August 11, 2025

Mr. Patrick Lennberg
Division of Reclamation, Mining, and Safety
1313 Sherman Street, Room 215
Denver, Colorado 80203

RE: Response to Adequacy Review No. 2, 112c Construction Materials Permit Application Section 25 Sand Mine, Permit No. M-2025-015

Dear Mr. Lennberg:

This letter addresses the *Adequacy Review* letter dated July 22, 2025 regarding the Section 25 Gravel Mine 112 Construction Materials Reclamation Permit Application Package. Responses to the Division's comments follow in **bold**:

EXHIBIT C – Pre-Mining and Mining Plan Map(s) of Affected Lands (Rule 6.4.3):
1. In the Division's item no. 1, of the June 4th letter, it requested the coordinates of the permit boundary corners. In response the Applicant provided a land survey plat of the permit area. The map provided indicates the permit boundary to be the section lines. The area of Lot 25 is stated to be 621.97 acres. The permit application is for 640 acres not 621.97 acres. Please clarify this discrepancy and provide the coordinates of the permit boundary corners.

The permit application should be 621.97. All references to 640 have been changed to reflect the surveyed boundary. The lat/long coordinates have been provided for the permit boundary corners on map C-1.

EXHIBIT D – Mining Plan (Rule 6.4.4):
2. In response to Division's item no. 3 the Applicant stated that the existing infiltration ponds will be mined down another 5 feet. Is the applicant referring to the lined pond? If so, please update Figure C-2 to adjust the mine limit boundary to include the pond and update the narrative of Mining Plan toclearly indicate mining of the pond. If the pond is included does that increase the total mine acreage of 396 acres?

If the Applicant is referring to infiltration ponds that will be installed as part of the processing plant, please show their general location as part of the processing plant. The Division cannot locate within the Mining Plan, where it discusses mining down of the infiltration ponds, please update.

The infiltration ponds on the property are to the south of the mine cell. There was internal discussion about mining out the bottom of these ponds to increase functionality but it was later dropped. The mention of mining this area should have been removed from the item 3 response. Please disregard.

3. In the last paragraph of page D-2 it is stated that a near vertical highwall will be developed during mining. Please state the maximum dimensions of the highwall (length x height) that may be developed during mining and that may need to be reclaimed.

This section has been removed. The mine slope will be at a 3H:1V slope. Additionally, subsequent drilling has shown that the bedrock elevation towards the southwest of the mine pit drops off more than what was shown as a part of the initial drilling investigation. The Mine Plan, Maps, and Stability Analysis have been updated to reflect this additional information.

4. In the Earthmoving subsection there is a reference to Figure C-6, please revise with the correct figure.

Corrected to refer to C-2.

EXHIBIT E – Reclamation Plan (Rule 6.4.5):
5. On page E-5 first paragraph it is stated that mulch will be used. Please state the amount of mulch to used per acre and whether it will be crimped into place or not.

Exhibit E has been changed to state:

> **"Seed will be drilled and mulched with crimped straw. Crimped straw should be at 2 tons/acre of weed free and crop seed free straw. Straw length should be at least 10 inches long for 70% of the product used. Mulch should be free of mold, decay, mud and other debris."**

EXHIBIT L – Reclamation Costs (Rule 6.4.12):
6. Attached for your review is the Division's reclamation cost estimate. If agreed upon this is the amount the Applicant will be bonded to for the permit to be issued.

Agreed.

EXHIBIT S – Permanent Man-made Structures (Rule 6.4.19):
7. The engineering evaluation, pursuant to Rule 6.4.19(b), for the structures at the site is still outstanding.

See attached slope stability evaluation.

Other:
8. Pursuant to Rule 1.6.2(2), please demonstrate that the Applicant's response to these adequacy issues have been placed with the application materials previously placed with the County Clerk or Recorders Office and made available for public review.

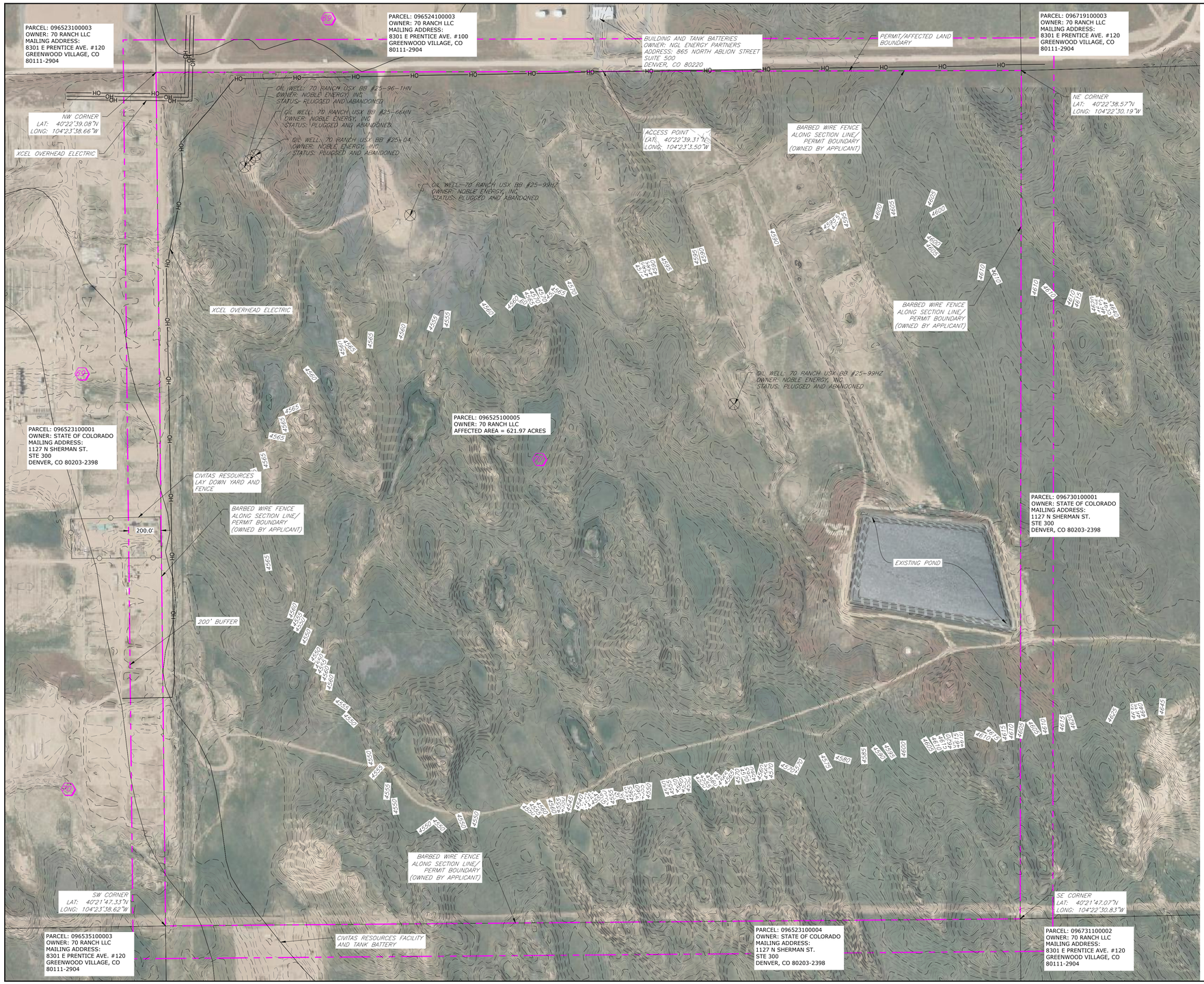
Additionally, the proof of filing for the responses to the Division's preliminary adequacy review was not attached to the submittal, please provide the conformation email.

See attached email confirmation.
Please feel free to contact me with any questions or concerns at Kyle@civilresources.com or my cell number 408-930-2544.

Regards,

CIVIL RESOURCES, LLC

Kyle Regan
Project Geologist



LEGEND:

- PROPOSED PERMIT BOUNDARY
- SLURRY WALL ALIGNMENT
- SOIL TYPE
- 5740 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING BARBED WIRE FENCE

SOILS LEGEND:

- 82 VALENT SAND, 0-3% SLOPES
- 70 VALENT SANDS, 3-9% SLOPES

NORTH

0 150 300
(IN FEET)

Know what's below. Call before you dig.

CIVIL RESOURCES

323 5th STREET
P.O. Box 680
FREDERICK, CO 80530
303.833.1416
WWW.CIVILRESOURCES.COM

70 RANCH LLC.
8301 EAST PRENTICE AVE. SUITE 120
GREENWOOD VILLAGE, CO 80111
303.659.5000 (p)
CONTACT: JASON VONLEMBKE

70 RANCH SECTION 25 PROPPANT MINE
WELD COUNTY, COLORADO

REVISIONS

NO.	DESCRIPTION	DATE

DESIGNED BY:	KSR	DATE:	6/18/2025
DRAWN BY:	KSR	SCALE:	AS NOTED
CHECKED BY:	ARR		AS NOTED
JOB NO.:	####		
DWG NAME:	70-RANCH MP3.DWG		

EXISTING

SHEET:

EXHIBIT C1

J:\Active Work & Site - 141-70 Ranch_25MD\Drawing\Sheets\70-ranch mp3.dwg, EXISTING, 6/7/2025 3:43:28 PM

LEGEND:

- PROPOSED PERMIT BOUNDARY
- SLURRY WALL ALIGNMENT
- PROPOSED MINE LIMIT
- PROPOSED MAJOR CONTOUR (5740)
- PROPOSED MINOR CONTOUR
- EXISTING BARBED WIRE FENCE

NORTH

0 150 300
(IN FEET)

Know what's **below.**
Call before you dig.

CIVIL RESOURCES

323 5th STREET
P.O. Box 680
FREDERICK, CO 80530
303.833.1416
WWW.CIVILRESOURCES.COM

70 RANCH LLC.

8301 EAST PRENTICE AVE. SUITE 120
GREENWOOD VILLAGE, CO 80111
303.659.5000 (p)
CONTACT: JASON VONLEMBKE

70 RANCH SECTION 25 PROPPANT MINE WELD COUNTY, COLORADO

REVISIONS		
NO.	DESCRIPTION	DATE

DESIGNED BY:	KSR	DATE: 8/7/2025
DRAWN BY:	KSR	SCALE AS NOTED
CHECKED BY:	ARR	AS NOTED
JOB NO.:	####	
DWG NAME:	70-RANCH MP2.DWG	

MINE PLAN MAP

SHEET: C-2

EXHIBIT D – MINING PLAN

The information provided in this Exhibit is intended to satisfy the requirements outlined in Section 6.4.4 of the Colorado Mined Land Reclamation Board Construction Material Rules and Regulations:

(a) Description of the method(s) of mining to be employed in each stage of the operation as related to any surface disturbance on affected lands;

The permit area includes a significant deposit of windblown sands located in dunes in Weld County. The site is located north of the South Platte River and is accessible through private roads owned by property the owner. It encompasses 621.97 acres (plus or minus) and consists of one slurry wall lined pond. Prior to starting construction of any slurry wall, a Technical Revision to update the site bonding will be applied for and will include the slurry wall design report.

Site Preparation:
Initial disturbance on the property will be stripping overburden and flattening the area in the northeast portion of the Site to establish the processing area footprint. An access road will be constructed to the plant area.

Mining:
The property boundary/affected land boundary is delineated by a barbed wire fence surrounding the section. The site will contain one (1) mine cell of approximately 396 acres. Excavation will start in the northeast corner of the Site to establish a flat area for the plant. After establishing the plant and access road mining will proceed from east to west. Initially, topsoil will be removed from the current phase and stockpiled in the stockpile area depicted on Map C2. Subsequent to initial stripping, the mine cell will be excavated down to bedrock with 3:1 side slopes utilizing scrapers, loaders, and/or excavators. Haul trucks will move the mined material to the plant location.

Groundwater was not encountered at the Site during exploratory drilling except in isolated areas. Since groundwater is not expected to be encountered during mining, mining will be performed in an unlined cell. There are plans to line the western side of the cell tying into bedrock at elevation 4,555 feet. The slurry wall will be utilized for water storage and will be ancillary to the mining operation. The slurry wall will be constructed once the western side of the site has been mined to 4,555 feet.

The sand deposit is an average of 35-feet in thickness and ranges from 15 feet to 85 feet deep within the windblown sand deposit. The deposit is overlain by an average of 6 inches of topsoil and no overburden. The pit is made up of the primary sand layer overlain with topsoil. An additional alluvium sand layer exists within the windblown sand deposit, found primarily in the areas approaching bedrock along the south of the site. It reaches an average thickness of 1 foot in the southernmost mining area of the main pit. The bedrock is an tan to olive-gray siltstone and some grey sandstone that exists between approximately 15 to 85 feet below the surface with the depth dropping off significantly towards the southwest of the Site.

All mining will continue to the bottom of the sand deposit with 3H:1V mining slopes along the perimeter.

The operator will develop and comply with a Stormwater Management Plan and Spill, Prevention, Control and Countermeasures Plan. The operator will notify the Division of Reclamation and Mine Safety and in the event of a reportable spill.

Processing:
The material will be washed and screened or not screened at all and transported offsite by truck. The processing area will be located on the north side of the site closest to the entrance.

Import Material:
The Operator may import material from and export material to other sites. The applicant is aware that in accordance with Rule 3.1.5(9) of the Construction Material Rules and Regulations, if any offsite material is used as backfill, a notarized letter will be submitted to the Division indicating the materials are inert. The applicant will supply such a letter to the Division if, at the time of Reclamation, the applicant intends to use off-site material as backfill.

(b) Earthmoving;

Topsoil will be stripped with scrapers or bulldozers and stockpiled in segregated piles at the edge of the active mine phase or as described above and shown in Figure C-2. Excavators, front-end loaders, and bulldozers will be used to excavate the material. Haul trucks will be utilized to transport the raw material from the active mine phase to the processing area.

(c) All water diversions and impoundments;

Storm water will be discharged per a CDPHE discharge permit. There are no planned diversions or impoundments of existing water bodies. A wash cycle for the aggregate processing area will be established using the existing pond as a source and the silt pond for return flow, with natural groundwater filtration between the source pond and the return pond. Any water consumed will be provided by the existing water rights associated with the property with associated substitute water supply plan (see Exhibit G).

(d) The size of area(s) to be worked at any one time.

