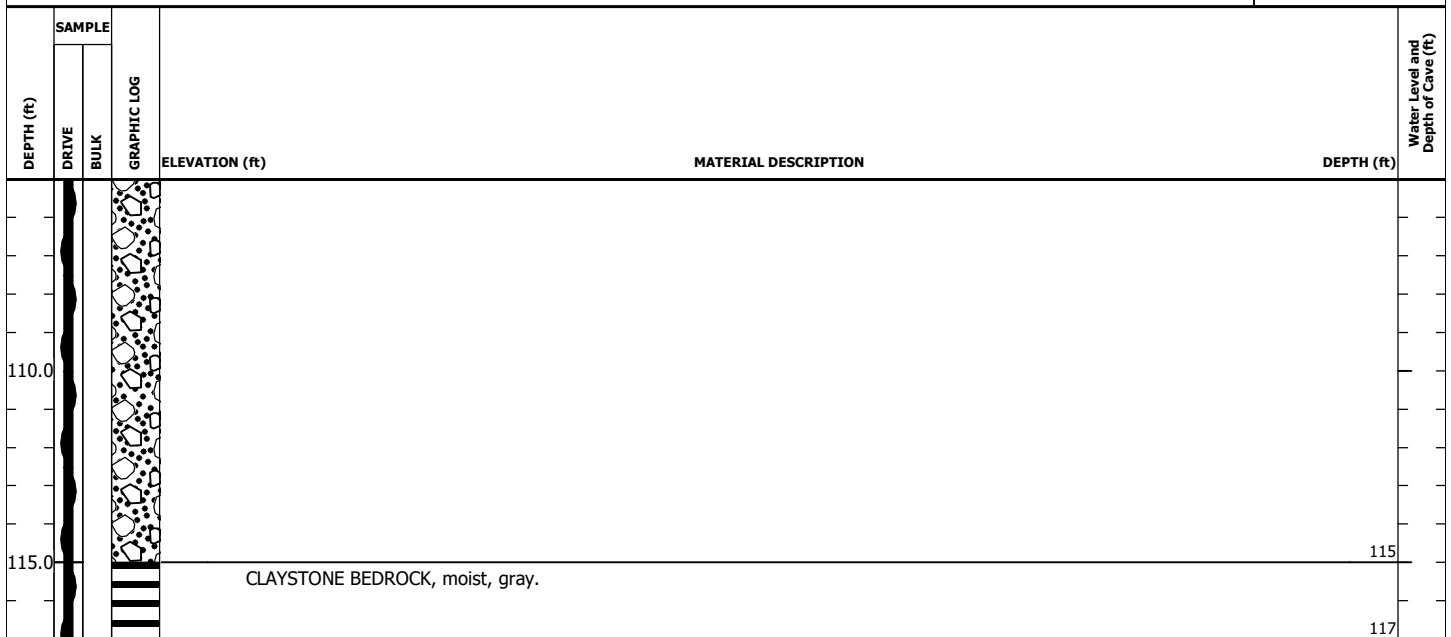
DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
75.0						75	
					GRAVEL, sandy, gravels 1"-3", wet, brown.		
100.0							

