



J&T Consulting, Inc.

April 17, 2023

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: Broken Arrow Investments, LLC – Derr Pit – Technical Revision No. 8 Adequacy Review
Response – File No. M-2008-017

Dear Mr. Scott,

Broken Arrow Investments, LLC has received the Division's Adequacy Review of the Technical Revision No. 8 Request letter dated February 9, 2023. Below are the comments and the corresponding responses that we have provided to address the comments.

Adequacy Review Comments

1. Update the Mining Plan Map to reflect current conditions at the site.

Response: *An updated Mining Plan Map has been provided with the attachments to this letter showing the current conditions.*

2. Update/Clarification of the status of all structures/utilities (electric, gas/oil lines or wells existing or proposed, existing structures) within phases 5, 6 and 7. DRMS will require the operator to adhere to all previously identified setback distances from these features unless/until these structures are removed.

Response: *The status of the structures/utilities are as follows:*

Electric – Owned by Xcel Energy – Will be removed after house has been demoed in Phase 6a. Working with Alyse DeVan of Xcel Energy for abandonment and removal.

Oil/Gas – Leashold is Chevron/Noble – Working with Greg Wilson, they removed the existing tank battery in Phase 7a. Greg Wilson indicated the last remaining well in place just south of existing house is planned to be abandoned in the next 6 to 12 months. DCP Midstream owns the gas line that runs north south on the Phase 6a and 7a phase line. We contacted Lew Hagenlock with DCP and he indicated the line was abandoned and removed. See e-mails from Lew Hagenlock and Greg Wilson.

3. What is the proposed depth of this initial phase of mining?

Response: *The depth of the mining is 40 feet on the north and 43 feet on the south so no groundwater will be exposed. This is based on the baseline data from the existing monitor wells from 2019 to present.*



- 2 -

4. The currently approved mining plan indicates that the slurry wall will be located well outside of the top-of-slope mining limit and within the current 200' setback from the County Road ROW on the North, East and West sides of Phases 5, 6 and 7. Setback distances to the top-of-slope mining limit along the south side of these phases vary at this time, but will need to be specified. The mining plan/mining plan map will need to be updated to accurately show how the setbacks will be maintained while excavating to install the slurry wall. This would seem to require that the proposed slurry wall alignment be modified to move it within the current limit of excavation.

Response: The mining limit and setbacks have been revised to accommodate the slurry wall so that it can be installed by benching down to an elevation range of 4621 to 4627 in order to keep the slurry wall depth to 75'-80' excavation with key into bedrock. Please see the attached updated mining plan for reference.

5. How will the interior slopes of this excavation be mined and sloped to maintain stability and facilitate reclamation at 3H:1V?

Response: The interior slopes of the excavation will be mined at 2H:1V slopes per the attached slope stability analysis results and updated mining plan. This is needed so that the excess overburden soils for the mine can be utilized to reclaim the slopes to 3H:1V above the slurry wall bench and 4.5H:1V below the slurry wall bench.

6. Modification of the mining plan into essentially two distinct stages (excavation above groundwater prior to installing slurry wall, followed by installation of slurry wall and excavation to full depth) will require that DRMS implement a two-stage mining, bonding and reclamation plan. Please revise the mining plan and reclamation plans (and supporting maps as needed) to provide sufficient detail to fully describe how both stages will be conducted.

-The mining/reclamation of the first stage of excavation (above groundwater) will need to include backfill/sloping of all interior slopes to 3H:1V or flatter, replacement of topsoil over the entire disturbed area, and revegetation with the approved reclamation seed mix. The operator will need to commit to retaining all salvaged topsoil from the affected areas on-site for use in reclamation for reclamation of this initial stage.

-The second stage of excavation to full depth will need to include the bonding/installation of the slurry wall, backfill/sloping of all interior slopes to final configuration identified, and replacement of topsoil/revegetation above the water line of the completed reservoir.

Response: The mining plan, reclamation plan, and bond calculations have been updated to reflect the changes and the 2 stages.

7. Reclamation bonding costs will need to be provided for both stages as outlined above.

Response: The bond calculations have been updated to reflect the 2 stages. We have combined the previous phases at the surface that were Phase 5a, 6a, and 7a to just 5a for the overall surface area to the slurry wall bench elevation and Phase 5 for everything below the slurry wall bench (previously Phase 5, 6, and 7).

8. Given the amount of modification to the existing plans that will be required for this revision, DRMS would encourage the operator to take this opportunity to review the mining and reclamation plans for the site as a whole, and determine if additional modifications are needed.

Response: The operator has reviewed all of the plans for the site as a whole and provided all the necessary modifications with this submittal response back to the DRMS.

Broken Arrow Investments, LLC appreciates your consideration of these adequacy review responses and looks forward to your review of the information.



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

Sincerely,



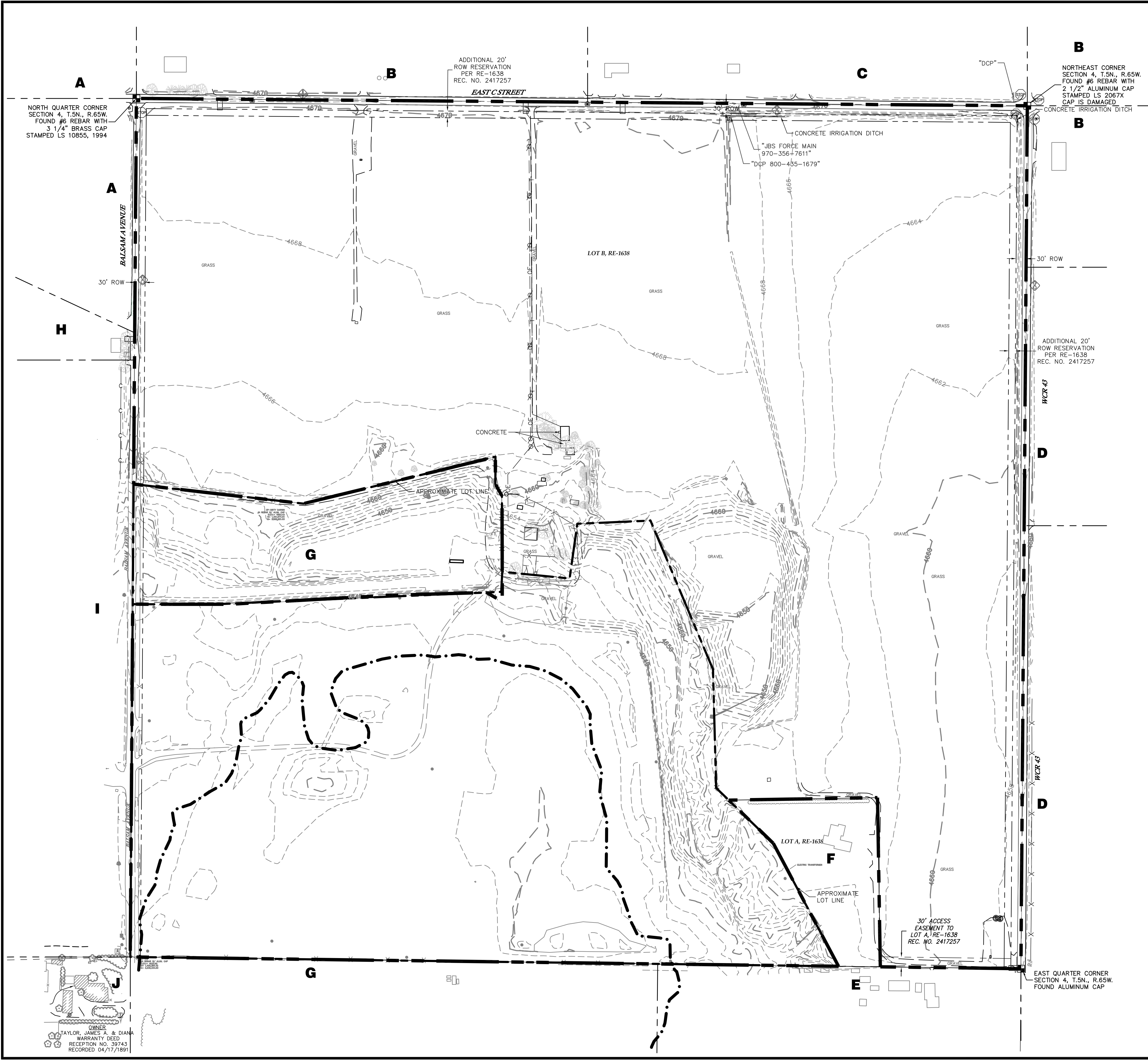
J.C. York, P.E.
J&T Consulting, Inc.

Attachments:

1. Updated Exhibit C Pre-Mining/Mining Plan Maps and Details
2. Updated Exhibit D Mining Plan
3. Updated Exhibit E Reclamation Plan
4. Updated Exhibit F Reclamation Plan Maps
5. Updated Exhibit L Bond Calculations
6. Exhibit S Slope Stability Analysis and Report
7. E-mail Correspondence with DCP Midstream
8. E-mail Correspondence with Chevron

cc: Broken Arrow Investments, LLC
File

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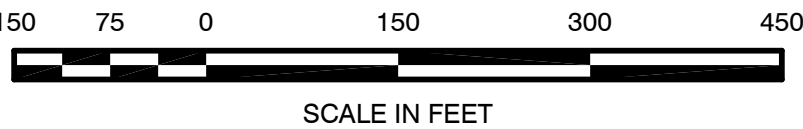
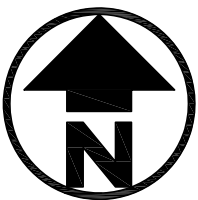
- PROPERTY LINE
- FENCE LINE
- EXISTING CONTOURS (2' INTERVALS)
- GRAVEL ROAD
- 100 YR. FLOODPLAIN
- PERMIT BOUNDARY
- PARCEL LINE

PROPERTY OWNERS WITHIN 500 FEET:
ASSESSORS I.D. NO.

A	HOSHIKO LAND, LLC P.O. BOX 119 KERSEY, CO 80644-019	096104301027 096104200017
B	DAVID BLISS 13165 E COUNTY LINE RD LONGMONT, CO 80504	080333000016 080334000018
C	JAMES R KOEHLER, TRUST 1001 E C ST GREELEY, CO 80631	080333000017
D	DIXIE ANN HOFFNER & JERRY D WINTERS 49 WILLOWCROFT DR LITTLETON, CO 80123	096103000023 096103000044 096103000051
E	JEANETTE SNOW 503 CHERRY AVE. GREELEY, CO 80631	096104000064
F	GENE MURATA 22000 WELD COUNTY ROAD 62 GREELEY, CO 80631	096104000066
G	GLOBAL ASSET RECOVERY, LLC 6530 CONSTITUTION DR FORT WAYNE, IN 46804	096104000047
H	SYLVIA & VERNIE H PARKER 211 M BALSAM AVE GREELEY, CO 80631	096104200012
I	LOLOFF CONSTRUCTION INC. P.O. BOX 518 KERSEY, CO 80644	096104200013
J	DIANA TAYLOR 665 N BALSAM AVE GREELEY, CO 80631	096104301009

VEGETATION:

ALL AREAS WITHIN THE PERMIT BOUNDARY ARE
PRIMARYLY VEGETATED WITH SWEET CLOVER AND
KOCIA, WITH SPARSELY INTERMIXED AREAS OF
WESTERN WHEATGRASS.



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Fort Lupton, CO 80621
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Exhibit C-1

Broken Arrow Investments
Derr Pit

M-2008-017

REVISIONS				Description	
No	Date	By	Chk	Adequacy Review #1	Technical Revision No. 8
1	6.6.18	WSS	JCY		
2	6.21.18	WSS	JCY		
3	4.13.23	TPY	JCY		

J&T Consulting, Inc.

J.C. York

Job #	07123
Date	2/6/18
Drawn By	WSS
Designed By	TPY
Checked By	JCY
File	JT-Derr 2018 Mining
Scale	1" = 150'

Sheet: Of:

1 4

LEGEND:

- 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 XCEL POWER LINE
- EXISTING DCP MIDSTREAM GAS LINE
- NORTH WELD WATER DISTRICT WATER LINE
- EXISTING CONTOURS (2' INTERVALS)
- GRAVEL ROAD
- PROPOSED PERMIT BOUNDARY
- PROPOSED FINAL MINING LIMIT
- PROPOSED SLURRY WALL

REVISIONS

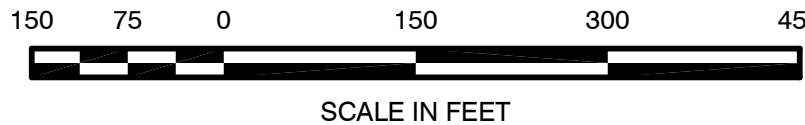
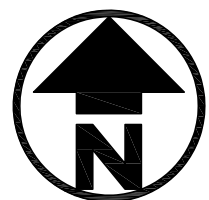
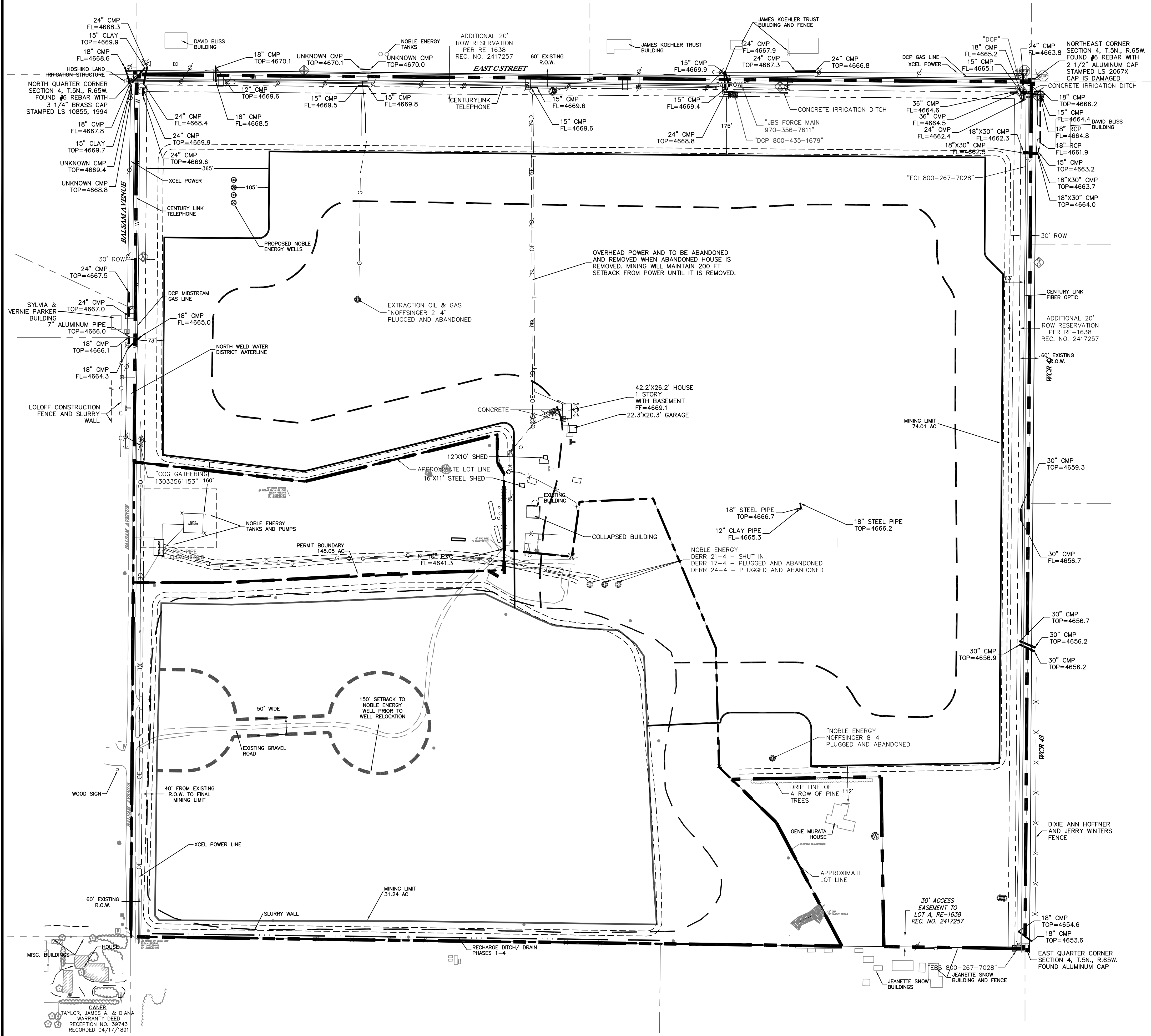
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2	6.21.18	WSS	JCY	Accuracy Review #2
3	5.1.20	TPY	JCY	Technical Revision No. 4
4	4.13.23	TPY	JCY	Technical Revision No. 8

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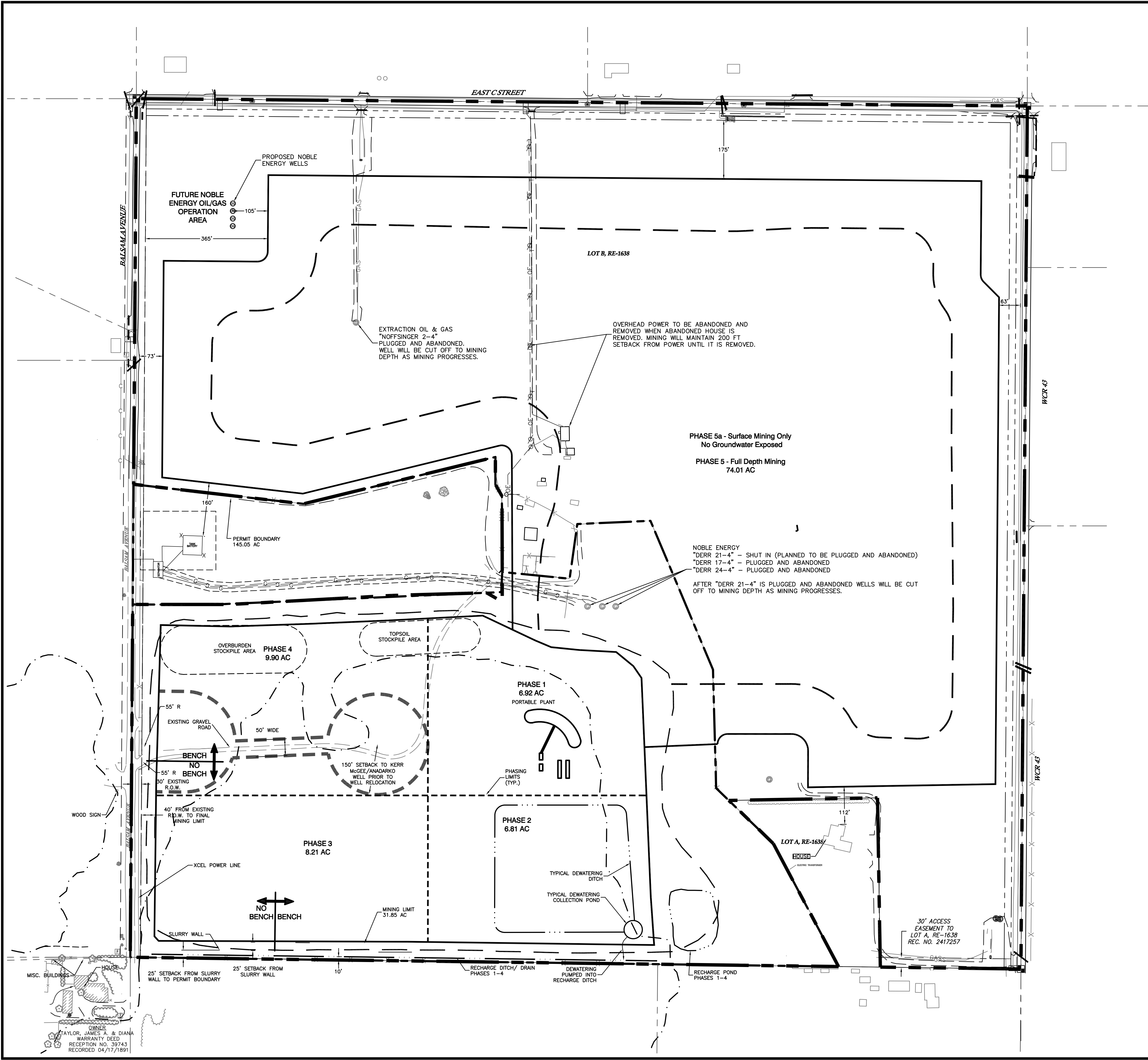
J.C. York

Job # 07123
Date 2/6/18
Drawn By WSS
Designed By TPY
Checked By JCY
File JT-Derr 2018 Mining
Scale 1" = 150'

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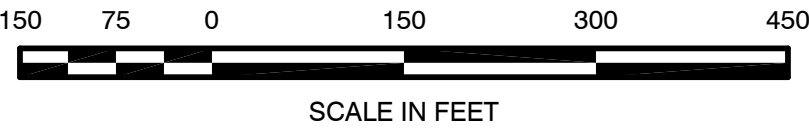
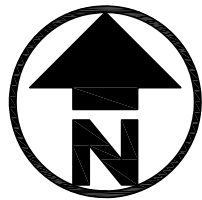


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- LEGEND:**
- PROPERTY LINE
 - FENCE LINE
 - RELOCATED GAS LINE
 - GRAVEL ROAD
 - PROPOSED PERMIT BOUNDARY
 - PROPOSED FINAL MINING LIMIT
 - STOCK PILE AREA
 - PROPOSED SLURRY WALL
 - DISTURBED AREA

TOTAL PERMIT AREA = 145.05 AC
TOTAL MINING AREA = 105.25 AC



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Exhibit C-3

Broken Arrow Investments
Derr Pit

Pre-Mining/Mining Plan Map

M-2008-017

REVISIONS

No	Date	By	Chk	Description
1	6.8.18	WSS	JCY	Adequacy Review #1
2	6.12.18	WSS	JCY	Added Phase 5a
3	10.24.18	WSS	JCY	Added Disturbed Area
4	5.1.20	TPY	JCY	Technical Revision No. 4
5	6.15.20	TPY	JCY	Technical Revision No. 6
6	4.13.23	TPY	JCY	Technical Revision No. 8

J&T Consulting, Inc.

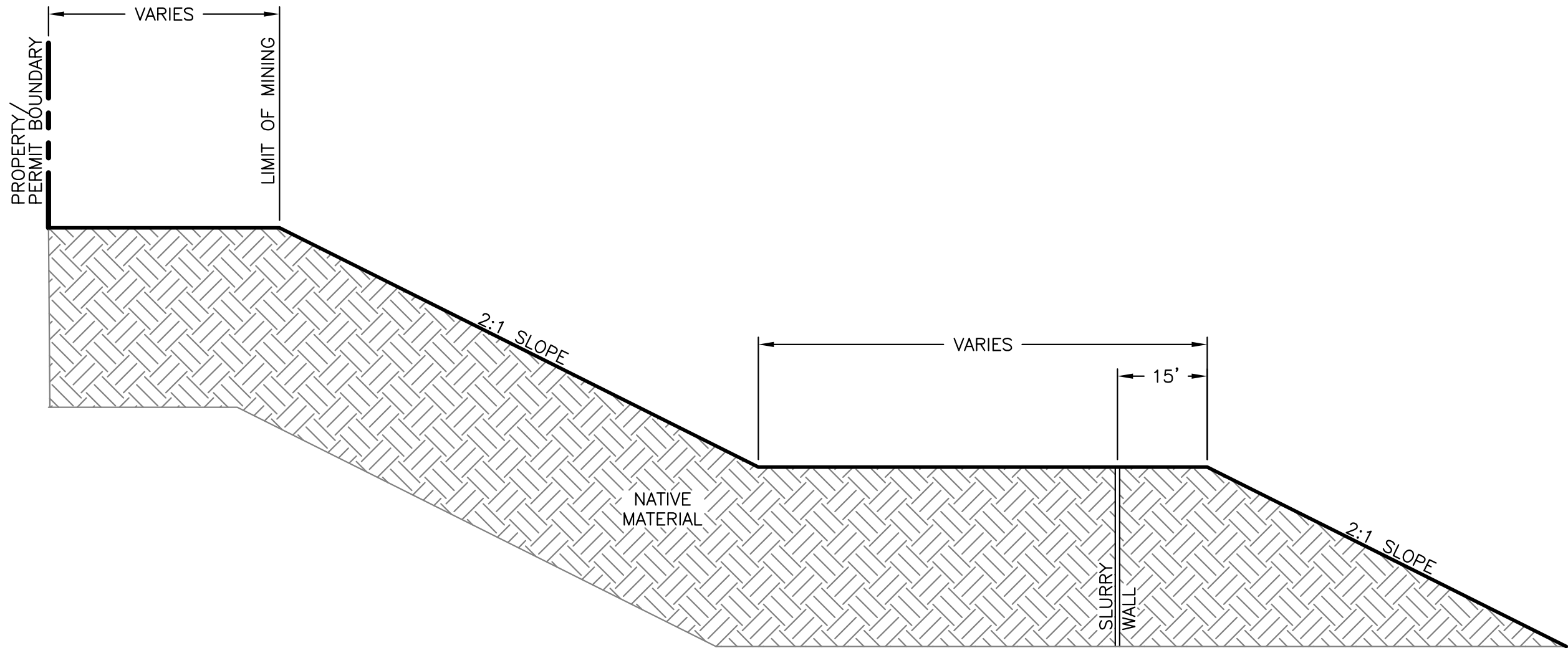
J.C. York

Job # 07123
Date 2/6/18
Drawn By WSS
Designed By TPY
Checked By JCY
File JT-Derr 2018 Mining
Scale 1" = 150'

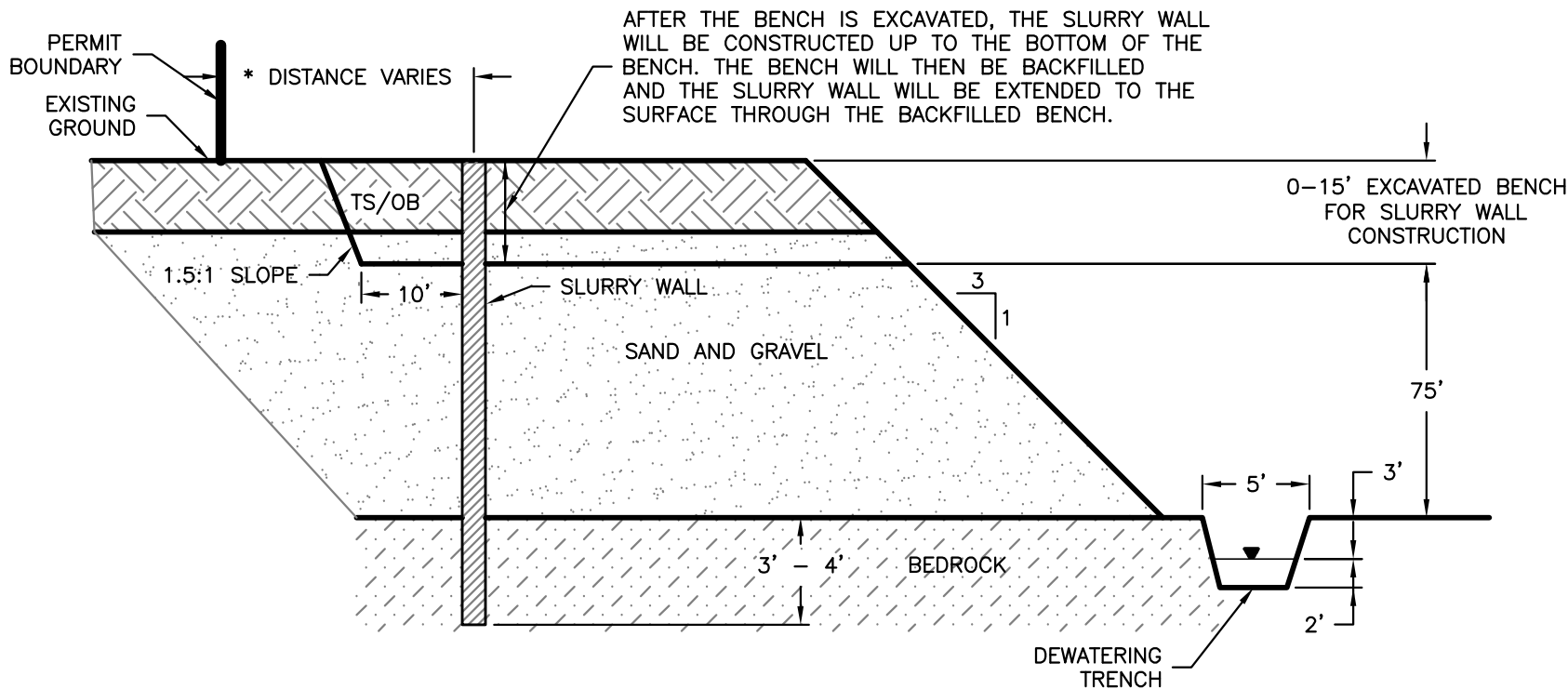
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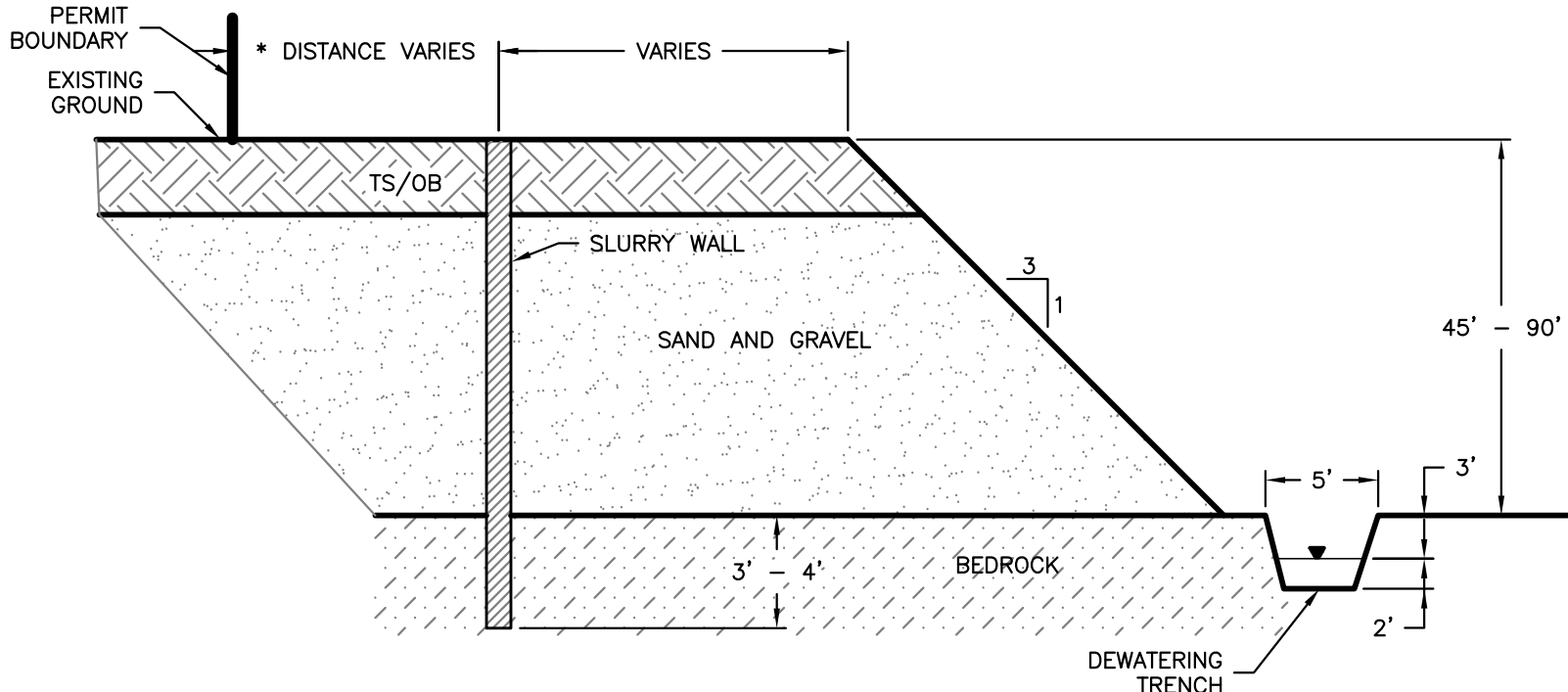
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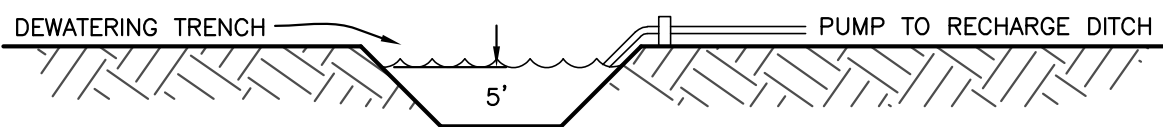
**NORTH CELL
TYPICAL MINING SECTION**
N.T.S.



**SOUTH CELL
TYPICAL MINING SECTION - BENCHED**
N.T.S.



**SOUTH CELL
TYPICAL MINING SECTION - NO BENCH**
N.T.S.



DEWATERING COLLECTION POND

REVISIONS					Description
No	Date	By	Chk		
1	6.6.18	WSS	JCY	Adequacy Review	PI
2	6.12.18	WSS	JCY	Added Phase 5a	
3	10.24.18	WSS	JCY	Added Disturbed Area	
4	5.1.20	TPY	JCY	Technical Revision No. 4	
5	6.15.20	TPY	JCY	Technical Revision No. 6	
6	4.13.23	TPY	JCY	Technical Revision No. 8	

J&T Consulting, Inc.