Each phase is approximately 30-55 acres in size. The Operator will mine multiple phases concurrently in order to obtain a range of material for production. In addition to mining, the Operator, will begin reclaiming slopes as mining is finished in each stage. Since multiple phases will be being worked at any one time, the approximate size of the areas to be worked at any one time will range from 25 acres to 120 acres and will depend on market conditions.

(e) An approximate timetable to describe the mining operation. The timetable is for the purpose of establishing the relationship between mining and reclamation during the different phases of a mining operation.

The Operator anticipates that mining will commence as soon as all permits are in place. The Operator anticipates extracting approximately 250,000 in the first year and up to 1,000,000 tons at peak capacity. Production rates will vary based on market demands. There is approximately 24 million tons of sand at the mine which will take approximately 26 years to fully mine out.

(f) Use Mining Plan Map in conjunction with narrative to present:

(i.) Nature, depth and thickness of the deposit and thickness and type of overburden to be removed

Overburden consists mainly of sandy topsoil. Overburden thickness varied across the site from non-existent to a few feet thick.

The aggregate reserves at the site consist mainly of fine windblown sand, with thin alluvium sand deposits near above. No cobble units (grain size 4" or greater), or gravel units (grain size .08" to 2.5") were encountered at the site. Sands unit thickness varied from 45 feet in BH-8 in the southern side of the site to 10-15 feet in BH-18, BH-12, in the northeastern side of the site.

(ii.) Nature of the stratum immediately beneath the material to be mined in sedimentary deposits

Depth to bedrock ranges from 45 feet in BH-15 in the southern side of the site to 11 feet in BH-18 in the northeast corner of the site. The bedrock encountered at the site consists of wet brown weathered siltstone drilled/tested to a depth of up to 10' and brown to blue/gray claystone for the first 1 to 5 feet; in the far western side of the site.

(g) Identify the primary and secondary commodities to be mined/extracted and describe the intended use.

The primary commodities are sands intended for use as proppants in oil and gas development.

(h) Name and describe the intended use of all expected incidental products to be mined/extracted by the proposed operation.

Gold may be extracted as an adjunct component of any wash equipment installed at the site.

(i) Specify if explosives will be used in conjunction with the mining (or reclamation)

No explosive material will be used on-site.

(j) Specify the dimensions of any existing or proposed roads that will be used for the mining operation. Describe any improvements necessary on existing roads and the specifications to be used in the construction of new roads. New or improved roads must be included as part of the affected lands and permitted acreage. Affected land shall not include off-site roads which existed prior to the date on which notice was given or permit application was made to the office and which were constructed for purposes unrelated to the proposed mining operation and which will not be substantially upgrades to support the mining operation. Describe any associated drainage and runoff conveyance structures to include sufficient information to evaluate structure sizing.

The affected land and permitted acreage is inclusive of over one and one-half miles of land directly abutting private roadways; there is no need for any additional driveways, and on-site haul roads will be incidental to mining areas depicted on the Mining Plan Map. No roadways are affected by the mining operation other than access roads within the permit boundary and existing private roads to the site. The Operator will apply for a Weld County Access Permit for the site.

EXHIBIT E – RECLAMATION PLAN

This information provided in this Exhibit is intended to satisfy the requirements outlined in Section 6.4.5 of the Colorado Mined Land Reclamation Board Construction Material Rules and Regulations: The proposed mining and reclamation plan focuses on minimizing the ecological impacts of mining, minimizing the length of time of impact, and maximizing long-term benefits.

(a) A description of the type(s) of reclamation the Operator proposes to achieve in the reclamation of the affected land, why each was chosen, the amount of acreage accorded to each, and a general discussion of methods of reclamation as related to the mechanics of earthmoving;

The majority of the excavation will be reclaimed to a slurry wall lined water storage reservoir due to a need within the county and state for water storage facilities. Refer to Exhibit F for the acreages of the reservoir and additional details.

Topsoil will be stripped prior to mining and will be stored in the stockpile area depicted on map C2. Areas above the highwater line of the proposed reservoir will receive one (1) foot of the native topsoil and reseeded with the seed mix indicated on map F1. Topsoil may be replaced by a scraper or haul truck, excavator and bulldozer, and will generally be graded with a blade. All grading will be done in a manner that controls erosion and siltation of the affected lands, to protect areas outside the affected land from slides and other damage.

Reclamation will be performed concurrent with mining. Once an area has been mined to final depth reclamation on that area will begin. Materials not suitable for the proposed end use will be removed from mining phases and placed near reclamation phases or directly in the reclamation slope. If no reclamation phase is open, the unsuitable materials will be stockpiled in the stockpile location shown in Figure C-2. All disturbed areas will be regraded and smoothed to a finished grade that is suitable for revegetation.

(b) A comparison of the proposed post-mining land use to other land uses in the vicinity and to adopted state and local land use plans and programs.

The water storage reservoirs will be compatible with the other land uses in the vicinity, which includes water storage and energy exploration.

(c) A description of how the Reclamation Plan will be implemented to meet each applicable requirement of Section 3.1.

The Operator will carry reclamation to completion with reasonable diligence. Each area of reclamation will be generally completed with completion of mining, since mining will be done at a 3H:1V slope required for reclamation.

Section 3.1.5 Reclamation Measures Material Handling:

Grading will be performed to help control erosion and siltation of the affected lands through phased mining, implementing good operation techniques to handle material as little as possible, and vegetation of stockpiles remaining in place for more than 180 days with the Weld County Sandy Site seed mix:

Weld County - Sandy Site Mix
Bluestem (Champ, Chet) 1.00 lbs pls/acre
Sand Lovegrass (Bend, Native, Ne27) 2.50 lbs pls/acre
Indian Ricegrass (Nezpar, Rimrock) 3.00 lbs pls/acre
Prairie Sandreed (Goshen) 0.75 lbs pls/acre
Green Needlegrass (Lodorm) 1.50 lbs pls/acre
Little bluestem (Blaze, Cimarron, Camper) 0.75 lbs pls/acre
Yellow Indiangrass (Cheyenne, Holt, Scout) 0.50 lbs pls/acre
Switchgrass (Blackwell, Nebraska 28) 1.50 lbs pls/acre
Sand Dropseed 0.50 lbs pls/acre
Total: 12.00 pounds pls/acre

Although the use of erosion protection devices is not anticipated, if deemed necessary by the operator at the time of excavation, silt fence, haybale dams or other erosion control devices will be installed. Backfilling and grading will be completed as soon as feasible as the mining process is completed for each phase.

Maximum slopes and slope combinations will be compatible with the configuration of surrounding conditions and selected land use. Mining will occur at a slope that is stable. Reclaimed slopes in the water storage reservoir will not be steeper than a 3:1 ratio and will be mined/reclaimed at a 3:1 ratio for the slurry wall lined cell mined at 3:1 ratio. A representative sample of the fill material will be analyzed for shear strength and optimal moisture content prior to backfilling the slope. The material will be worked to the optimal moisture content as determined by Proctor compaction tests and placed back into the slope at no more than one-foot lifts. The lifts will be compacted with a sheepsfoot roller to tie lifts together. The upland area will be reclaimed to grades consistent with pre-mining drainage patterns.

The operator will backfill using fill material generated on-site, or imported inert fill generated outside the permit area. If any inert off-site material is used as backfill, a notarized letter will be submitted to the Division as required by Section 3.1.5(9) of the MLRB Construction Material Rules and Regulations.

It is not anticipated that mining will uncover any refuse or acid-forming or toxic producing materials, however if any such materials are encountered the operator will take precaution to handle the materials in a manner that will control unsightliness and protect the drainage system.

Drill or auger holes that are part of the mining operation shall be plugged with non-combustible material, which shall prevent harmful or polluting drainage. Any test pits, soils boring holes, or monitoring wells not located within the mine excavation limits will be plugged as soon as it can be confirmed that they are no longer needed for the operation.

Mined material to be disposed of within the affected area will be handled in such a manner to prevent any unauthorized release of pollutants to the surface drainage system. No unauthorized release of pollutants to groundwater shall occur from any materials mined, handled or disposed of within the permit area.

***Section 3.1.6 Water-General Requirements*:**

The Operator will comply with applicable Colorado water laws governing injury to existing water rights and with applicable state and federal water quality and dredge and fill laws and regulations.

The operator will develop and comply with a stormwater management plan and will use best management practices (BMPs) to ensure groundwater and surface water are protected to the greatest possible extent. BMPs include schedules of activities, prohibitions of practices, maintenance procedures and other management practices to prevent or reduce the pollution in runoff from the site.

***Section 3.1.7 Groundwater - Specific Requirements*:**

The Operator will comply with the applicable standards and conditions for classified and unclassified groundwater.

***Section 3.1.8 Wildlife*:**

The mining and reclamation plans have been designed to account for the safety and protection of wildlife on the mine site. The Operator will mine the site in phases and use concurrent reclamation methods to minimize the impact on wildlife. The proposed reclamation plan may improve wildlife habitat. The proposed seed mix and plantings will create improved cover, foraging, roosting, and nesting areas for wildlife. The water area within the reservoir will serve as habitat for waterfowl and other bird species and the fringes of the reservoir will be used by mammal, bird, reptile and amphibian species. Control and/or removal of noxious and weedy species during the project and the introduction of desirable graminoid, forb and potential woody species during reclamation will result in enhancement of wildlife habitat on the project site.

***Section 3.1.9 Topsoiling*:**

Topsoil shall be removed and segregated from other spoil. Topsoil stockpiles shall be stored in places and configurations to minimize erosion and located in areas where disturbance by ongoing mining operations will be minimized. Once stockpiled, topsoil shall be re-handled as little as possible. Stockpiles that will remain in place for more than one growing season will receive vegetative cover.

Section 3.1.10 Revegetation:

In those areas where revegetation is part of the reclamation plan, the land shall be revegetated in a manner that establishes a diverse, effective, and long-lasting vegetative cover that is capable of self-regeneration without continued dependence on irrigation or fertilizer and is at least equal in extent of cover to the natural vegetation of the surrounding area. The proposed seed-mix and plantings for reclamation are outlined on the Reclamation Plan Map included in Exhibit F of this application.

Section 3.1.11 Buildings and Structures:

There is a lined pond and water line that are both owned by the applicant on the property. In addition to the water infrastructure, there are five (5) plugged and abandoned wells within the permit boundary all belonging to Noble Energy.

An aggregate processing plant will be located at the site during the duration of mining operations. These structures will be removed and the areas below mined out prior to final reclamation. The plant structures are shown on Figure C-2.

Conveyors may be constructed at the site to move material from the cells to the processing plant.

Section 3.1.12 Signs and Markers:

The Operator will post appropriate signage at the entrance to the mine site. The permit area perimeter is marked by barbed wire fencing.

(d) Plans for topsoil segregation, preservation and replacement; for stabilization, compaction and grading of spoil; and for revegetation.

Topsoil will be removed and segregated from other spoil. Topsoil will likely not needed for reclamation and may be sold or removed from the site. For reclamation, mining will be done at a 3:1 reclamation slope and will not need additional placing of topsoil material. Grading shall be done in a manner that controls erosion and siltation of the affected land and protects areas outside the affected land from slides and other damage. In addition, backfilling and grading shall be completed as soon as feasible during the mining process.

Final grading will create a final topography that is appropriate for the final land use. For example, final grading of the reservoir above the high water line will replace material no steeper than 3:1 slope to meet the grade at the top of the banks. Topsoil will be uniformly placed and spread on areas disturbed by the mining, above the anticipated high water line. The minimum thickness shall be 6 inches above the surrounding finished grade. The topsoil shall be keyed to the underlying and surrounding material by the use of harrows, rollers or other equipment suitable for the purpose.

In those areas where revegetation is part of the reclamation plan, the Operator will revegetate the land in such a manner to establish a diverse, effective, and long-lasting vegetative cover that is capable of self-regeneration without continued dependence on irrigation or fertilizer and is at least equal in extent of cover to the natural vegetation of the

surrounding area. Seed will be drilled and mulched with crimped straw. Crimped straw should be at 2 tons/acre of weed free and crop seed freestraw. Straw length should be at least 10 inches long for 70% of the product used. Mulch should be free of mold, decay, mud and other debris

The revegetation seeding and plant list on the Reclamation Plan Map contains the preferred species of grasses, shrubs and trees to be planted.

Seeding will take place once final grading and replacement of topsoil have been completed for each phase. Timing of seeding will be consistent with standard horticultural practice for dryland applications - generally between late September and the middle of April to ensure there is adequate moisture for germination.

(e) A plan or schedule indicating how and when reclamation will be implemented. Include:

i. An estimate of the periods of time which will be required for the various stages or phases of reclamation.
Reclamation for any given stage of mining may take up to five years to allow for successful revegetation. Please refer to the Timetable for Mining and Reclamation in Section (e) of Exhibit D.

ii. A description of the size and location of each area to be reclaimed during each phase.

Please refer to the Reclamation Plan Map (Exhibit F).

iii. Outlining the sequence in which each stage or phase of reclamation will be carried out.
Please refer to the Timetable for Mining and Reclamation in Section (e) of Exhibit D.

(f) A description of:

i. Final grading – maximum anticipated slope gradient or expected ranges thereof;
The finished slopes of the reservoir will be no steeper than 3:1 for slopes mined at a 3:1.

ii. Seeding – types, mixtures, quantities and time of application;
The operator will utilize the Weld County Sandy Site Seed Mix which is listed above and on the Reclamation Plan Map. The operator will seed during the appropriate season to ensure adequate moisture for germination and implement weed controls to allow the grasses to successfully establish. Additional plantings may be installed once the reservoirs are full of water and the grasses are established.

All disturbed areas 1 foot above the maximum water surface elevation will be seeded.

iii. Fertilization – types, mixtures, quantities, and time of application;

The type and application rate of fertilizer shall be determined based on a soil test at the time of final reclamation.

iv. Revegetation – types of trees, shrubs, etc.;

The site is historically windblown dunes and cattle grazeland . The site will be revegetated with the Weld County Sandy Site grass seed mix in areas that are above the highwater line.

v. *Topsoiling – specify anticipated minimum depth or range of depths for those areas where topsoil will be replaced.*

Topsoil will be uniformly placed and spread on all areas disturbed by the mining above the anticipated high water line and areas graded back to native grade. The minimum thickness shall be 6 inches above the surrounding finished grade.

WEED MANAGEMENT PLAN

Noxious weeds will be eradicated or managed within the Section 25 Sand & Gravel Mine operations areas. Noxious weed species to be managed are defined as those plant species currently identified by the Colorado State Department of Agriculture (CDA) as noxious under the Colorado Noxious Weed Act. Management efforts will be directed to those species identified under List A or List B by the CDA. List A species are required to be eradicated, while List B species will be controlled.