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

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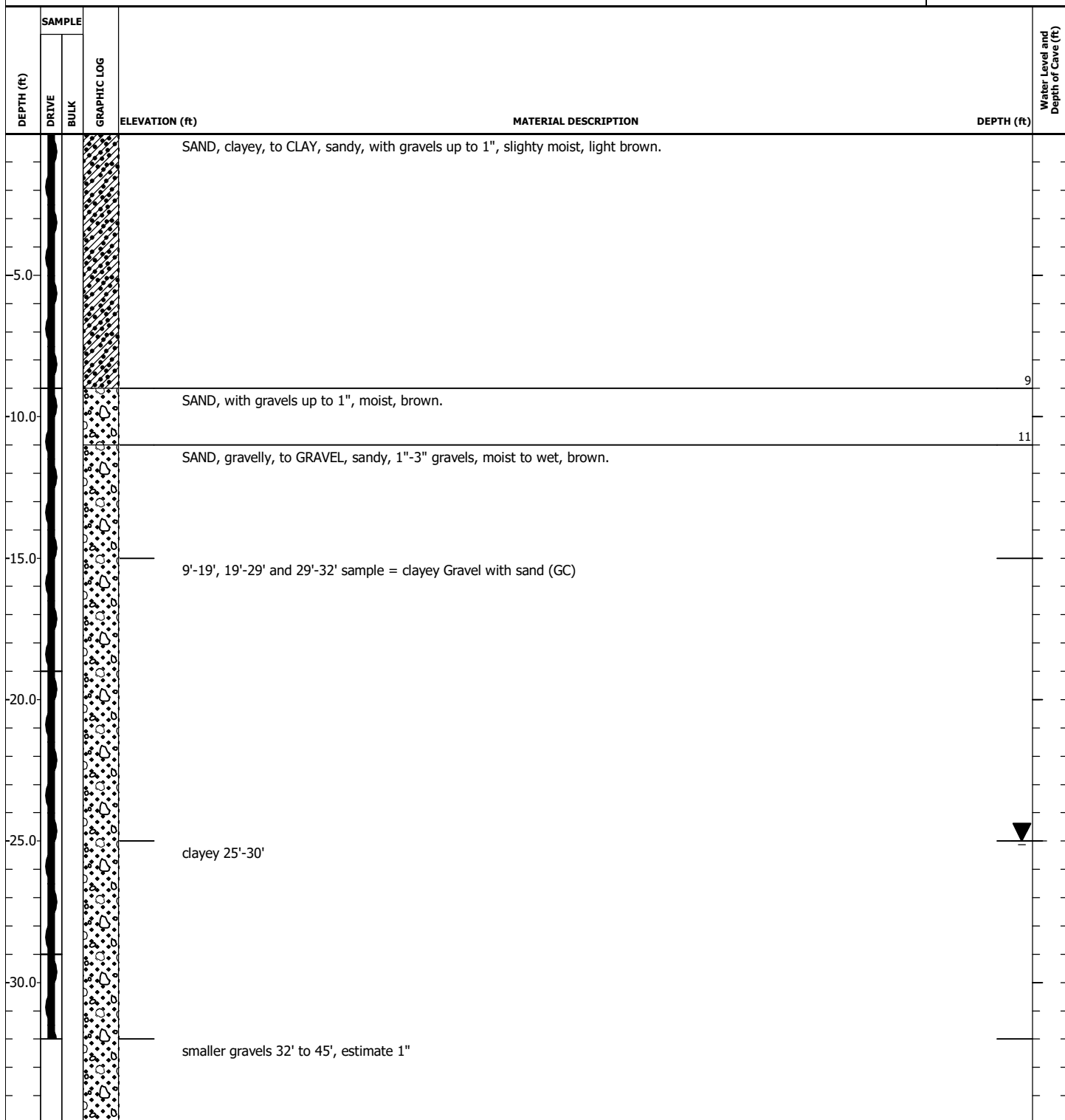


Boring terminated at 117 feet

	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



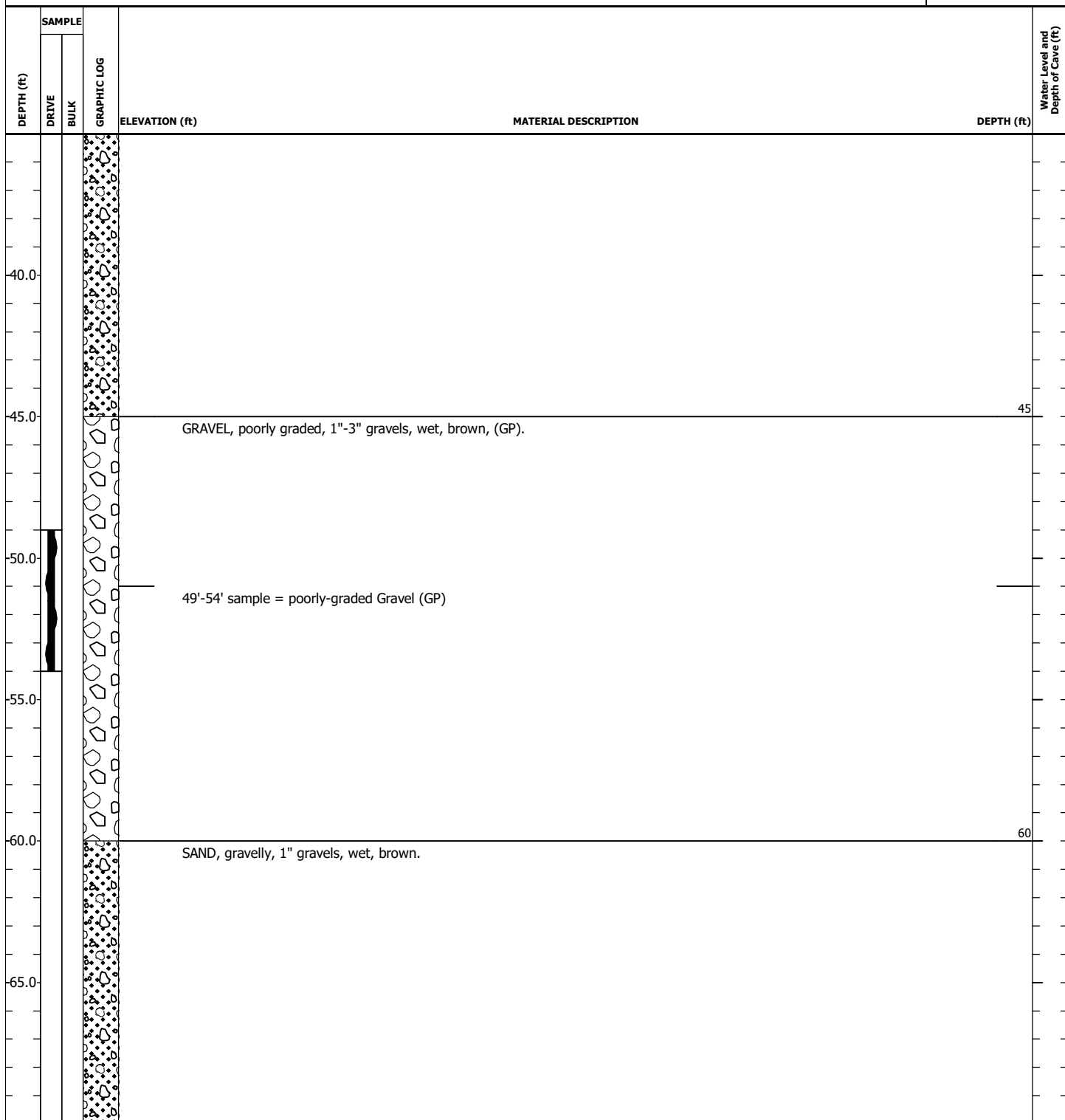
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-12
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 1 of 3



LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-12
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 2 of 3



LEGEND

- WATER LEVEL AT TIME OF DRILLING
- WATER LEVEL # DAYS AFTER DRILLING
- DEPTH OF CAVE # DAYS AFTER DRILLING
- DEPTH OF REFUSAL
- AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-12
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 3 of 3

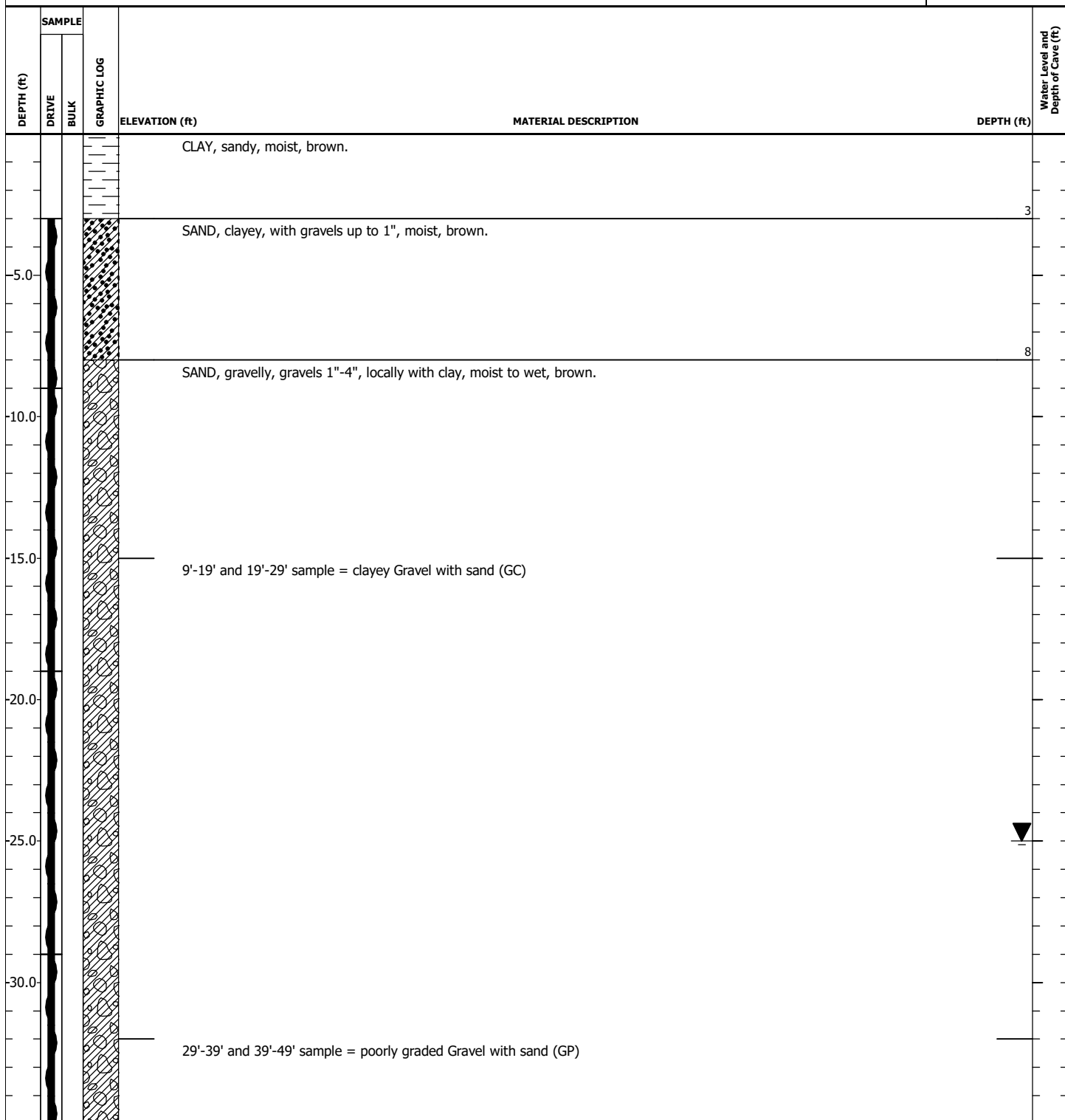
DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
-75.0					CLAYSTONE BEDROCK, moist, gray.	75	
					Boring terminated at 76 feet	76	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL



PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-13
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
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LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/25/2022
DATE COMPLETED	4/25/2022

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	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



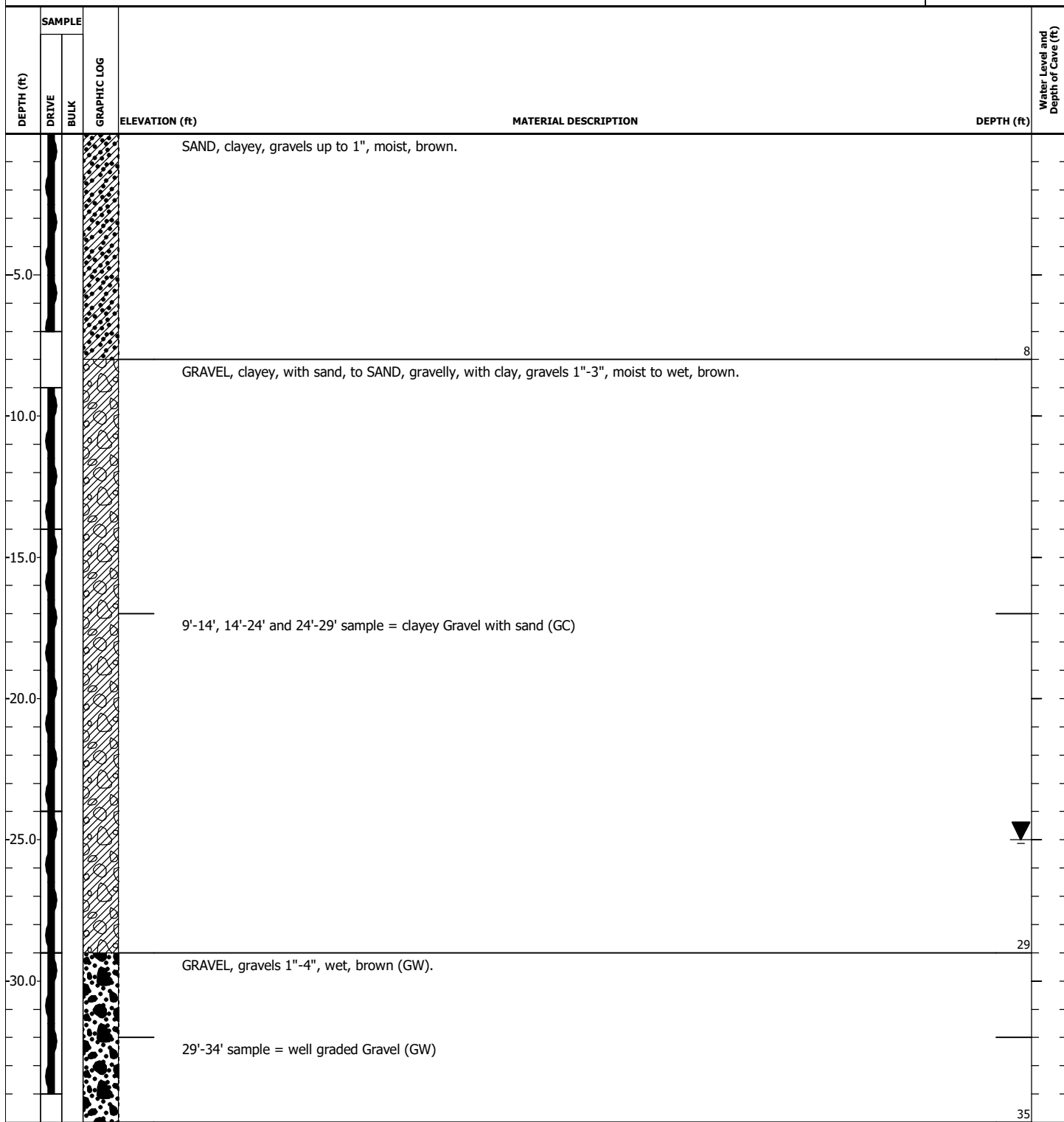
PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/25/2022
DATE COMPLETED	4/25/2022