J.C. York

Job #	07123
Date	2/6/18
Drawn By	WSS
Designed By	TPY
Checked By	JCY
File	JT-Derr 2018 Mining
Scale	As Shown

Sheet: Of:

EXHIBIT D

Mining Plan

Mining Limits

Broken Arrow Investments, LLC proposes to mine the Northeast $\frac{1}{4}$ of Section 4, Township 5 North, Range 65 West, Sixth P.M. in Weld County, Colorado. The site lies $\frac{1}{4}$ of a mile north of State Highway 263 (8th Street) and east adjacent to Balsam Avenue. Additional permitted mining operations are immediately west of the proposed site, and directly south of State Highway 263 (8th Street). The dominant non-mining land use surrounding the property is agricultural.

A portable aggregate processing plant will be located within the mining area as shown on the Mining Plan Map. The area will contain stockpiles and portable equipment as necessary to support the plant operations.

All local, State, and Federal rules and regulations will be followed for the storage and handling of any fuel for the facilities.

The permit boundary will encompass approximately 145.05 acres with approximately 105.25 acres being mined. The remaining area will consist of setbacks, road and utility right-of-ways, equipment storage, and plant site access. Various setbacks from adjacent roads, adjacent structures, and oil and gas infrastructure will be observed as mining occurs. See Exhibit C, Mining Plan Map, and the Slope Stability Report for information on the setbacks and their locations. A 200 feet setback from any existing structure, utility, or oil/gas facility will be maintained until an agreement can be reached or has been attempted to be reached. Agreements will be sent to oil/gas companies and other owners of structures and utilities that are within 200 feet of the mine permit boundary / affected area. If agreements cannot be reached on setbacks that are less than the 200 feet minimum; the slope stability analysis setback with the DRMS required factors of safety will be used. See the Mining Plan Map for the mining limit configuration and information on setbacks and their locations.

Products

Sand and gravel will be the primary product produced from the Derr Pit Project site. The principal intended use for the sand and gravel is for road base and construction aggregates. There will also be recycled products such as concrete and asphalt that will be brought into the pit and screened and crushed for recycled road base.

Subsurface drilling and testing has verified that the Derr Pit Project property contains a significant commercial deposit of sand and gravel.

In Phases 1-4 the depth of the overburden ranges from less than 2.5 feet to 7.5 feet. A lense of sandy clay exists at an approximate depth of 47 feet to 56 feet and is 3 ft to 7 ft thick in a few of the borings performed by Terracon in 2001. The volume of overburden/clay removed is expected to total 300,000 cubic yards mining at a 3H:1V



slope. The depth of the aggregate material ranges from 2.5 feet to 90 feet. A significant portion of material has been mined from Phases 1-4 to date.

Phase 5a/5 has depths of overburden that range from 3 feet to 8 feet. Borings conducted in 2022 by Cesare, Inc. identified intermittent lenses of clay/sandy clay at various depths within the phase, ranging in thickness from 1 foot to 22 feet. In Phase 5a/5 a 2H:1V mining slope will be used. The volume of overburden/clay removed is expected to total 1,600,000 cubic yards. The depth of the aggregate material ranges from and 3 feet to 115 feet. Phase 5a/5 is estimated to contain approximately 6.4 million cubic yards of sand and gravel.

Mining Methods

The deposit is being dry mined, and a slurry wall has been constructed around Phases 1-4 of the mining area. The perimeter of the mining area in Phase 5 will also have a slurry wall constructed prior to exposing groundwater. The slurry wall is expected to be constructed for Phase 5 within the next two years (2024 or 2025). Design specifications for the slurry wall and quality control procedures used during construction will ensure that the reclaimed reservoir(s) meets State Engineer's Office (SEO) performance standards. The existing slurry wall around the perimeter of Phases 1-4 has passed the leak test. Dewatering trenches will be excavated around the perimeter of each mining area in Phases 1-5 prior to mining operations commencing.

The equipment and facilities may include, but are not limited to the following:

Processing Equipment

Screens, crusher, conveyors, stackers, wash plant and other miscellaneous processing equipment. (The plant will be a portable setup.)

Earth Moving Equipment

Dozers, loaders, scrapers, excavators, and compactors will be used for mining and earth moving operations.

Miscellaneous Equipment

Dewatering pumps, electrical trailer, generator trailer, small portable generators and watering trucks will be used as needed.

As mining progresses, topsoil and overburden will be stripped with scrapers to expose the aggregate product below. All soil and overburden material will be used on-site for reclamation; so long-term stockpiling of these materials is not anticipated. Overburden and topsoil stockpiles will be located within the proposed mining area and placed so that they do not impede potential floodwaters. The stockpiles will be placed outside the floodplain where possible. The overburden and topsoil stockpiles will be separated and stored in individual piles.

Mining of the aggregate will progress down to the underlying bedrock. Since reclamation will occur concurrently with mining, it is not anticipated that overburden and



or bedrock material will be stockpiled long-term prior to use if it is used in the reclamation slopes.

During mining and at the completion of reclamation, the mining face will have a 3H:1V slope at locations in Phases 1-4, above the slurry wall bench in Phase 5a, and 4.5H:1V at locations below the slurry wall bench in Phase 5. The aggregate material will be temporarily stockpiled near the portable plant site outside the floodplain where possible until mining has progressed where stockpiles as well as the portable plant site can be placed below the existing grade within the mining boundary.

Topsoil Handling Plan

As stated previously the topsoil will be stripped to expose the aggregate product underlying the topsoil. The topsoil will be stripped using scrapers and stockpiled in the topsoil stockpile as depicted in Exhibit C. The volume of topsoil is approximately 85,000 cubic yards. The depth of the topsoil is approximately six inches over the majority of the mining area. The topsoil will be stripped and stockpiled during each phase. The height of the topsoil stockpile will be approximately 15 feet.

Mine Phasing

Broken Arrow Investments, LLC anticipates mining and reclaiming the Derr Pit Project site in approximately 19 - 39 years. Phases 1 – 5 would be mined to a depth of 70 – 115 feet with each phase being 6.81 – 74.01 acres. However, it is possible that due to demand fluctuations, mining could progress slower than anticipated and additional time may be required for mining and reclamation of the site. After Phase 1 is mined to depth the mining operations will continue to expand as needed from the northeast corner in order of the phases shown on the Mining Plan until mining is completed.

The mining will progress in each phase beginning at the outer edge of the phase where material will be moved toward the interior of the phase such that a 3H:1V mining slope can be established on the exterior of the phase for Phases 1-4. Phase 5a will be mined at a 2H:1V slope to the slurry wall bench and reclaimed to a 3H:1V slope using overburden soils. Phase 5 will be mined at a 2H:1V slopes and reclaimed to a 4.5H:1V slope. The mining slope will be established for the entire perimeter of the phases in 3 to 6 foot intervals.

Dewatering

Dewatering trenches will be placed along the perimeter of each mining area in Phases 1-5. The dewatering trench around the perimeter of the phase being mined will be placed at the toe of the mining slope. As the phase is mined deeper the dewatering trench will be lowered and moved laterally along the mining slope toward the center of that phase. Once the interior area becomes small enough where the mining slopes from three to four sides are encroaching upon the portable plant and haul roads another phase will be opened to continue mining.

Explosives

Explosives will not be used during mining.



EXHIBIT E

Reclamation Plan

Water storage will be the primary final reclaimed use for the Derr Pit Project site. Portions of mining areas will be backfilled and reclaimed as “native” areas, which will be re-seeded with native vegetation and will also include areas where native trees could be re-planted. The majority of the mining areas will be reclaimed as a water storage reservoir. The remaining area within the proposed permit boundary will consist of reservoir shoreline, unimproved access roads around the reservoir, and reclaimed or otherwise undisturbed land. The approximate acreage of each of these areas is:

Final Land Use	Reclamation Plan Area (acres)	Alternate Reclamation Plan Area (acres)
Reservoir(s) Water Surface	75.75	79.31
Street/County Roads/Access Roads	6.06	6.06
Reclaimed Vegetated Land and Undisturbed Land	63.24	59.68
TOTAL	145.05	145.05

Water Storage Reservoir(s)

In general, the mining limits will be mined to the siltstone/claystone bedrock. The relatively impermeable bedrock will make the bottom of the reservoir. The reservoir will also be separated from the surrounding alluvial aquifer by a slurry wall liner. The slurry wall liner will be keyed into the bedrock material and extend upward through the entire height of the alluvium. Design specifications and quality control procedures used during construction of the slurry wall liner will ensure that the reservoir meets State Engineer's Office (SEO) performance standards for permeability. The slurry wall liner will be constructed between year two and year three of the mining.

All reservoir slopes left by the mining operation will be reclaimed to at least 3H:1V for Phases 1-4 for final grade. Phase 5a and Phase 5 will be reclaimed to a 3H:1V slope above the slurry wall bench and reclaimed to a 4.5H:1V below the slurry wall bench for final grade. Reclamation of the exterior cell walls will be concurrent with mining. Scrapers and dozers will be used to place overburden material along the reservoir perimeters to achieve the final grade. Upon placing the backfill material, 95 percent compaction will be achieved to ensure adequate integrity of the slope. Final reclamation by capping with topsoil and re-vegetating above the expected reservoir water level will follow backfilling operations closely to minimize the amount of disturbance at any one time.

Reclamation Measures/Materials Handling

Backfilling will be done to provide stabilized shorelines around the reservoir and to minimize erosion. The backfill material will consist of native bedrock claystone, gravel,



overburden, and topsoil. There will not be known toxic or hazardous materials in the backfill material. Additionally, it is not likely that acid forming or toxic materials will be encountered during mining. The mining will not leave high walls on the property. In addition, there will be no auger holes, excavations, or shafts left on the property.

Overburden and topsoil that is removed during the mining will be used to reclaim the mining slopes and areas that are disturbed during the mining such as haul/access roads and the recharge pond. Overburden will be placed in the areas such as haul/roads to bring the grade to the final reclaimed elevation. The overburden may also be spread on the 3H:1V mining slope in Phases 1-4 and on the 2H:1V mining slope in Phase 5a and Phase 5 to use the excess overburden to exhaustion. This will be accomplished by using a scrapers and dozers to place the overburden material to a depth across the entire mining slope to reclaim to the 3H:1V slopes for Phases 1-4 and Phase 5a and to the 4.5H:1V slopes for Phase 5. The slope will be compacted as described in the previous paragraphs for the Water Storage Reservoir. Topsoil will then be placed to finalize the grading such that seeding can occur. The topsoil will be placed at all disturbed areas and on the mining slope to an elevation matching the expected reservoir water level.

Top soiling

The top six inches of soil on the property is classified as topsoil. This layer includes the root zone of grasses and crops, which will be stripped and stockpiled separately. By using concurrent reclamation techniques, the topsoil is not expected to remain in stockpiles for more than one to five years. If the stockpile remains more than one growing season, it will be seeded with a fast-growing vegetative cover to prevent erosion. All topsoil will be retained on-site to reclaim the reservoir shoreline, and other areas disturbed by mining activities. Where required, topsoil will be replaced to a depth of approximately twelve inches.

Revegetation

As mining operations are completed, areas for reclamation will be graded and shaped for revegetation. Runoff or excess water from adjacent areas will not be allowed to flow over slopes being graded and seeded. If needed, berms or channels will be constructed to divert excess water and dispose of it in a safe and non-erosive manner.

Upland Areas. For disturbed upland areas, the reclamation plan includes re-vegetating with appropriate seed mixes to minimize erosion and reestablish natural terrain. The grass mixture below was selected to be long lasting and regenerating, as recommended by the Greeley NRCS field office. The ground will be fine graded prior to seeding according to recommendations from the Natural Resource Conservation Service. Reservoir side slopes below the anticipated reservoir water level will not be seeded. The proposed seed mix is shown in the following table.



Upland Grass Seed	Application Rate * (#PLS/acre)	% in mix
Switchgrass (Greenville, Nebraska 28, Blackwell, Pathfinder)	0.8 #PLS/ac	20
Yellow Indiangrass (Lano, Holt, Cheyenne, Oto)	1.0 #PLS/ac	10
Sideoats Grama	1.8 #PLS/ac	20
Blue Grama (Hachital, Lovington)	0.3 #PLS/ac	10
Western Wheatgrass (Arriba, Bartonk, Rosana)	4.0 #PLS/ac	25
Sand Dropseed	0.03 #PLS/ac	5
Little Bluestem	0.7 #PLS/ac	10
Totals	8.63 #PLS/ac	100
*Application rate is for drilling the seed. If seed is to be broadcast, the application rate will be doubled.		

The seed mix for final reclamation as described above does not require fertilizer as recommended by the local NRCS office in Greeley, Colorado. The seed mix was revised slightly per the NRCS's latest recommendations that require less seed to be drilled or broadcast per acre of disturbed area.

Upland grass seed will be planted with a drill equipped with depth bands and press wheels. The seed should be drilled in the spring in the month of April for best results. The seeded areas will then be covered with straw mulch at a rate of 4,000 pounds per acre. The straw will be crimped into the soil to control erosion until the grass becomes established. See the attached NRCS seeding recommendations.

If a significant invasion of noxious weeds occurs after seeding, the weeds will be mowed before they can go to seed. The areas will be mowed periodically for additional control as needed. Mechanical control will be used as a first priority. Chemical methods will only be used if no other alternative produces acceptable results.

Temporary Stockpile Areas. For temporary stockpiles, the reclamation plan includes re-vegetating with appropriate seed mixes to minimize erosion and establish more rapidly to stabilize the stockpiles. The grass mixture below was selected as recommended by the Greeley NRCS field office. The proposed seed mix is shown in the following table.

Temporary Stockpile Seed	Application Rate * (#PLS/acre)	% in mix
Slender wheatgrass	2.8 #PLS/ac	25
Smooth brome grass	3.9 #PLS/ac	30
Pubescent wheatgrass	4.2 #PLS/ac	30
Sand dropseed	0.03 #PLS/ac	5
Crested wheatgrass	0.6 #PLS/ac	10
Totals	11.53 #PLS/ac	100



* Application rate is for drilling the seed. If seed is to be broadcast, the application rate will be doubled.

The seed mix for final reclamation as described above does not require fertilizer as recommended by the local NRCS office in Greeley, Colorado

Water – General Requirement

To minimize the effect on the prevailing hydrologic balance, the operator shall:

- a. Comply with all applicable Colorado water laws.
- b. Comply with all applicable Federal and State water quality laws and regulations.
- c. Comply with all Federal and State requirements for dredge and fill.
- d. Re-grade and backfill all sediment and siltation structures after mining is completed.

Groundwater – Specific Requirements

The operation will not affect groundwater quality on or off the site. The operation will comply with State groundwater quality standards. Due to the absence of sources of potential pollutants, groundwater quality monitoring is not required in this operation.

The mining and reclamation will affect the groundwater table surrounding the mine site. Proposed mitigation efforts to minimize these impacts are a recharge pond along the southeast corner of the property to maintain groundwater levels during the mining, and a perimeter drain if needed to convey groundwater around the lined reservoir after the slurry wall is installed.

The depth to groundwater has been measured on a monthly basis in piezometers located on the interior and exterior of the Phases 1-4 since October 2006 and Phase 5a and Phase 5 since August 2019. These measurements will be used to establish what the seasonal groundwater levels were prior to the mining exposing groundwater, and as a benchmark for maintaining the groundwater levels in subsequent years. Groundwater depths will continue to be measured and recorded at monthly intervals in each piezometer and compared to the benchmark levels. The triggers that would require the perimeter drain to be installed are as follows:

A three-foot difference in the depth to groundwater from the benchmark seasonal groundwater levels in two or more piezometers for two consecutive months.

Broken Arrow Investments, LLC proposes that the groundwater elevations be monitored through onsite wells before, during, and after the mining and reclamation is complete so that impacts to the groundwater table, from this mining operation, can be identified and addressed. It is the intent of Broken Arrow Investments, LLC to operate responsibly and to mitigate damages to wells that are directly attributable to the mining and reclamation of this site. For more specific information please refer to the well owner agreements and narrative included in Exhibit G.



Reclamation – Approximate Time Table

The proposed rate of production for the mine is 300,000 to 600,000 tons per year. The total time frame to mine every phase is approximately 19 to 39 years which allows for years where the 300,000 to 600,000 tons per year production rate is less. The following table shows the approximate time frame to finish each phase of mining:

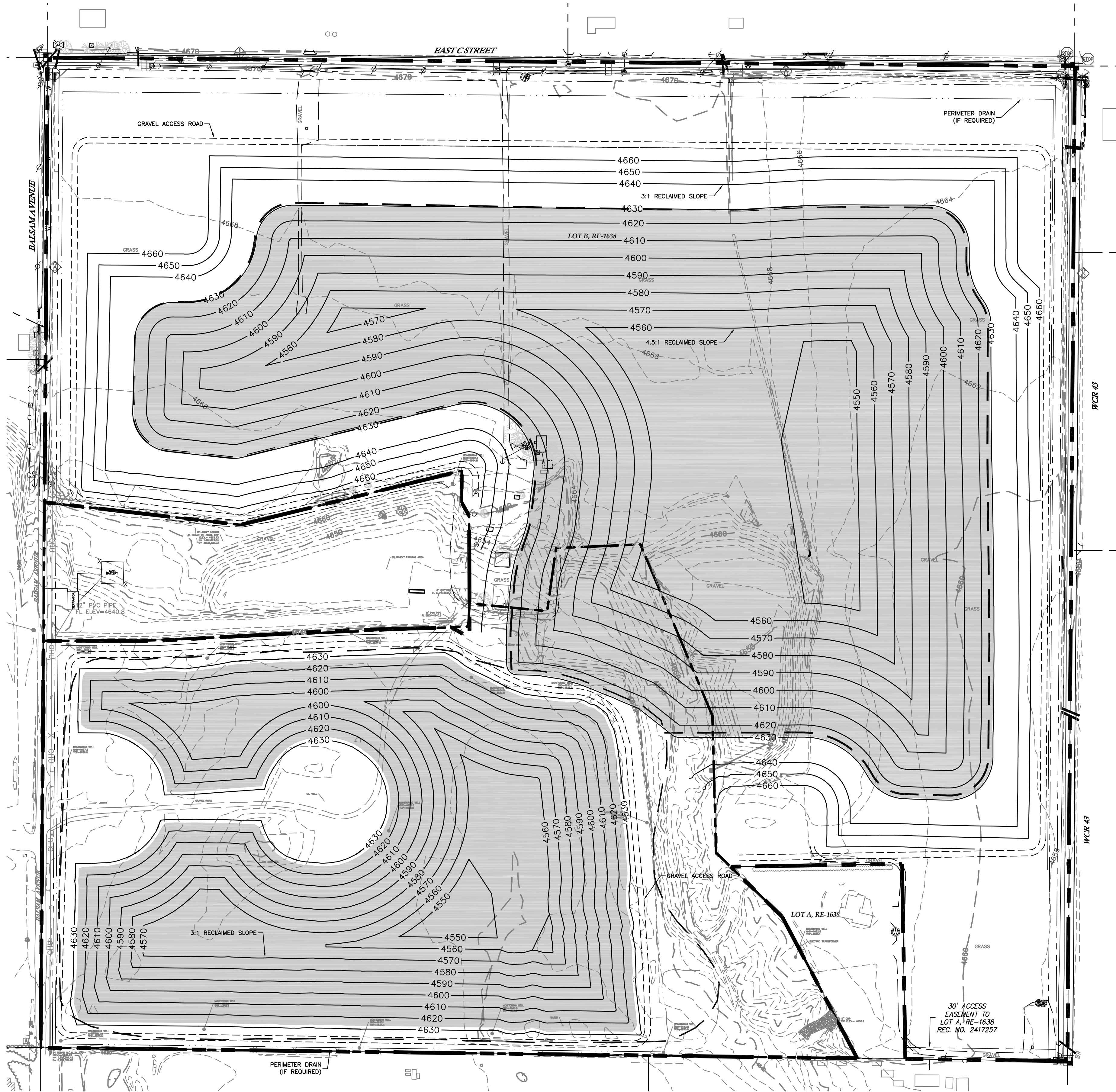
Mine Phase and Acreage	Time Frame to Complete and Reclaim Phase
Phase 1 – 6.92 acres	2 years and 7 months
Phase 2 – 6.81 acres	2 years and 7 months
Phase 3 – 8.21 acres	3 years and 3 months
Phase 4 – 9.90 acres	3 years and 10 months
Phase 5 – 74.01 acres	26 years and 8 months

The assumed maximum production rate is 300,000 to 600,000 tons for processed material leaving the mine each year. An average production rate of 300,000 tons per year was used to calculate the reclamation time table. The size and area of reclamation varies for each phase but generally consists of the outside mining slope being reclaimed at 3H:1V and 4.5H:1V slopes with the addition of overburden, topsoil, and revegetation. For more information on sequencing and size of the reclamation activities refer to Exhibit L financial warranty calculations.



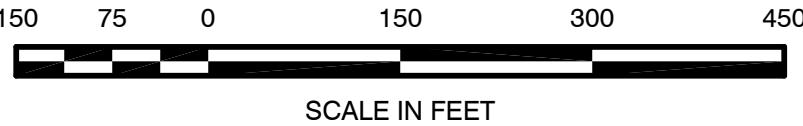
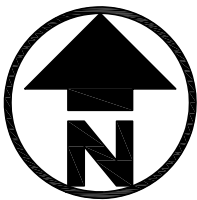
NOTE:

ALL DISTURBED AREAS OUTSIDE OF WATER SURFACE WILL BE SEEDED AND MULCHED WITH THE EXCEPTION OF ACCESS ROADS WHICH WILL BE GRAVEL SURFACED.



LEGEND:

- 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 XCEL POWER LINE
- EXISTING DCP MIDSTREAM GAS LINE
- NORTH WELD WATER DISTRICT WATER LINE
- EXISTING CONTOURS (2' INTERVALS)
- GRAVEL ROAD
- PROPOSED PERMIT BOUNDARY
- PROPOSED SLURRY WALL
- PROPOSED CONTOURS
- PERIMETER DRAIN
- WATER SURFACE



REVISIONS		Description	
No	Date	By	Chk
1	6.6.18	WSS	JCY
2	6.21.18	WSS	JCY
3	5.7.20	TPY	JCY
4	4.13.23	TPY	JCY

J&T Consulting, Inc.

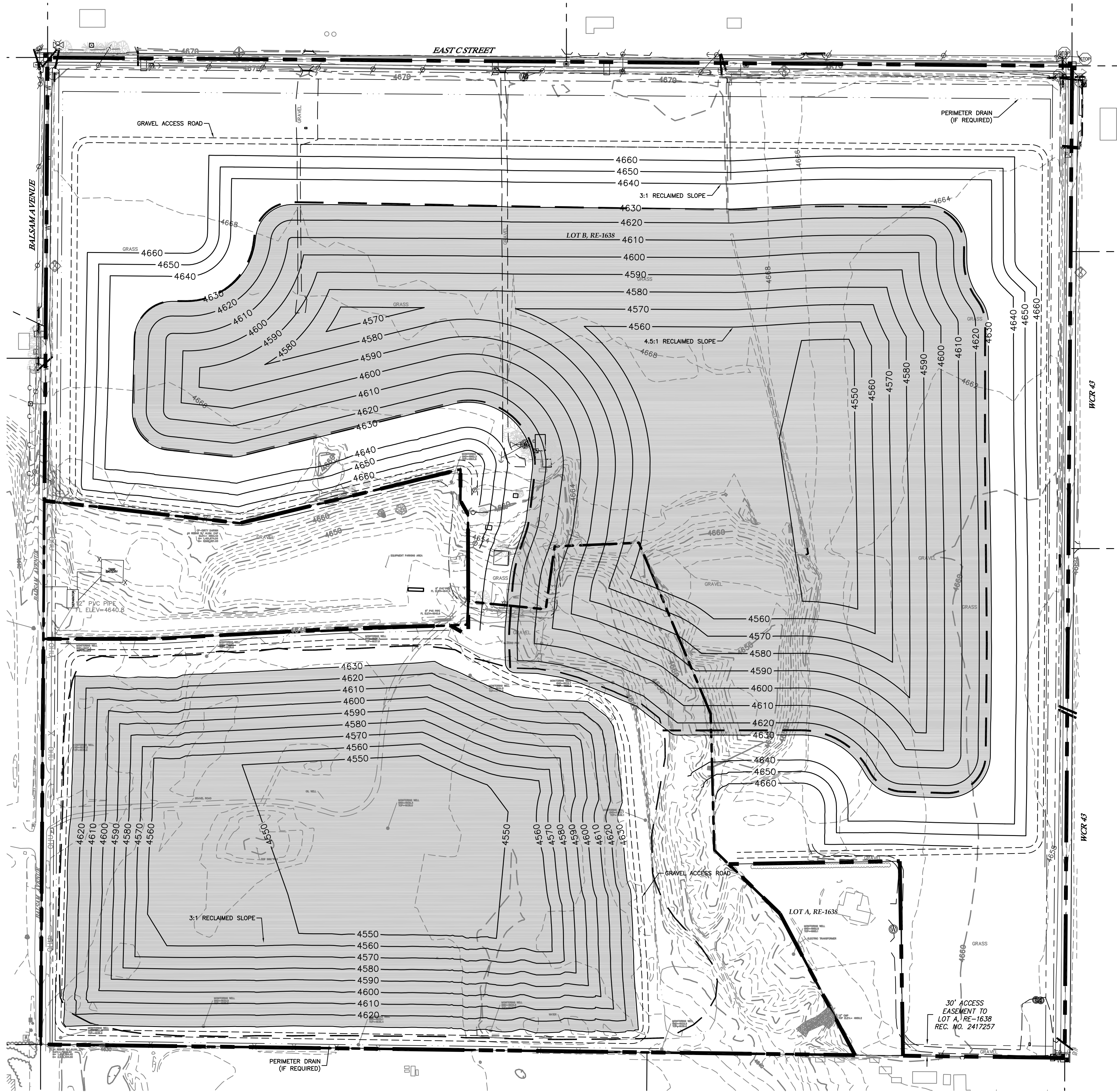
J.C. York

Job #	07123
Date	2.13.18
Drawn By	WSS
Designed By	TPY
Checked By	JCY
File	JT-Derr 2020 Rec
Scale	1" = 150'

Sheet: 1 of 3

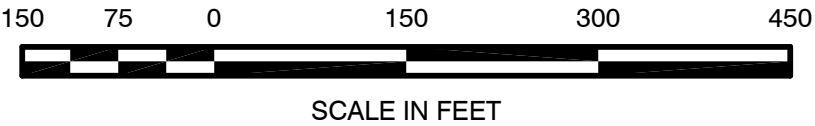
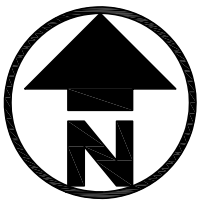
NOTE:

ALL DISTURBED AREAS OUTSIDE OF WATER SURFACE WILL BE SEEDED AND MULCHED WITH THE EXCEPTION OF ACCESS ROADS WHICH WILL BE GRAVEL SURFACED.



LEGEND:

- UTILITY POLE
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- GRAVEL ROAD
- PROPOSED PERMIT BOUNDARY
- PROPOSED SLURRY WALL
- PROPOSED CONTOURS
- PERIMETER DRAIN
- WATER SURFACE



REVISIONS

No	Date	By	Chk	Description
1	6.6.18	WSS	JCY	Adequacy Review #1
2	6.21.18	WSS	JCY	Adequacy Review #2
3	5.7.20	TPY	JCY	Technical Revision No. 4
4	4.13.23	TPY	JCY	Technical Revision No. 8

J&T Consulting, Inc.

J.C. York

Job #	07123
Date	2.13.18
Drawn By	WSS
Designed By	TPY
Checked By	JCY
File	JT-Derr 2020 Rec
Scale	1" = 150'

Sheet: of:



9. Above specifications (notes 1–8) are provided as a general guideline for permitting purposes. Final specifications and design criteria will be developed during the final design of the slurry wall.

Sheet: Of:



Summary of Unit Costs

Direct costs

Re-applying topsoil 6" thick	\$1,800.00	/ acre
Revegetating disturbed area	\$1,000.00	/ acre
Dewatering full pit	\$200.00	/ million gallons
Slurry Wall Cost (75 foot average depth @ \$6.00/ft)	\$450	/ linear foot
Perimeter Drain	\$20	/ linear foot
Scarifying Ground	\$200	/ acre
Grading and Backfill of Reclamation Slopes	\$2.00	/ cy
Mobilization	\$2,500	lump sum

Overhead and Profit Costs

Liability insurance	1.55%	of direct cost
Performance bond	1.05%	of direct cost
Profit	10.00%	of direct cost
Total Overhead Cost	12.60%	of direct cost

Project Management

Engineering and bidding	4.25%	of direct cost
Management and administration	5.00%	of direct cost
Total Additional Cost	9.25%	of direct cost

Current Financial Warranty Required For Phase 1-4

\$753,487

Phase 5a (74.01 acres)

Reclamation Operation	Quantity	Unit	Unit Cost	Cost
Active Mining Area				
Reclaimed Slope Grading and Backfill	303,400	cy	\$2.00	\$606,800
Scarifying Disturbed Area	74.01	ac	\$200	\$14,802
Topsoil Placement Disturbed Area	74.01	ac	\$1,800	\$133,218
Revegetate Disturbed Area	74.01	ac	\$1,000	\$74,010
Mobilization	1.00	ls	\$2,500	\$2,500
Total Direct Cost				\$831,330
Overhead and Profit Cost (12.60%)				\$104,748
Contract Cost				\$936,078
Project Management (9.25%)				\$86,587

Additional Financial Warranty Required For Phase 5a

\$1,022,665

Cummulative Financial Warranty Required For Phases 1-4 and 5a

\$1,776,152

Phase 5

Reclamation Operation	Quantity	Unit	Unit Cost	Cost
Active Mining Area				
Reclaimed Slope Grading and Backfill	1,289,100	cy	\$2.00	\$2,578,200
Slurry Wall	6,620	lf	\$450	\$2,979,000
Perimeter Drain (if required)	5,430	lf	\$20	\$108,600
Dewatering of Phase 5 Area	797.8	Mil. Gal.	\$200	\$159,560
Mobilization	1.00	ls	\$2,500	\$2,500
Total Direct Cost				\$5,827,860
Overhead and Profit Cost (12.60%)				\$734,310
Contract Cost				\$6,562,170
Project Management (9.25%)				\$607,001

Additional Financial Warranty Required For Phase 5

\$7,169,171

Cummulative Financial Warranty Required For Phases 1-5

\$8,945,323

SLOPE STABILITY REPORT

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

APRIL 2023

PREPARED FOR:
BROKEN ARROW INVESTMENTS, LLC
801 8TH STREET, SUITE 130
GREELEY, CO 80631

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 Broken Arrow Investments, LLC. 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

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

Broken Arrow Investments, LLC. proposes a technical revision to their current Derr Pit reclamation permit located in the Northeast ¼ 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.



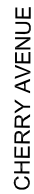
The following recommendations for monitoring of slope stability should be followed:

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





	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

Job #	07123
Date	4.12.23
Drawn By	TPY
Designed By	TPY
Checked By	JCY
File	JT-IHC North Mining
Scale	As Shown

Sheet: **1** Of: **1**

Broken Arrow Investments

Derr Pit

Slope Stability Case Location Map

J&T Consulting, Inc.