The noxious species are not listed here as the list of noxious species changes regularly. The Colorado State Department of Agriculture maintains a list of noxious weed species on their web site (https://www.colorado.gov/pacific/agconservation/noxious-weed-species).

The presence of noxious weeds will be monitored annually during the summer growing season at the Section 25 Sand & Gravel Mine site. Weed management measures will be undertaken where a single or combination of noxious weed species comprises or shows a deleterious effect to more than ten (10) percent of the live site vegetation. Further, where noxious weed species or plant pests constitute more than 25 percent relative vegetation cover in a contiguous area of 1000 square feet, the area will be identified as requiring weed management.
Noxious weeds will be controlled by any combination of cultural, mechanical, biological or chemical measures. Weed control measures will be developed specifically for the noxious weed species encountered and in conjunction with the local county weed control district and/or the Colorado State Department of Agriculture. Weed control measures will be undertaken by trained and/or licensed (if required by law) personnel. Weed management control will initiate within two weeks of noxious weed identification at any operation, or as specified by the county weed control specialist.

Where noxious weed control measures cause elimination of vegetation at a revegetated site, seeding or planting of desirable replacement vegetation will occur during the first normal planting or seeding season after weed control measures have been implemented.

Kyle Regan

From: Mariah Higgins <mhiggins@weld.gov>
Sent: Monday, August 11, 2025 2:36 PM
To: Kyle Regan; CTB
Subject: RE: DRMS Application - M2025015 - Adequacy Review 1 and 2

Received. Thank you!

Mariah Higgins
Deputy Clerk to the Board
Desk: 970-400-4219
P.O. Box 758, 1150 O St., Greeley, CO 80632

From: Kyle Regan <Kyler@civilresources.com>
Sent: Monday, August 11, 2025 2:30 PM
To: Mariah Higgins <mhiggins@weld.gov>; CTB <CTB@co.weld.co.us>
Subject: DRMS Application - M2025015 - Adequacy Review 1 and 2

Dear Clerk to the Board's Office,

Please see the attached DRMS 112 Reclamation Permit Adequacy Review 1 and 2 response letters for the Section 25 Sand Mine Permit #M-2025-015 to be posted for public review. The Section 25 Sand mine is located in S25 T5N R63W.

Please confirm receipt.

Thanks!

Kyle Regan
(m) 408.930.2544 ; (o) 303.833.1416 ext 10
KyleR@civilresources.com
Civil Resources, LLC.
8308 Colorado Blvd. Suite 200
Firestone, CO 80504

August 7, 2025

Mr. Jason VonLembke
Vice President of Land and Resource Management
70 Ranch LLC
8301 E. Prentice Ave, Suite 120
Greenwood Village, CO 80111

Re: 70-Ranch, LLC., Section 25 Sand Mine, Geotechnical Stability Analysis

Dear Mr. VonLembke:

This letter has been prepared to address the Mined Land Reclamation Board (MLRB) Construction Materials Rule 6, Section 4, Subsection 19, Exhibit S - Permanent Man-Made Structures (6.4.19, Exhibit S) for the proposed Thunderbird Gravel Mine. This letter describes the project and slope stability analyses utilized to evaluate the minimum distance between the edge of mining and adjacent structures to avoid damage to the structure.

The site is located approximately 9.2 miles east of the town of Kersey. More specifically, the site occupies Section 20 Township 5 North Range 63 West of the 6th Principle Meridian. The mine is in an area of irrigated agricultural land with common oil and gas wells and related infrastructure.

The Section 25 mine will consist of one mine cell which will be reclaimed to a slurry wall lined below grade reservoir. The mine cell will be excavated at a 3H:1V slope. A slurry wall will be constructed at a top elevation of 4,555 feet.

Based on the stability analyses, this report indicates that the setbacks and perimeter slopes in the mining plan are sufficient to protect structures within 200 feet of the permitted mining boundary. Actual setbacks may be greater due to permit limitations, zoning requirements, construction issues, agreements with owners, and extent of economically mineable aggregate or other issues.

GEOLOGY

The Site is located approximately 40 miles east of the eastern flank of the Rocky Mountain Front Range. Younger sedimentary strata dip eastward off the Pre-Cambrian igneous and metamorphic rocks that form the core of the Front Range into the Denver Structural Basin. The Denver Basin is an asymmetrical downwarp of sedimentary strata with a steeply dipping west limb and a gently dipping east limb.

Bedrock does not crop out at the Site, however regional geologic mapping of the area, Palkovic (2021), indicates the near surface bedrock beneath the site is most likely the Pierre Shale. Palkovic (2021) describes the Pierre Shale as mostly shale with interbedded sandstone. The regional mapping indicates the bedrock is overlain by the Eolian Sand. Palkovic (2021) describes the Eolian Sand as a sand deposit with well-sorted quartz sand grading from very fine to fine. In the northern part of the Hardin Quadrangle the Eolian Sand is typically on the order of 12 to 51 feet thick but can range up to 85 feet thick.

GEOTECHNICAL CONDITIONS

Based on the site investigations by Civil Resources in the mine area, the natural site stratigraphy generally consists of two main units: 1) Sand: wind-blown deposits that overlie the bedrock; and 2) Bedrock usually consisting of silty claystone.

Sand

The sand and gravel unit was encountered in all of the borings underlying the overburden and overlying the bedrock.

This unit thicknesses ranges from approximately fifteen (25) to eighty-five (85) feet.

Bedrock
The bedrock was encountered in all of the borings at depths ranging from fifteen (15) to eighty-five (85) feet.

Groundwater
Groundwater was not encountered at the site borings except for isolated areas.

STABILITY ANALYSES

Division of Reclamation and Mining Safety (DRMS) drafted a policy regarding stability analyses of neighboring structures. The policy summarizes adequate factors of safety (FOS) for non-critical and critical structures. The Xcel overhead electric lines, fences and access road are considered critical structures. The FOS are for both static and seismic (ground accelerations from an earthquake) stability analyses are listed in the DRMS policy. For generalized strength assumptions and critical structures, an FOS of 1.5 is considered sufficient for static conditions and an FOS of 1.3 is considered suitable for seismic conditions.

The stability of structures listed above were evaluated at the most critical representative section under anticipated loading conditions as discussed below. The GALENA computer program was used for the analysis. The method for selecting the critical failure surface for each analyzed loading condition was the following. The Simplified Bishop's Method of Analysis was used to find the critical failure surface by randomly searching 30,001 trial failure circles over a broad range of the slope surface and at the structure in question to evaluate the lowest FOS. Both static stability under anticipated mining conditions and seismic stability under peak ground acceleration loads were performed. Seismic loading was obtained from the U.S.G.S. Unified Hazard Tool. Review of the Hazard Tool indicated a maximum horizontal acceleration of 0.0928g with a return period of 2,475 years for the site.

The two (2) most critical cross section locations were selected and analyzed as described below.

- Northwest Section: This section is in the northwest section of the mine cell. An exploratory boring in the area encountered (BH-20) encountered approximately 38 feet of sand above a claystone bedrock. This section considers an 11 foot high 3H:1V excavation down to the 45 foot wide slurry wall bench then a 37-foot high 3H:1V highwall down to bedrock. See attached Figure S1 Section A. The top foot of the claystone was modelled at residual strength reflecting the weathered nature at the top of the claystone. Unweathered claystone was modelled below the top foot.

- Southwest Section: This section is in the southwest section of the mine cell. An exploratory boring in the area encountered (BH-2) encountered approximately 75 feet of sand above a claystone bedrock. This section considers 75 foot high 3H:1V highwall down to bedrock. See attached Figure S1 Section A. The top foot of the claystone was modelled at residual strength reflecting the weathered nature at the top of the claystone. Unweathered claystone was modelled below the top foot.

MATERIAL PROPERTIES

The material index and engineering strengths assumed in this slope stability report are discussed below.

Eolian Sand

The sand and gravel is generally a fine grained sand overlying a fine to coarse grained sand that is typically medium dense and locally gravelly. The Eolian sand and gravel unit was modeled as follows:

Unit Weight (pcf)	***Cohesion C' psf***	***Friction Angle Φ' °***
129	0	35

Bedrock
Bedrock below the alluvium is claystone. Claystone is generally a weak bedrock. For the claystone bedrock, two potential strength conditions were considered. These strength conditions are referred to as: 1) peak strength, and 2) residual strength.

Peak strength is the maximum shear strength the claystone bedrock exhibits. The shear strength is made up of both cohesion (diagenetic bonding) and internal friction. Under short-term conditions for unsheared claystone, peak strength governs behavior. If a sheared surface or sheared zone is present within claystone because of faulting, slippage between beds due to folding, past shrink-swell behavior, stress relief, weathering, or from a landslide, the cohesion along the sheared surface is reduced to zero, and the angle of internal friction is decreased, due to alignment of clay minerals parallel to the shear plane. Under these conditions a claystone exhibits its lowest strength known as residual strength. Residual strength bedrock occurs in discrete zones, parallel with the sheared surface or zone, whereas fully softened strength occurs over a broader area (not used in this modeling). Based on data from site investigations, the residual strength claystone was modeled in a 1-foot thick, weathered layer overlying the peak strength bedrock as follows:

Unit Weight (pcf)	***Cohesion C' psf***	***Friction Angle Φ' °***
Peak = 126 Residual = 110	Peak = 100 Residual = 0	Peak = 25 Residual = 16

Soil-Bentonite Slurry Wall
The proposed slurry wall will consist of a mix of imported clay, alluvial sand, and imported bentonite. The resulting mix will produce a non-Newtonian fluid with some shear strength characteristics based on a reduced friction angle of the overlying overburden. Based on engineering judgment, we modeled the slurry wall as follows:

Unit Weight (pcf)	***Cohesion C' psf***	***Friction Angle Φ' °***
115	0	0

STABILITY ANALYSES RESULTS
The stability analyses assumed the mining will be per the mine plan. The plan calls for the cell to be mined at a 3H:1V mine slope and reclaimed at a 3H:1V reclamation slope. Setbacks listed in Table 1 (below) indicate the setback from the structure to the final mining slope limit.

The factor of safety shown below is the minimum factor of safety of the conditions listed above.

TABLE 1 - SLOPE STABILITY RESULTS AND SETBACKS

Section	Location	Critical Structure	Structure Setback From Mine/Excavation Limit (ft)	Static Factor of Safety at Structure	Seismic Factor of Safety at Structure (0.0928g horizontal)	DRMS Draft FOS Requirement Static/Quake
A	Northwest Mine/Reclamation Slope (44', 3h:1v)	Xcel OHE	18	2.36	1.67	1.5/1.3
B	Southwest Mine/Reclamation Slope (75', 3h:1v)	Slurry Wall	30	2.06	1.57	1.5/1.3

CONCLUSIONS

The Xcel overhead electric and site slurry wall are stable based on the Factors of Safety listed in the table above.

LIMITATIONS

Our review is based on regional geologic mapping, present mining plans, and borehole data. Stability analyses were performed using typical strength parameters for the various strata in the critical sections. Should the mining plans change or subsurface conditions vary from those portrayed in this letter, we should be contacted in order to re-evaluate the potential affects on permanent man-made structures. Stability analyses were run at the structure in question and were not on failure surfaces closer to the highwall. Note also that surcharge loads due to temporary material stockpiles and overburden berms were not considered in the analysis.

Please call with any questions or comments.

Sincerely,

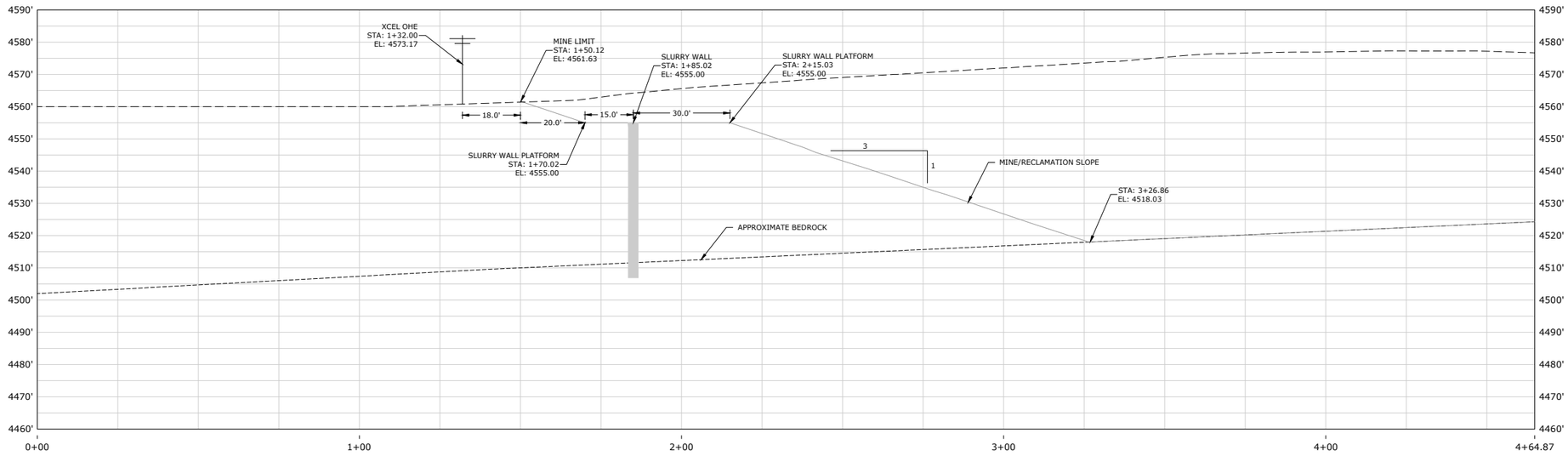
Civil Resources, LLC

Kyle Regan, P.G.
Project Geologist

Attachments:

Attachment A: Sections
Attachment B: Galena Model Sections A, B
Attachment C: Galena Output Files

ATTACHMENT A



A C2 S1 SECTION - NORTHWEST

0 10 20 (IN FEET)

B C2 S1 SECTION - SOUTHWEST

0 10 20 (IN FEET)

20 10 0

0 10 20 (SCALE IN FEET)