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 WATER LEVEL AT TIME OF DRILLING AUGER CUTTINGS
WATER LEVEL # DAYS AFTER DRILLING
DEPTH OF CAVE # DAYS AFTER DRILLING
 DEPTH OF REFUSAL



PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-14
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 1 of 3



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-14
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 2 of 3

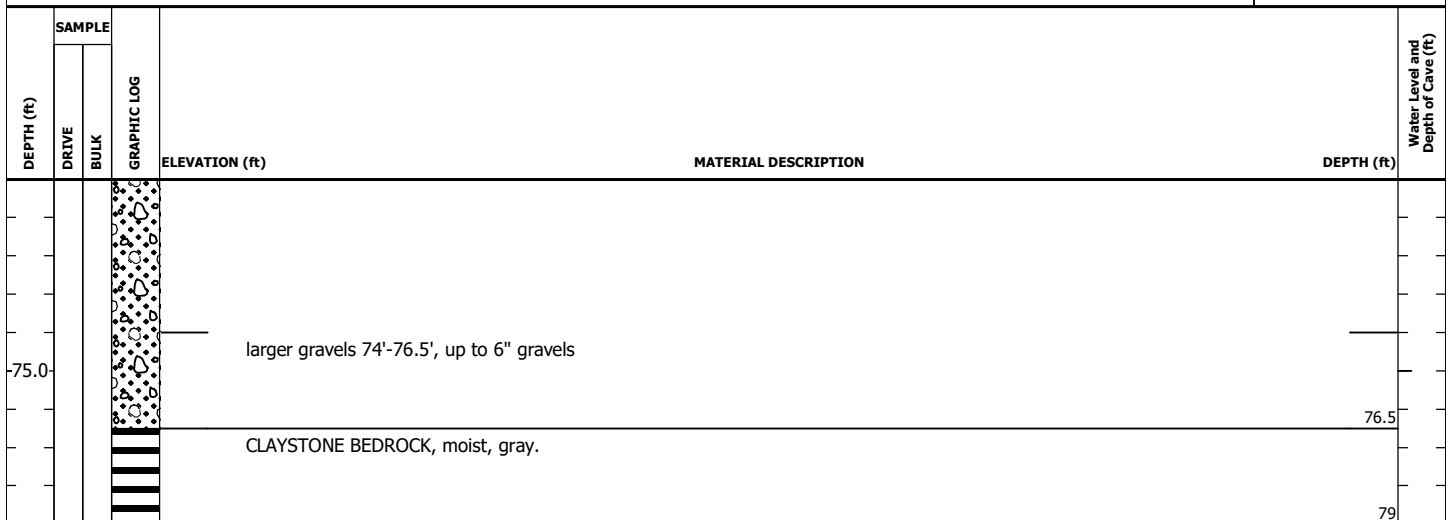
DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
40.0					SAND, with gravel up to 1" wet, brown.		
45.0							
50.0					CLAY, sandy, wet, brown.	50	
					SAND, with gravel to gravelly, 1"-2" gravels, wet, brown.	52	
55.0							
60.0							
65.0							

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/25/2022
DATE COMPLETED	4/25/2022