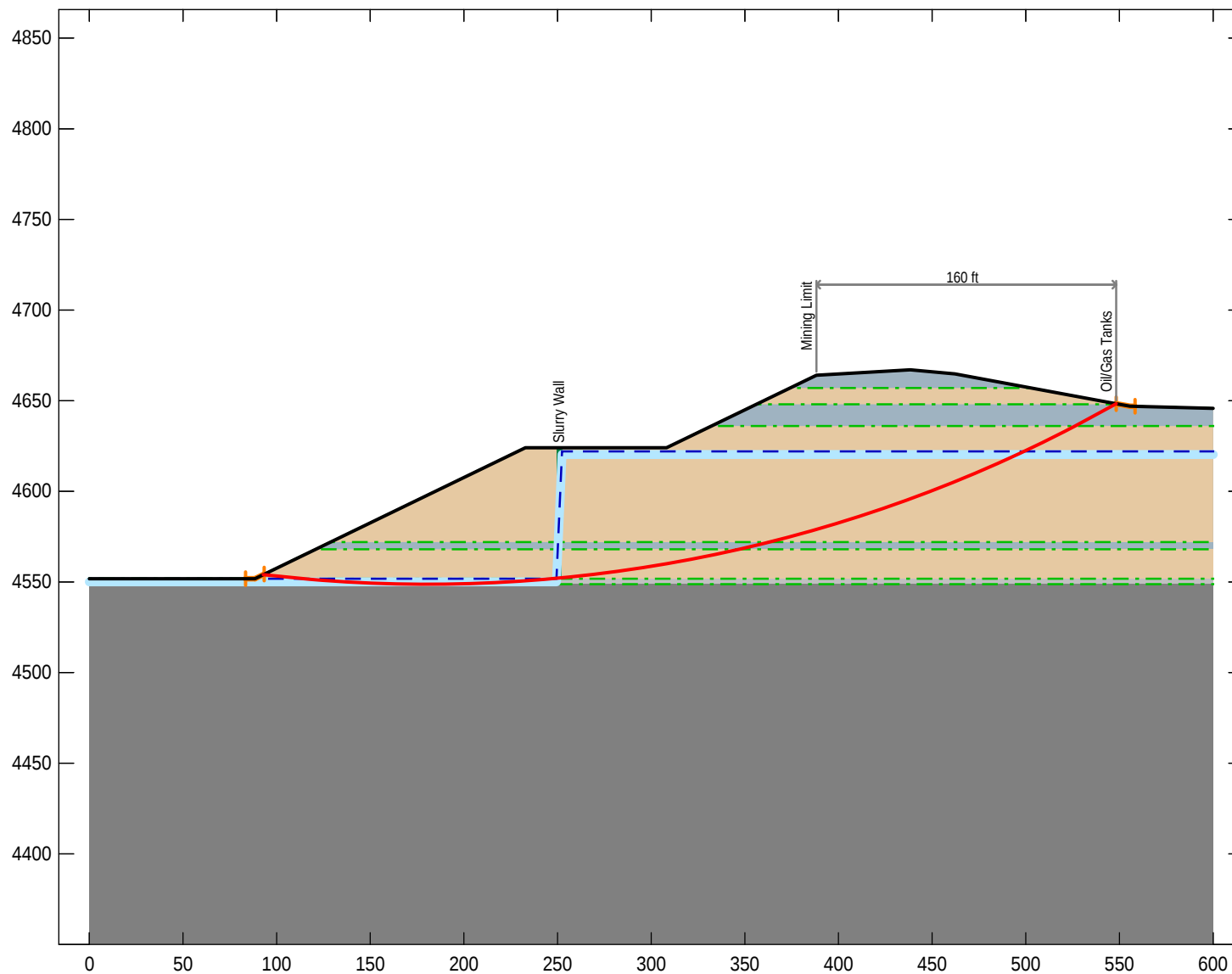
305 Denver Avenue - Suite D
Fort Lupton, CO 80621
Ph: 303-857-6222 Fax: 303-857-6224
www.j-tconsulting.com

APPENDIX B



Mining Conditions





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

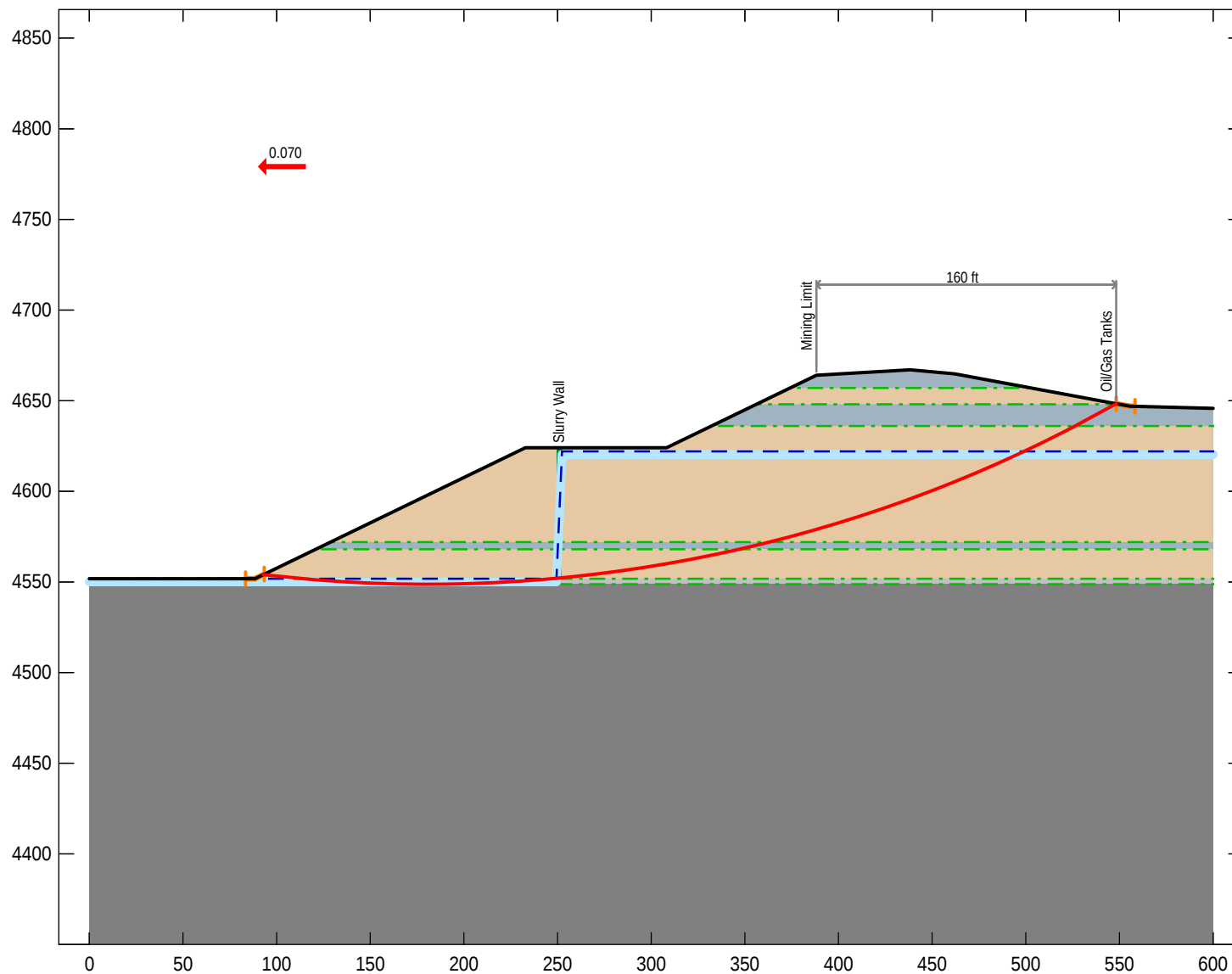
Critical Factor of Safety: 2.14

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)
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Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

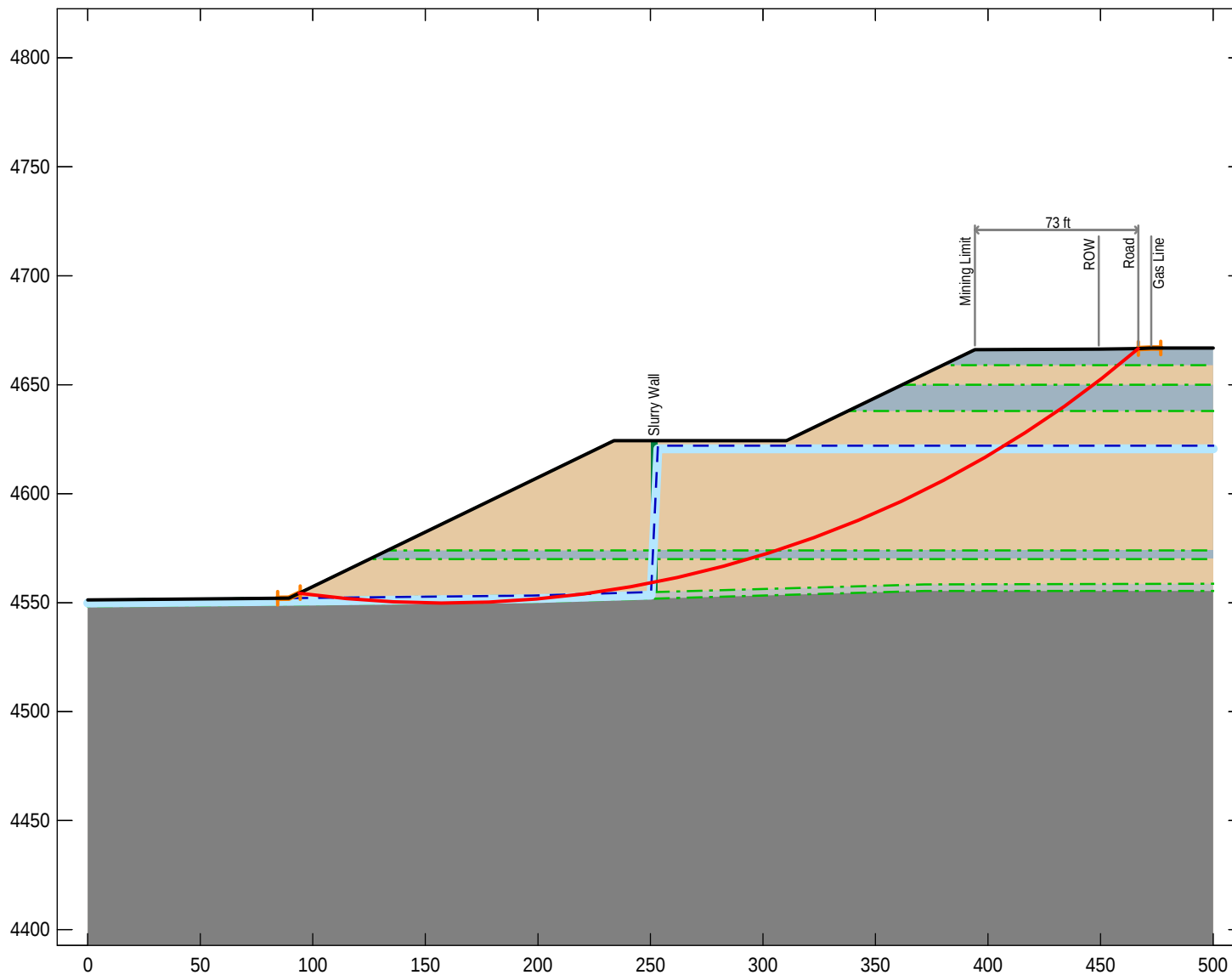
Critical Factor of Safety: 1.59

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

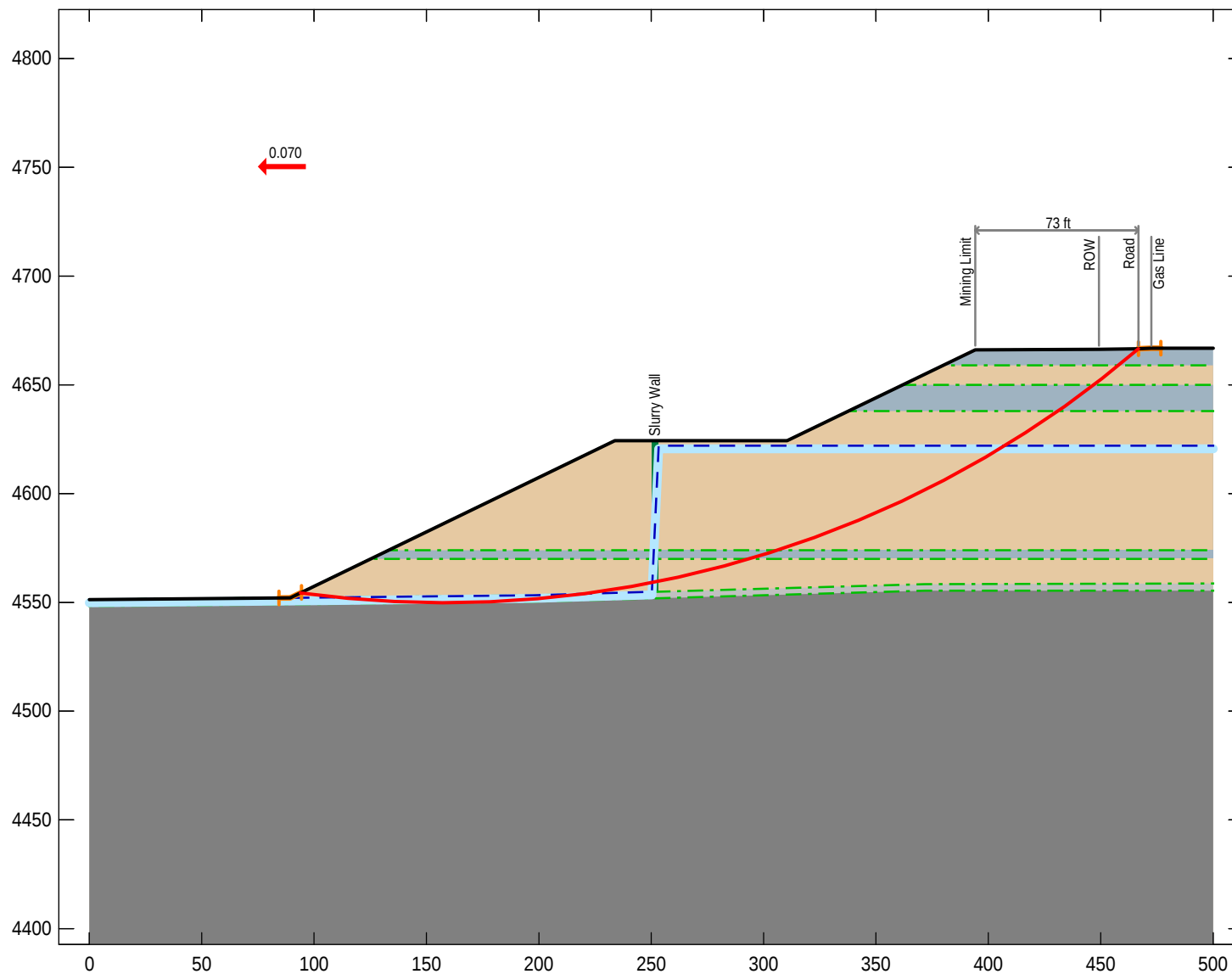
Licensed to: J & T Consulting

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

File: C:\Galena Models\Derr TR8 SS2.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: 1.32

GALENA Version 7.2

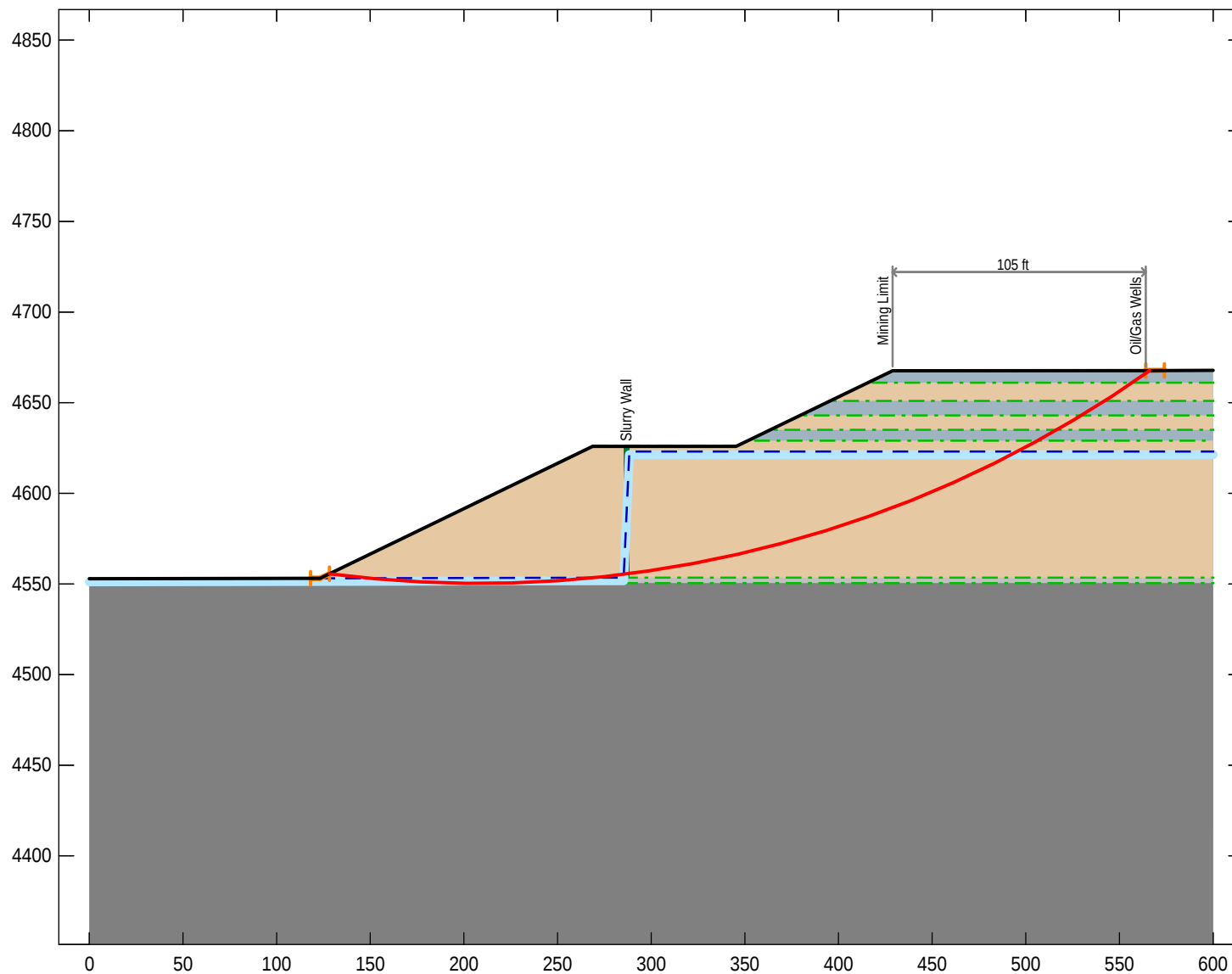
Licensed to: J & T Consulting

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

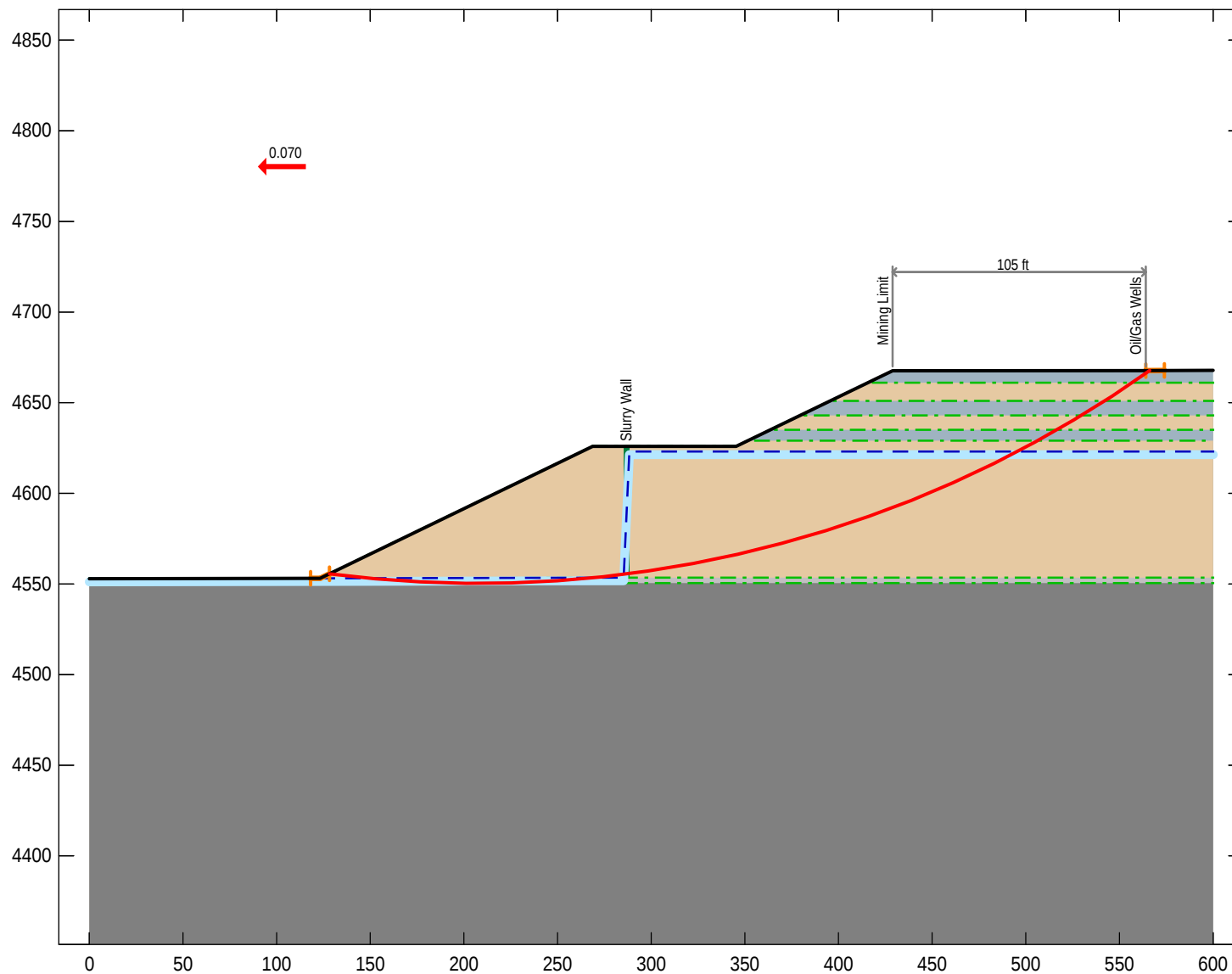
Licensed to: J & T Consulting

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

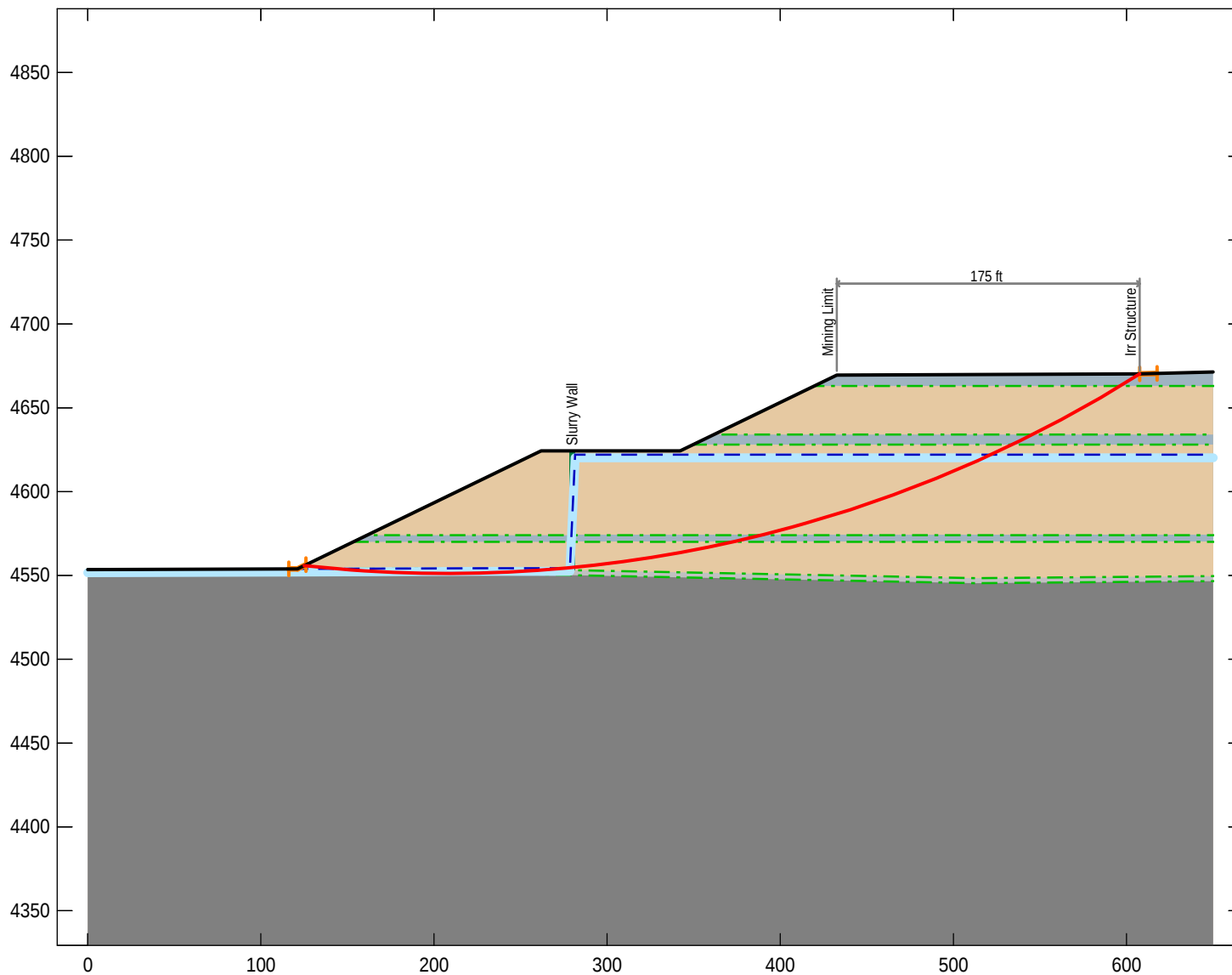
Critical Factor of Safety: 1.47

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





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Material Keys

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

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

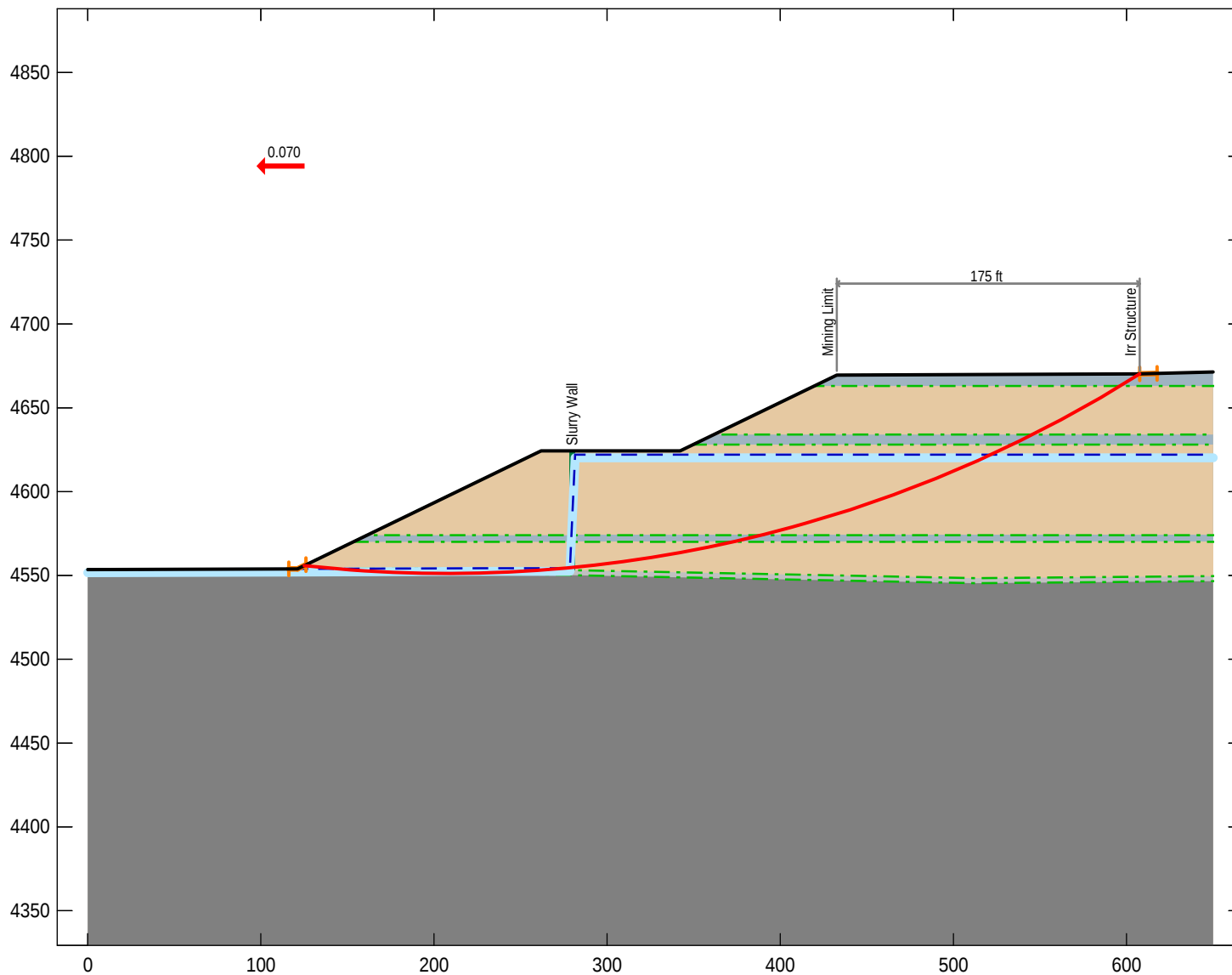
Critical Factor of Safety: 2.08

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





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

GALENA Version 7.2

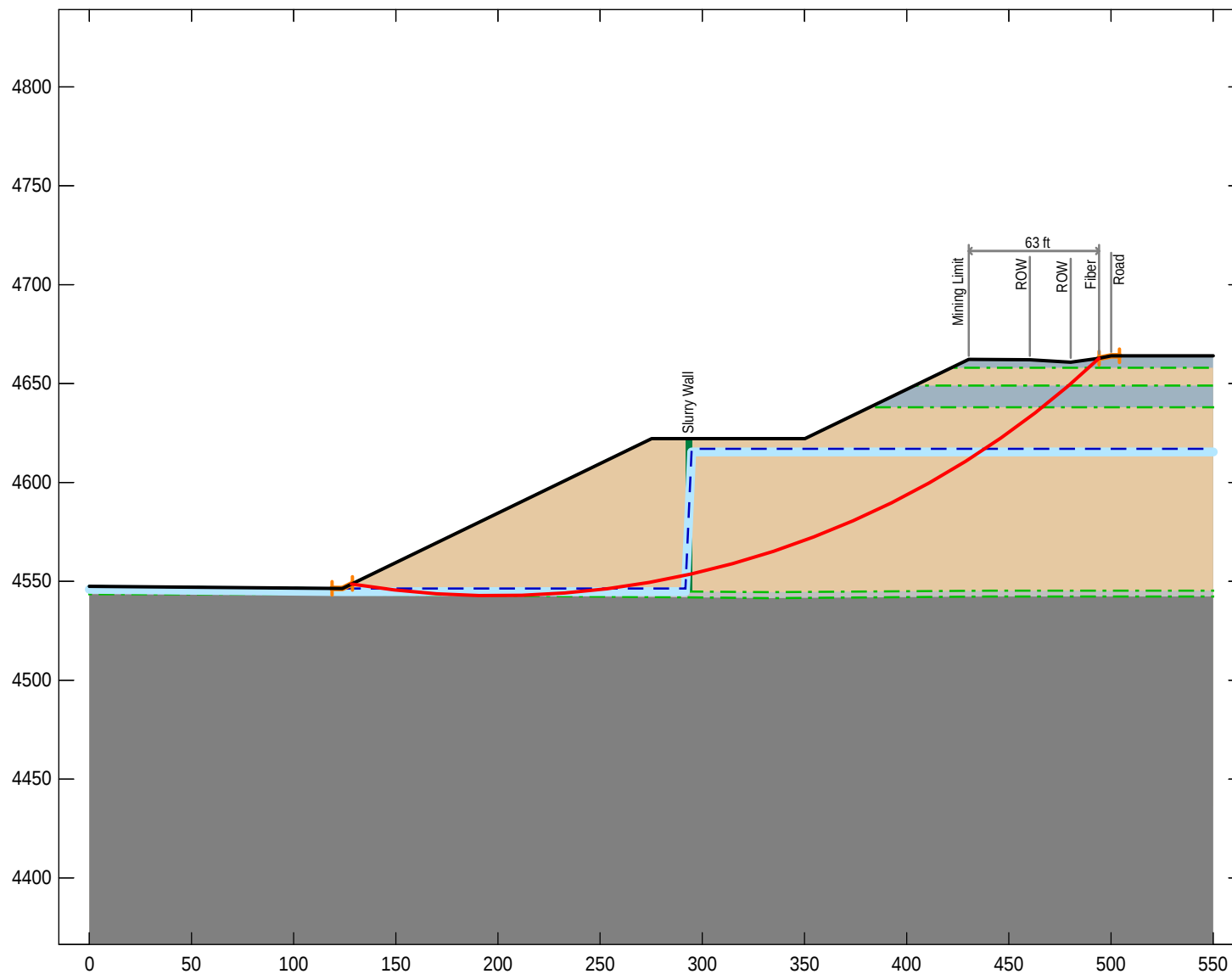
Licensed to: J & T Consulting

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





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

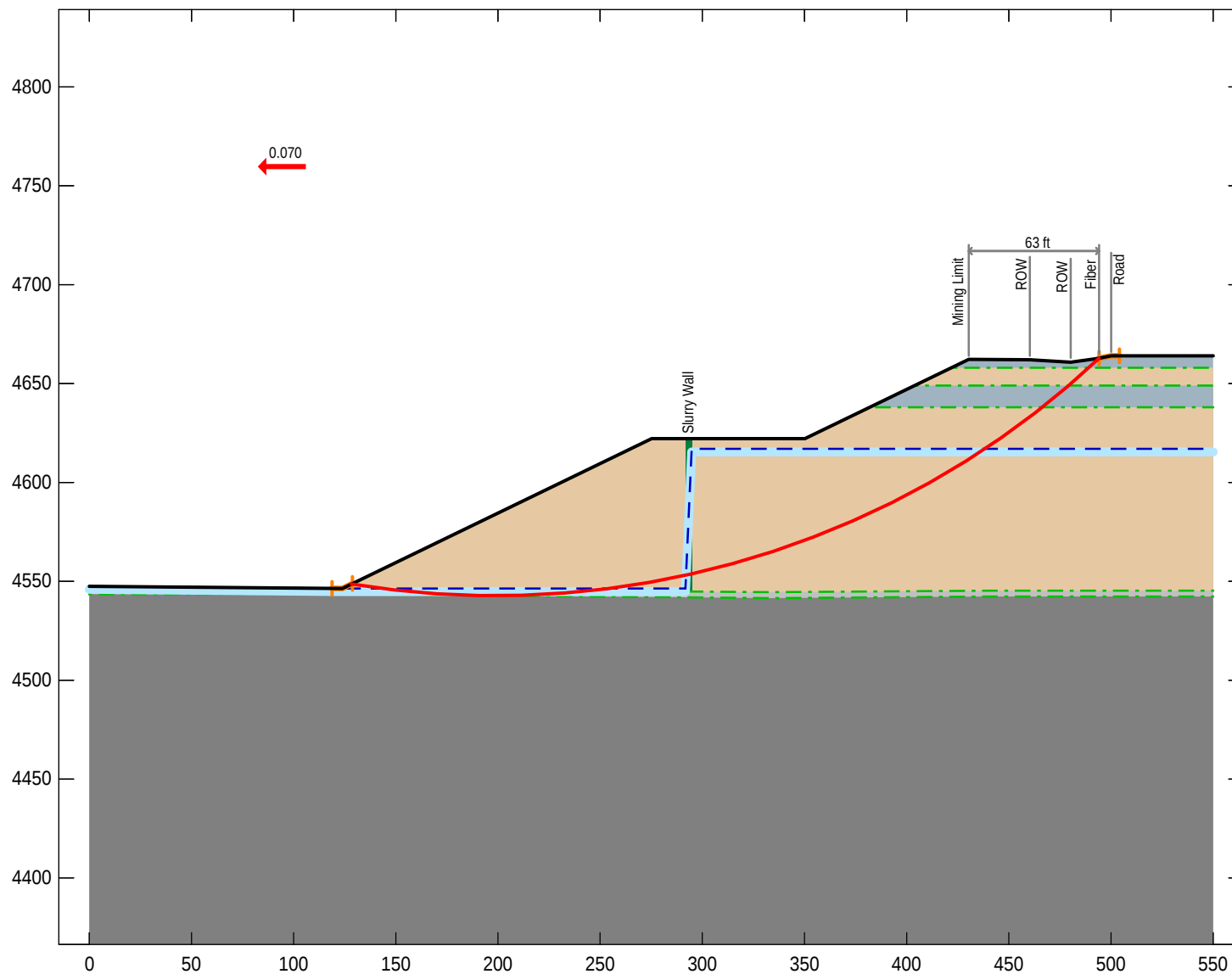
Critical Factor of Safety: 1.76

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

File: C:\Galena Models\Derr TR8 SS5.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: 1.40