CIVIL RESOURCES

323 5th STREET
P.O. Box 680
FREDERICK, CO 80530
303.833.1416
WWW.CIVILRESOURCES.COM

UNITED WATER

UNITED WATER & SANITATION DIST

8301 EAST PRENTICE AVE. SUITE 100
GREENWOOD VILLAGE, CO 80111
303.659.5000 (p)
CONTACT: DREW DAMIANO

70 RANCH SECTION 25
DRMS 112 APPLICATION
WELD COUNTY, COLORADO

REVISIONS

NO	DESCRIPTION	DATE

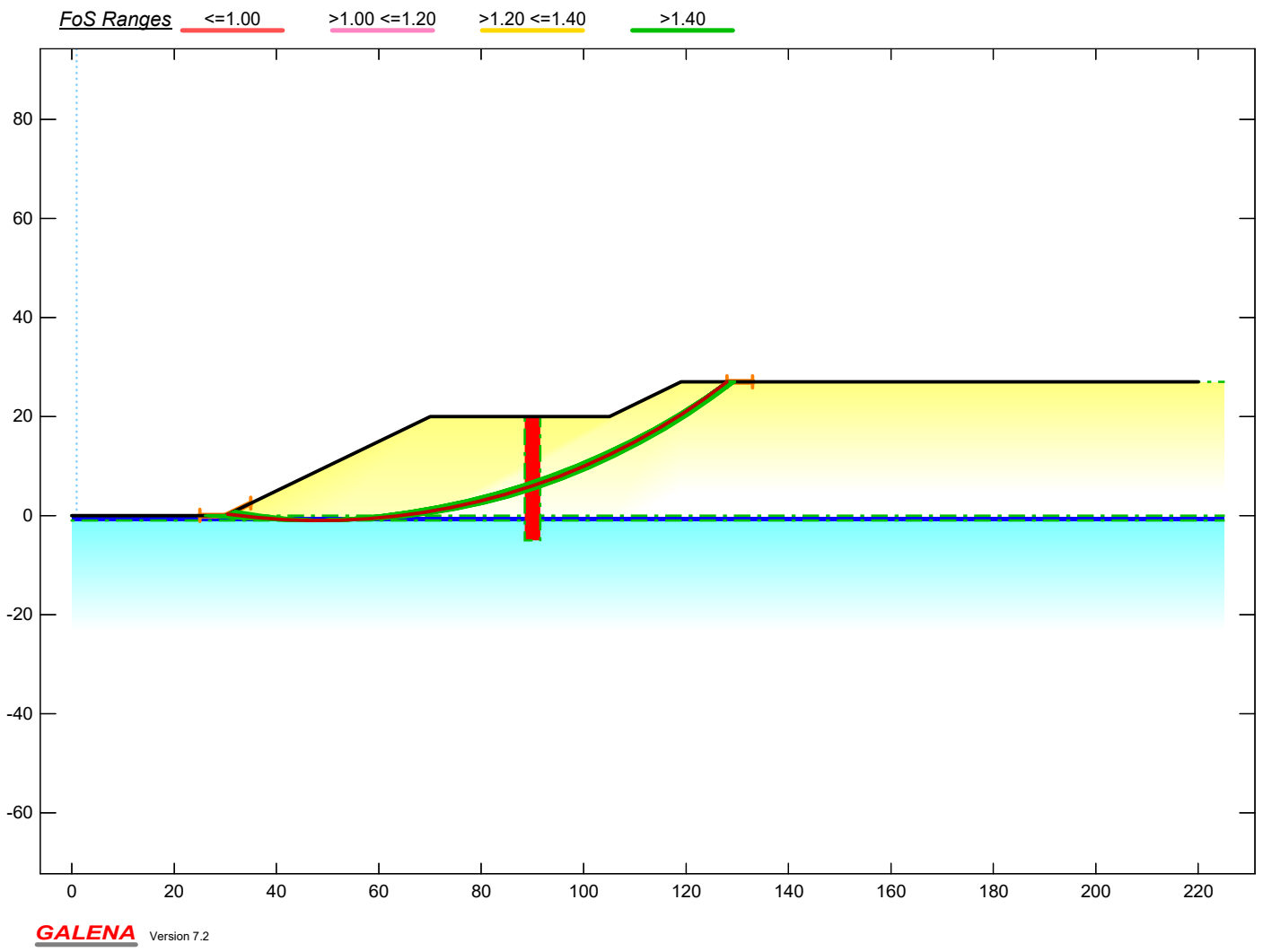
DESIGNED BY: KSR | DATE: 8/7/2025
DRAWN BY: KSR | SCALE: AS NOTED
CHECKED BY: ARR | AS NOTED
JOB NO.: ####
DWG NAME: 70-RANCH MP2.DWG

SLOPE STABILITY SECTIONS

SHEET: S1

J:\United Water & San - 141\70-Ranch_DRMS\Drawings\Sheets\70-ranch mp2.dwg, 22x34 P&P, 8/11/2025 9:15:08 AM