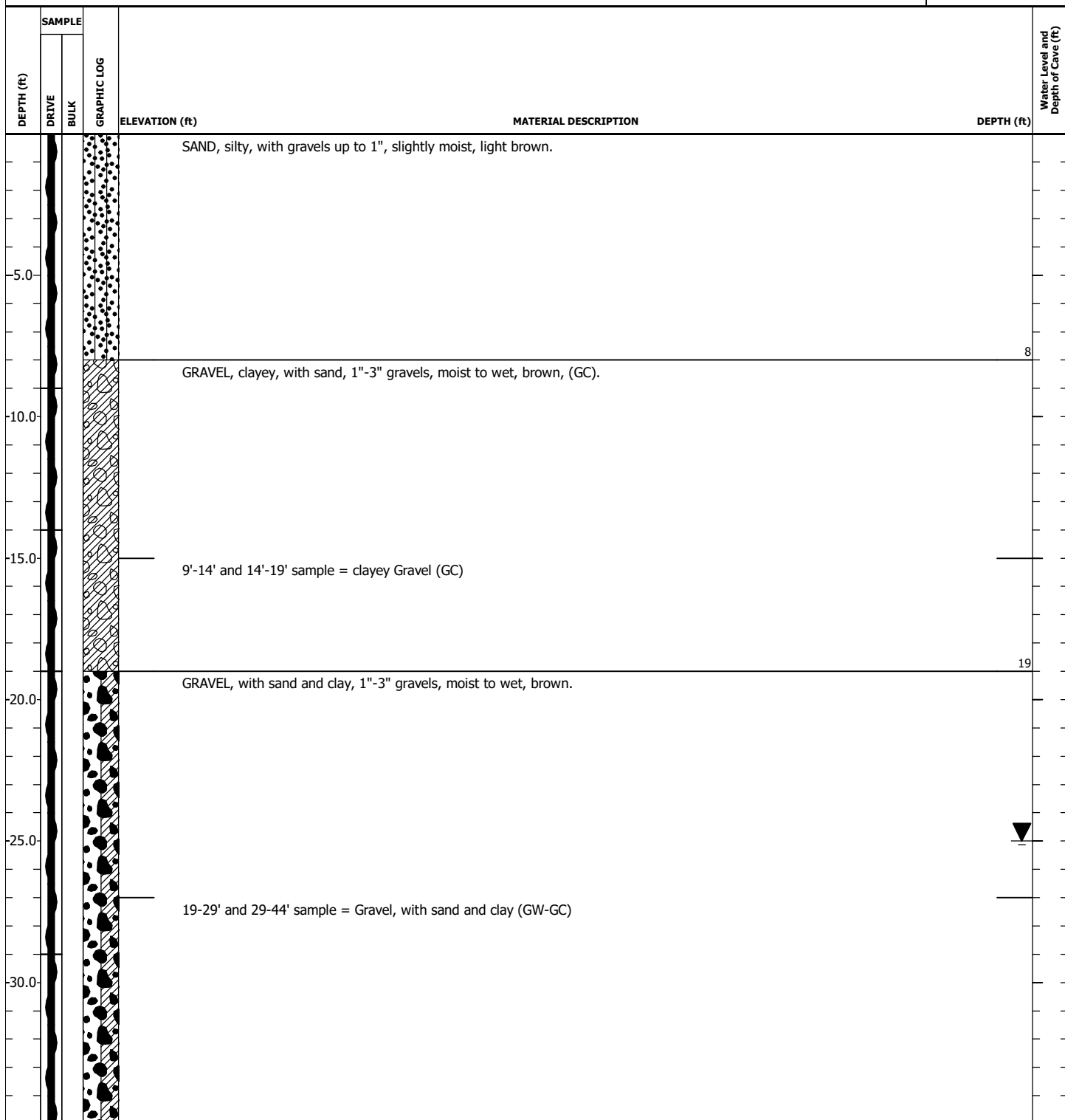
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	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



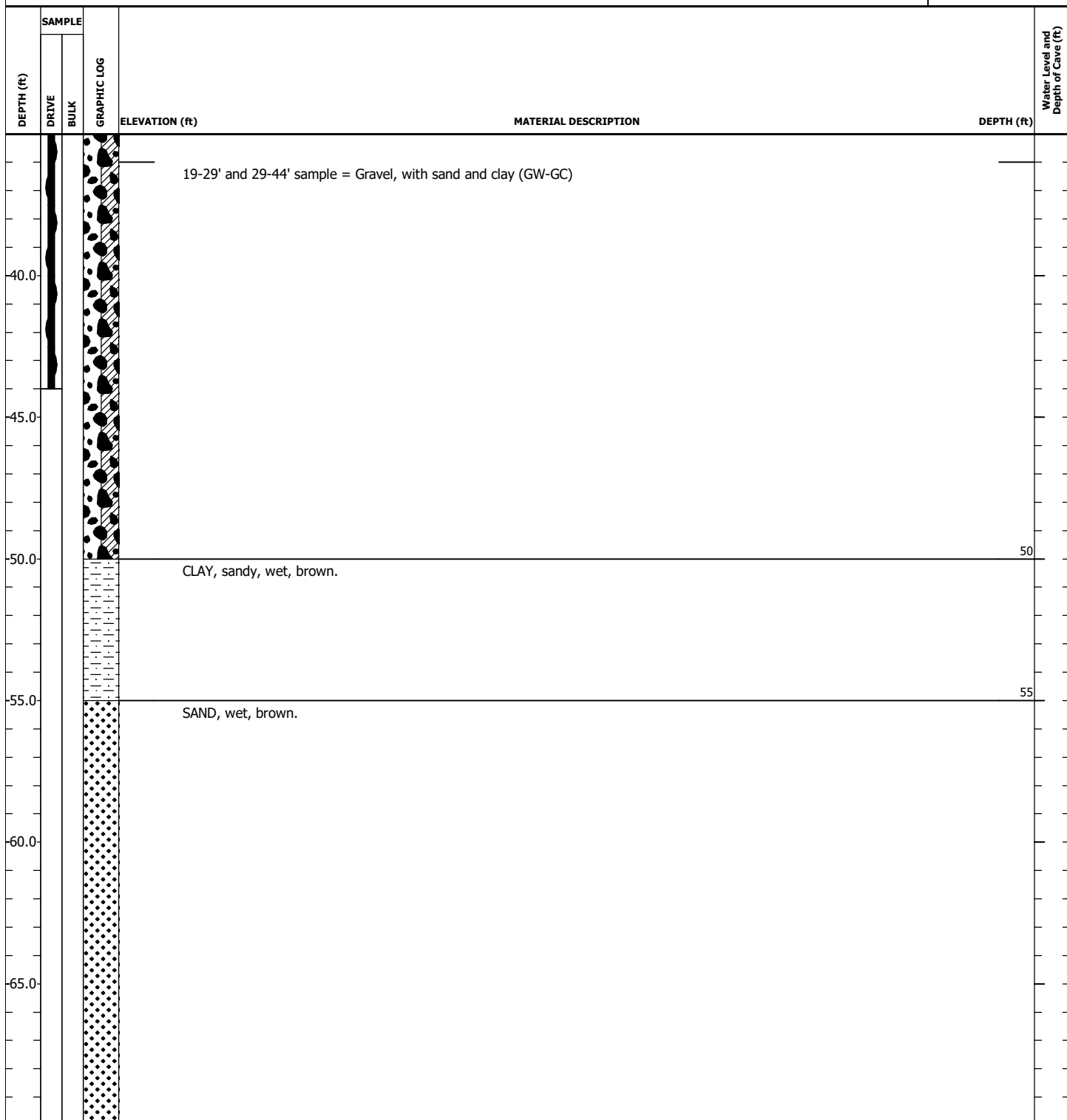
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-15
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 1 of 3