GALENA Version 7.2

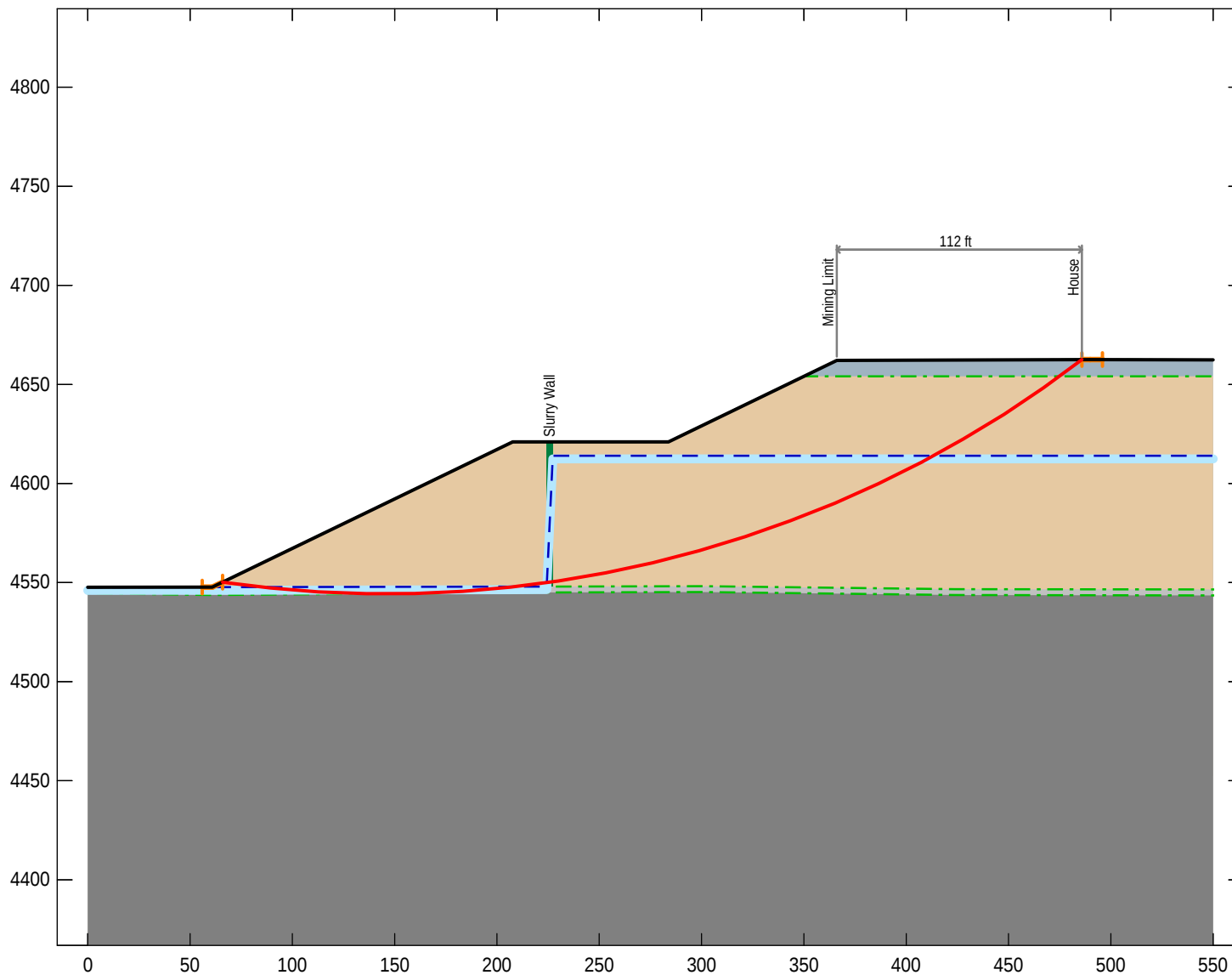
Licensed to: J & T Consulting

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





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

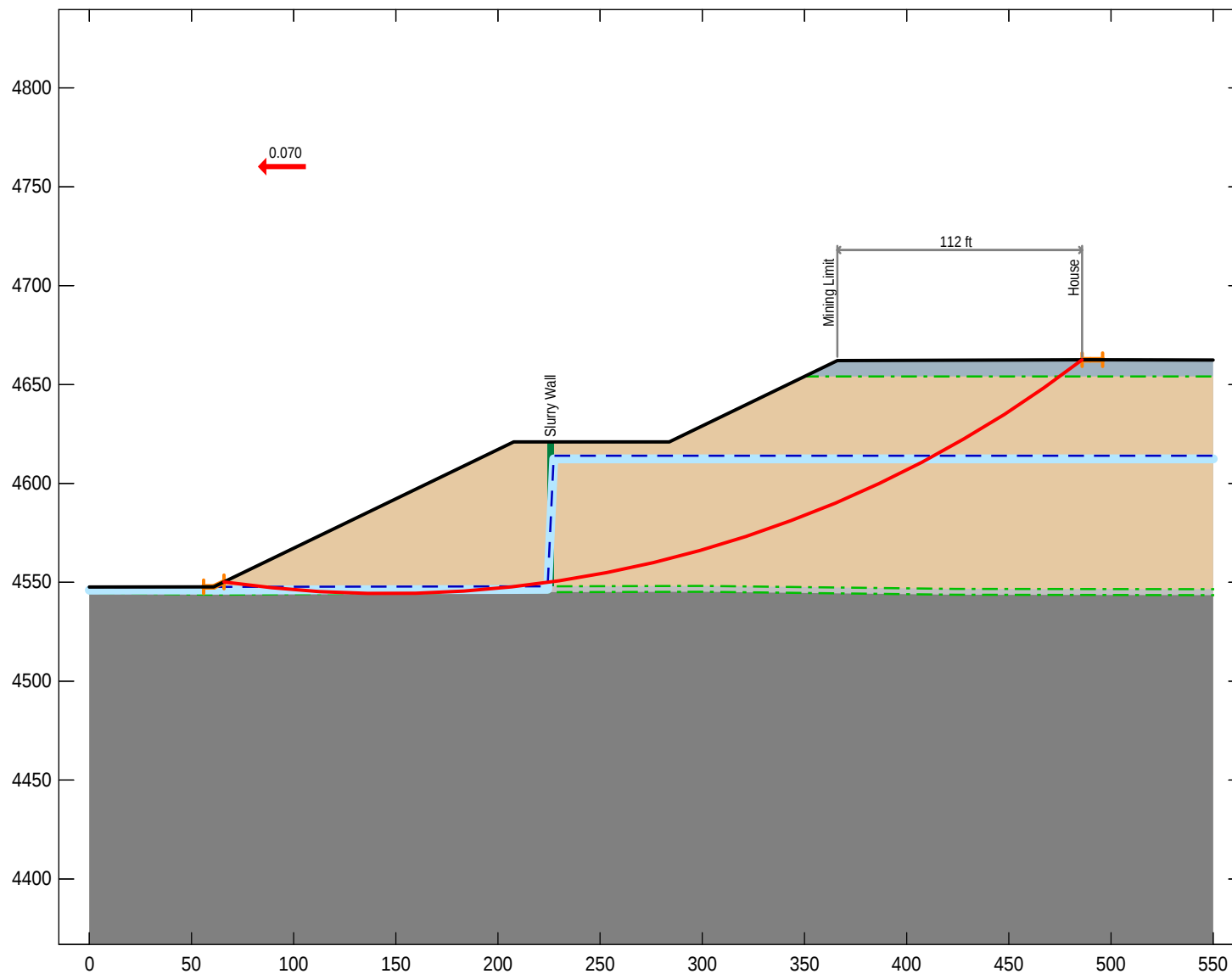
Critical Factor of Safety: 1.90

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





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: 1.47

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

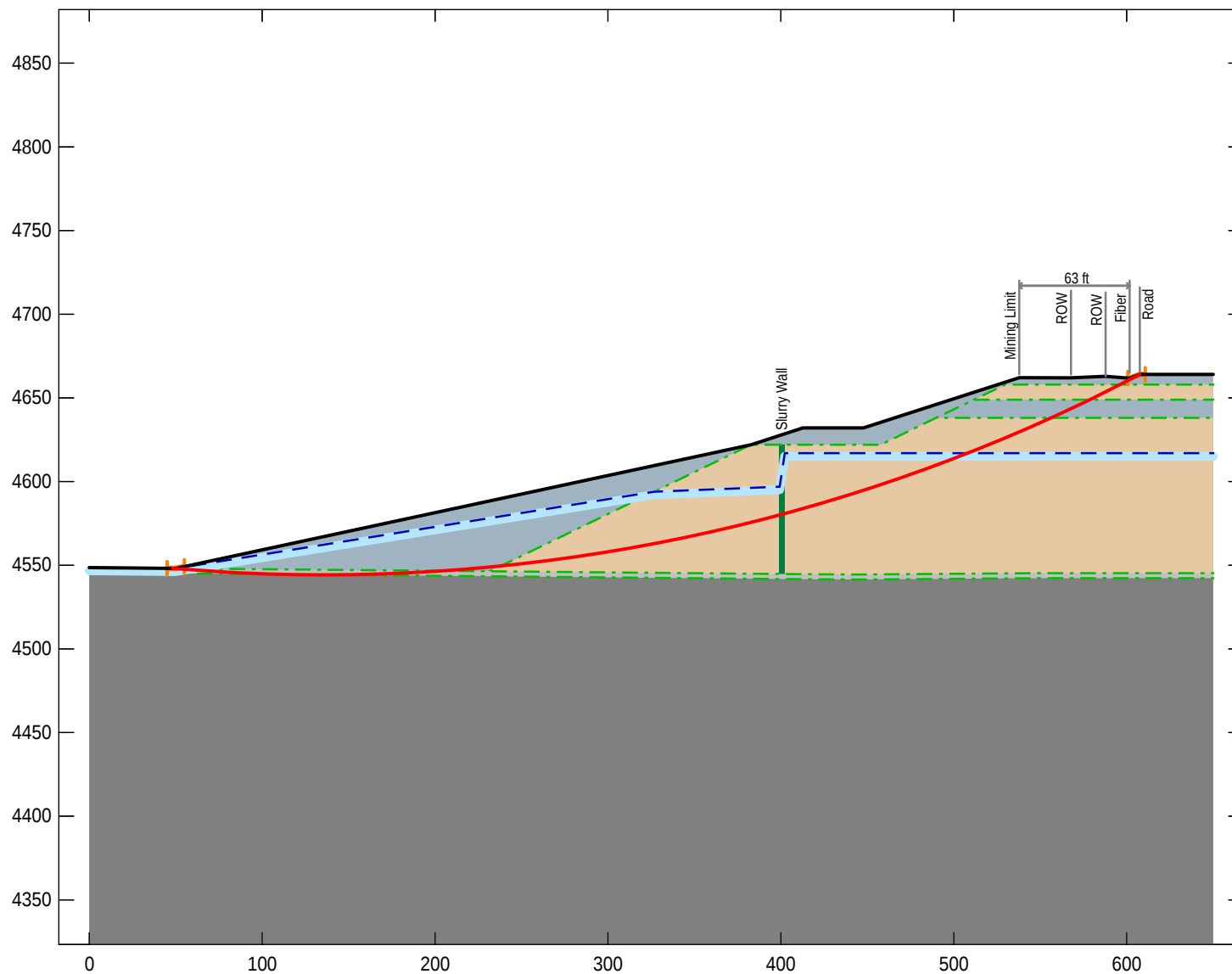
File: C:\Galena Models\Derr TR8 SS6-EQ.gmf

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	

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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

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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

```

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

```

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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

=====
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

```

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 - 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

```

-----
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

```

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

Derr TR8 SS2.gar

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

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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	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	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

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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)

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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

```

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

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	Base 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

Derr TR8 SS3-EQ.gar

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

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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	

Derr TR8 SS4.gar

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

Derr TR8 SS4.gar

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

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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)

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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-Left	X-S	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Porewater Force	Normal Stress	Test Factor
1	125.05	29.16	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	207.35	5.0	3.00	3.01	1	0.00	35.0	25990.54	12556.08	8503.60	0.97

Derr TR8 SS4-EQ.gar

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

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	

Derr TR8 SS5.gar

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

Derr TR8 SS5.gar

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
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	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

Processed: 07 Apr 2023 10:11:03

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
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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

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	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	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

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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

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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	Matl	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

Processed: 11 Apr 2023 15:01:14

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	

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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

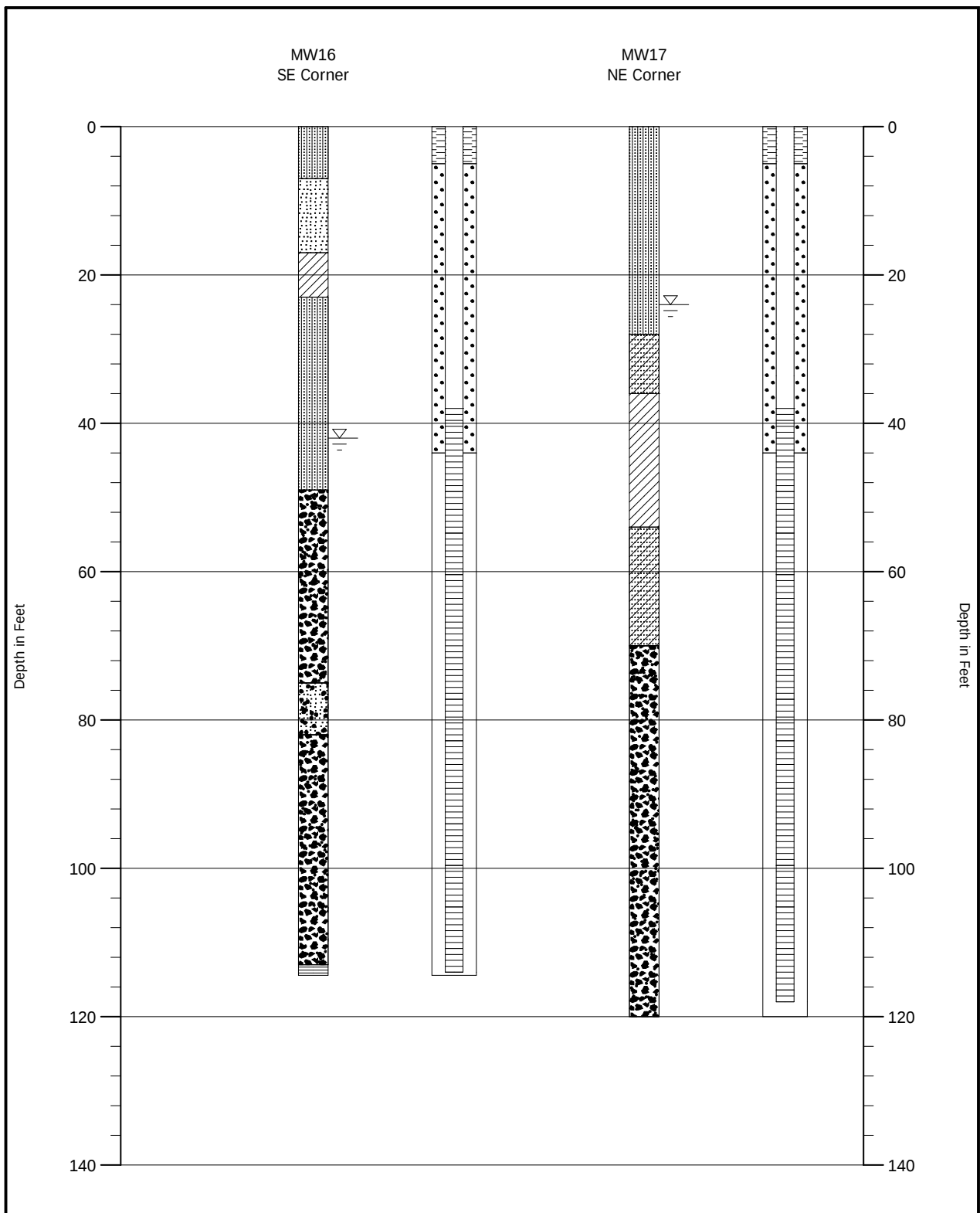


FIGURE 1
Logs of Borings

PROJECT NO:	19.3069	
PROJECT NAME:	Derr Pit Monitoring Wells	
DWG DATE:	8/12/2019	

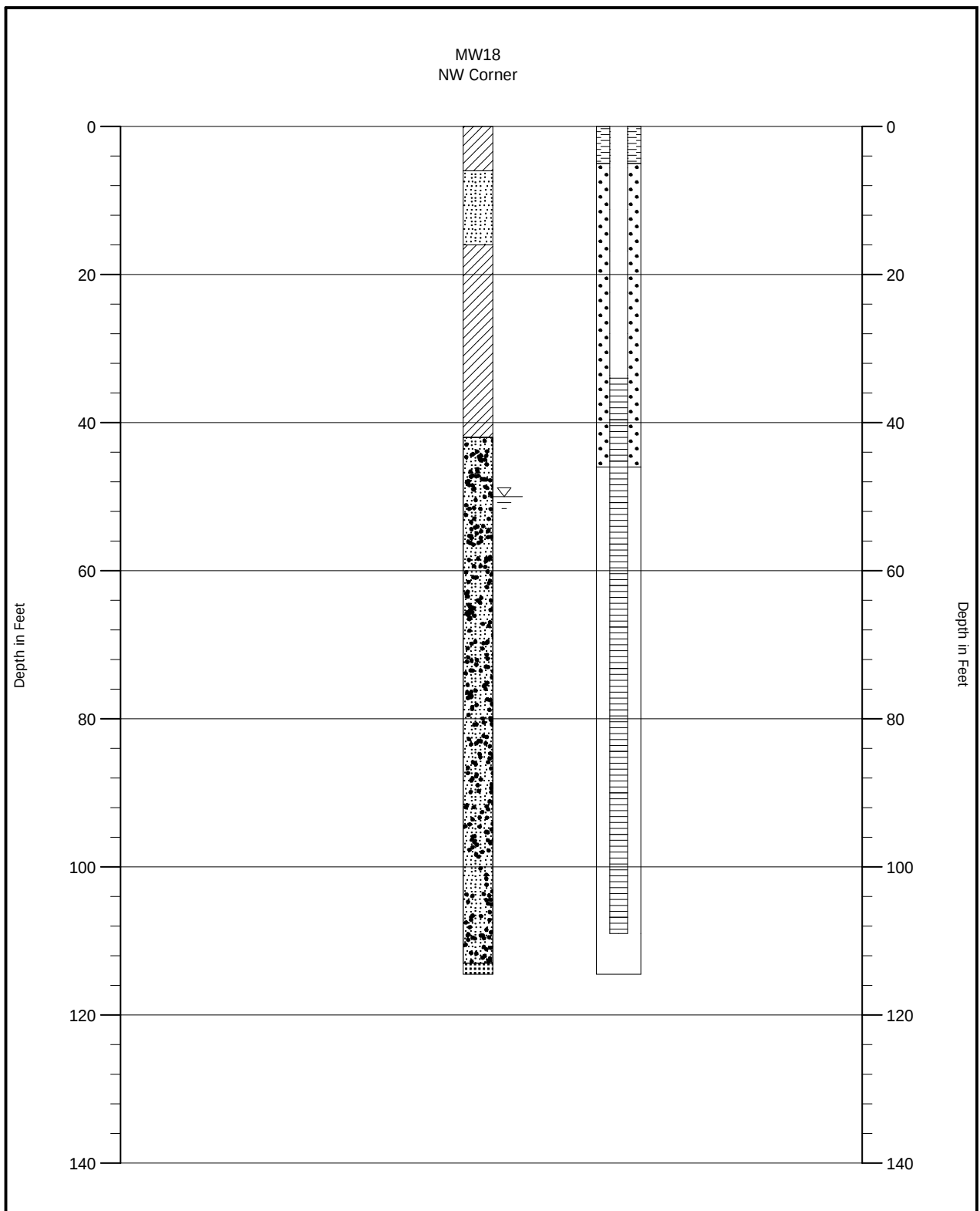


FIGURE 2
Logs of Borings

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**

TABLE OF CONTENTS

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
-------------------------	------------

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 claystone 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.

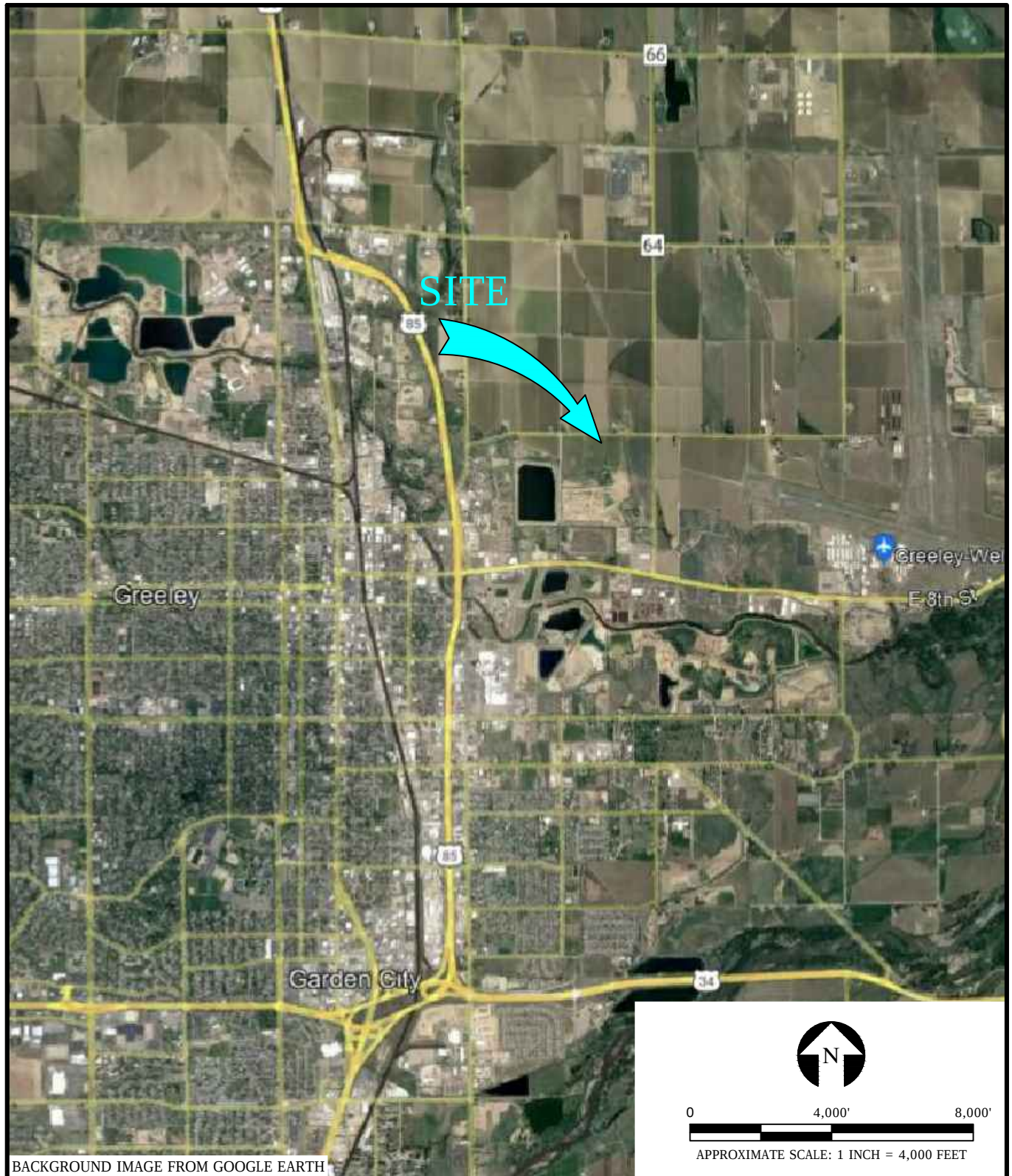


FIGURE 1
Vicinity Map

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

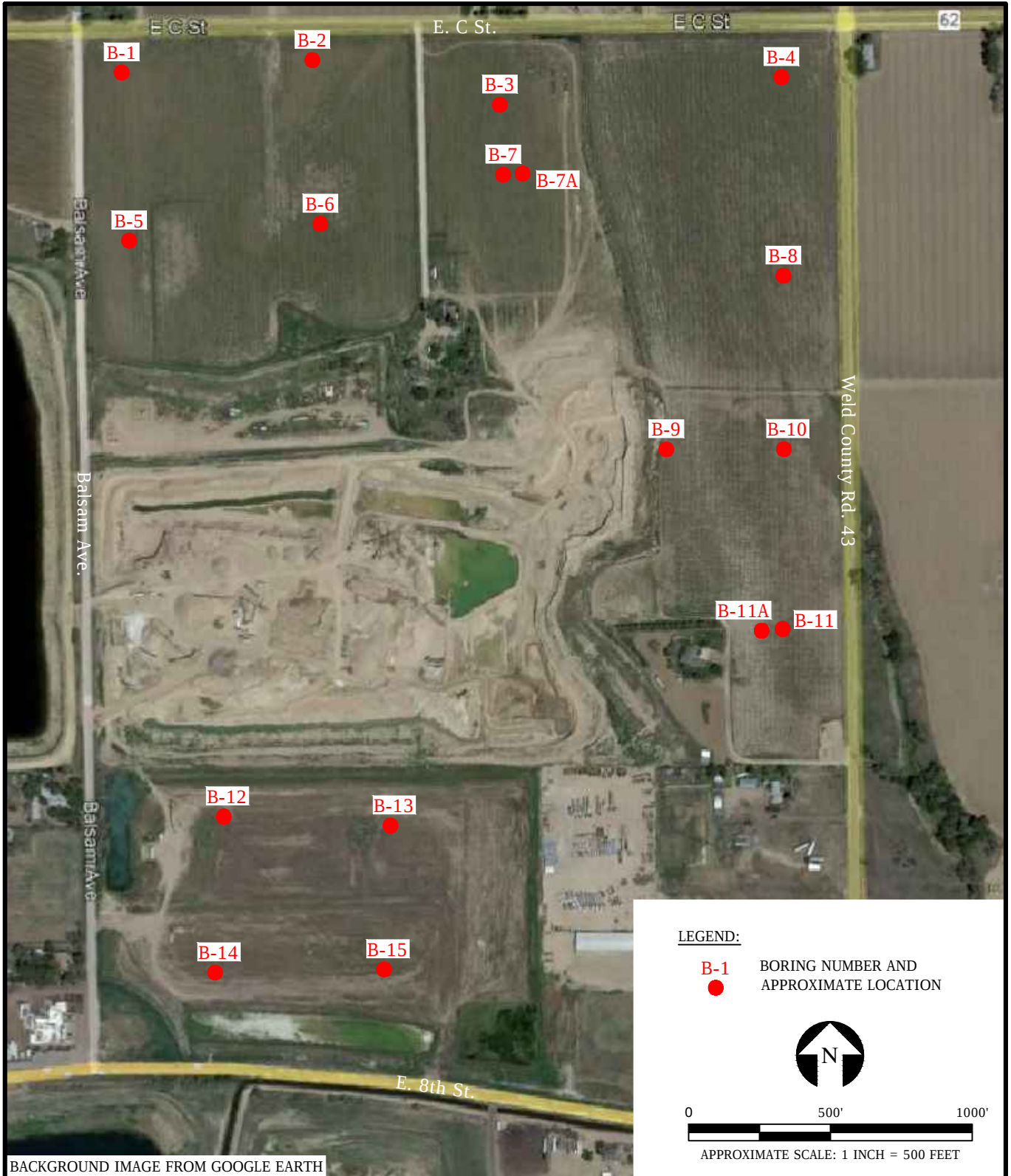


FIGURE 2
Site Plan and Boring Locations

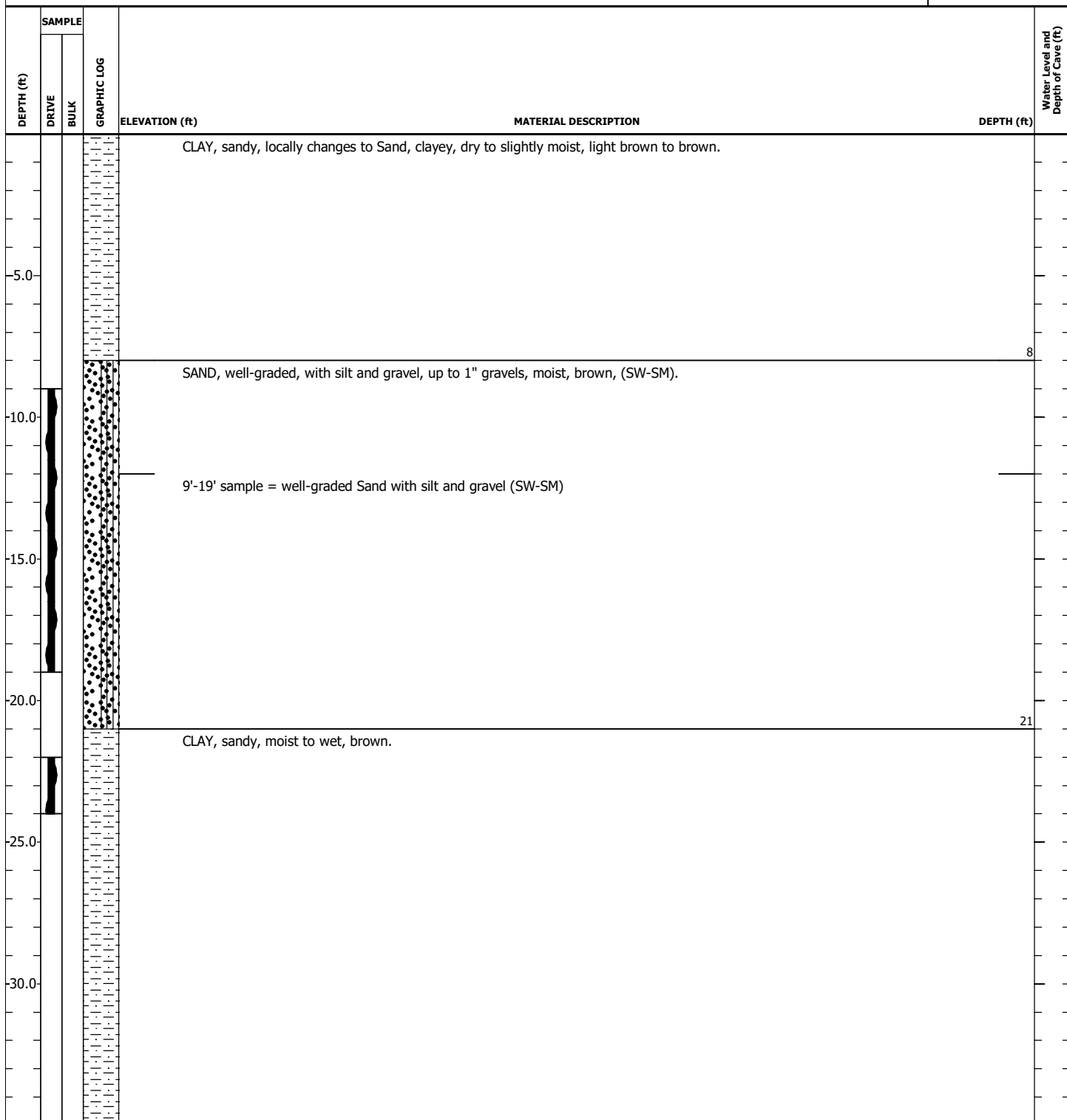
PROJECT NO:	22.3026		
PROJECT NAME:	Mill Iron Pit		
DRAWN BY:	JBE	CHECKED BY:	CAC
DWG DATE:	05.11.22	REV. DATE:	--