ATTACHMENT B



Material Keys

2: Sand and Gravel

3: Residual Claystone

4: Unweathered Claystone

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

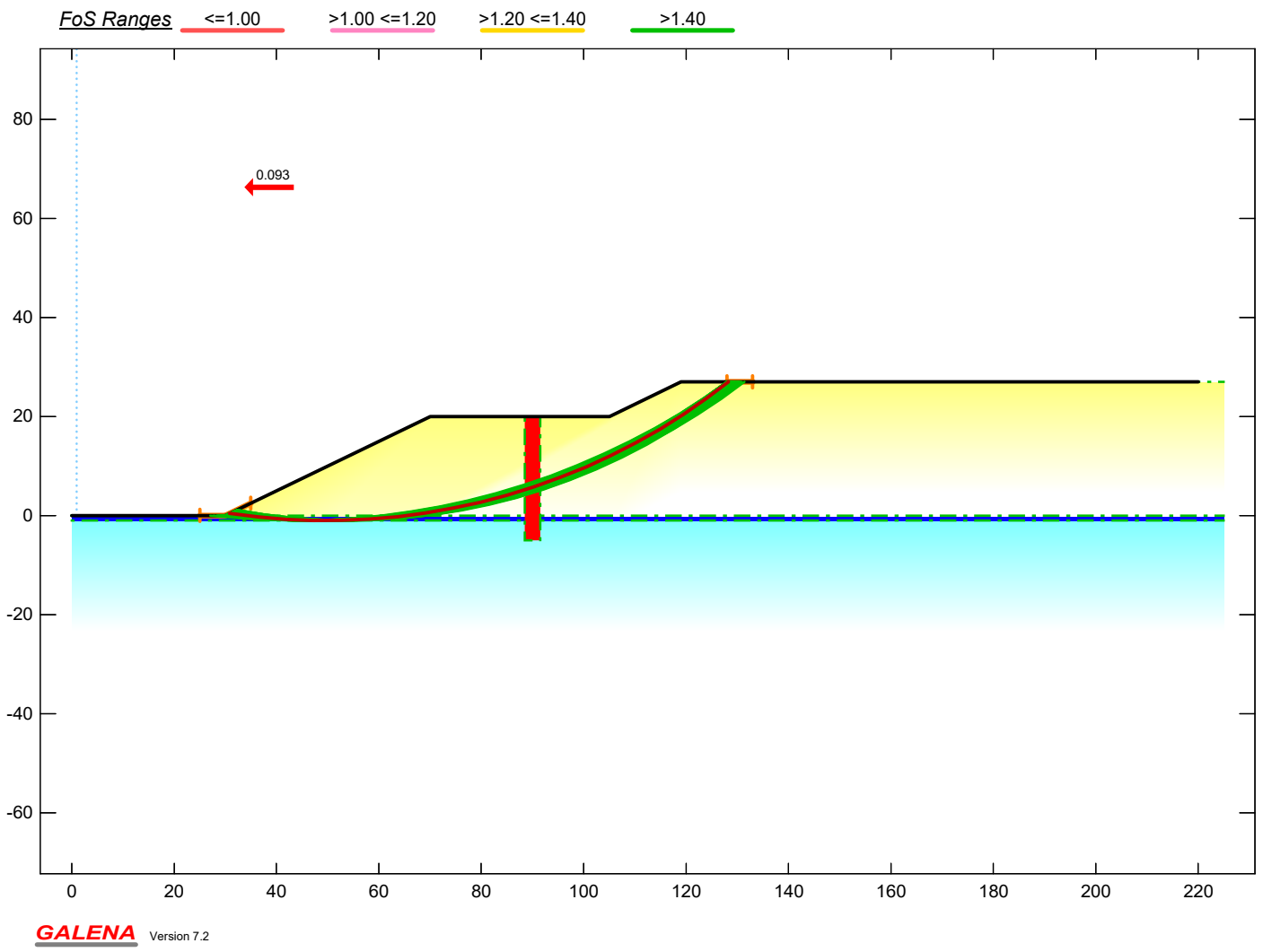
Critical Factor of Safety: 2.36

Project Section 25-XSECT1
Static

File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_1.gmf

Edited: 7 Aug 2025 *Processed:* 7 Aug 2025

Civil Resources



Material Keys

2: Sand and Gravel

3: Residual Claystone

4: Unweathered Claystone

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

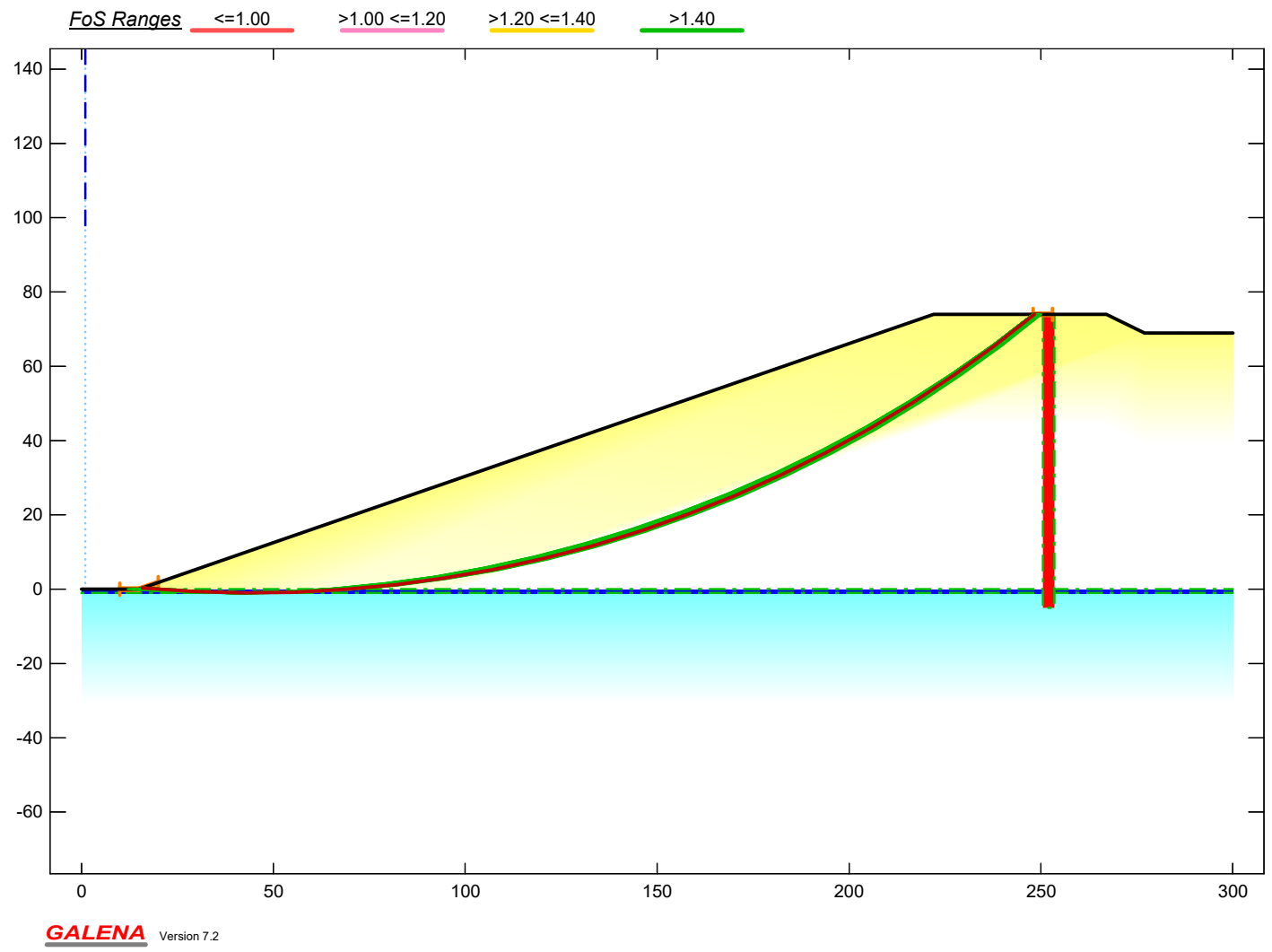
Critical Factor of Safety: 1.67

Project Section 25-XSECT1
Static

File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_1_Seismic.gmf

Edited: 7 Aug 2025 *Processed:* 7 Aug 2025

Civil Resources



Material Keys

2: Sand and Gravel

3: Residual Claystone

4: Unweathered Claystone

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

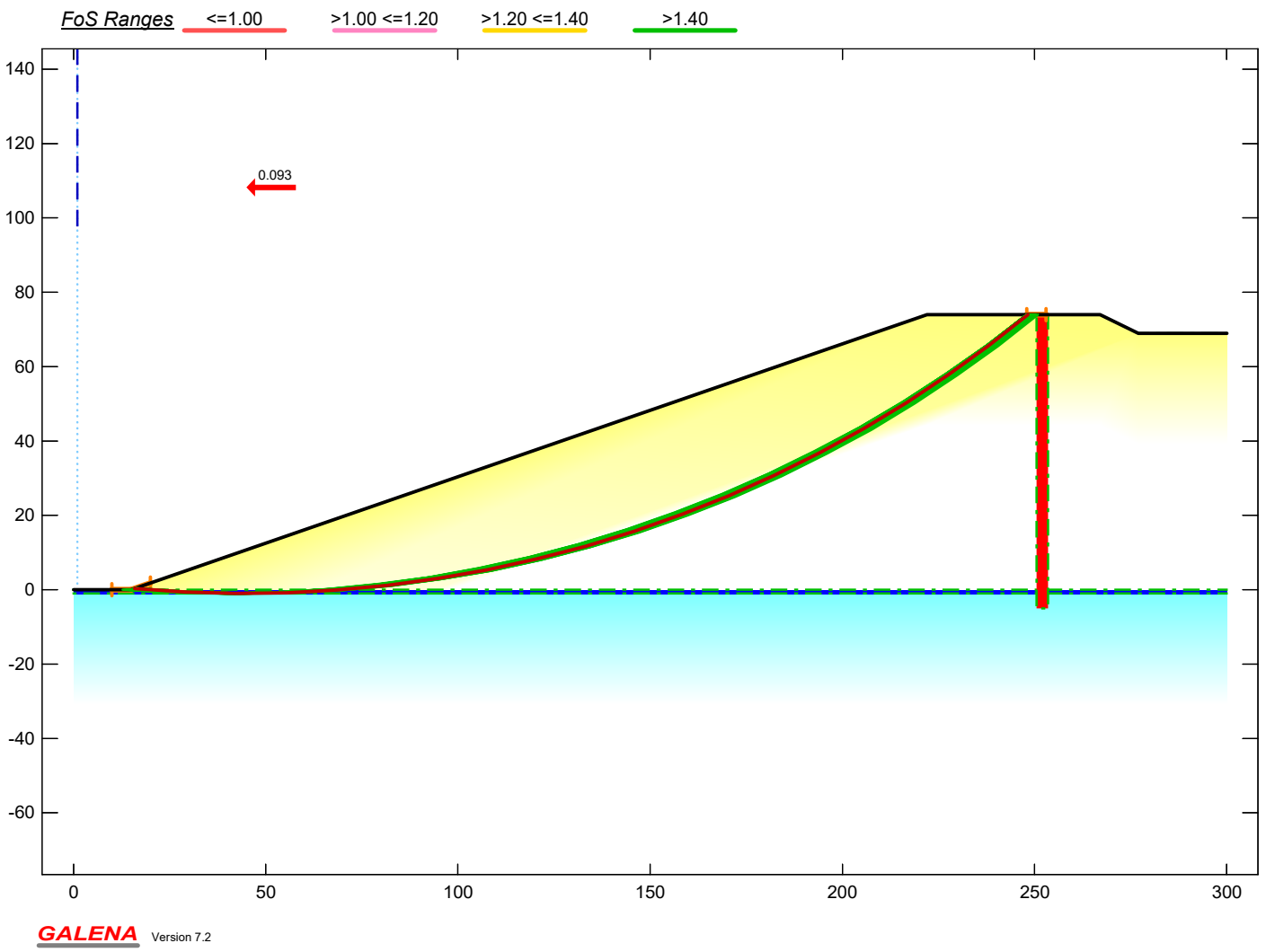
Critical Factor of Safety: 2.06

Project Section 25-XSECTB
Static

File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_2.gmf

Edited: 29 Jul 2025 *Processed:* 7 Aug 2025

Civil Resources



Material Keys

2: Sand and Gravel

3: Residual Claystone

4: Unweathered Claystone

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.57

Project Section 25-XSECTB
Seismic

File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_2_Seismic.gmf

Edited: 29 Jul 2025 *Processed:* 7 Aug 2025

Civil Resources

ATTACHMENT C

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

---

Project: Section 25-XSECT1
File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_1.gmf
Processed: 07 Aug 2025 09:10:14

DATA: Analysis 1 - Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion Phi UnitWeight Ru
50.00 27.0 114.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion Phi UnitWeight Ru
0.00 35.0 129.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Residual Claystone
Cohesion Phi UnitWeight Ru
0.00 16.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Unweathered Claystone
Cohesion Phi UnitWeight Ru
100.00 25.0 126.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion Phi UnitWeight Ru
0.00 0.0 115.00 Auto

Water Properties

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

Material Profiles (4 profiles)

Profile: 1 (4 points) Material beneath: 2 - Sand and Gravel
0.00 27.00 88.50 27.00 91.50 27.00 225.00 27.00
Profile: 2 (4 points) Material beneath: 3 - Residual Claystone
0.00 0.00 88.50 0.00 91.50 0.00 225.00 0.00
Profile: 3 (4 points) Material beneath: 4 - Unweathered Claystone
0.00 -1.00 88.50 -1.00 91.50 -1.00 225.00 -1.00
Profile: 4 (7 points) Material within: 5 - Slurry Wall
88.50 20.00 91.50 20.00 91.50 0.00 91.50 -5.00 88.50 -5.00
88.50 0.00 88.50 20.00

Slope Surface (6 points)

0.00 0.00 30.00 0.00 70.00 20.00 105.00 20.00 119.00 27.00
220.00 27.00

Phreatic Surface (2 points)

1.00 98.00 1.00 220.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 30.00 YL: 0.00 XR: 130.50 YR: 27.00
Centre: XC: 46.53 YC: 139.02 Radius: R: 140.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	5.00	50.00
Trial positions within range:	30	20	50

- -

RESULTS: Analysis 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: 2.407

Analysis Summary
==========
There were: 30001 successful analyses from a total of 30001 trial failure surfaces

Critical (minimum) Factor of Safety: 2.36
==========

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	30.52	0.26	128.00	27.00	48.37	126.25	127.24	2.364	<-- Critical Surface
2	30.52	0.26	128.53	27.00	48.52	127.25	128.27	2.368	
3	30.17	0.09	128.00	27.00	46.95	130.34	131.33	2.368	
4	30.86	0.43	128.26	27.00	49.70	123.18	124.18	2.368	
5	27.07	0.00	128.00	27.00	43.83	139.51	140.51	2.370	
6	30.86	0.43	128.79	27.00	49.85	124.19	125.20	2.371	
7	29.14	0.00	128.00	27.00	45.55	134.41	135.41	2.372	
8	29.83	0.00	128.26	27.00	46.16	133.39	134.39	2.372	
9	29.48	0.00	128.00	27.00	45.89	133.38	134.39	2.372	
10	30.52	0.26	128.26	27.00	48.30	127.29	128.27	2.373	
11	31.21	0.60	128.00	27.00	50.89	119.08	120.10	2.373	
12	30.86	0.43	128.00	27.00	49.48	123.21	124.18	2.374	
13	30.17	0.09	128.26	27.00	46.89	131.37	132.35	2.375	
14	30.17	0.09	128.53	27.00	47.11	131.34	132.35	2.375	
15	31.21	0.60	128.26	27.00	50.82	120.13	121.12	2.375	
16	28.79	0.00	128.00	27.00	45.21	135.44	136.43	2.376	
17	29.83	0.00	128.00	27.00	46.23	132.36	133.37	2.376	
18	30.52	0.26	128.79	27.00	48.45	128.29	129.29	2.376	
19	29.48	0.00	128.26	27.00	45.82	134.42	135.41	2.376	

20	28.79	0.00	128.53	27.00	45.38	136.44	137.45	2.377
21	30.17	0.09	128.79	27.00	47.05	132.38	133.37	2.377
22	30.86	0.43	128.53	27.00	49.63	124.22	125.20	2.378
23	31.21	0.60	128.79	27.00	50.96	121.14	122.14	2.378
24	29.48	0.00	128.79	27.00	45.99	135.43	136.43	2.378
25	31.55	0.78	128.26	27.00	51.93	117.07	118.06	2.379
26	30.52	0.26	129.32	27.00	48.61	129.30	130.31	2.379
27	28.45	0.00	128.00	27.00	44.87	136.46	137.45	2.380
28	29.83	0.00	128.00	27.00	45.93	133.42	134.39	2.380
29	27.41	0.00	128.00	27.00	44.16	138.48	139.49	2.380
30	29.14	0.00	128.26	27.00	45.48	135.45	136.43	2.380
31	27.76	0.00	128.26	27.00	44.43	138.49	139.49	2.381
32	30.86	0.43	129.05	27.00	49.78	125.23	126.22	2.381
33	30.52	0.26	128.53	27.00	48.23	128.33	129.29	2.381
34	28.45	0.00	128.53	27.00	45.04	137.47	138.47	2.381
35	31.21	0.60	129.32	27.00	51.11	122.15	123.16	2.381
36	29.83	0.00	128.53	27.00	46.10	134.43	135.41	2.382
37	26.72	0.00	128.26	27.00	43.44	141.57	142.55	2.382
38	29.14	0.00	128.79	27.00	45.65	136.45	137.45	2.382
39	31.55	0.78	128.79	27.00	52.07	118.08	119.08	2.382
40	31.21	0.60	128.00	27.00	50.60	120.16	121.12	2.383
41	28.10	0.00	128.26	27.00	44.77	137.46	138.47	2.383
42	30.17	0.09	128.00	27.00	46.66	131.40	132.35	2.383
43	29.83	0.00	128.79	27.00	46.32	134.40	135.41	2.383
44	29.83	0.00	129.05	27.00	46.26	135.44	136.43	2.383
45	29.48	0.00	128.00	27.00	45.59	134.45	135.41	2.384
46	28.10	0.00	128.00	27.00	44.54	137.49	138.47	2.384
47	30.86	0.43	128.26	27.00	49.41	124.25	125.20	2.384
48	27.07	0.00	128.26	27.00	43.77	140.54	141.53	2.384
49	26.72	0.00	128.00	27.00	43.50	140.53	141.53	2.384
50	30.86	0.43	129.58	27.00	49.94	126.24	127.24	2.384
51	26.38	0.00	128.53	27.00	43.34	142.57	143.57	2.384
52	29.14	0.00	128.53	27.00	45.71	135.42	136.43	2.384
53	28.79	0.00	128.26	27.00	45.15	136.47	137.45	2.384
54	30.52	0.26	129.05	27.00	48.38	129.33	130.31	2.384
55	27.07	0.00	128.00	27.00	43.54	140.57	141.53	2.385
56	30.17	0.09	128.53	27.00	46.82	132.41	133.37	2.385
57	27.41	0.00	128.26	27.00	44.10	139.52	140.51	2.385
58	30.17	0.09	129.32	27.00	47.21	133.39	134.39	2.385
59	28.45	0.00	128.26	27.00	45.10	136.44	137.45	2.385
60	28.10	0.00	128.53	27.00	44.71	138.50	139.49	2.385
61	29.48	0.00	128.53	27.00	45.76	135.45	136.43	2.385
62	31.21	0.60	128.53	27.00	50.74	121.17	122.14	2.386
63	28.79	0.00	128.79	27.00	45.32	137.48	138.47	2.386
64	30.17	0.09	129.05	27.00	46.98	133.42	134.39	2.386
65	27.76	0.00	128.00	27.00	44.49	137.45	138.47	2.387
66	27.41	0.00	128.00	27.00	43.87	139.54	140.51	2.387
67	30.86	0.43	128.79	27.00	49.56	125.26	126.22	2.387
68	29.48	0.00	128.53	27.00	46.05	134.39	135.41	2.387
69	30.86	0.43	128.00	27.00	49.78	122.13	123.16	2.387
70	29.48	0.00	129.05	27.00	45.92	136.46	137.45	2.387
71	29.14	0.00	128.00	27.00	45.26	135.47	136.43	2.387
72	27.76	0.00	128.00	27.00	44.21	138.52	139.49	2.388
73	28.79	0.00	128.26	27.00	45.44	135.41	136.43	2.388

74	26.38	0.00	128.00	27.00	43.17	141.56	142.55	2.388
75	30.52	0.26	129.58	27.00	48.54	130.34	131.33	2.388
76	31.55	0.78	128.00	27.00	51.71	117.10	118.06	2.388
77	28.79	0.00	129.32	27.00	45.48	138.49	139.49	2.388
78	30.52	0.26	128.00	27.00	48.07	127.32	128.27	2.388
79	30.17	0.09	129.58	27.00	47.15	134.43	135.41	2.388
80	28.45	0.00	128.26	27.00	44.81	137.50	138.47	2.388
81	29.83	0.00	128.26	27.00	45.87	134.45	135.41	2.388
82	29.14	0.00	129.32	27.00	45.82	137.46	138.47	2.388
83	31.21	0.60	129.05	27.00	50.89	122.18	123.16	2.389
84	27.76	0.00	128.53	27.00	44.38	139.52	140.51	2.389
85	29.48	0.00	129.58	27.00	46.09	137.47	138.47	2.389
86	29.14	0.00	128.53	27.00	45.42	136.48	137.45	2.389
87	30.86	0.43	128.00	27.00	49.19	124.29	125.20	2.390
88	28.10	0.00	128.00	27.00	44.83	136.43	137.45	2.390
89	30.86	0.43	129.32	27.00	50.00	125.20	126.22	2.390
90	30.86	0.43	129.32	27.00	49.71	126.27	127.24	2.390
91	30.52	0.26	128.26	27.00	48.00	128.36	129.29	2.390
92	28.45	0.00	128.79	27.00	44.98	138.51	139.49	2.390
93	27.07	0.00	128.79	27.00	43.94	141.55	142.55	2.390
94	29.83	0.00	128.79	27.00	46.03	135.46	136.43	2.390
95	31.90	0.95	128.00	27.00	52.83	114.03	115.00	2.391
96	30.52	0.26	129.05	27.00	48.67	128.26	129.29	2.391
97	26.03	0.00	128.79	27.00	42.96	144.63	145.61	2.391
98	26.72	0.00	128.53	27.00	43.67	141.54	142.55	2.391
99	31.55	0.78	128.53	27.00	51.85	118.11	119.08	2.391

Critical Failure Surface (circle 1)

Intersects: XL: 30.52 YL: 0.26 XR: 128.00 YR: 27.00

Centre: XC: 48.37 YC: 126.25 Radius: R: 127.24

Generated failure surface: (20 points)

30.52	0.26	35.95	-0.39	41.40	-0.81	46.87	-0.99	52.34	-0.94
57.81	-0.65	63.25	-0.13	68.67	0.63	74.05	1.62	79.38	2.84
84.66	4.29	89.87	5.96	95.00	7.85	100.04	9.97	104.99	12.30
109.84	14.84	114.57	17.58	119.18	20.53	123.66	23.67	128.00	27.00

Slice Geometry and Properties - Critical Failure Surface (circle 1, 43 slices)

Slice	X-S	Base						PoreWater	Normal	Test	
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	30.52	1.44	-6.8	2.16	2.17	2	0.00	35.0	186.30	0.00	89.48	1.04
2	32.68	3.02	-6.8	1.64	1.65	3	0.00	16.0	386.49	0.00	239.64	1.02
3	34.31	4.68	-6.8	1.64	1.65	3	0.00	16.0	594.53	0.00	368.64	1.02
4	35.95	11.33	-4.4	2.73	2.74	3	0.00	16.0	1435.34	0.00	531.19	1.01
5	38.68	15.61	-4.4	2.73	2.74	3	0.00	16.0	1977.65	0.00	731.88	1.01
6	41.40	19.79	-1.9	2.73	2.74	3	0.00	16.0	2508.78	0.00	921.40	1.00
7	44.14	23.78	-1.9	2.73	2.74	3	0.00	16.0	3018.17	0.00	1108.49	1.00
8	46.87	27.62	0.6	2.74	2.74	3	0.00	16.0	3511.78	0.00	1282.41	1.00
9	49.61	31.28	0.6	2.74	2.74	3	0.00	16.0	3986.30	0.00	1455.69	1.00
10	52.34	34.74	3.0	2.73	2.74	3	0.00	16.0	4436.89	0.00	1613.98	1.00
11	55.07	38.08	3.0	2.73	2.74	3	0.00	16.0	4874.82	0.00	1773.28	1.00
12	57.81	41.12	5.5	2.72	2.74	3	0.00	16.0	5277.38	0.00	1915.90	0.99
13	60.53	44.11	5.5	2.72	2.74	3	0.00	16.0	5677.24	0.00	2061.07	0.99