LEGEND

- ▼ WATER LEVEL AT TIME OF DRILLING
- ▽# WATER LEVEL # DAYS AFTER DRILLING
- # DEPTH OF CAVE # DAYS AFTER DRILLING
- ↑ DEPTH OF REFUSAL
-  AUGER CUTTINGS

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-15
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 2 of 3



LEGEND

- WATER LEVEL AT TIME OF DRILLING
- AUGER CUTTINGS
- WATER LEVEL # DAYS AFTER DRILLING
- DEPTH OF CAVE # DAYS AFTER DRILLING
- DEPTH OF REFUSAL

PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-15
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
				Page 3 of 3

DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
						72	
					SAND, with 1-2" gravels, wet, brown.		
-75.0							
						80	
-80.0					GRAVEL, sandy, 1"-4" gravels, wet, brown.		
-85.0							
						90	
-90.0					CLAYSTONE BEDROCK, moist, gray.		
						94	

Boring terminated at 94 feet

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

Well Designation	MW-15			MW-16			MW-17			MW-18		
Top of Well (ft)	4660.36			4656.19			4663.63			4667.49		
Ground Elevation (ft)	4657.92			4653.45			4660.53			4664.55		
Date	Depth to Groundwater from Top of Well (ft)	Depth to Groundwater from Ground (ft)	Elevation of Groundwater (ft)	Depth to Groundwater from Top of Well (ft)	Depth to Groundwater from Ground (ft)	Elevation of Groundwater (ft)	Depth to Groundwater from Top of Well (ft)	Depth to Groundwater from Ground (ft)	Elevation of Groundwater (ft)	Depth to Groundwater from Top of Well (ft)	Depth to Groundwater from Ground (ft)	Elevation of Groundwater (ft)
August 21, 2019	44.71	42.27	4615.65	43.63	40.89	4612.56	47.00	43.90	4616.63	46.38	43.44	4621.11
September 17, 2019	45.08	42.64	4615.28	44.44	41.70	4611.75	46.95	43.85	4616.68	46.52	43.58	4620.97
October 17, 2019	45.40	42.96	4614.96	44.52	41.78	4611.67	46.59	43.49	4617.04	46.61	43.67	4620.88
November 13, 2019	45.64	43.20	4614.72	44.87	42.13	4611.32	46.75	43.65	4616.88	46.74	43.80	4620.75
December 10, 2019	45.57	43.13	4614.79	44.91	42.17	4611.28	46.80	43.70	4616.83	46.73	43.79	4620.76
January 9, 2020	45.63	43.19	4614.73	45.30	42.56	4610.89	47.16	44.06	4616.47	46.95	44.01	4620.54
February 12, 2020	46.98	44.54	4613.38	46.53	43.79	4609.66	47.87	44.77	4615.76	47.54	44.60	4619.95
March 12, 2020	45.42	42.98	4614.94	45.22	42.48	4610.97	47.68	44.58	4615.95	47.32	44.38	4620.17
April 9, 2020	44.25	41.81	4616.11	44.38	41.64	4611.81	47.31	44.21	4616.32	46.97	44.03	4620.52
May 14, 2020	43.85	41.41	4616.51	43.90	41.16	4612.29	47.00	43.90	4616.63	46.63	43.69	4620.86
June 11, 2020	43.53	41.09	4616.83	43.50	40.76	4612.69	46.52	43.42	4617.11	46.15	43.21	4621.34
July 9, 2020	43.38	40.94	4616.98	43.33	40.59	4612.86	48.89	45.79	4614.74	46.14	43.20	4621.35
August 13, 2020	44.61	42.17	4615.75	44.61	41.87	4611.58	48.41	45.31	4615.22	47.21	44.27	4620.28
September 10, 2020	44.10	41.66	4616.26	44.25	41.51	4611.94	47.56	44.46	4616.07	46.85	43.91	4620.64
October 8, 2020	43.53	41.09	4616.83	43.56	40.82	4612.63	46.27	43.17	4617.36	46.05	43.11	4621.44