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

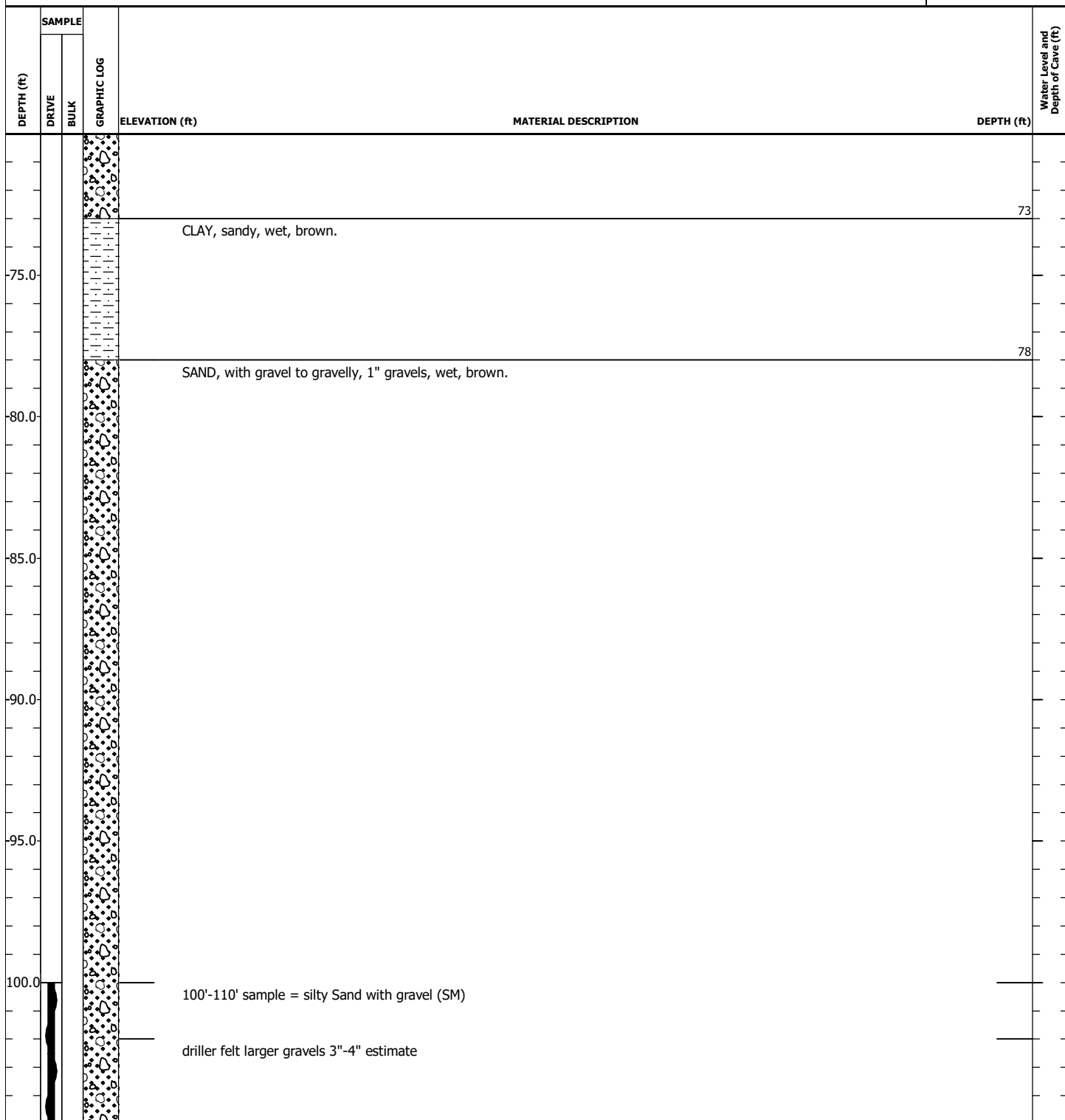
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-1
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				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							
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
-  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-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		



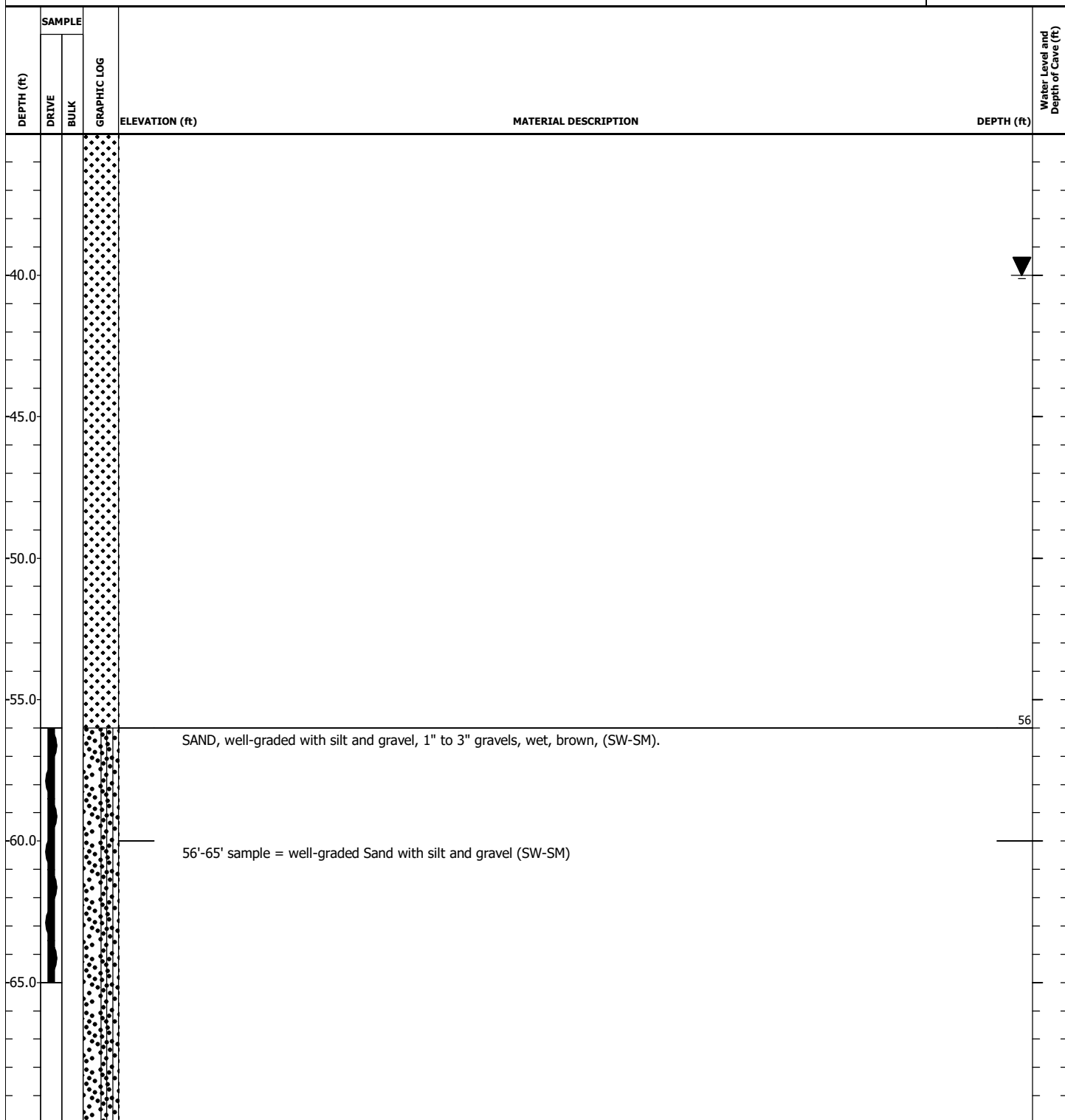
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-2
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 1 of 3

DEPTH (ft)	SAMPLE		GRAPHIC LOG	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

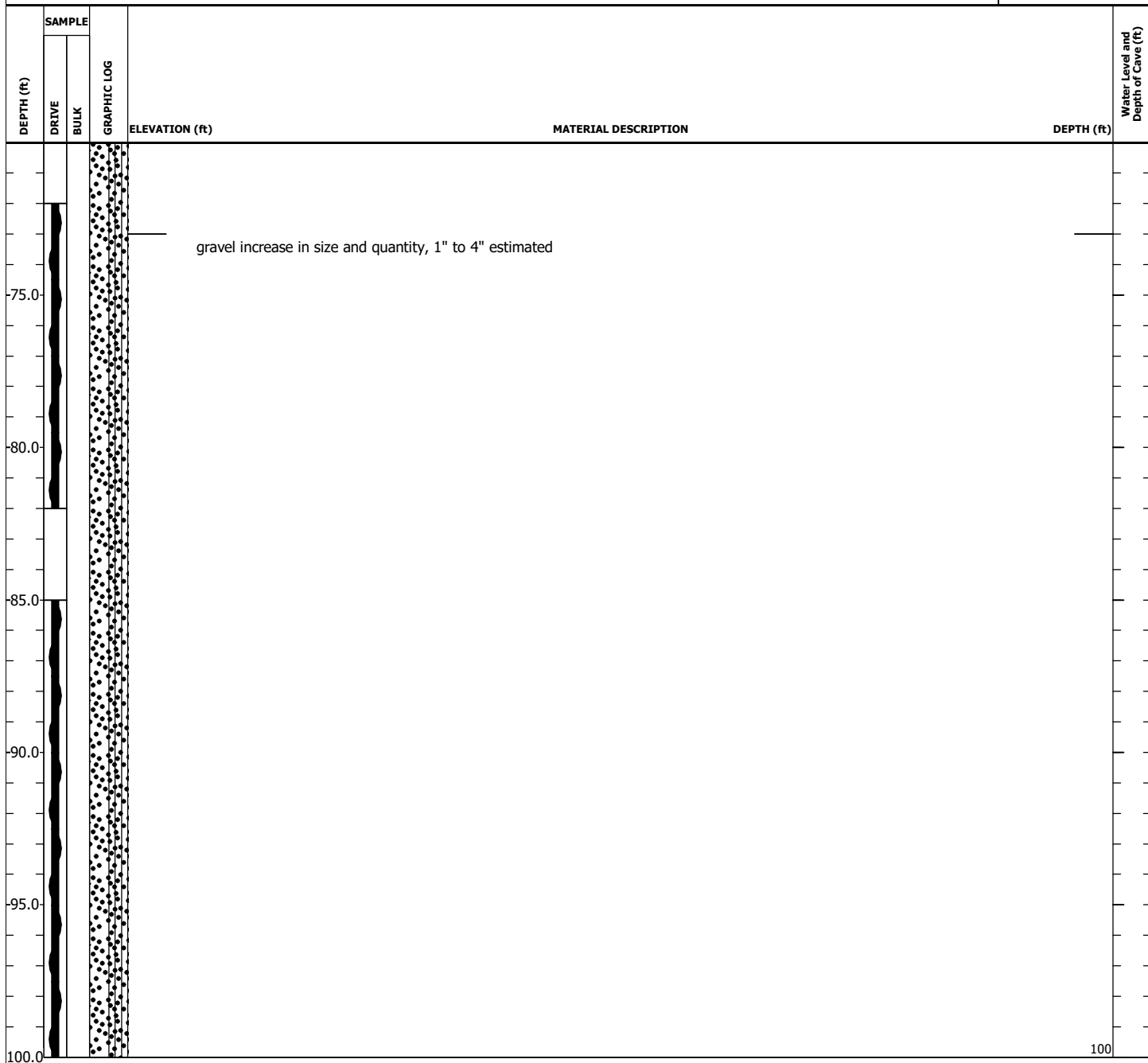
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-2
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				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).		
-15.0						
					19	
				CLAY, sandy, moist, brown.	20	
-20.0						
				SAND, with gravel, 1"-2" gravels, moist, brown.		
					24	
-25.0						
				CLAY, sandy, with gravels up to 1", moist, brown.		
-30.0						
					32	
				SAND, well-graded with silt and gravel, 1"-2" gravels, moist, brown, (SW-SM).		
					35	

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
  AUGER CUTTINGS
-  # WATER LEVEL # DAYS AFTER DRILLING
-  # DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL

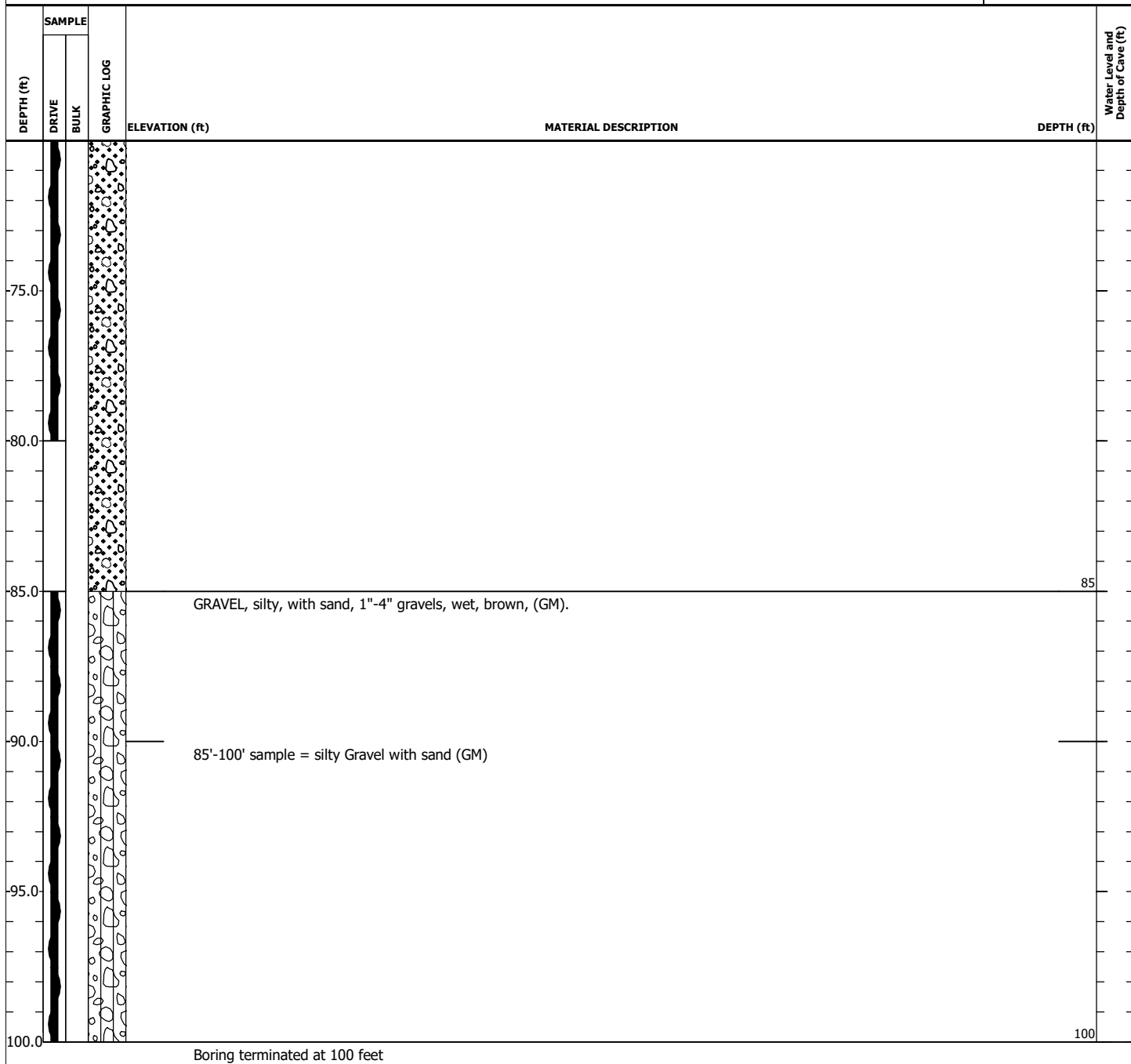
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-3
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				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



LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

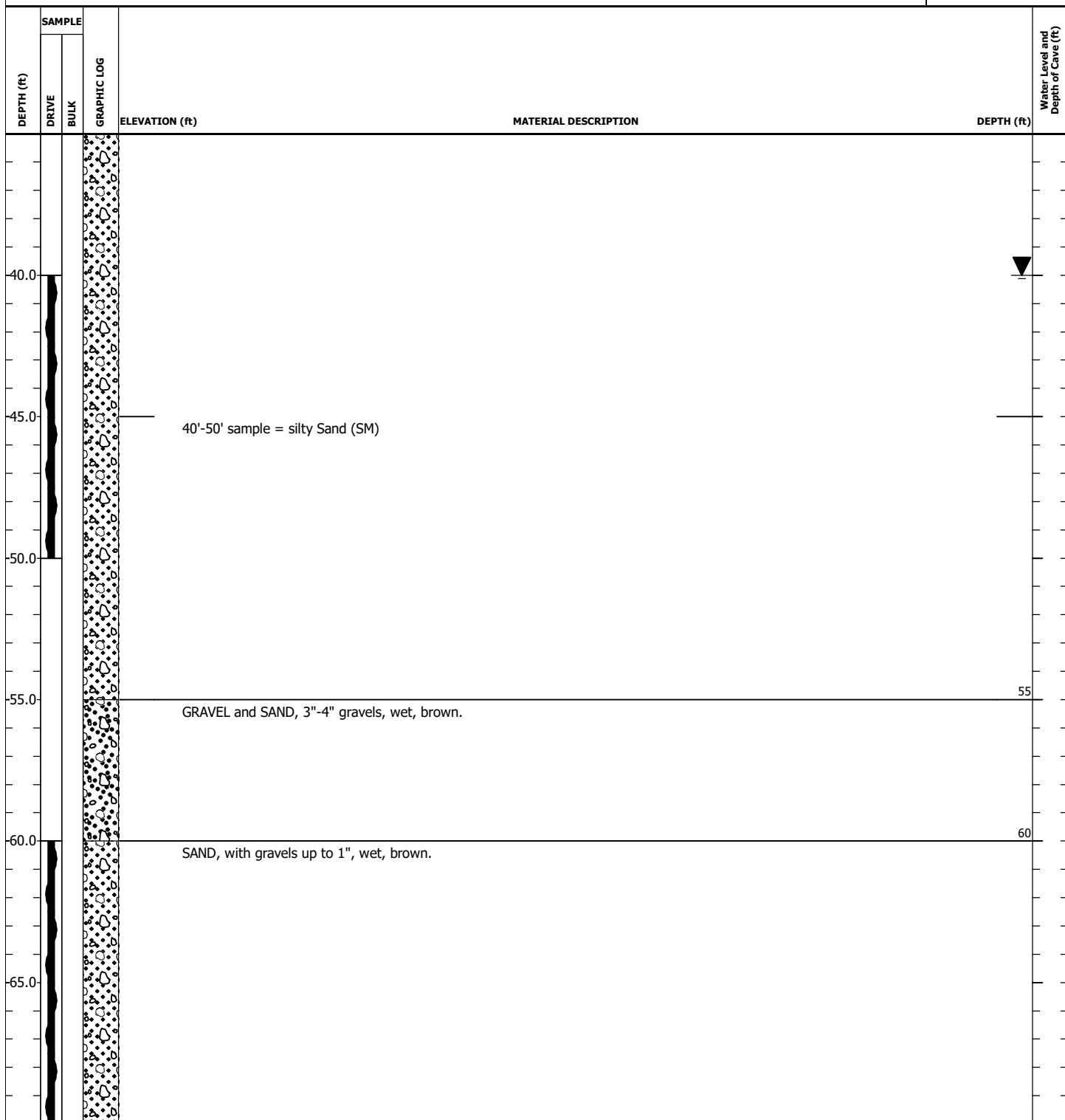
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-4
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				Page 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.		
					3	
				SAND, well-graded, with gravel and silt, gravels up to 1", moist, brown, (SW-SM).		
-5.0						
				4'-19' sample = well-graded Sand with silt and gravel (SW-SM)		
-10.0						
-15.0						
-20.0						
-25.0						
-30.0						
				CLAY, sandy, moist, brown.	31	
				SAND, gravelly, gravels up to 1", moist to wet, brown.	34	

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 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

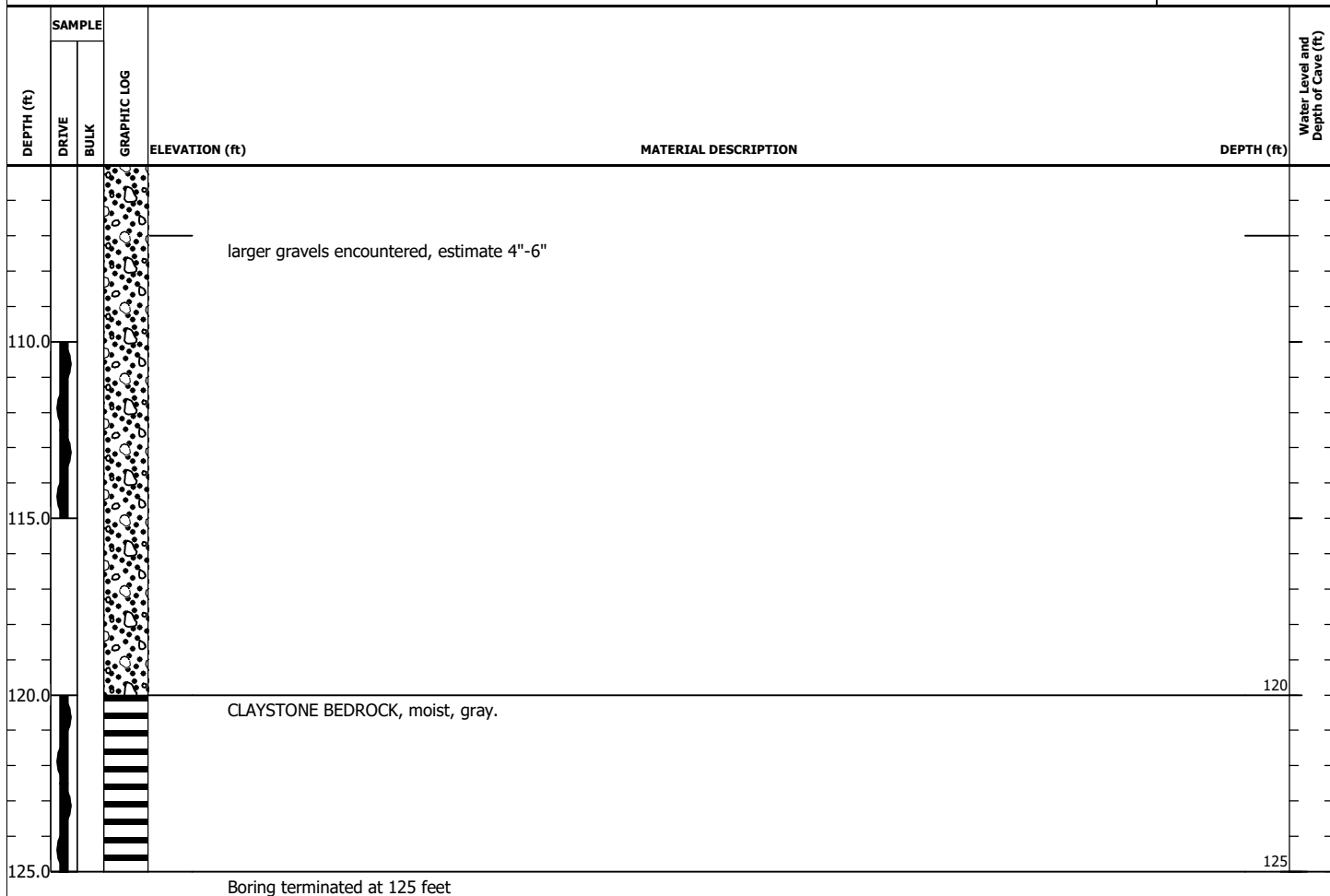
▼ WATER LEVEL AT TIME OF DRILLING  AUGER CUTTINGS

▽# WATER LEVEL # DAYS AFTER DRILLING

→# DEPTH OF CAVE # DAYS AFTER DRILLING

↑ DEPTH OF REFUSAL

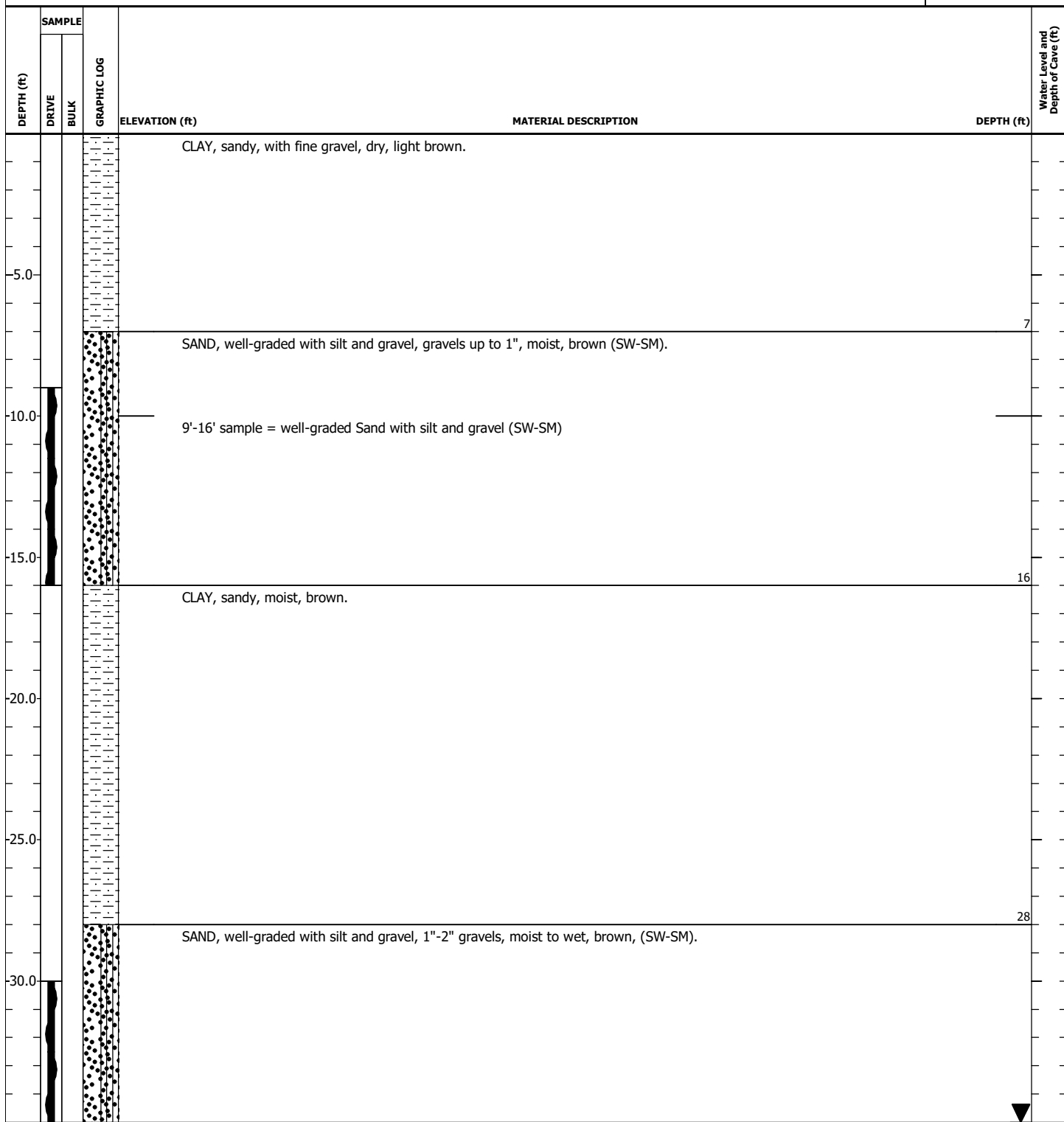
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-4
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				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

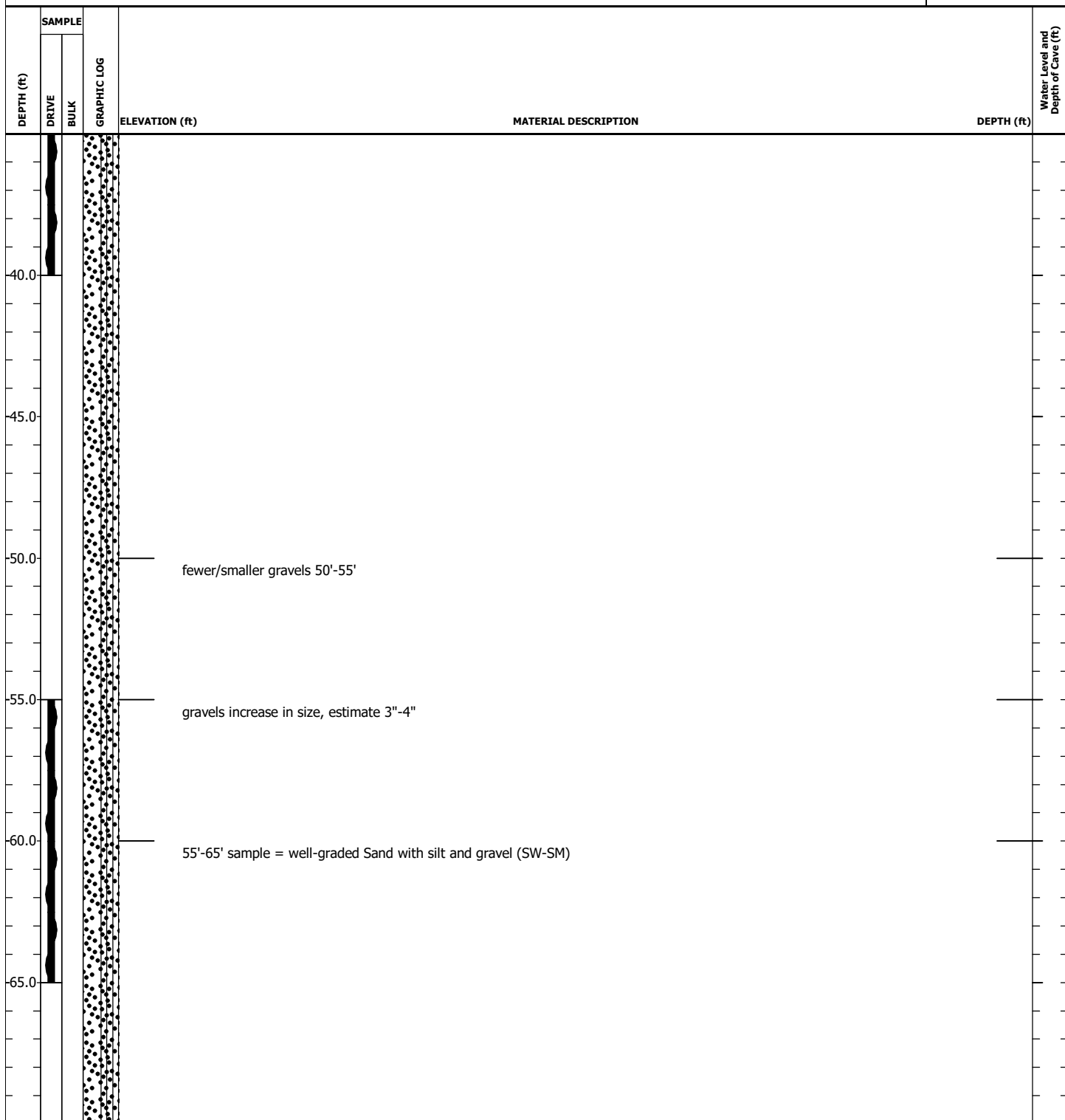
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-5
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				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