14	63.25	15.24	7.9	0.90	0.91	3	0.00	16.0	1964.66	0.00	2144.32	0.99
15	64.15	39.49	7.9	2.26	2.28	2	0.00	35.0	5093.68	0.00	2165.71	0.97
16	66.41	41.32	7.9	2.26	2.28	2	0.00	35.0	5330.80	0.00	2266.53	0.97
17	68.67	25.18	10.4	1.33	1.35	2	0.00	35.0	3248.29	0.00	2313.98	0.96
18	70.00	38.34	10.4	2.02	2.06	2	0.00	35.0	4946.29	0.00	2316.97	0.96
19	72.02	37.59	10.4	2.02	2.06	2	0.00	35.0	4849.12	0.00	2271.46	0.96
20	74.05	48.20	12.9	2.67	2.74	2	0.00	35.0	6217.79	0.00	2183.91	0.96
21	76.72	46.57	12.9	2.67	2.74	2	0.00	35.0	6008.12	0.00	2110.26	0.96
22	79.38	44.31	15.3	2.64	2.74	2	0.00	35.0	5716.62	0.00	2004.31	0.96
23	82.02	42.41	15.3	2.64	2.74	2	0.00	35.0	5470.40	0.00	1917.97	0.96
24	84.66	29.59	17.8	1.92	2.02	2	0.00	35.0	3817.53	0.00	1814.74	0.96
25	86.58	28.41	17.8	1.92	2.02	2	0.00	35.0	3664.67	0.00	1742.07	0.96
26	88.50	19.49	17.8	1.37	1.44	5	0.00	0.0	2241.53	0.00	1640.00	1.05
27	89.87	22.44	20.3	1.63	1.74	5	0.00	0.0	2580.61	0.00	1580.08	1.07
28	91.50	22.94	20.3	1.75	1.86	2	0.00	35.0	2959.78	0.00	1525.10	0.96
29	93.25	21.81	20.3	1.75	1.86	2	0.00	35.0	2813.99	0.00	1449.98	0.96
30	95.00	29.31	22.7	2.52	2.74	2	0.00	35.0	3781.06	0.00	1333.29	0.96
31	97.52	26.64	22.7	2.52	2.74	2	0.00	35.0	3437.07	0.00	1211.99	0.96
32	100.04	23.39	25.2	2.48	2.74	2	0.00	35.0	3017.40	0.00	1070.02	0.97
33	102.52	20.51	25.2	2.48	2.74	2	0.00	35.0	2645.62	0.00	938.18	0.97
34	104.99	18.59	27.7	2.42	2.74	2	0.00	35.0	2397.81	0.00	856.72	0.98
35	107.42	18.45	27.7	2.42	2.74	2	0.00	35.0	2379.59	0.00	850.21	0.98
36	109.84	17.72	30.1	2.37	2.74	2	0.00	35.0	2285.92	0.00	824.50	0.99
37	112.21	17.27	30.1	2.37	2.74	2	0.00	35.0	2228.02	0.00	803.62	0.99
38	114.57	15.61	32.6	2.21	2.63	2	0.00	35.0	2013.68	0.00	764.82	1.00
39	116.79	14.93	32.6	2.21	2.63	2	0.00	35.0	1925.71	0.00	731.41	1.00
40	119.00	13.48	34.9	2.33	2.84	2	0.00	35.0	1738.44	0.00	618.43	1.01
41	121.33	9.67	35.0	2.33	2.85	2	0.00	35.0	1247.05	0.00	443.10	1.01
42	123.66	5.42	37.5	2.17	2.74	2	0.00	35.0	699.26	0.00	262.59	1.03
43	125.83	1.81	37.5	2.17	2.74	2	0.00	35.0	233.09	0.00	87.53	1.03

X-S Area: 1052.74 Path Length: 103.94 X-S Weight: 134825.28

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

---

Project: Section 25-XSECT1
File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_1_Seismic.gmf
Processed: 07 Aug 2025 09:13:26

DATA: Analysis 1 - Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion Phi UnitWeight Ru
50.00 27.0 114.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion Phi UnitWeight Ru
0.00 35.0 129.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Residual Claystone
Cohesion Phi UnitWeight Ru
0.00 16.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Unweathered Claystone
Cohesion Phi UnitWeight Ru
100.00 25.0 126.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion Phi UnitWeight Ru
0.00 0.0 115.00 Auto

Water Properties

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

Material Profiles (4 profiles)

Profile: 1 (4 points) Material beneath: 2 - Sand and Gravel
0.00 27.00 88.50 27.00 91.50 27.00 225.00 27.00
Profile: 2 (4 points) Material beneath: 3 - Residual Claystone
0.00 0.00 88.50 0.00 91.50 0.00 225.00 0.00
Profile: 3 (4 points) Material beneath: 4 - Unweathered Claystone
0.00 -1.00 88.50 -1.00 91.50 -1.00 225.00 -1.00
Profile: 4 (7 points) Material within: 5 - Slurry Wall
88.50 20.00 91.50 20.00 91.50 0.00 91.50 -5.00 88.50 -5.00
88.50 0.00 88.50 20.00

Slope Surface (6 points)

0.00 0.00 30.00 0.00 70.00 20.00 105.00 20.00 119.00 27.00
220.00 27.00

Phreatic Surface (2 points)

1.00 98.00 1.00 220.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 30.00 YL: 0.00 XR: 130.50 YR: 27.00
Centre: XC: 46.53 YC: 139.02 Radius: R: 140.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.093

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	5.00	50.00
Trial positions within range:	30	20	50

- -

RESULTS: Analysis 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: 1.704

Analysis Summary
==========
There were: 30001 successful analyses from a total of 30001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.67
==========

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	30.86	0.43	128.26	27.00	49.70	123.18	124.18	1.674	<-- Critical Surface
2	30.52	0.26	128.00	27.00	48.37	126.25	127.24	1.675	
3	30.86	0.43	128.79	27.00	49.85	124.19	125.20	1.675	
4	30.52	0.26	128.53	27.00	48.52	127.25	128.27	1.676	
5	31.21	0.60	128.00	27.00	50.89	119.08	120.10	1.677	
6	31.21	0.60	128.26	27.00	50.82	120.13	121.12	1.677	
7	31.55	0.78	128.26	27.00	51.93	117.07	118.06	1.677	
8	31.21	0.60	128.79	27.00	50.96	121.14	122.14	1.678	
9	31.55	0.78	128.79	27.00	52.07	118.08	119.08	1.678	
10	31.21	0.60	129.32	27.00	51.11	122.15	123.16	1.679	
11	30.86	0.43	128.00	27.00	49.48	123.21	124.18	1.680	
12	30.17	0.09	128.00	27.00	46.95	130.34	131.33	1.680	
13	30.52	0.26	128.26	27.00	48.30	127.29	128.27	1.681	
14	30.86	0.43	128.53	27.00	49.63	124.22	125.20	1.681	
15	30.86	0.43	129.05	27.00	49.78	125.23	126.22	1.682	

16	30.52	0.26	128.79	27.00	48.45	128.29	129.29	1.682
17	30.86	0.43	129.58	27.00	49.94	126.24	127.24	1.682
18	30.52	0.26	129.32	27.00	48.61	129.30	130.31	1.683
19	31.21	0.60	128.00	27.00	50.60	120.16	121.12	1.683
20	31.90	0.95	128.00	27.00	52.83	114.03	115.00	1.684
21	31.21	0.60	128.53	27.00	50.74	121.17	122.14	1.684
22	30.17	0.09	128.53	27.00	47.11	131.34	132.35	1.684
23	31.90	0.95	128.53	27.00	52.96	115.04	116.02	1.685
24	31.55	0.78	128.00	27.00	51.71	117.10	118.06	1.685
25	29.83	0.00	128.26	27.00	46.16	133.39	134.39	1.685
26	31.21	0.60	129.05	27.00	50.89	122.18	123.16	1.685
27	30.17	0.09	128.26	27.00	46.89	131.37	132.35	1.685
28	30.17	0.09	128.79	27.00	47.05	132.38	133.37	1.685
29	31.55	0.78	128.53	27.00	51.85	118.11	119.08	1.685
30	31.90	0.95	128.26	27.00	53.04	113.99	115.00	1.686
31	29.14	0.00	128.00	27.00	45.55	134.41	135.41	1.686
32	29.48	0.00	128.00	27.00	45.89	133.38	134.39	1.686
33	30.86	0.43	128.26	27.00	49.41	124.25	125.20	1.686
34	30.52	0.26	128.53	27.00	48.23	128.33	129.29	1.686
35	31.90	0.95	129.58	27.00	53.24	117.06	118.06	1.686
36	31.55	0.78	129.05	27.00	52.00	119.12	120.10	1.686
37	30.86	0.43	128.79	27.00	49.56	125.26	126.22	1.687
38	30.52	0.26	129.05	27.00	48.38	129.33	130.31	1.687
39	31.21	0.60	130.63	27.00	51.34	125.21	126.22	1.687
40	27.07	0.00	128.00	27.00	43.83	139.51	140.51	1.688
41	31.55	0.78	130.11	27.00	52.29	121.15	122.14	1.688
42	30.86	0.43	129.32	27.00	49.71	126.27	127.24	1.688
43	30.86	0.43	129.32	27.00	50.00	125.20	126.22	1.688
44	30.52	0.26	129.58	27.00	48.54	130.34	131.33	1.688
45	31.21	0.60	130.11	27.00	51.19	124.20	125.20	1.688
46	29.83	0.00	128.00	27.00	46.23	132.36	133.37	1.688
47	29.48	0.00	128.79	27.00	45.99	135.43	136.43	1.688
48	29.48	0.00	128.26	27.00	45.82	134.42	135.41	1.688
49	30.86	0.43	129.84	27.00	49.87	127.28	128.27	1.689
50	31.55	0.78	130.63	27.00	52.44	122.16	123.16	1.689
51	30.52	0.26	130.11	27.00	48.70	131.35	132.35	1.689
52	28.79	0.00	128.53	27.00	45.38	136.44	137.45	1.689
53	30.17	0.09	129.32	27.00	47.21	133.39	134.39	1.689
54	28.79	0.00	128.00	27.00	45.21	135.44	136.43	1.689
55	30.86	0.43	128.00	27.00	49.78	122.13	123.16	1.690
56	30.52	0.26	129.84	27.00	48.77	130.31	131.33	1.690
57	30.86	0.43	130.11	27.00	50.09	127.25	128.27	1.690
58	31.55	0.78	128.00	27.00	52.01	116.02	117.04	1.690
59	31.21	0.60	128.26	27.00	50.52	121.21	122.14	1.690
60	30.86	0.43	130.89	27.00	50.18	129.30	130.31	1.691
61	29.83	0.00	129.05	27.00	46.26	135.44	136.43	1.691
62	29.83	0.00	128.53	27.00	46.10	134.43	135.41	1.691
63	29.83	0.00	128.00	27.00	45.93	133.42	134.39	1.691
64	31.55	0.78	129.58	27.00	52.14	120.14	121.12	1.691
65	30.17	0.09	129.58	27.00	47.15	134.43	135.41	1.691
66	31.21	0.60	128.79	27.00	50.67	122.22	123.16	1.691
67	30.86	0.43	128.00	27.00	49.19	124.29	125.20	1.691
68	30.17	0.09	129.05	27.00	46.98	133.42	134.39	1.691
69	29.83	0.00	128.79	27.00	46.32	134.40	135.41	1.691

70	32.24	1.12	129.32	27.00	54.13	114.02	115.00	1.691
71	30.17	0.09	128.53	27.00	46.82	132.41	133.37	1.691
72	30.86	0.43	131.42	27.00	50.34	130.31	131.33	1.692
73	29.14	0.00	128.79	27.00	45.65	136.45	137.45	1.692
74	30.17	0.09	128.00	27.00	46.66	131.40	132.35	1.692
75	29.14	0.00	128.26	27.00	45.48	135.45	136.43	1.692
76	31.21	0.60	129.32	27.00	50.82	123.23	124.18	1.692
77	31.90	0.95	129.05	27.00	53.10	116.05	117.04	1.692
78	30.52	0.26	129.05	27.00	48.67	128.26	129.29	1.692
79	30.86	0.43	128.53	27.00	49.34	125.30	126.22	1.692
80	31.90	0.95	130.11	27.00	53.39	118.07	119.08	1.692
81	32.24	1.12	129.84	27.00	54.27	115.03	116.02	1.692
82	31.55	0.78	128.26	27.00	51.64	118.15	119.08	1.692
83	30.52	0.26	129.32	27.00	48.32	130.37	131.33	1.692
84	28.45	0.00	128.53	27.00	45.04	137.47	138.47	1.693
85	30.86	0.43	130.37	27.00	50.02	128.29	129.29	1.693
86	30.52	0.26	128.00	27.00	48.07	127.32	128.27	1.693
87	28.45	0.00	128.00	27.00	44.87	136.46	137.45	1.693
88	30.86	0.43	129.05	27.00	49.49	126.30	127.24	1.693
89	31.90	0.95	128.26	27.00	52.75	115.08	116.02	1.693
90	31.55	0.78	128.79	27.00	51.78	119.16	120.10	1.693
91	32.24	1.12	130.37	27.00	54.41	116.04	117.04	1.693
92	31.21	0.60	128.53	27.00	51.04	120.09	121.12	1.693
93	30.52	0.26	129.84	27.00	48.48	131.38	132.35	1.693
94	31.55	0.78	129.32	27.00	52.22	119.09	120.10	1.694
95	31.21	0.60	130.37	27.00	51.12	125.25	126.22	1.694
96	30.52	0.26	128.26	27.00	48.00	128.36	129.29	1.694
97	31.90	0.95	128.79	27.00	52.89	116.09	117.04	1.694
98	27.76	0.00	128.26	27.00	44.43	138.49	139.49	1.694
99	29.14	0.00	128.53	27.00	45.71	135.42	136.43	1.694