November 12, 2020	43.72	41.28	4616.64	43.85	41.11	4612.34	46.19	43.09	4617.44	46.06	43.12	4621.43
December 10, 2020	43.13	40.69	4617.23	44.03	41.29	4612.16	46.22	43.12	4617.41	45.91	42.97	4621.58
January 14, 2021	42.31	39.87	4618.05	43.68	40.94	4612.51	46.09	42.99	4617.54	45.67	42.73	4621.82
February 12, 2021	42.69	40.25	4617.67	43.84	41.10	4612.35	46.23	43.13	4617.40	45.95	43.01	4621.54
March 11, 2021	43.10	40.66	4617.26	43.65	40.91	4612.54	46.43	43.33	4617.20	46.33	43.39	4621.16
April 8, 2021	43.44	41.00	4616.92	43.96	41.22	4612.23	46.69	43.59	4616.94	46.65	43.71	4620.84
May 13, 2021	43.70	41.26	4616.66	43.49	40.75	4612.70	47.01	43.91	4616.62	46.87	43.93	4620.62
June 10, 2021	43.29	40.85	4617.07	43.16	40.42	4613.03	46.50	43.40	4617.13	46.56	43.62	4620.93
July 8, 2021	42.70	40.26	4617.66	42.71	39.97	4613.48	46.10	43.00	4617.53	46.00	43.06	4621.49
August 12, 2021	43.50	41.06	4616.86	43.45	40.71	4612.74	47.70	44.60	4615.93	46.95	44.01	4620.54
September 9, 2021	42.33	39.89	4618.03	43.94	41.20	4612.25	47.70	44.60	4615.93	46.28	43.34	4621.21
October 14, 2021	42.10	39.66	4618.26	43.02	40.28	4613.17	45.65	42.55	4617.98	46.05	43.11	4621.44
November 12, 2021	41.46	39.02	4618.90	42.59	39.85	4613.60	45.14	42.04	4618.49	45.44	42.50	4622.05
December 9, 2021	40.28	37.84	4620.08	42.57	39.83	4613.62	45.00	41.90	4618.63	44.21	41.27	4623.28
January 13, 2022	40.47	38.03	4619.89	42.21	39.47	4613.98	45.31	42.21	4618.32	44.46	41.52	4623.03
February 9, 2022	40.50	38.06	4619.86	43.02	40.28	4613.17	45.36	42.26	4618.27	44.48	41.54	4623.01
March 11, 2022	40.63	38.19	4619.73	43.15	40.41	4613.04	45.51	42.41	4618.12	44.55	41.61	4622.94
April 14, 2022	39.97	37.53	4620.39	43.10	40.36	4613.09	45.76	42.66	4617.87	44.91	41.97	4622.58
May 17, 2022	40.05	37.61	4620.31	42.93	40.19	4613.26	45.91	42.81	4617.72	45.19	42.25	4622.30
June 9, 2022	40.77	38.33	4619.59	42.43	39.69	4613.76	45.50	42.40	4618.13	44.90	41.96	4622.59
July 14, 2022	40.75	38.31	4619.61	43.24	40.50	4612.95	No Reading			45.18	42.24	4622.31
August 11, 2022	41.51	39.07	4618.85	43.11	40.37	4613.08	9/8/22 MW-17 Repaired			45.70	42.76	4621.79
September 8, 2022	41.52	39.08	4618.84	43.46	40.72	4612.73	49.63	44.47	4614.00	45.49	42.55	4622.00
October 11, 2022	40.47	38.03	4619.89	42.46	39.72	4613.73	47.36	42.20	4616.27	44.43	41.49	4623.06
November 10, 2022	41.10	38.66	4619.26	42.28	39.54	4613.91	46.93	41.77	4616.70	44.10	41.16	4623.39
December 8, 2022	40.11	37.67	4620.25	42.27	39.53	4613.92	47.03	41.87	4616.60	44.12	41.18	4623.37
January 12, 2023	40.39	37.95	4619.97	42.65	39.91	4613.54	47.33	42.17	4616.30	44.40	41.46	4623.09
February 9, 2023	40.39	37.95	4619.97	42.65	39.91	4613.54	47.33	42.17	4616.30	44.40	41.46	4623.09
March 9, 2023	39.90	37.46	4620.46	43.30	40.56	4612.89	47.89	42.73	4615.74	44.91	41.97	4622.58
	Max		4620.46		Max	4613.98		Max	4618.63		Max	4623.39

APPENDIX E



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
USGS Map, Oct. 2002rev