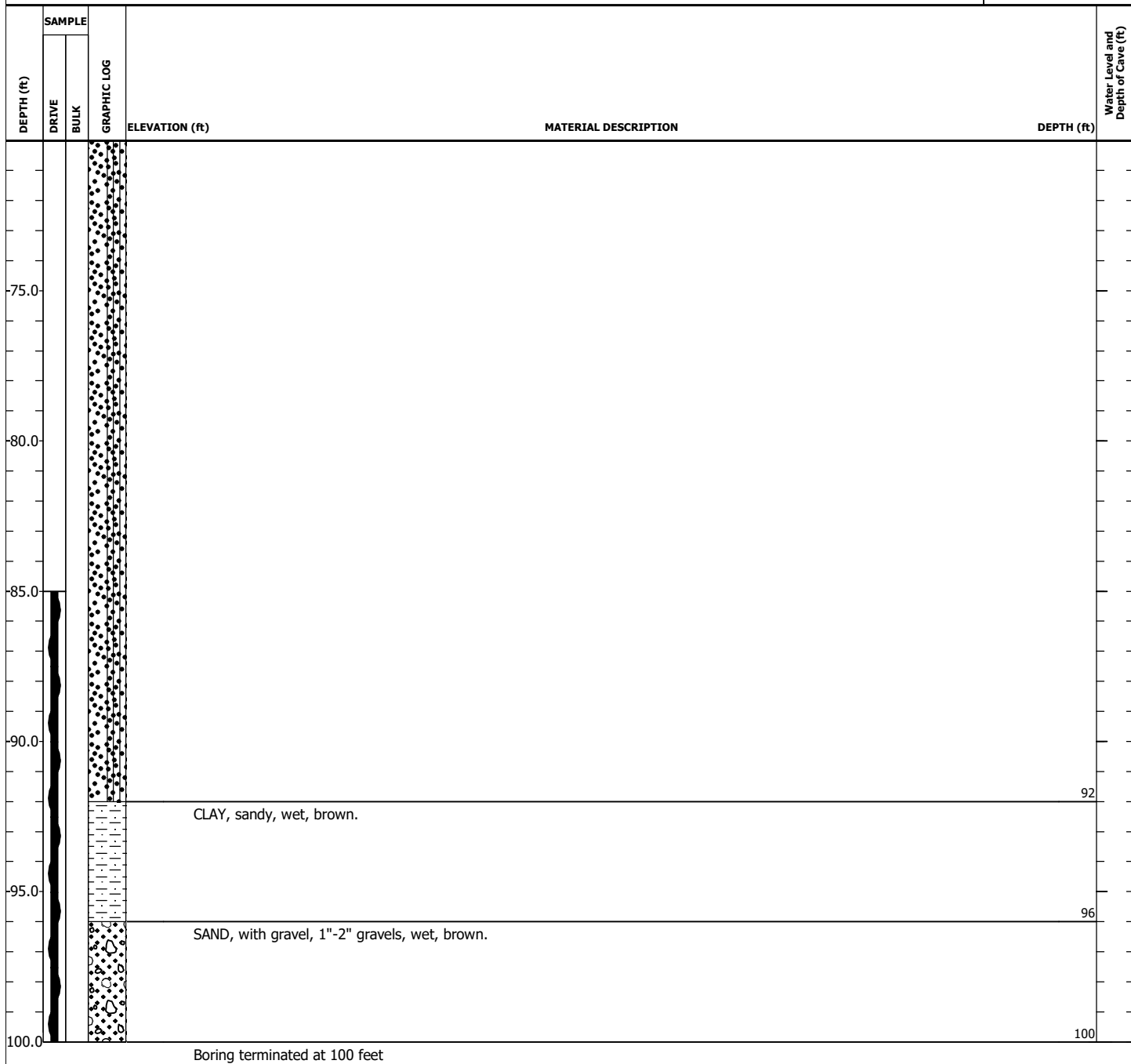
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-5
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				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
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

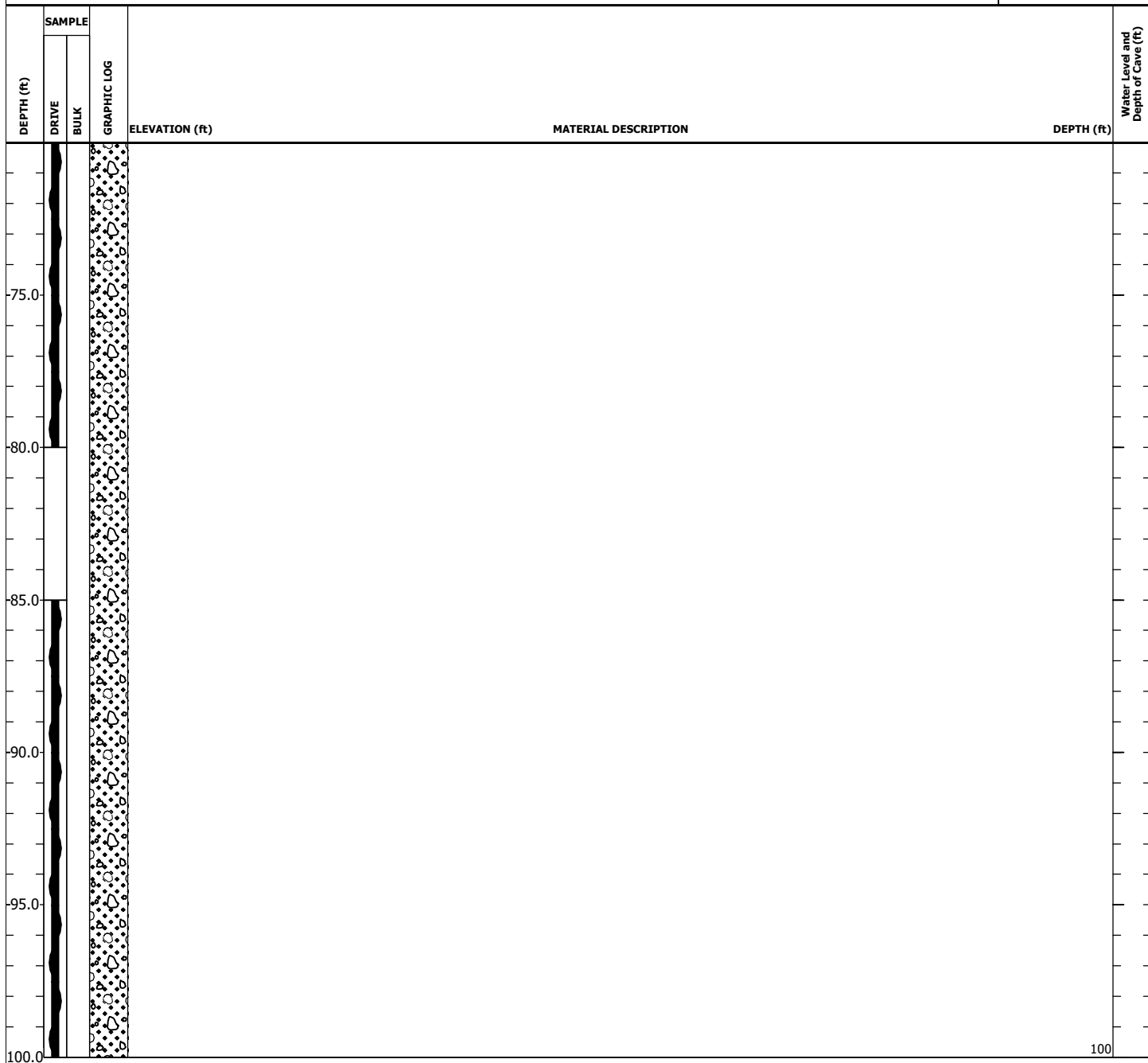
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-6
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				Page 2 of 3

DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
40.0				SAND, with gravel, 1"-4" gravels, moist to wet, brown.	39	▼
45.0						
50.0				SAND, well-graded with silt and gravel, 1"-4" gravels, moist, brown, (SW-SM).	50	
55.0				50'-60' sample = well-graded Sand with silt and gravel (SW-SM)		
60.0				SAND, with gravel, 1"-4" gravels, moist to wet, brown.	60	
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

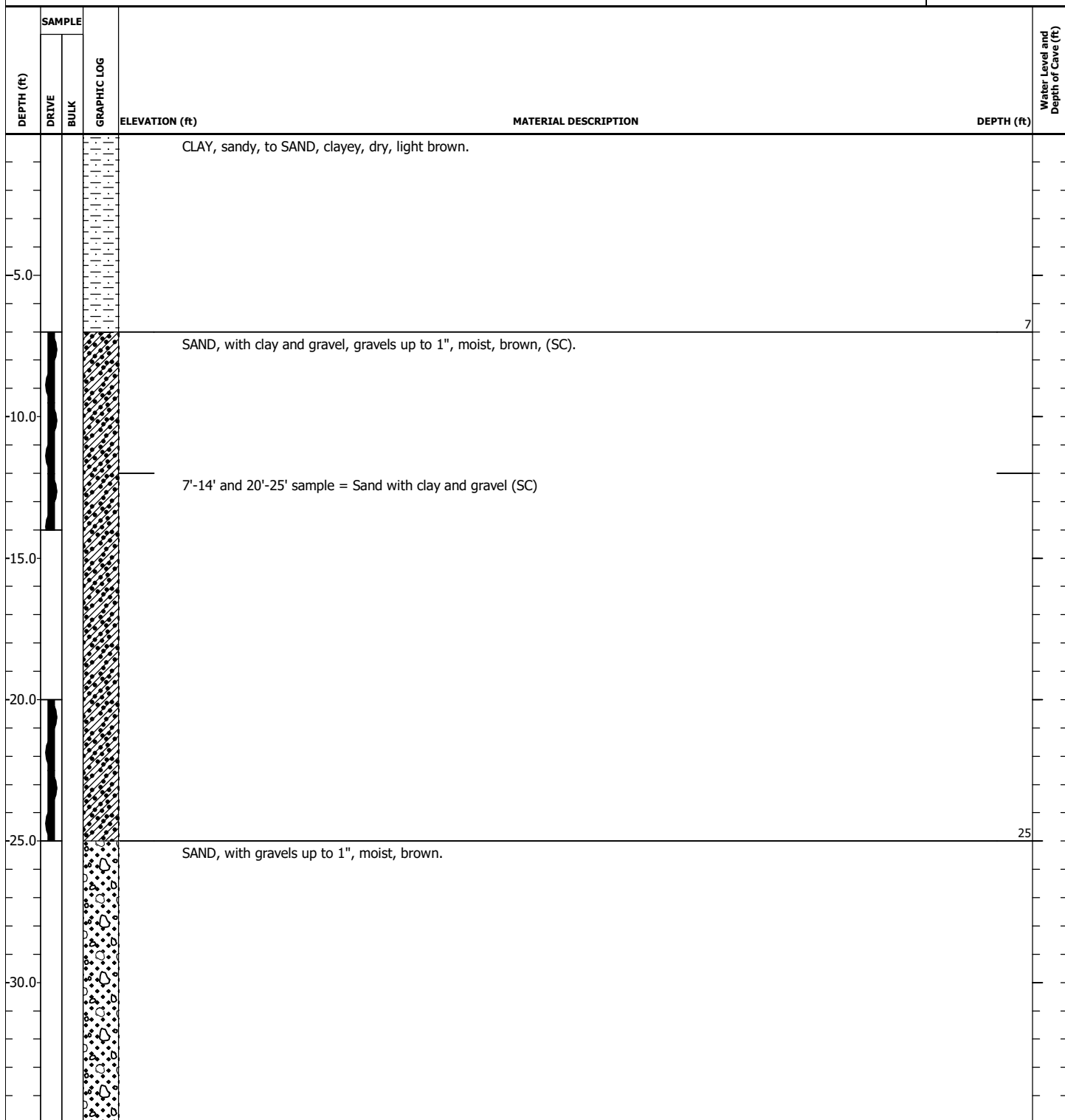
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-6
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/28/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/28/2022	
				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

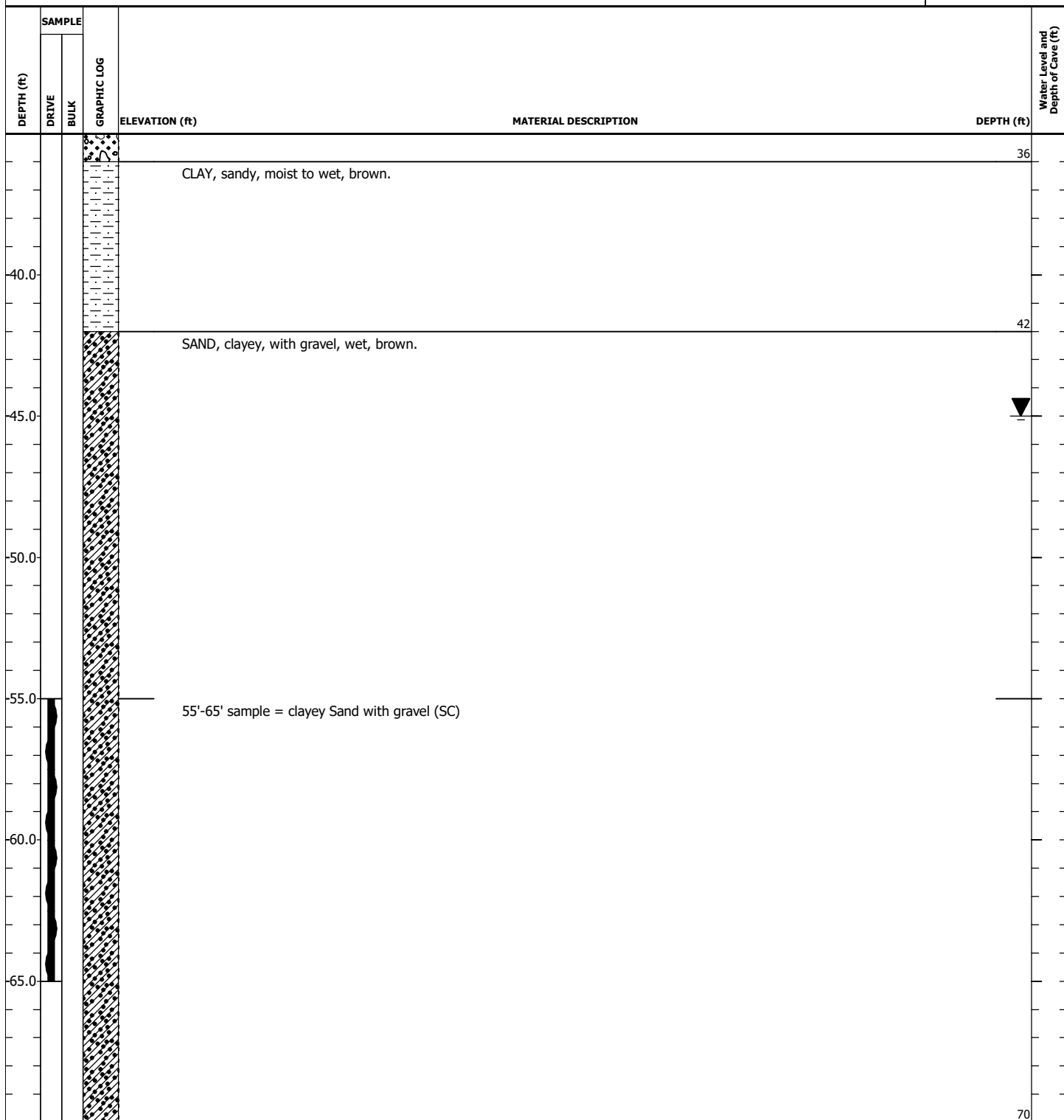
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				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

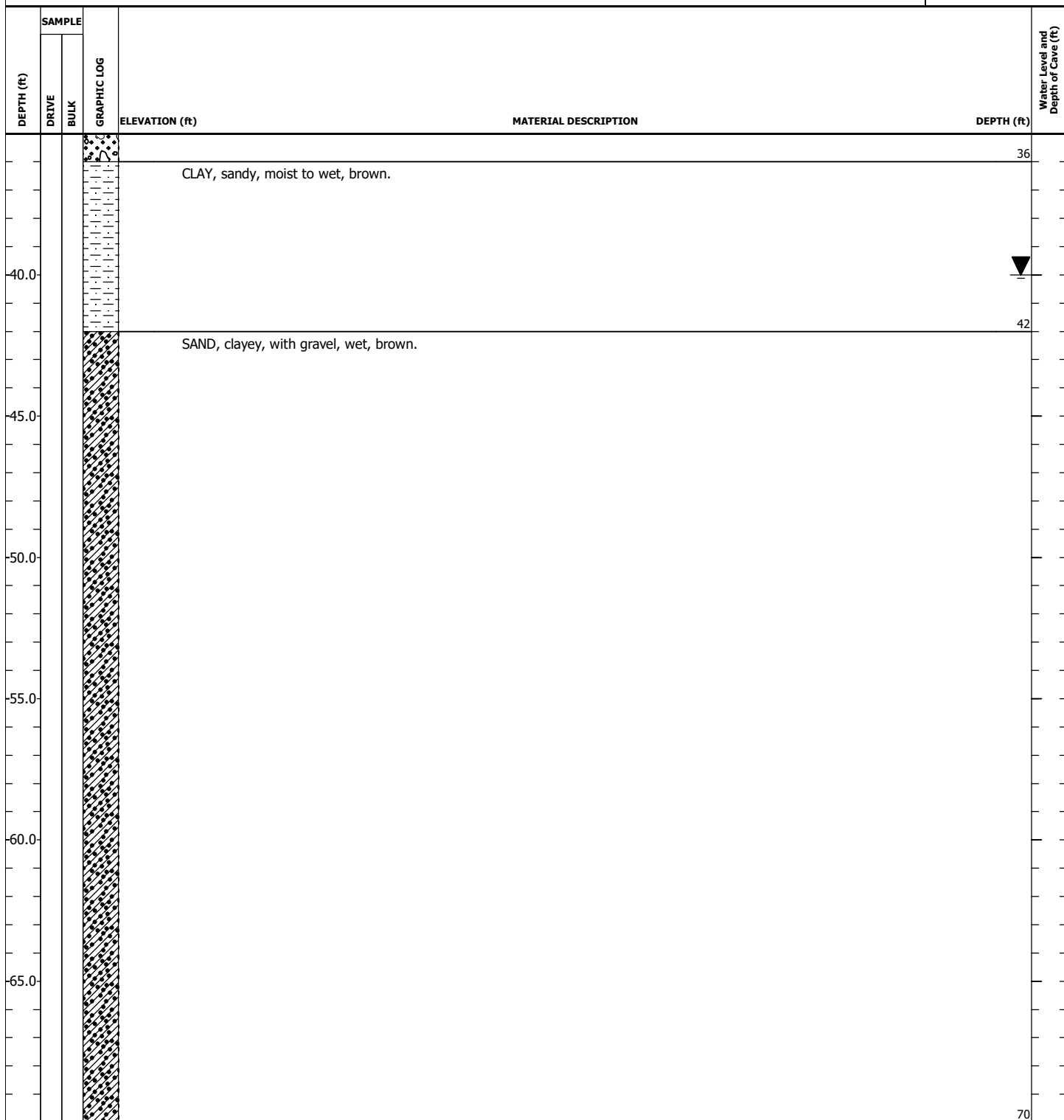
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7A
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				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
-  # 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 2 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

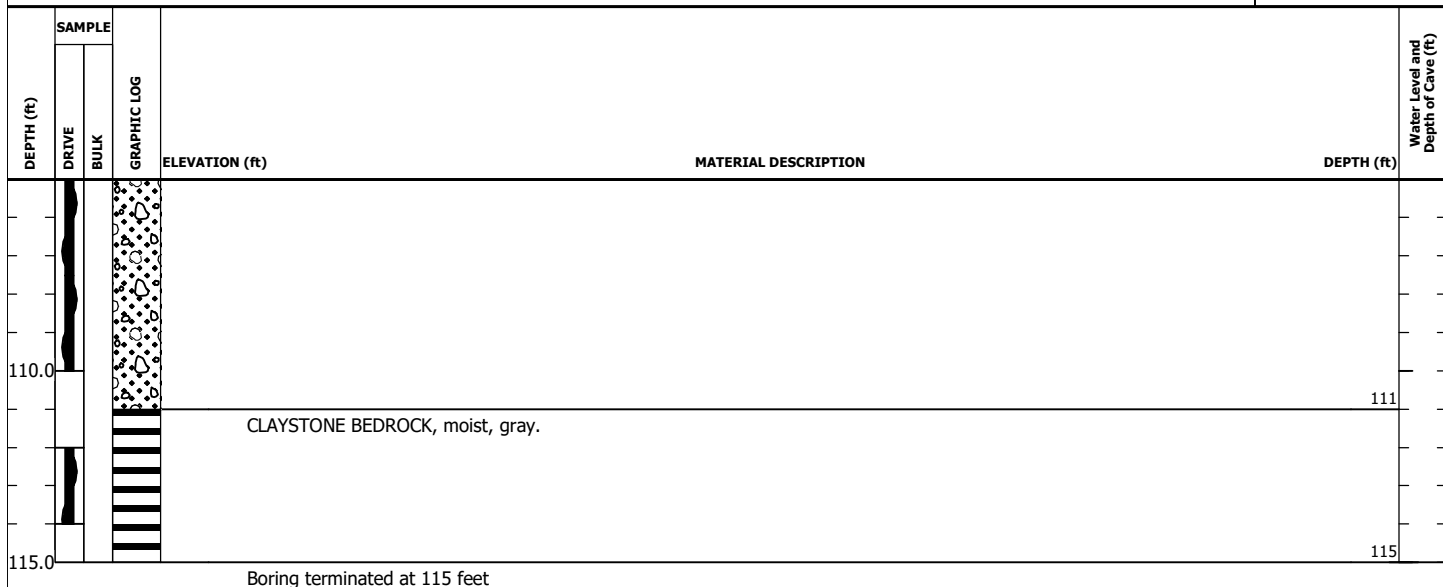
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-7A
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	4" in. Diameter SSA	DATE STARTED	4/27/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/27/2022	
				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

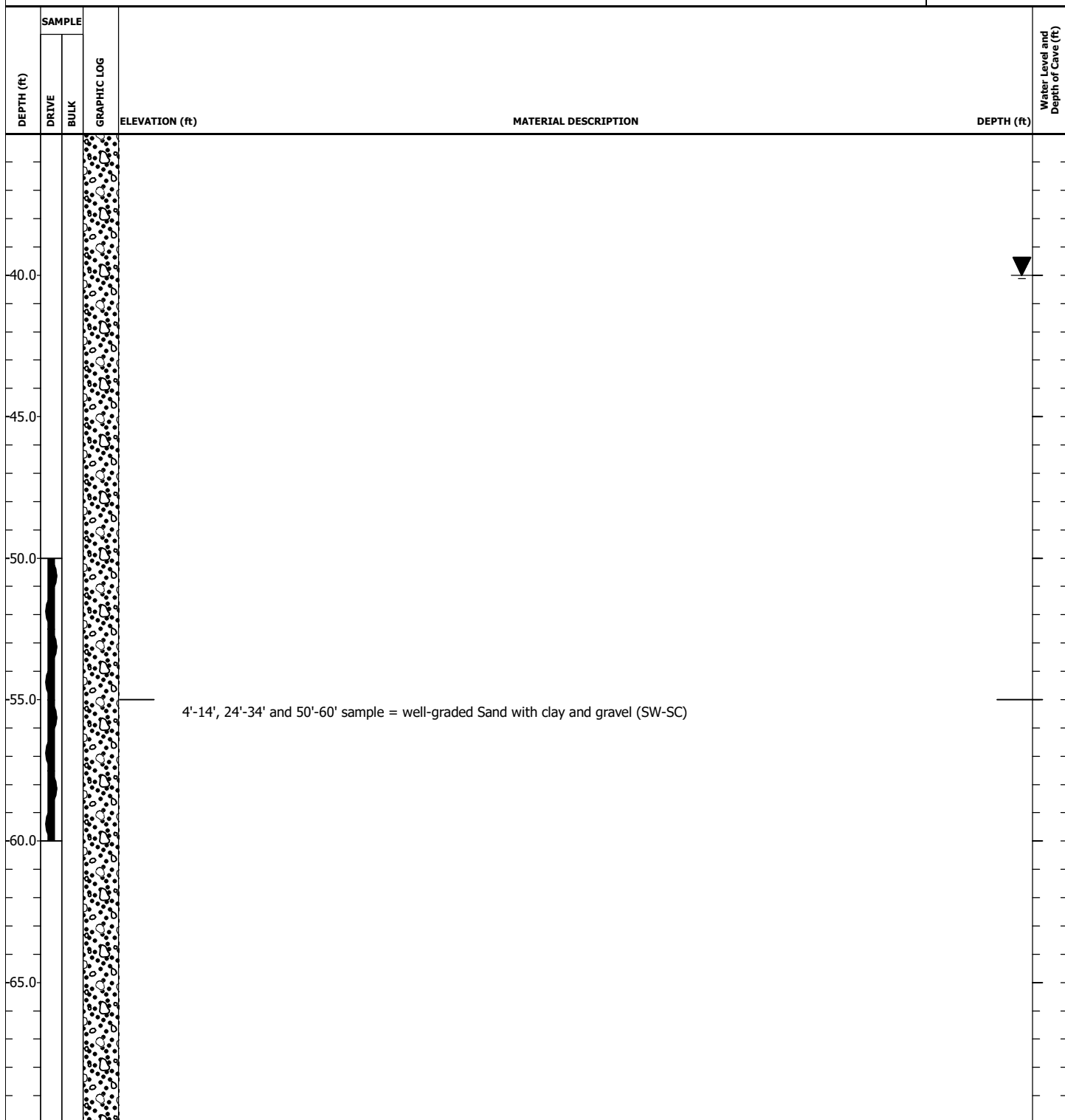
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-8
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				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

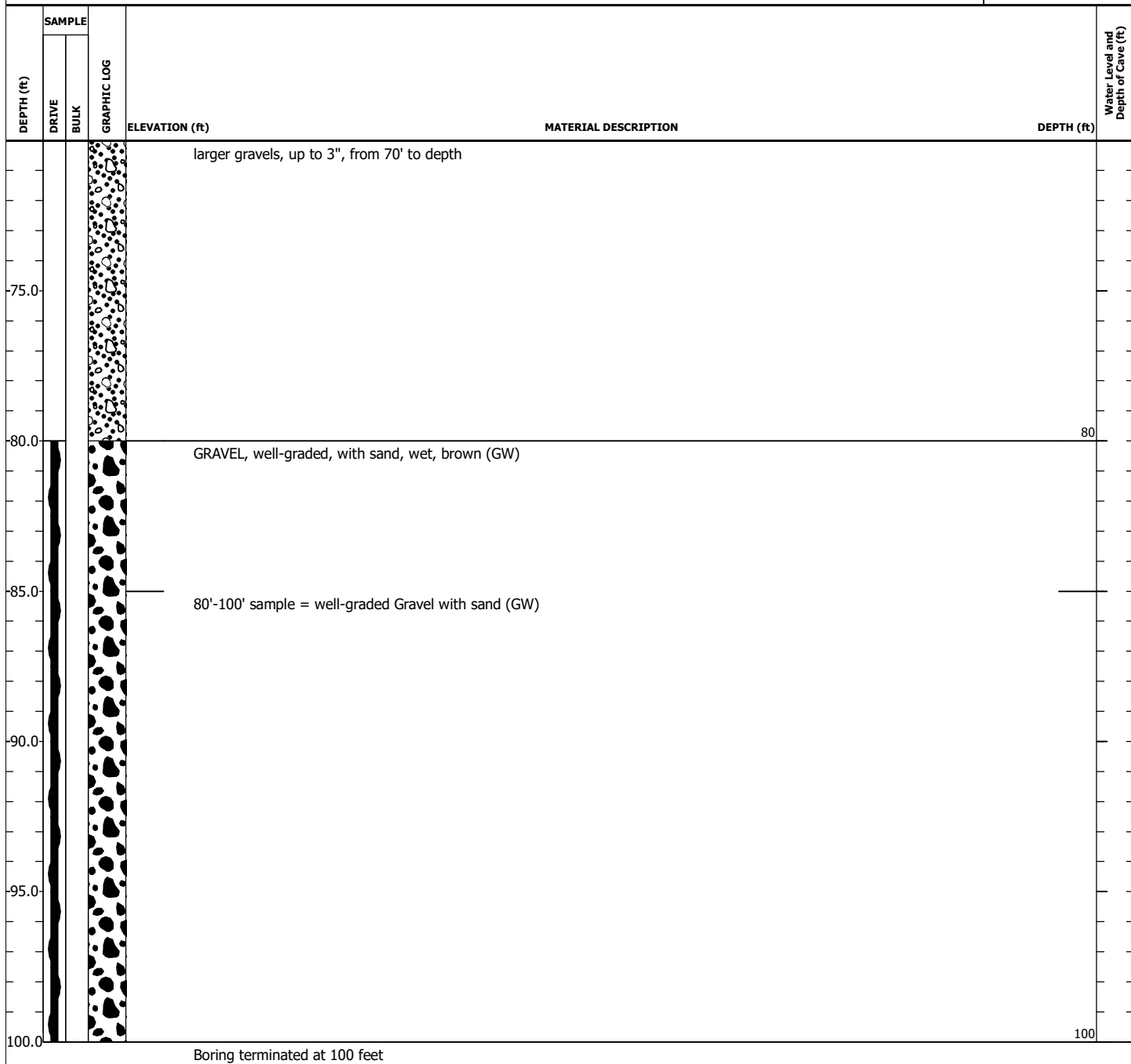
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-8
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				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

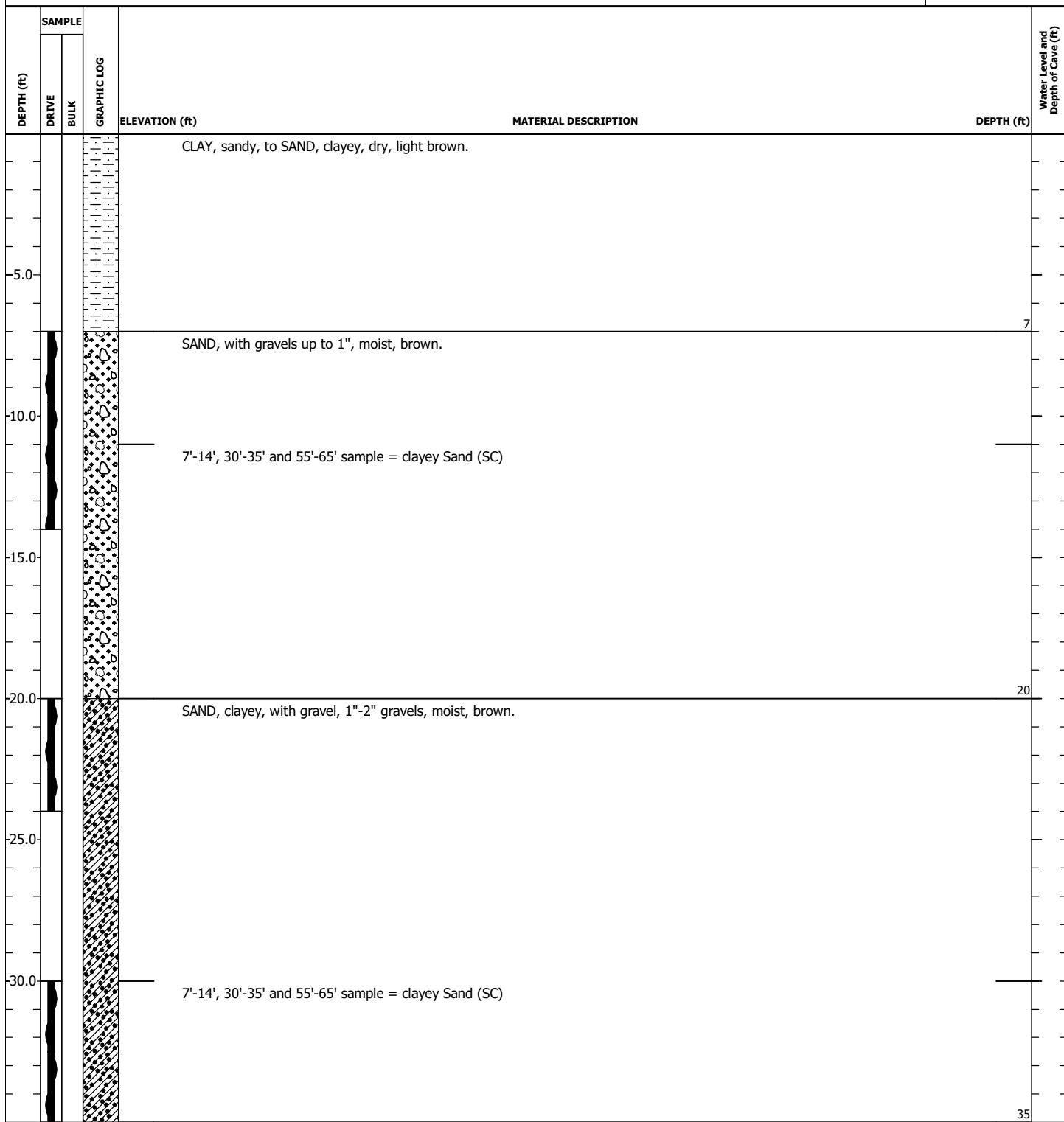
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-8
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				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
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

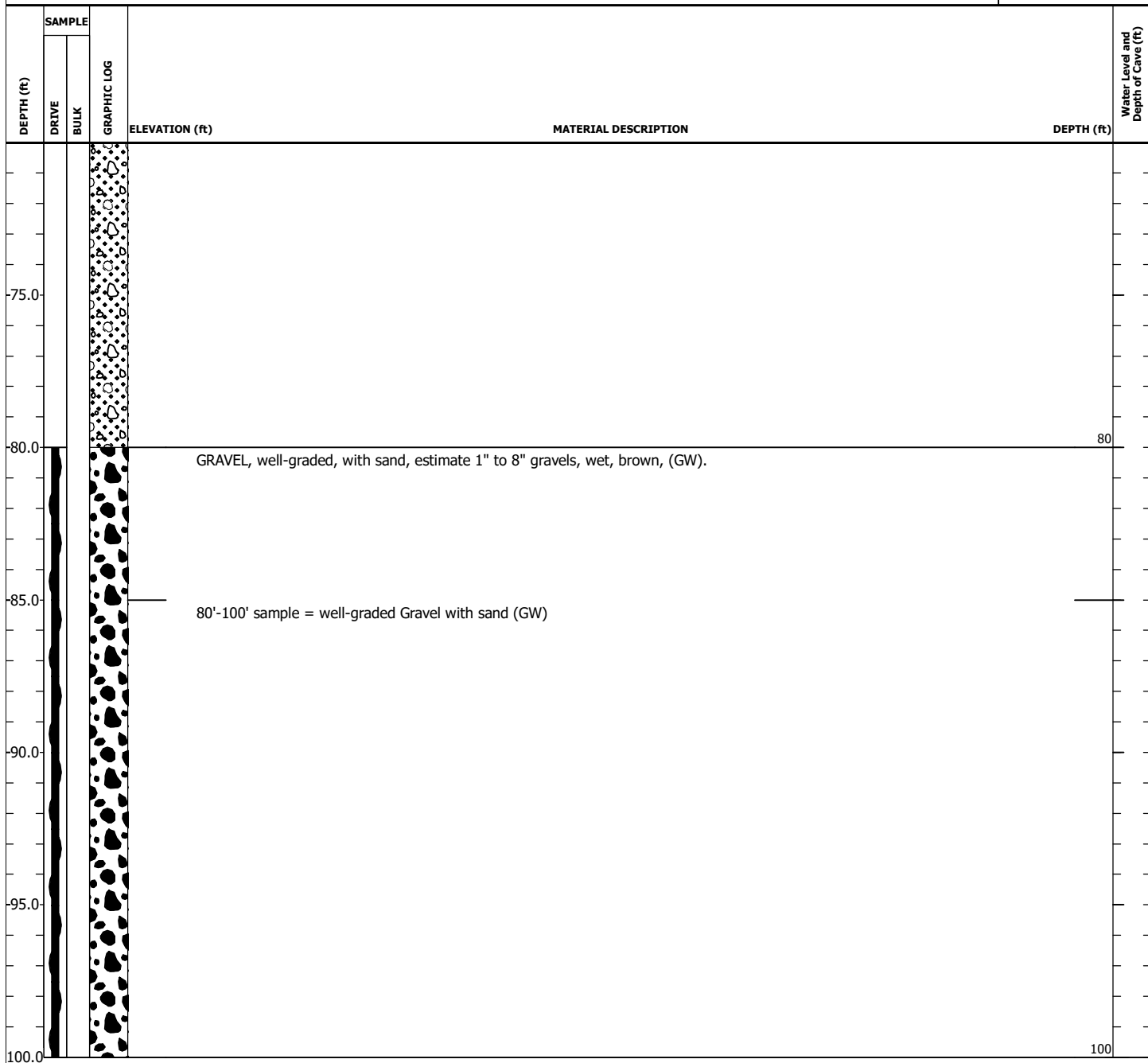
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-9
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 2 of 3

DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, moist, brown.		
				SAND, clayey, with gravel, 1"-2" gravels, moist to wet, brown.	37	
40.0						▼
				SAND, with gravel to gravelly, 1"-3" gravels, wet, brown.	43	
45.0						
50.0						
55.0				7'-14', 30'-35' and 55'-65' sample = clayey Sand (SC)		
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 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

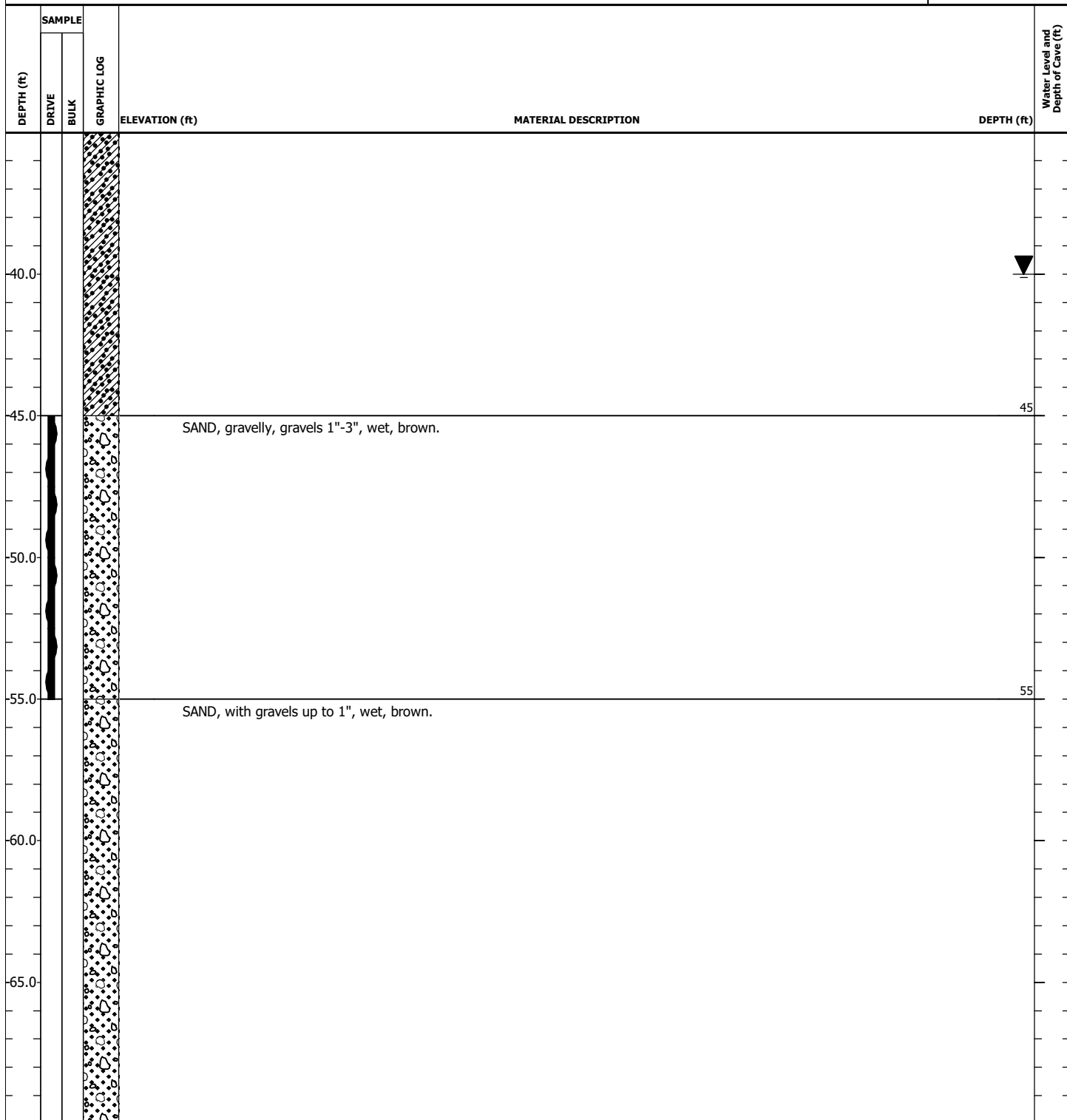
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-10
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 1 of 3

DEPTH (ft)	DRIVE	BULK	GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
					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						30	
					SAND, clayey, with gravels up to 1", moist to wet, brown.		

LEGEND

-  WATER LEVEL AT TIME OF DRILLING
-  WATER LEVEL # DAYS AFTER DRILLING
-  DEPTH OF CAVE # DAYS AFTER DRILLING
-  DEPTH OF REFUSAL
-  AUGER CUTTINGS

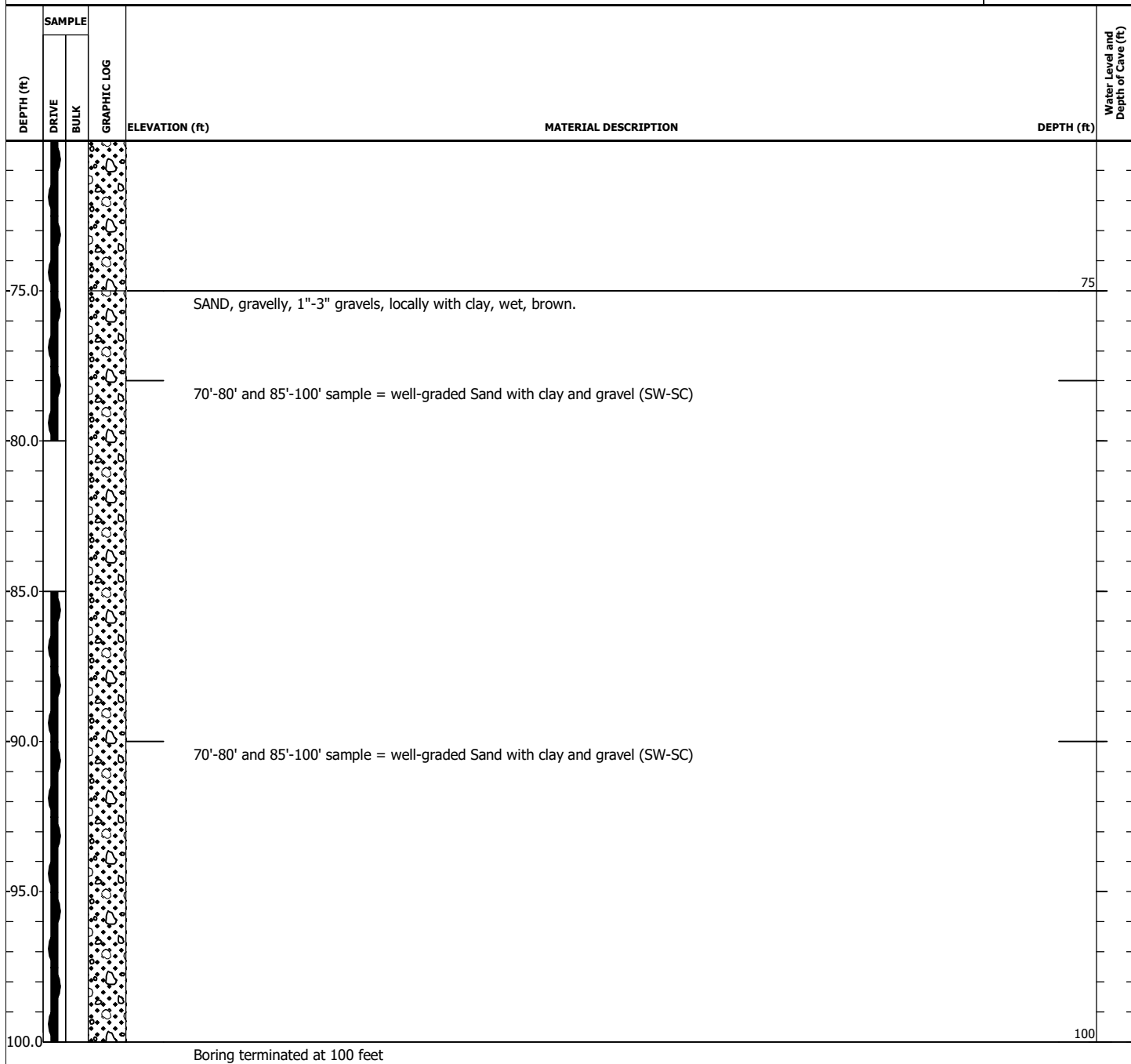
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-10
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				Page 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

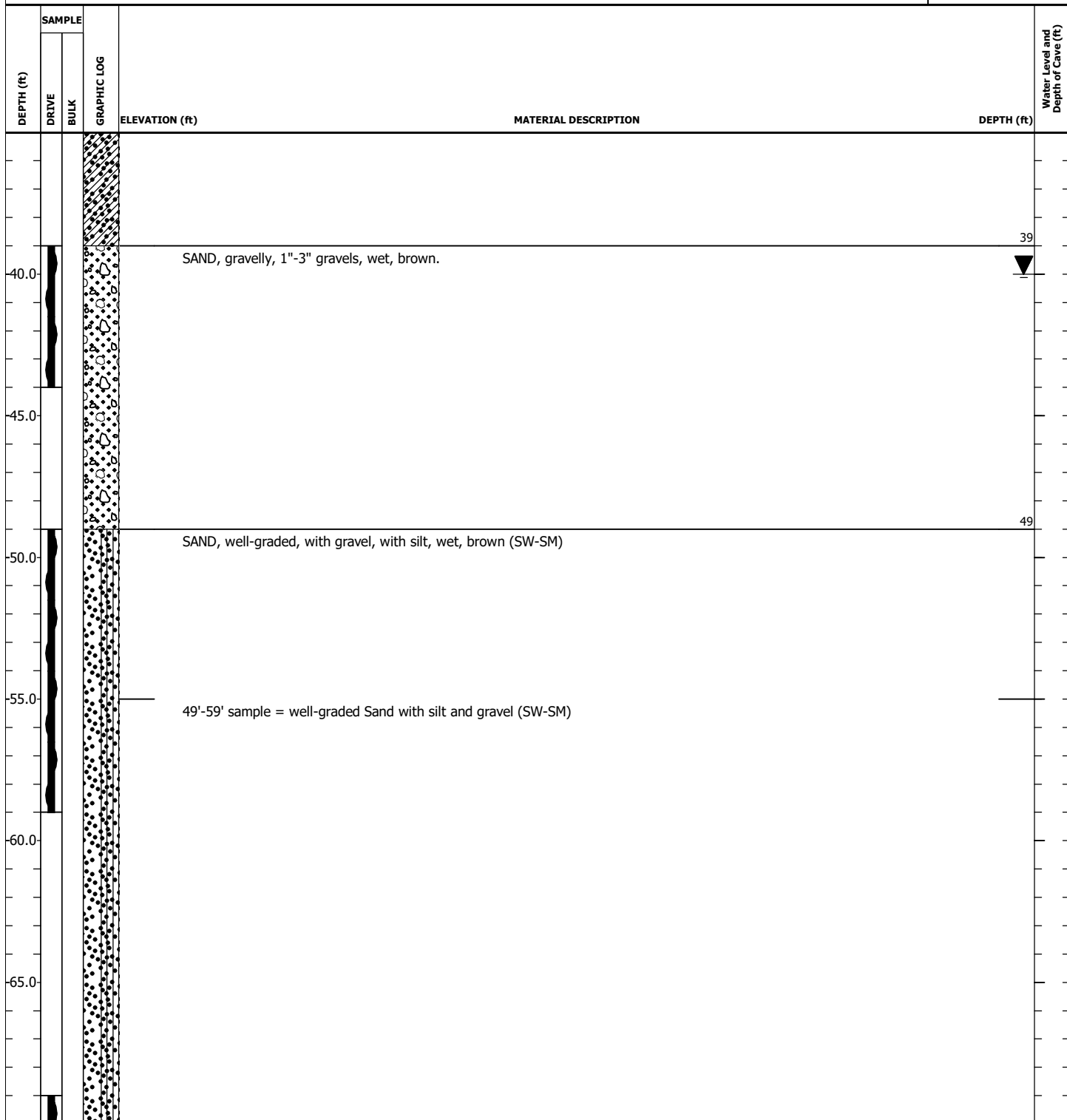
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-11
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				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					17.5	
				SAND, clayey, with gravels up to 1", moist, brown, (SC)		
-20.0				8'-14' and 17.5'-24' sample = clayey Sand with gravel (SC)		
-25.0					27	
				SAND, well-graded, moist, brown.		
-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

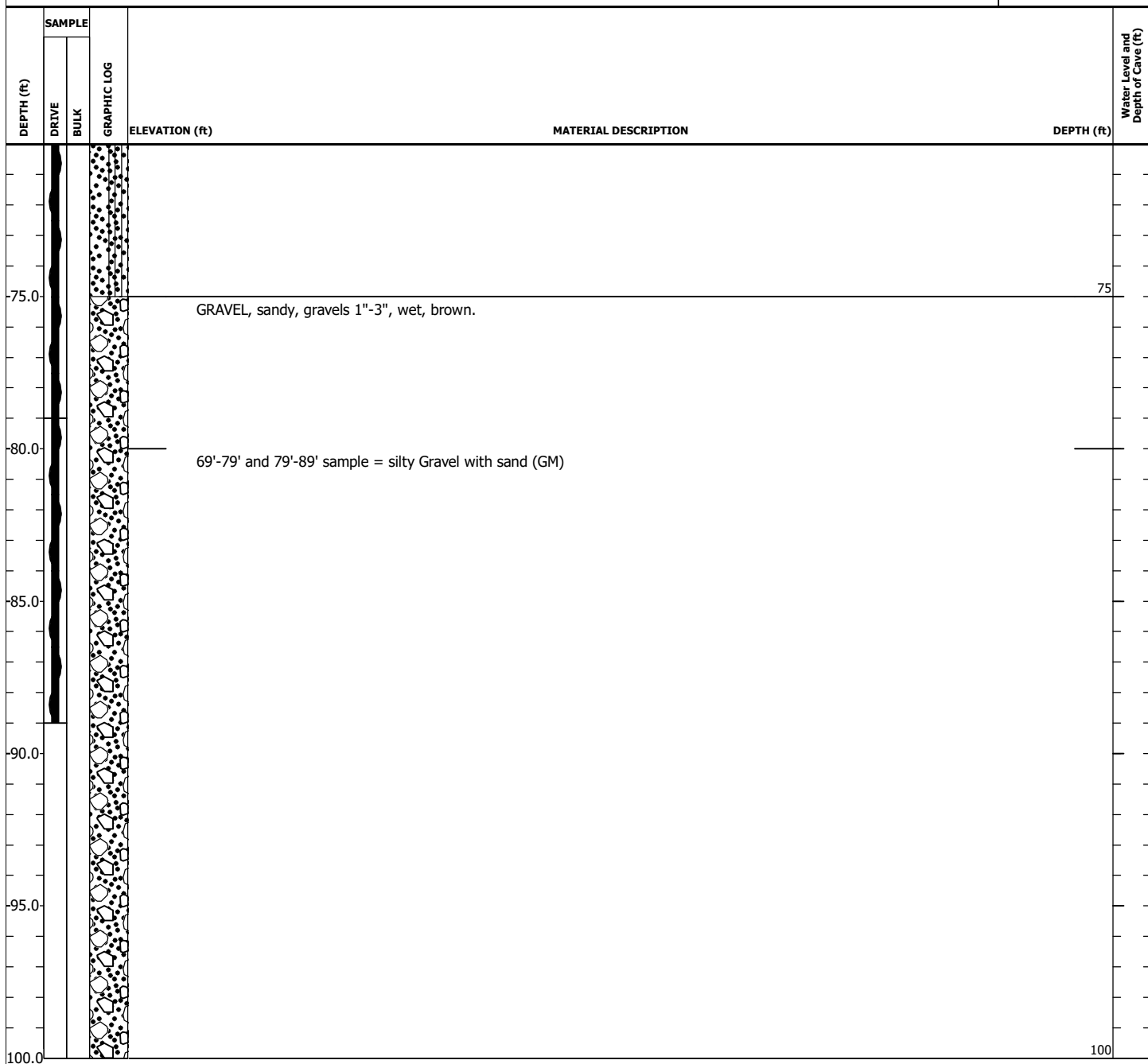
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-11
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/26/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/26/2022	
				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

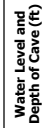
DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
				CLAY, sandy, dry, light brown.		
-5.0						
					8	
-10.0				SAND, with clay, with gravels up to 1", moist, brown.		
					12	
-15.0				SAND, with gravels up to 1", moist, brown.		
					17.5	
-20.0				SAND, clayey, gravelly, gravels up to 1", moist, brown.		
-25.0					27	
				SAND, well-graded, moist, brown.		
-30.0					29	
				SAND, clayey, with gravels up to 1", moist, brown.		

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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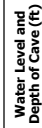


	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

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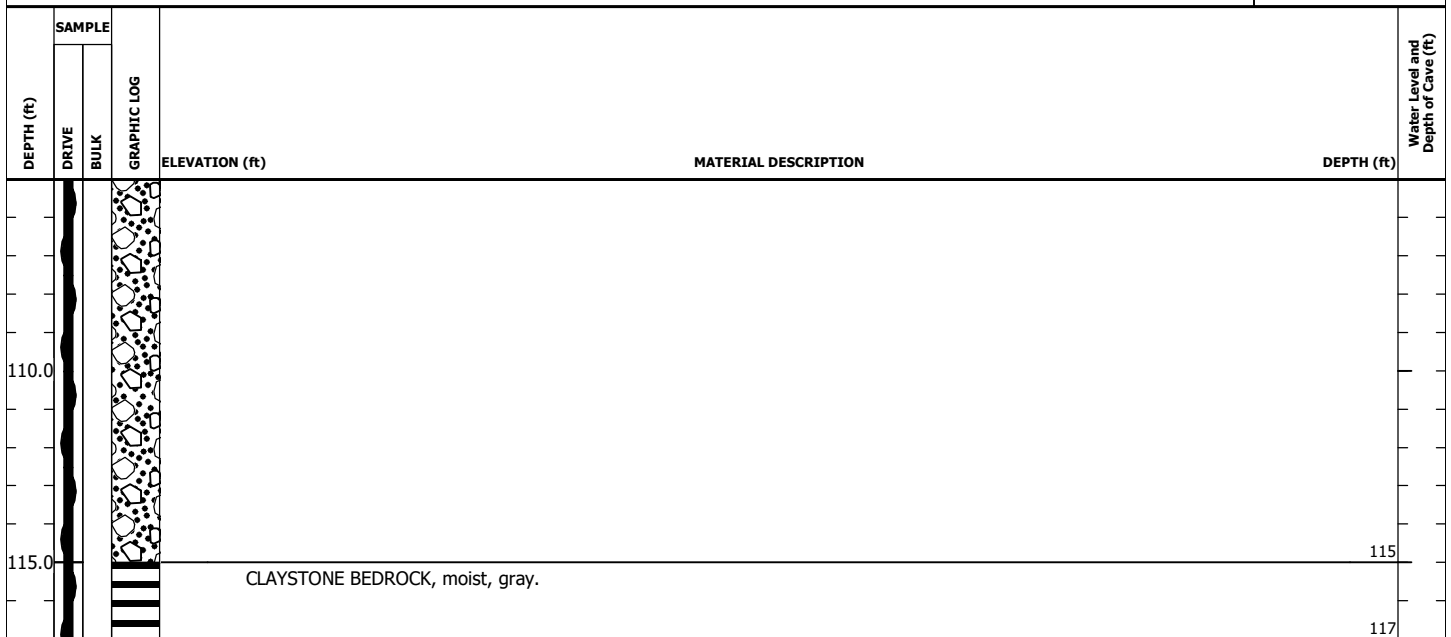


	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



PROJECT NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/27/2022
DATE COMPLETED	4/27/2022

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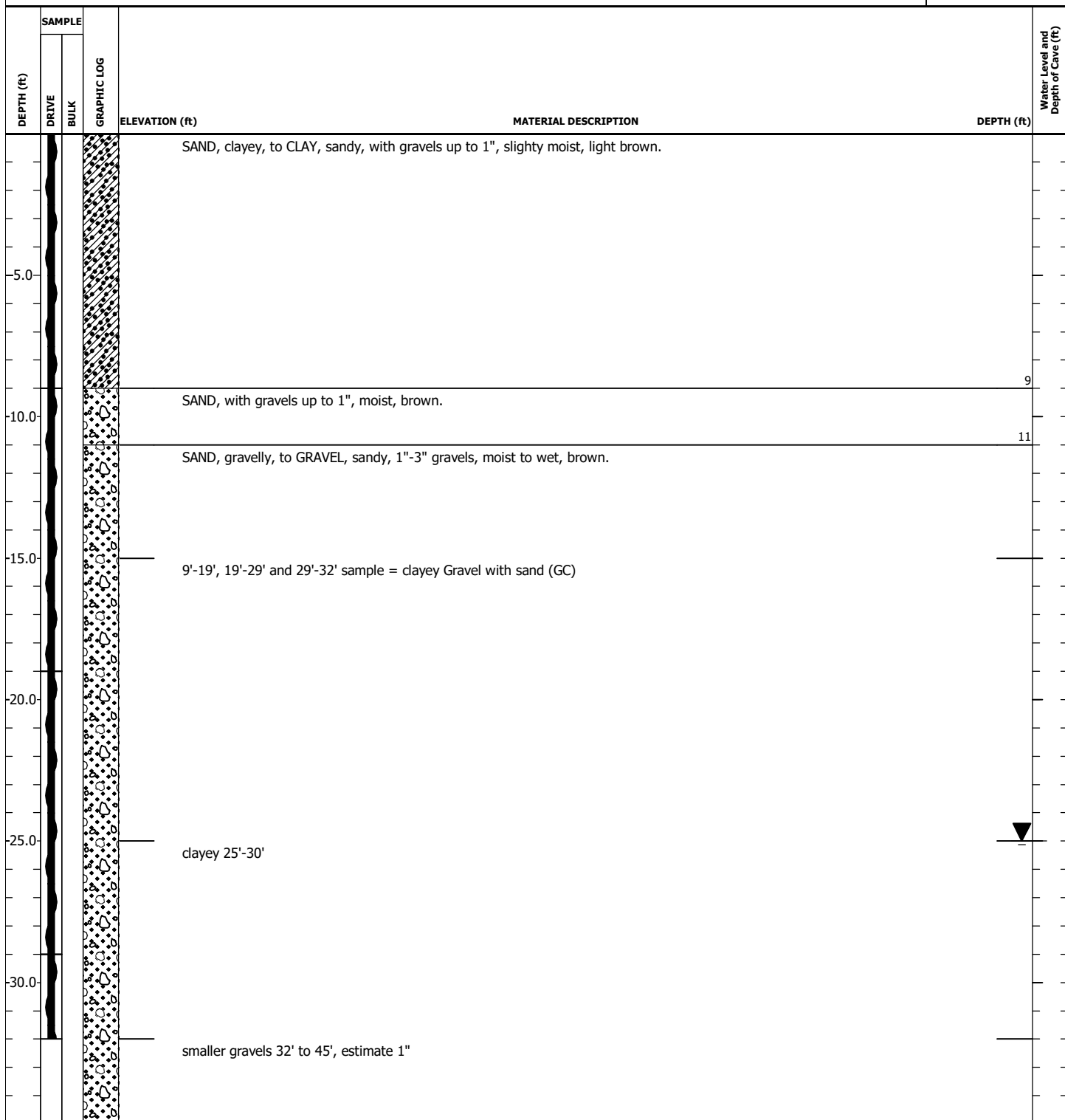


Boring terminated at 117 feet

	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



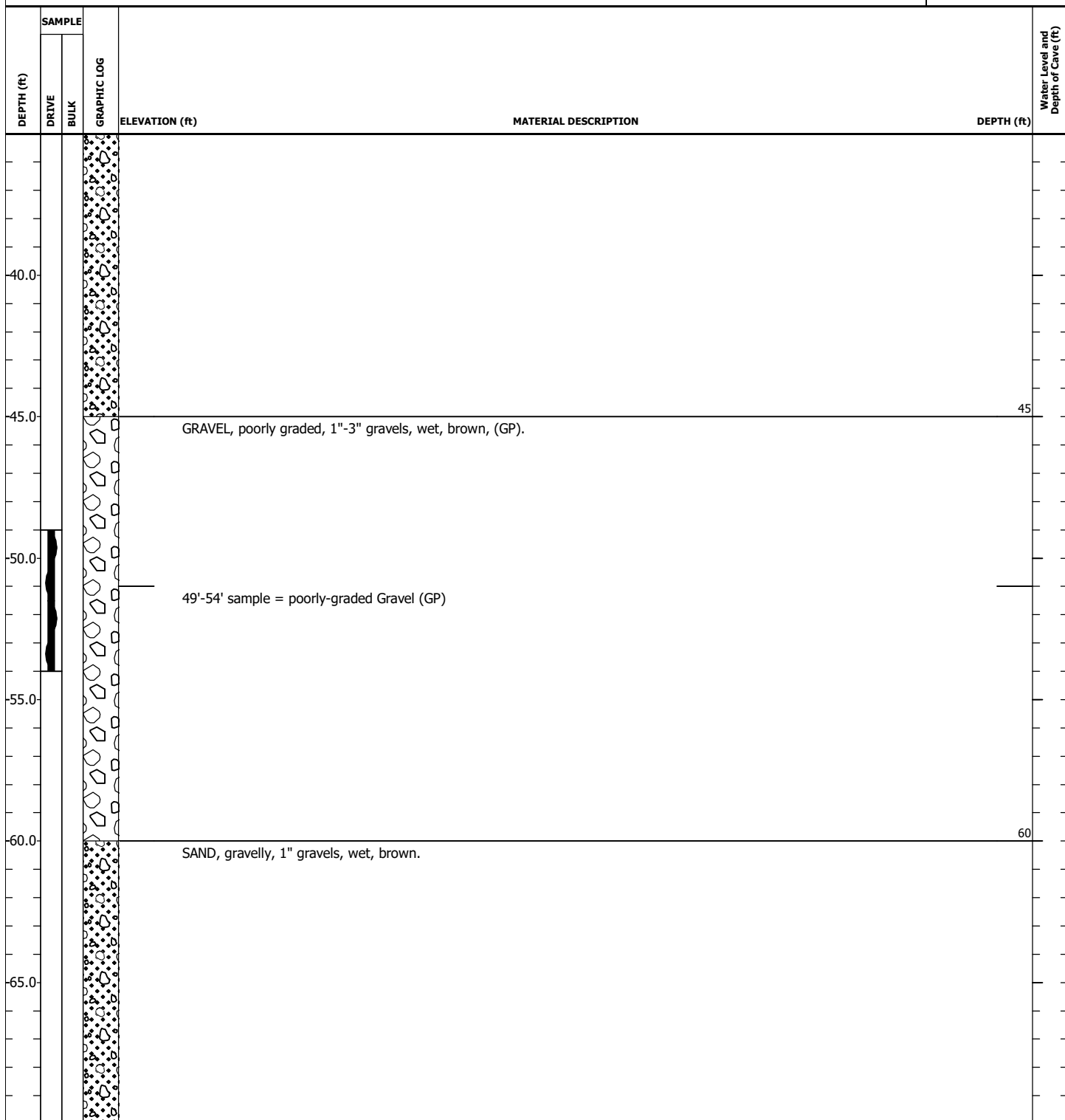
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-12
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J.Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
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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 NUMBER	22.3026
BORING ELEVATION	
CESARE REP.	J.Edwards
DATE STARTED	4/25/2022
DATE COMPLETED	4/25/2022

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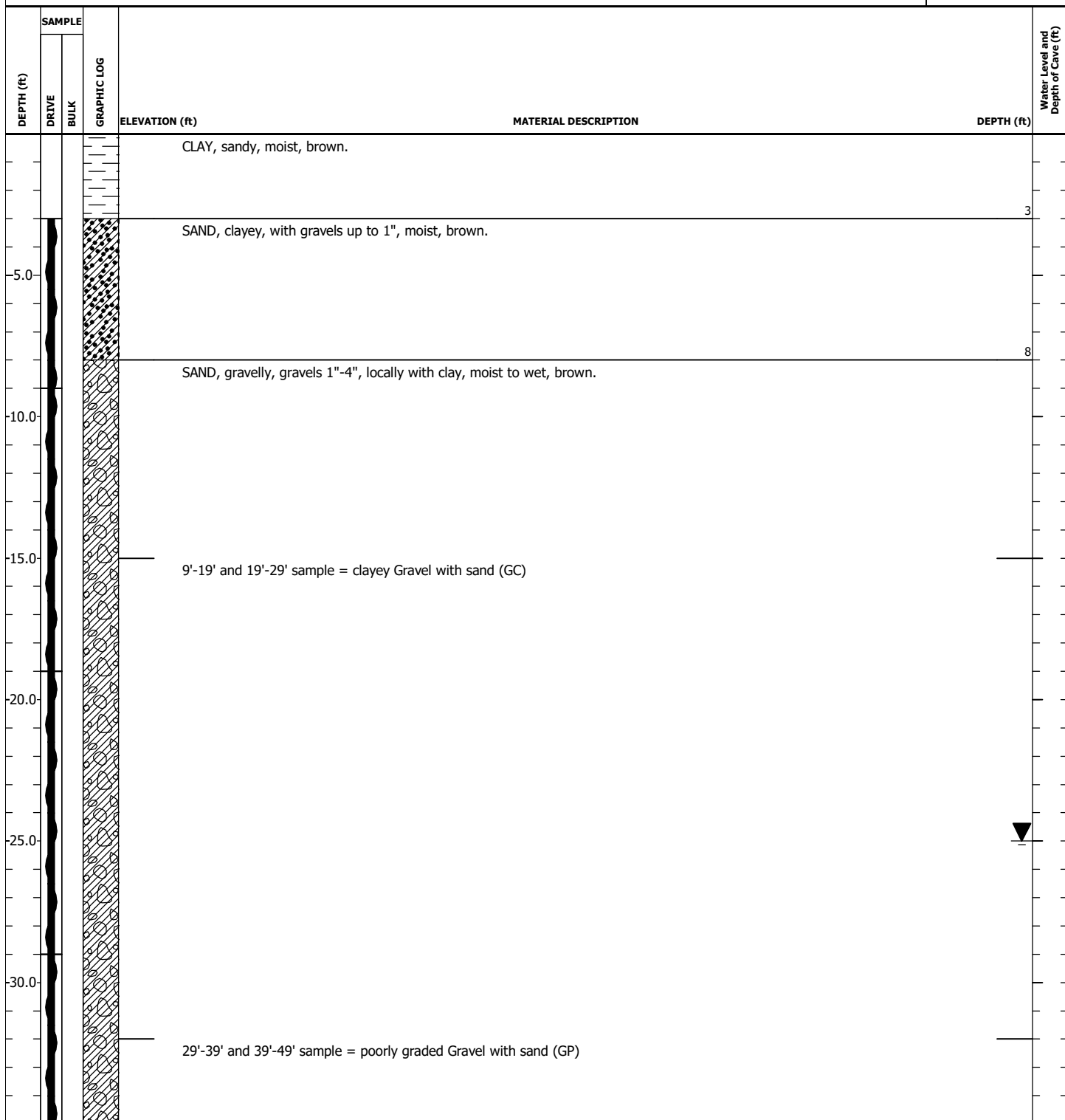
DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
-75.0						75	
					CLAYSTONE BEDROCK, moist, gray.	76	

Boring terminated at 76 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-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	
				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-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	
				Page 2 of 3