Critical Failure Surface (circle 1)

Intersects: XL: 30.86 YL: 0.43 XR: 128.26 YR: 27.00

Centre: XC: 49.70 YC: 123.18 Radius: R: 124.18

Generated failure surface: (20 points)

30.86	0.43	36.29	-0.28	41.74	-0.75	47.21	-0.98	52.68	-0.97
58.14	-0.72	63.59	-0.23	69.02	0.50	74.40	1.47	79.74	2.68
85.02	4.12	90.23	5.79	95.36	7.69	100.40	9.81	105.35	12.16
110.18	14.71	114.90	17.48	119.49	20.46	123.95	23.63	128.26	27.00

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	30.86	0.85	-7.5	1.64	1.66	2	0.00	35.0	110.12	0.00	70.83	1.07
2	32.51	2.56	-7.5	1.64	1.66	2	0.00	35.0	330.37	0.00	212.49	1.07
3	34.15	5.87	-7.5	2.14	2.15	3	0.00	16.0	751.82	0.00	360.14	1.03
4	36.29	11.51	-4.9	2.73	2.74	3	0.00	16.0	1464.16	0.00	545.24	1.02
5	39.01	15.87	-4.9	2.73	2.74	3	0.00	16.0	2013.97	0.00	749.99	1.02
6	41.74	20.12	-2.4	2.73	2.74	3	0.00	16.0	2553.66	0.00	941.04	1.01
7	44.47	24.17	-2.4	2.73	2.74	3	0.00	16.0	3070.23	0.00	1131.40	1.01
8	47.21	28.08	0.1	2.74	2.74	3	0.00	16.0	3572.07	0.00	1305.24	1.00
9	49.94	31.81	0.1	2.74	2.74	3	0.00	16.0	4053.25	0.00	1481.06	1.00

10	52.68	35.34	2.6	2.73	2.74	3	0.00	16.0	4511.34	0.00	1637.81	0.99
11	55.41	38.73	2.6	2.73	2.74	3	0.00	16.0	4955.30	0.00	1798.98	0.99
12	58.14	41.82	5.2	2.72	2.74	3	0.00	16.0	5364.27	0.00	1938.75	0.99
13	60.87	44.86	5.2	2.72	2.74	3	0.00	16.0	5769.39	0.00	2085.17	0.99
14	63.59	29.23	7.7	1.69	1.70	3	0.00	16.0	3767.34	0.00	2183.19	0.99
15	65.28	33.59	7.7	1.87	1.88	2	0.00	35.0	4332.67	0.00	2195.62	0.96
16	67.15	34.86	7.7	1.87	1.88	2	0.00	35.0	4497.01	0.00	2278.90	0.96
17	69.02	18.87	10.2	0.98	1.00	2	0.00	35.0	2434.49	0.00	2298.67	0.94
18	70.00	42.07	10.2	2.20	2.24	2	0.00	35.0	5426.54	0.00	2293.81	0.94
19	72.20	41.19	10.2	2.20	2.24	2	0.00	35.0	5314.10	0.00	2246.28	0.94
20	74.40	48.63	12.7	2.67	2.74	2	0.00	35.0	6273.73	0.00	2148.02	0.94
21	77.07	47.02	12.7	2.67	2.74	2	0.00	35.0	6066.13	0.00	2076.94	0.94
22	79.74	44.76	15.3	2.64	2.74	2	0.00	35.0	5774.64	0.00	1963.86	0.93
23	82.38	42.86	15.3	2.64	2.74	2	0.00	35.0	5529.50	0.00	1880.49	0.93
24	85.02	27.18	17.8	1.74	1.83	2	0.00	35.0	3505.83	0.00	1774.52	0.93
25	86.76	26.20	17.8	1.74	1.83	2	0.00	35.0	3380.26	0.00	1710.97	0.93
26	88.50	25.01	17.8	1.73	1.81	5	0.00	0.0	2875.68	0.00	1665.89	1.05
27	90.23	17.80	20.3	1.27	1.36	5	0.00	0.0	2046.92	0.00	1606.95	1.07
28	91.50	25.81	20.3	1.93	2.06	2	0.00	35.0	3329.53	0.00	1494.82	0.92
29	93.43	24.43	20.3	1.93	2.06	2	0.00	35.0	3151.91	0.00	1415.08	0.92
30	95.36	29.70	22.8	2.52	2.74	2	0.00	35.0	3831.48	0.00	1292.07	0.92
31	97.88	27.02	22.8	2.52	2.74	2	0.00	35.0	3486.18	0.00	1175.62	0.92
32	100.40	22.17	25.4	2.30	2.54	2	0.00	35.0	2860.39	0.00	1038.11	0.92
33	102.70	19.67	25.4	2.30	2.54	2	0.00	35.0	2537.09	0.00	920.77	0.92
34	105.00	20.70	27.6	2.59	2.92	2	0.00	35.0	2670.00	0.00	845.99	0.93
35	107.59	20.50	27.9	2.59	2.93	2	0.00	35.0	2644.84	0.00	835.91	0.93
36	110.18	18.34	30.4	2.36	2.74	2	0.00	35.0	2366.09	0.00	805.18	0.93
37	112.54	17.86	30.4	2.36	2.74	2	0.00	35.0	2303.73	0.00	783.95	0.93
38	114.90	14.99	32.9	2.05	2.44	2	0.00	35.0	1933.99	0.00	742.49	0.94
39	116.95	14.37	32.9	2.05	2.44	2	0.00	35.0	1853.95	0.00	711.77	0.94
40	119.00	3.31	32.9	0.49	0.59	2	0.00	35.0	426.43	0.00	680.18	0.94
41	119.49	12.81	35.5	2.23	2.74	2	0.00	35.0	1652.31	0.00	571.31	0.95
42	121.72	9.27	35.5	2.23	2.74	2	0.00	35.0	1196.09	0.00	413.57	0.95
43	123.95	5.45	38.0	2.16	2.74	2	0.00	35.0	702.50	0.00	245.59	0.96
44	126.11	1.82	38.0	2.16	2.74	2	0.00	35.0	234.16	0.00	81.86	0.96

X-S Area: 1069.11 Path Length: 103.96 X-S Weight: 136925.48

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

---

Project: Section 25-XSECT1
File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_2.gmf
Processed: 07 Aug 2025 09:19:44

DATA: Analysis B - Static

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion Phi UnitWeight Ru
50.00 27.0 114.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion Phi UnitWeight Ru
0.00 35.0 129.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Residual Claystone
Cohesion Phi UnitWeight Ru
0.00 16.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Unweathered Claystone
Cohesion Phi UnitWeight Ru
100.00 25.0 126.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion Phi UnitWeight Ru
0.00 0.0 115.00 Auto

Water Properties

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

Material Profiles (4 profiles)

Profile: 1 (4 points) Material beneath: 2 - Sand and Gravel
0.00 74.00 222.00 74.00 267.00 74.00 300.00 74.00
Profile: 2 (4 points) Material beneath: 3 - Residual Claystone
0.00 0.00 222.00 0.00 267.00 0.00 300.00 0.00
Profile: 3 (4 points) Material beneath: 4 - Unweathered Claystone
0.00 -1.00 222.00 -1.00 267.00 -1.00 300.00 -1.00
Profile: 4 (7 points) Material within: 5 - Slurry Wall
250.50 74.00 253.50 74.00 253.50 0.00 253.50 -5.00 250.50 -5.00
250.50 0.00 250.50 74.00

Slope Surface (6 points)

0.00 0.00 15.00 0.00 222.00 74.00 267.00 74.00 277.00 69.00
300.00 69.00

Phreatic Surface (2 points)

1.00 98.00 1.00 220.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 15.00 YL: 0.00 XR: 250.50 YR: 74.00
Centre: XC: 38.10 YC: 338.21 Radius: R: 339.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	5.00	50.00
Trial positions within range:	30	20	50

- -

RESULTS: Analysis 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: 2.106

Analysis Summary
==========
There were: 30001 successful analyses from a total of 30001 trial failure surfaces

Critical (minimum) Factor of Safety: 2.06
==========

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	15.86	0.31	248.26	74.00	44.60	312.99	314.00	2.061	<-- Critical Surface
2	15.52	0.18	248.00	74.00	42.86	317.09	318.08	2.062	
3	15.86	0.31	248.79	74.00	44.74	314.00	315.02	2.064	
4	15.86	0.31	248.00	74.00	44.03	314.07	315.02	2.064	
5	15.52	0.18	248.53	74.00	43.00	318.10	319.10	2.064	
6	15.86	0.31	248.00	74.00	44.36	313.01	314.00	2.065	
7	15.52	0.18	248.26	74.00	43.10	317.07	318.08	2.065	
8	15.17	0.06	248.00	74.00	41.36	321.16	322.16	2.065	
9	15.52	0.18	248.26	74.00	42.76	318.12	319.10	2.065	
10	15.86	0.31	248.53	74.00	44.84	312.97	314.00	2.066	
11	15.52	0.18	248.00	74.00	43.19	316.04	317.06	2.066	
12	15.86	0.31	248.26	74.00	44.26	314.05	315.02	2.066	
13	15.52	0.18	248.00	74.00	42.52	318.14	319.10	2.067	
14	15.86	0.31	248.26	74.00	43.93	315.10	316.04	2.067	
15	15.86	0.31	248.53	74.00	44.17	315.08	316.04	2.067	
16	15.52	0.18	248.79	74.00	42.91	319.13	320.12	2.067	
17	15.52	0.18	249.05	74.00	43.14	319.11	320.12	2.068	
18	15.17	0.06	248.00	74.00	41.69	320.11	321.14	2.068	
19	15.52	0.18	248.00	74.00	43.53	314.98	316.04	2.068	

20	15.17	0.06	248.26	74.00	41.26	322.19	323.18	2.068
21	14.48	0.00	248.00	74.00	40.23	324.20	325.22	2.068
22	15.86	0.31	248.53	74.00	44.50	314.02	315.02	2.068
23	15.86	0.31	248.00	74.00	43.69	315.12	316.04	2.068
24	14.83	0.00	248.00	74.00	40.26	324.23	325.22	2.068
25	15.17	0.06	248.26	74.00	41.60	321.14	322.16	2.069
26	15.52	0.18	248.53	74.00	42.67	319.15	320.12	2.069
27	15.86	0.31	248.79	74.00	44.07	316.11	317.06	2.069
28	15.17	0.06	248.00	74.00	41.02	322.21	323.18	2.069
29	15.86	0.31	249.58	74.00	44.78	316.05	317.06	2.069
30	14.48	0.00	248.26	74.00	40.14	325.23	326.24	2.069
31	13.45	0.00	248.00	74.00	39.14	327.28	328.29	2.069
32	15.52	0.18	249.32	74.00	43.05	320.15	321.14	2.069
33	15.86	0.31	248.79	74.00	44.40	315.06	316.04	2.069
34	15.17	0.06	248.53	74.00	41.50	322.17	323.18	2.069
35	14.83	0.00	248.00	74.00	40.59	323.18	324.20	2.070
36	14.48	0.00	248.00	74.00	39.90	325.25	326.24	2.070
37	15.52	0.18	248.26	74.00	42.43	319.17	320.12	2.070
38	15.86	0.31	249.32	74.00	44.88	315.01	316.04	2.070
39	15.52	0.18	248.79	74.00	43.24	318.08	319.10	2.070
40	14.14	0.00	248.26	74.00	39.77	326.26	327.27	2.070
41	14.14	0.00	248.00	74.00	39.87	325.23	326.24	2.070
42	15.17	0.06	248.79	74.00	41.41	323.20	324.20	2.070
43	15.86	0.31	249.05	74.00	44.98	313.98	315.02	2.070
44	15.86	0.31	248.53	74.00	43.83	316.13	317.06	2.070
45	13.79	0.00	248.00	74.00	39.50	326.25	327.27	2.070
46	15.17	0.06	248.26	74.00	41.93	320.09	321.14	2.070
47	14.83	0.00	248.26	74.00	40.50	324.21	325.22	2.070
48	13.10	0.00	248.00	74.00	38.78	328.30	329.31	2.070
49	15.86	0.31	248.79	74.00	45.07	312.95	314.00	2.071
50	15.52	0.18	249.05	74.00	42.81	320.17	321.14	2.071
51	14.83	0.00	248.53	74.00	40.41	325.24	326.24	2.071
52	16.21	0.43	250.11	74.00	46.42	312.97	314.00	2.071
53	14.14	0.00	248.00	74.00	39.53	326.28	327.27	2.071
54	15.52	0.18	248.00	74.00	42.19	319.19	320.12	2.071
55	15.86	0.31	249.05	74.00	44.31	316.09	317.06	2.071
56	16.21	0.43	249.84	74.00	46.18	313.00	314.00	2.071
57	15.52	0.18	248.53	74.00	43.33	317.05	318.08	2.071
58	16.21	0.43	249.58	74.00	45.95	313.02	314.00	2.071
59	15.17	0.06	248.53	74.00	41.17	323.22	324.20	2.071
60	16.21	0.43	249.32	74.00	45.71	313.04	314.00	2.071
61	13.79	0.00	248.26	74.00	39.41	327.28	328.29	2.071
62	15.17	0.06	248.00	74.00	42.02	319.06	320.12	2.071
63	15.17	0.06	248.53	74.00	41.84	321.12	322.16	2.071
64	14.83	0.00	248.26	74.00	40.17	325.26	326.24	2.071
65	14.83	0.00	248.00	74.00	40.92	322.13	323.18	2.071
66	15.86	0.31	248.26	74.00	43.59	316.15	317.06	2.071
67	15.86	0.31	249.05	74.00	44.64	315.04	316.04	2.072
68	12.76	0.00	248.00	74.00	38.42	329.33	330.33	2.072
69	15.17	0.06	248.26	74.00	40.93	323.24	324.20	2.072
70	16.21	0.43	248.53	74.00	45.00	313.11	314.00	2.072
71	14.48	0.00	248.00	74.00	40.56	323.15	324.20	2.072
72	15.52	0.18	248.79	74.00	42.57	320.19	321.14	2.072
73	14.48	0.00	248.53	74.00	40.04	326.27	327.27	2.072