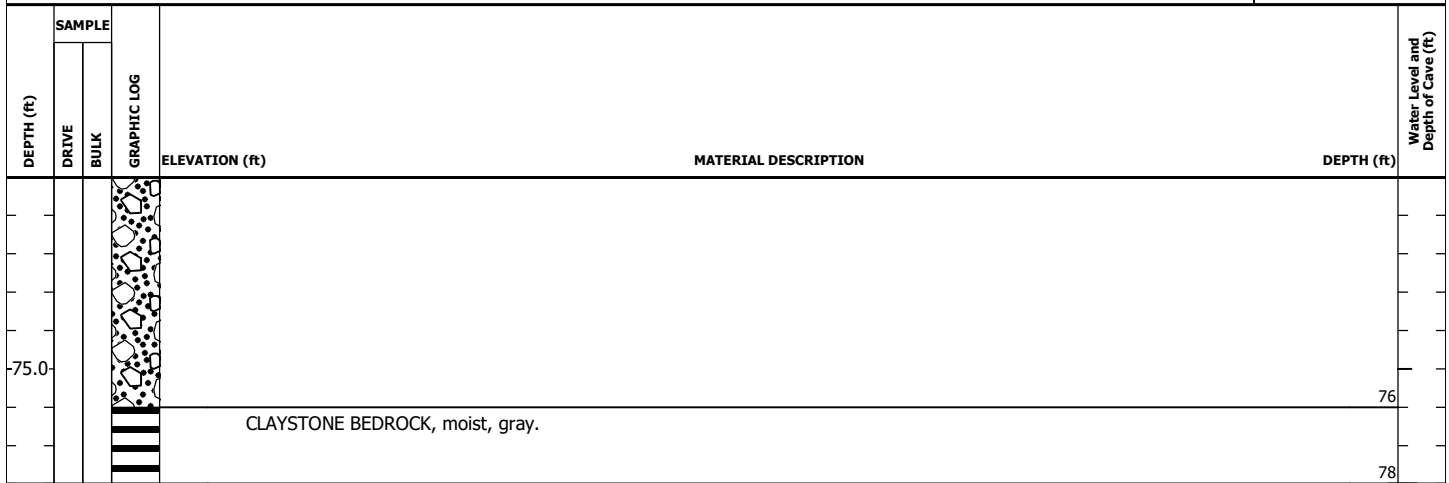
DEPTH (ft)	SAMPLE		ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK				
40.0				GRAVEL, sandy, gravels 1"-4", wet, brown.	39	
45.0				29'-39' and 39'-49' sample = poorly graded Gravel with sand (GP)		
50.0						
55.0				SAND, few gravels up to 1", possible clay lense, wet, brown.	55	
60.0						
65.0						
				GRAVEL, sandy, gravels 1"-6", wet, brown.	67	

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

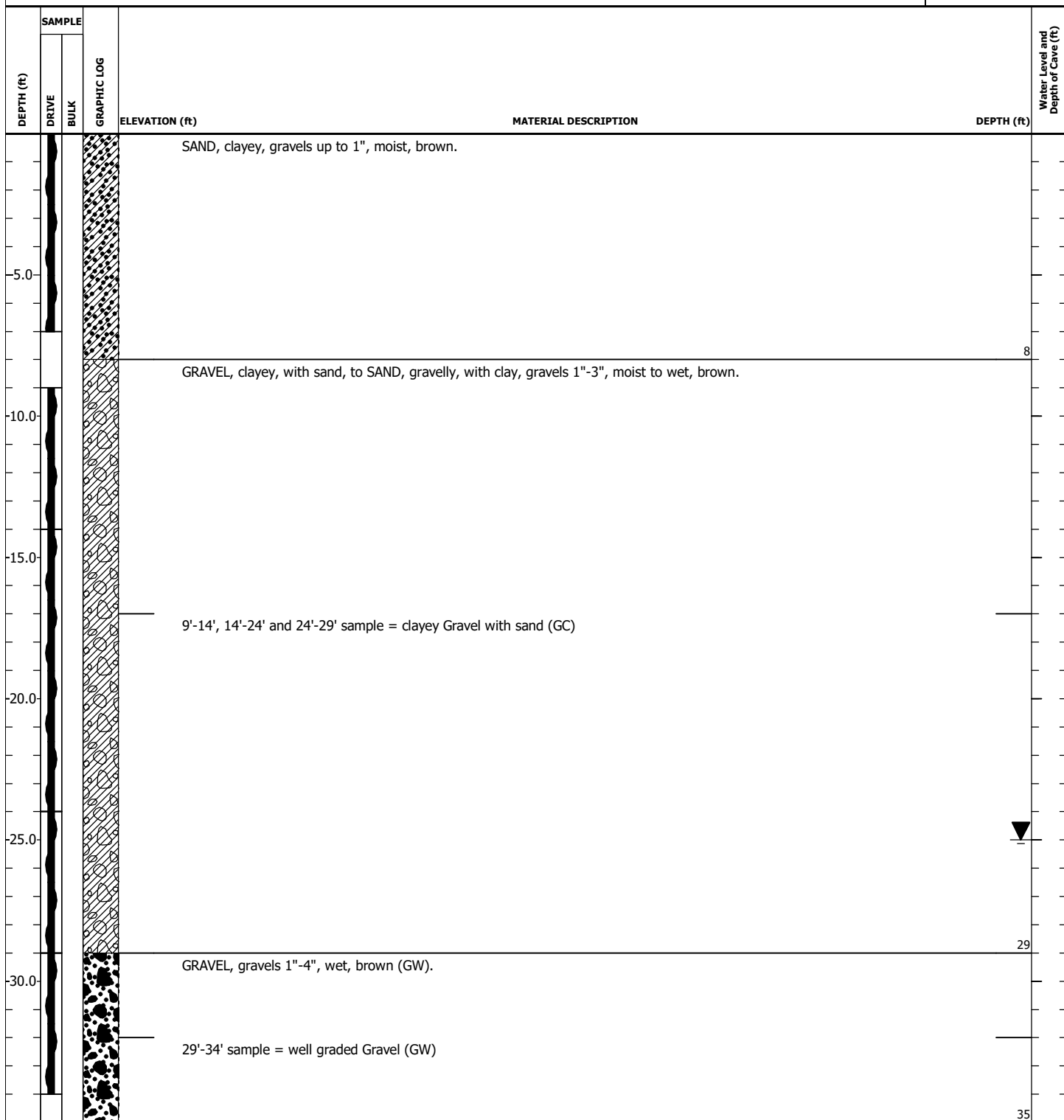
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LEGEND

- | | | | |
|---|-------------------------------------|---|----------------|
|  | 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	
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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-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

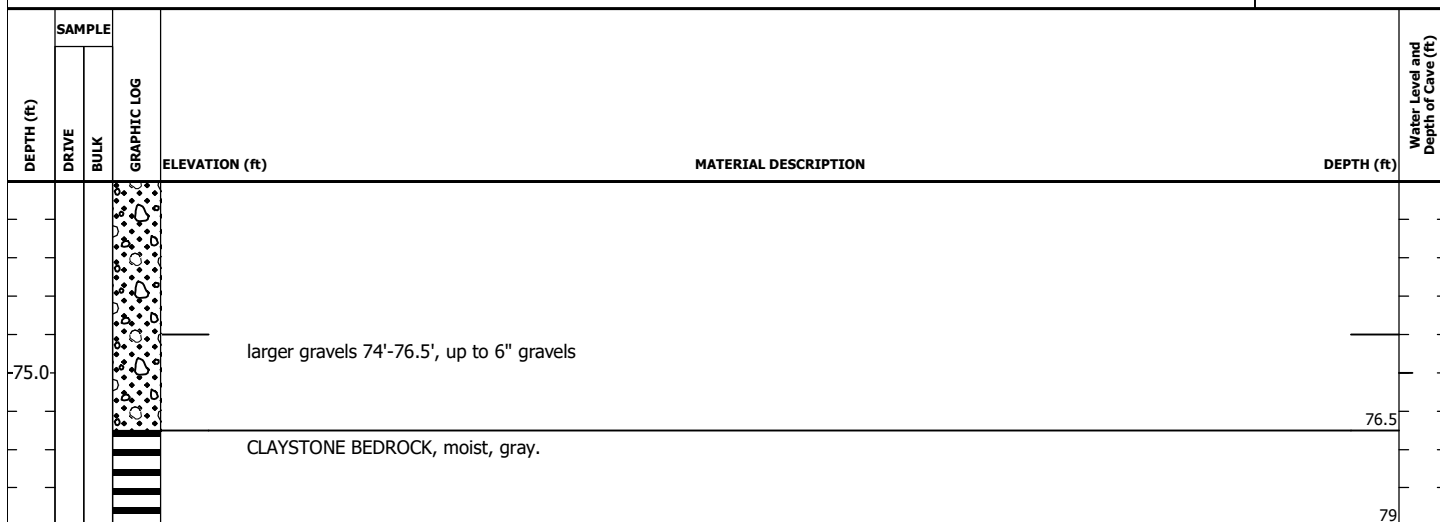
DEPTH (ft)	SAMPLE		GRAPHIC LOG	ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	Water Level and Depth of Cave (ft)
	DRIVE	BULK					
40.0					SAND, with gravel up to 1" wet, brown.		
45.0							
50.0						50	
					CLAY, sandy, wet, brown.		
						52	
					SAND, with gravel to gravelly, 1"-2" gravels, wet, brown.		
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

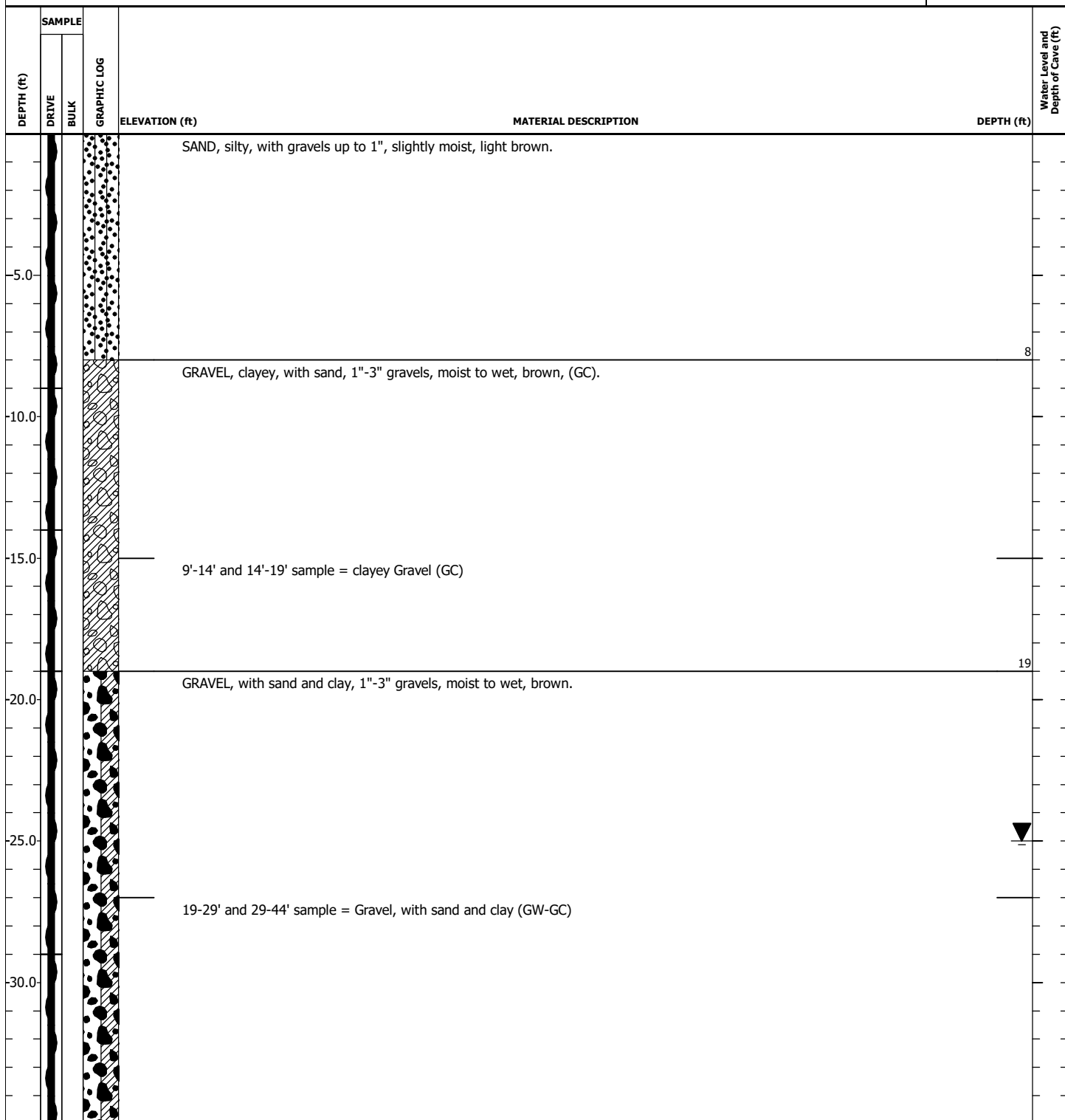
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	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		



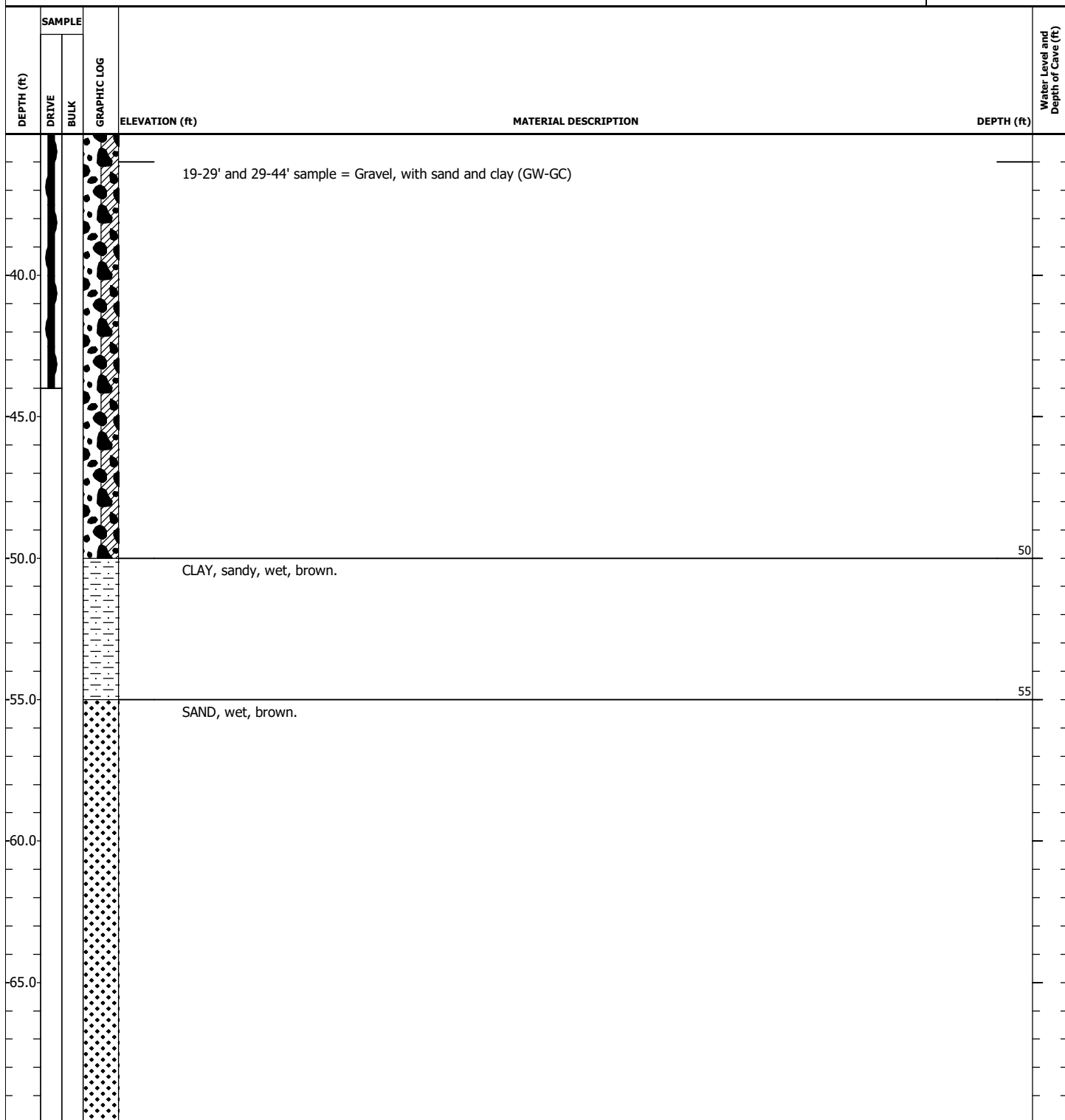
PROJECT NAME	Mill Iron Pit	PROJECT NUMBER	22.3026	B-15
BORING LOCATION	See Boring Location Plan	BORING ELEVATION		
DRILLING COMPANY/RIG	Dakota Drilling/D-120	CESARE REP.	J. Edwards	
DRILLING METHOD	8" in. Diameter SSA	DATE STARTED	4/25/2022	
HAMMER SYSTEM	140 lb Automatic Hammer	DATE COMPLETED	4/25/2022	
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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

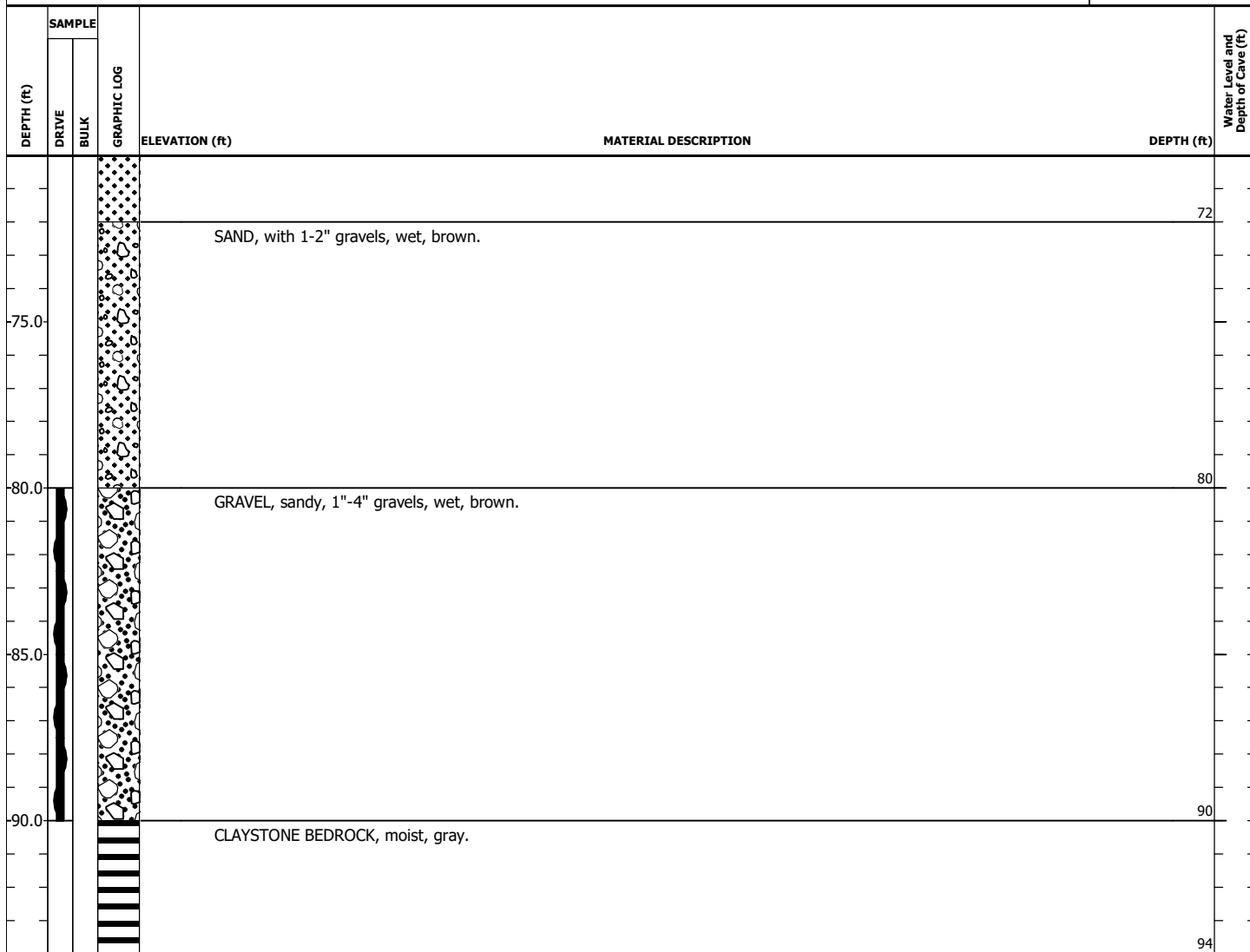


LEGEND

- WATER LEVEL AT TIME OF DRILLING
- 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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LEGEND

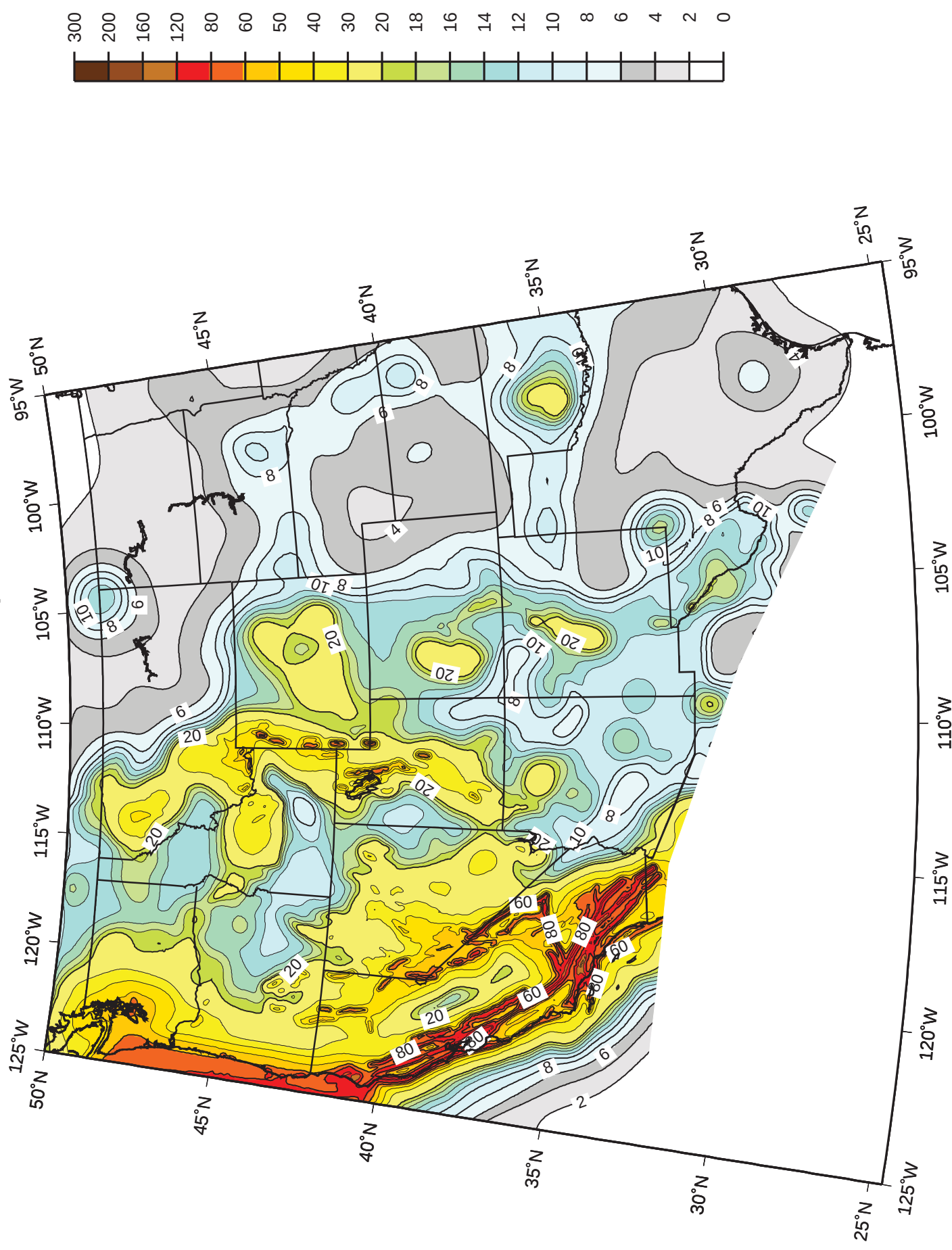
	WATER LEVEL AT TIME OF DRILLING		AUGER CUTTINGS
	WATER LEVEL # DAYS AFTER DRILLING		
	DEPTH OF CAVE # DAYS AFTER DRILLING		
	DEPTH OF REFUSAL		

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



JC York

From: Hagenlock, Lewis D <LHagenlock@dcpmidstream.com>
Sent: Wednesday, April 5, 2023 7:16 AM
To: JC York
Subject: FW: [EXTERNAL]RE: Fair Meadows Battery

Morning JC – See comments below.

I spoke with our DCP disconnect crew, they tell me they removed the Noffsinger 3" line north to CR62 with the exception around a septic by a house.

Let me know if you need any additional information.

Lew

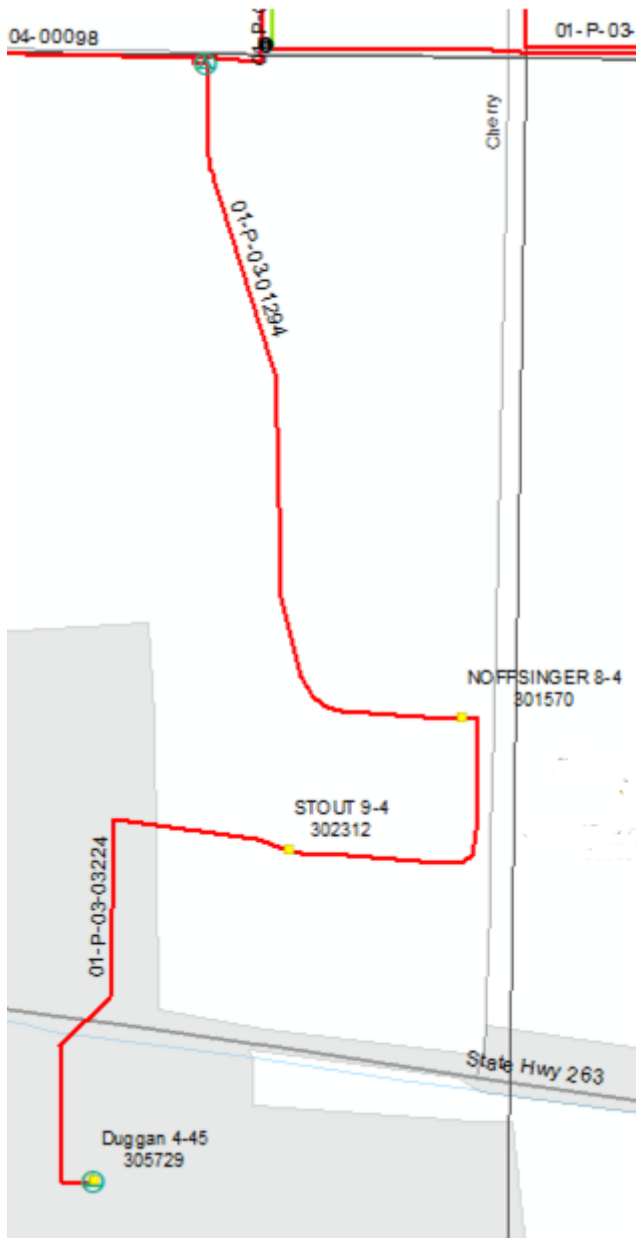
From: Wilson, Greg <greg.wilson@chevron.com>
Sent: Tuesday, April 4, 2023 3:54 PM
To: Tabor, Jon <jon.tabor@chevron.com>; Hagenlock, Lewis D <LHagenlock@dcpmidstream.com>; Alexander, Gordon <GAlexander@dcpmidstream.com>; Beavers, Tyler <tyler.beavers@chevron.com>
Subject: RE: [EXTERNAL]RE: Fair Meadows Battery

*** CAUTION! EXTERNAL SENDER *** TAKE A CLOSER LOOK! Do you know and trust this sender? Were you expecting this email? Are grammar and spelling correct? Does the content make sense? If suspicious, then do not click links, open attachments or enter your ID or password and report it as Phishing.***

Lew,

The three wells on the line below, running through the Derr Pit, have been P&A'd, cut and capped, and the production facilities have been removed. I know that Mill Iron Mining, and now IHC Scott are anxious to have this line removed. Noble has no current or future plans to place wells or facilities along this line.

Again, this applies only to the three wells on this line, the Duggan 4-45, Stout 9-4 and Noffsinger 8-4 mentioned by Jon below.



If you have questions about any of the other wells or locations from the discussion below I will be happy to address those also.

Thank you,

Greg Wilson

Land Representative

greg.wilson@chevron.com

Chevron Rockies Business Unit

Noble Energy, Inc.

2115 117th Ave

Greeley, Colorado 80634

Tel 970-304-5149

Mobile 970-373-7942

From: Tabor, Jon <jon.tabor@chevron.com>
Sent: Tuesday, April 4, 2023 1:33 PM
To: Wilson, Greg <greg.wilson@chevron.com>; Lew Hagenlock <ldhagenlock@dcpmidstream.com>; Gordon Alexander (GAlexander@dcpmidstream.com) <galexander@dcpmidstream.com>; Beavers, Tyler <tyler.beavers@chevron.com>
Subject: FW: [EXTERNAL]RE: Fair Meadows Battery

Hello Greg,

Could you reach out to Lew Hagenlock about the status and updates on the wells in 5N.,65W. Section 4 the Derr/Davis Facility.

This is what I am aware of in this section.

Duggan 4-45 P&A'd Meter Removal notification sent 7/02/2018.
Stout 9-4 P&A'd Meter Removal notification sent 11/26/2018.
Noffsinger 8-4 P&A'd Meter Removal notification sent 7/27/2022.

Derr/Davis facility:

Davis Farms 7-4 P&A'd 9/21/2017
Derr 17-4 P&A'd 3/31/2021
Derr 24-4 P&A'd 4/21/2021

Derr 21-4 Status out of Service needs P&A'd and facility decommissioned.

Thanks,

Jon

From: Hagenlock, Lewis D <LHagenlock@dcpmidstream.com>
Sent: Tuesday, April 4, 2023 12:12 PM
To: Tabor, Jon <jon.tabor@chevron.com>; Alexander, Gordon <GAlexander@dcpmidstream.com>
Subject: [**EXTERNAL**] RE: [EXTERNAL]RE: Fair Meadows Battery

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Ensure the email and contents are expected. If there are concerns, please submit suspicious messages to the Cyber Intelligence Center using the Report Phishing button.

Thanks Jon – please have Greg confirm if these wells are P&A'd.

Lew

From: Tabor, Jon <jon.tabor@chevron.com>
Sent: Tuesday, April 4, 2023 11:36 AM
To: Hagenlock, Lewis D <LHagenlock@dcpmidstream.com>; Alexander, Gordon <GAlexander@dcpmidstream.com>
Subject: RE: [EXTERNAL]RE: Fair Meadows Battery

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Lew,

Thanks for clearing this up. Plenty of future gravel pits in the works.

I will have Greg Wilson get back to you on this if you would like.

I think he is working the Land side for the plug and abandonment of the last well in the Derr facility.

Thanks,

Jon

From: Hagenlock, Lewis D <LHagenlock@dcpmidstream.com>

Sent: Tuesday, April 4, 2023 11:25 AM

To: Tabor, Jon <jon.tabor@chevron.com>; Alexander, Gordon <GAlexander@dcpmidstream.com>

Subject: [**EXTERNAL**] RE: [EXTERNAL]RE: Fair Meadows Battery

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Ensure the email and contents are expected. If there are concerns, please submit suspicious messages to the Cyber Intelligence Center using the Report Phishing button.

Thanks Jon – I just received more information, I guess it's the Derr pit....the 3" line for the Noffsinger, Stout & Duggan are the concern..

Lew

JC York

From: Wilson, Greg <greg.wilson@chevron.com>
Sent: Wednesday, April 5, 2023 4:45 PM
To: JC York
Subject: RE: Derr Pit - Remaining Oil/Gas Well Abandonment Schedule

J.C.,

The Derr P&A currently sits in September. I expect to see an update in the longer term schedule in a couple of weeks and should know more then.

Regards,

Greg Wilson
Land Representative
greg.wilson@chevron.com

Chevron Rockies Business Unit
Noble Energy, Inc.
2115 117th Ave
Greeley, Colorado 80634
Tel 970-304-5149
Mobile 970-373-7942

From: JC York <jcyork@j-tconsulting.com>
Sent: Wednesday, April 5, 2023 12:38 PM
To: Wilson, Greg <greg.wilson@chevron.com>
Subject: [**EXTERNAL**] Derr Pit - Remaining Oil/Gas Well Abandonment Schedule

Be aware this external email contains an attachment and/or link.

Ensure the email and contents are expected. If there are concerns, please submit suspicious messages to the Cyber Intelligence Center using the Report Phishing button.

Greg –

Just wanted to check in to see if you found out any more details on the schedule for abandonment of the remaining oil/gas well on the IHC Scott owned property for the Derr Pit gravel mine. Last we talked you were going to see if it was going to be potentially moved up on the schedule.

Regards,

J.C.

J.C. York, P.E.

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Fort Lupton, CO 80621

Office: (303) 857-6222
Mobile: (970) 222-9530
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