74	13.79	0.00	248.00	74.00	39.17	327.30	328.29	2.072
75	14.14	0.00	248.00	74.00	40.20	324.18	325.22	2.072
76	14.83	0.00	248.00	74.00	39.93	325.28	326.24	2.072
77	15.52	0.18	248.26	74.00	43.43	316.02	317.06	2.072
78	12.07	0.00	248.00	74.00	38.03	330.33	331.35	2.072
79	15.86	0.31	249.32	74.00	44.21	317.12	318.08	2.072
80	15.52	0.18	248.53	74.00	43.67	315.99	317.06	2.072
81	15.86	0.31	249.05	74.00	43.98	317.14	318.08	2.072
82	13.79	0.00	248.00	74.00	39.84	325.20	326.24	2.072
83	15.17	0.06	248.79	74.00	41.74	322.15	323.18	2.072
84	13.45	0.00	248.26	74.00	39.05	328.31	329.31	2.072
85	16.21	0.43	248.79	74.00	45.24	313.09	314.00	2.072
86	15.52	0.18	248.26	74.00	43.76	314.96	316.04	2.072
87	15.52	0.18	249.84	74.00	43.20	321.16	322.16	2.072
88	13.79	0.00	248.53	74.00	39.65	327.27	328.29	2.072
89	14.83	0.00	248.26	74.00	40.83	323.16	324.20	2.072
90	15.17	0.06	248.00	74.00	40.69	323.26	324.20	2.072
91	14.48	0.00	248.26	74.00	39.80	326.28	327.27	2.072
92	13.45	0.00	248.00	74.00	39.47	326.23	327.27	2.072
93	14.48	0.00	248.26	74.00	40.47	324.18	325.22	2.073
94	15.52	0.18	248.00	74.00	43.86	313.93	315.02	2.073
95	15.52	0.18	249.58	74.00	42.96	321.18	322.16	2.073
96	12.41	0.00	248.00	74.00	38.06	330.35	331.35	2.073
97	15.86	0.31	248.00	74.00	43.36	316.18	317.06	2.073
98	13.10	0.00	248.00	74.00	39.11	327.25	328.29	2.073
99	15.52	0.18	248.53	74.00	42.33	320.21	321.14	2.073

Critical Failure Surface (circle 1)

Intersects: XL: 15.86 YL: 0.31 XR: 248.26 YR: 74.00

Centre: XC: 44.60 YC: 312.99 Radius: R: 314.00

Generated failure surface: (20 points)

15.86	0.31	29.01	-0.62	42.18	-1.00	55.35	-0.83	68.51	-0.10
81.63	1.18	94.68	3.01	107.64	5.38	120.49	8.30	133.21	11.75
145.77	15.73	158.15	20.24	170.33	25.26	182.29	30.79	194.01	36.82
205.47	43.33	216.64	50.32	227.51	57.77	238.06	65.67	248.26	74.00

Slice Geometry and Properties - Critical Failure Surface (circle 1, 40 slices)

Slice	X-S	Base						PoreWater	Normal	Test	
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	15.86	4.06	-4.0	4.35	4.37	2	0.00	35.0	523.70	0.00	123.24	1.03
2	20.22	12.33	-4.0	4.40	4.41	3	0.00	16.0	1577.88	0.00	362.57	1.01
3	24.61	20.61	-4.0	4.40	4.41	3	0.00	16.0	2619.11	0.00	601.84	1.01
4	29.01	45.43	-1.6	6.58	6.59	3	0.00	16.0	5771.09	0.00	880.07	1.00
5	35.59	62.17	-1.6	6.58	6.59	3	0.00	16.0	7906.86	0.00	1205.77	1.00
6	42.17	78.09	0.8	6.59	6.59	3	0.00	16.0	9953.27	0.00	1507.54	1.00
7	48.76	93.03	0.8	6.59	6.59	3	0.00	16.0	11892.67	0.00	1801.28	1.00
8	55.35	106.87	3.2	6.58	6.59	3	0.00	16.0	13706.00	0.00	2067.52	0.99
9	61.93	119.95	3.2	6.58	6.59	3	0.00	16.0	15438.51	0.00	2328.87	0.99
10	68.51	19.37	5.6	1.00	1.01	3	0.00	16.0	2497.16	0.00	2462.76	0.99
11	69.51	122.81	5.6	6.06	6.09	2	0.00	35.0	15842.54	0.00	2531.56	0.97
12	75.57	132.35	5.6	6.06	6.09	2	0.00	35.0	17072.96	0.00	2728.18	0.97
13	81.63	152.33	8.0	6.52	6.59	2	0.00	35.0	19650.59	0.00	2874.81	0.96

14	88.15	161.59	8.0	6.52	6.59	2	0.00	35.0	20844.55	0.00	3049.49	0.96
15	94.68	168.75	10.4	6.48	6.59	2	0.00	35.0	21768.88	0.00	3162.21	0.96
16	101.16	176.07	10.4	6.48	6.59	2	0.00	35.0	22713.42	0.00	3299.42	0.96
17	107.64	180.89	12.8	6.43	6.59	2	0.00	35.0	23334.82	0.00	3371.80	0.95
18	114.06	186.28	12.8	6.43	6.59	2	0.00	35.0	24030.26	0.00	3472.30	0.95
19	120.49	188.75	15.2	6.36	6.59	2	0.00	35.0	24349.03	0.00	3505.99	0.95
20	126.85	192.23	15.2	6.36	6.59	2	0.00	35.0	24797.61	0.00	3570.58	0.95
21	133.21	192.38	17.6	6.28	6.59	2	0.00	35.0	24817.33	0.00	3567.26	0.95
22	139.49	193.98	17.6	6.28	6.59	2	0.00	35.0	25022.90	0.00	3596.81	0.95
23	145.77	191.89	20.0	6.19	6.59	2	0.00	35.0	24753.38	0.00	3558.14	0.95
24	151.96	191.64	20.0	6.19	6.59	2	0.00	35.0	24721.52	0.00	3553.56	0.95
25	158.15	187.41	22.4	6.09	6.59	2	0.00	35.0	24175.60	0.00	3481.31	0.95
26	164.24	185.38	22.4	6.09	6.59	2	0.00	35.0	23913.61	0.00	3443.58	0.95
27	170.33	179.14	24.8	5.98	6.59	2	0.00	35.0	23108.78	0.00	3339.53	0.95
28	176.31	175.39	24.8	5.98	6.59	2	0.00	35.0	22625.50	0.00	3269.70	0.95
29	182.29	167.31	27.2	5.86	6.59	2	0.00	35.0	21583.08	0.00	3135.74	0.96
30	188.15	161.93	27.2	5.86	6.59	2	0.00	35.0	20889.05	0.00	3034.90	0.96
31	194.01	152.20	29.6	5.73	6.59	2	0.00	35.0	19634.36	0.00	2873.05	0.96
32	199.74	145.28	29.6	5.73	6.59	2	0.00	35.0	18741.42	0.00	2742.39	0.96
33	205.47	134.13	32.0	5.59	6.59	2	0.00	35.0	17303.35	0.00	2554.76	0.97
34	211.05	125.77	32.0	5.59	6.59	2	0.00	35.0	16224.94	0.00	2395.54	0.97
35	216.64	111.96	34.4	5.36	6.50	2	0.00	35.0	14442.49	0.00	2185.69	0.98
36	222.00	99.84	34.4	5.51	6.68	2	0.00	35.0	12879.72	0.00	1896.19	0.98
37	227.51	75.20	36.8	5.27	6.59	2	0.00	35.0	9700.20	0.00	1466.32	1.00
38	232.78	54.37	36.8	5.27	6.59	2	0.00	35.0	7013.34	0.00	1060.16	1.00
39	238.06	31.90	39.2	5.10	6.59	2	0.00	35.0	4114.98	0.00	631.24	1.01
40	243.16	10.63	39.2	5.10	6.59	2	0.00	35.0	1371.67	0.00	210.42	1.01

X-S Area: 4991.69 Path Length: 250.37 X-S Weight: 643328.19

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

---

Project: Section 25-XSECT2
File: J:\United Water & San - 141\70-Ranch_DRMS\DRMS\Slope Stability\70Ranch_2_Seismic.gmf
Processed: 07 Aug 2025 09:22:18

DATA: Analysis B - Seismic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion Phi UnitWeight Ru
50.00 27.0 114.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion Phi UnitWeight Ru
0.00 35.0 129.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Residual Claystone
Cohesion Phi UnitWeight Ru
0.00 16.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Unweathered Claystone
Cohesion Phi UnitWeight Ru
100.00 25.0 126.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion Phi UnitWeight Ru
0.00 0.0 115.00 Auto

Water Properties

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

Material Profiles (4 profiles)

Profile: 1 (4 points) Material beneath: 2 - Sand and Gravel
0.00 74.00 222.00 74.00 267.00 74.00 300.00 74.00
Profile: 2 (4 points) Material beneath: 3 - Residual Claystone
0.00 0.00 222.00 0.00 267.00 0.00 300.00 0.00
Profile: 3 (4 points) Material beneath: 4 - Unweathered Claystone
0.00 -1.00 222.00 -1.00 267.00 -1.00 300.00 -1.00
Profile: 4 (7 points) Material within: 5 - Slurry Wall
250.50 74.00 253.50 74.00 253.50 0.00 253.50 -5.00 250.50 -5.00

250.50 0.00 250.50 74.00

Slope Surface (6 points)

0.00 0.00 15.00 0.00 222.00 74.00 267.00 74.00
277.00 69.00
300.00 69.00

Phreatic Surface (2 points)

1.00 98.00 1.00 220.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 15.00 YL: 0.00 XR: 250.50 YR: 74.00
Centre: XC: 38.10 YC: 338.21 Radius: R: 339.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.093

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	5.00	50.00
Trial positions within range:	30	20	50

- -

RESULTS: Analysis 1 - Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface
---
Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.601

Analysis Summary
==========
There were: 30001 successful analyses from a total of 30001 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	15.86	0.31	248.26	74.00	44.60	312.99	314.00	1.567	<-
- Critical Surface									
2	15.52	0.18	248.00	74.00	42.86	317.09	318.08	1.568	
3	15.86	0.31	248.79	74.00	44.74	314.00	315.02	1.569	
4	15.52	0.18	248.53	74.00	43.00	318.10	319.10	1.569	
5	15.86	0.31	248.00	74.00	44.03	314.07	315.02	1.570	
6	15.52	0.18	248.26	74.00	43.10	317.07	318.08	1.570	
7	15.86	0.31	248.00	74.00	44.36	313.01	314.00	1.570	
8	15.86	0.31	248.53	74.00	44.84	312.97	314.00	1.571	
9	15.17	0.06	248.00	74.00	41.36	321.16	322.16	1.571	
10	15.52	0.18	248.26	74.00	42.76	318.12	319.10	1.571	
11	15.86	0.31	248.26	74.00	44.26	314.05	315.02	1.571	
12	15.52	0.18	248.00	74.00	43.19	316.04	317.06	1.571	
13	15.52	0.18	249.05	74.00	43.14	319.11	320.12	1.572	
14	15.52	0.18	248.79	74.00	42.91	319.13	320.12	1.572	
15	15.86	0.31	248.26	74.00	43.93	315.10	316.04	1.572	
16	15.52	0.18	248.00	74.00	42.52	318.14	319.10	1.572	
17	15.86	0.31	248.53	74.00	44.17	315.08	316.04	1.572	
18	15.86	0.31	249.58	74.00	44.78	316.05	317.06	1.572	
19	15.86	0.31	248.53	74.00	44.50	314.02	315.02	1.573	
20	15.52	0.18	249.32	74.00	43.05	320.15	321.14	1.573	
21	15.86	0.31	248.79	74.00	44.07	316.11	317.06	1.573	
22	15.17	0.06	248.26	74.00	41.26	322.19	323.18	1.573	
23	16.21	0.43	250.11	74.00	46.42	312.97	314.00	1.573	
24	15.17	0.06	248.00	74.00	41.69	320.11	321.14	1.573	
25	15.52	0.18	248.53	74.00	42.67	319.15	320.12	1.573	
26	15.52	0.18	248.00	74.00	43.53	314.98	316.04	1.573	
27	15.86	0.31	249.32	74.00	44.88	315.01	316.04	1.573	
28	16.21	0.43	249.84	74.00	46.18	313.00	314.00	1.573	
29	15.86	0.31	248.00	74.00	43.69	315.12	316.04	1.573	
30	14.48	0.00	248.00	74.00	40.23	324.20	325.22	1.573	
31	15.86	0.31	248.79	74.00	44.40	315.06	316.04	1.573	
32	15.17	0.06	248.26	74.00	41.60	321.14	322.16	1.573	
33	14.83	0.00	248.00	74.00	40.26	324.23	325.22	1.574	
34	16.21	0.43	249.58	74.00	45.95	313.02	314.00	1.574	
35	14.48	0.00	248.26	74.00	40.14	325.23	326.24	1.574	
36	15.86	0.31	249.05	74.00	44.98	313.98	315.02	1.574	
37	15.17	0.06	248.53	74.00	41.50	322.17	323.18	1.574	
38	15.52	0.18	248.79	74.00	43.24	318.08	319.10	1.574	
39	15.17	0.06	248.00	74.00	41.02	322.21	323.18	1.574	
40	15.17	0.06	248.79	74.00	41.41	323.20	324.20	1.574	
41	16.21	0.43	249.32	74.00	45.71	313.04	314.00	1.574	
42	15.52	0.18	249.05	74.00	42.81	320.17	321.14	1.574	
43	15.86	0.31	249.05	74.00	44.31	316.09	317.06	1.574	
44	15.52	0.18	248.26	74.00	42.43	319.17	320.12	1.574	
45	15.86	0.31	248.53	74.00	43.83	316.13	317.06	1.574	
46	13.45	0.00	248.00	74.00	39.14	327.28	328.29	1.574	
47	15.86	0.31	248.79	74.00	45.07	312.95	314.00	1.574	
48	14.48	0.00	248.00	74.00	39.90	325.25	326.24	1.574	

49	14.83	0.00	248.00	74.00	40.59	323.18	324.20	1.575
50	15.52	0.18	249.84	74.00	43.20	321.16	322.16	1.575
51	14.14	0.00	248.26	74.00	39.77	326.26	327.27	1.575
52	16.21	0.43	250.37	74.00	46.33	314.01	315.02	1.575
53	15.86	0.31	249.05	74.00	44.64	315.04	316.04	1.575
54	14.83	0.00	248.53	74.00	40.41	325.24	326.24	1.575
55	15.17	0.06	248.26	74.00	41.93	320.09	321.14	1.575
56	14.14	0.00	248.00	74.00	39.87	325.23	326.24	1.575
57	15.86	0.31	249.32	74.00	44.21	317.12	318.08	1.575
58	14.83	0.00	248.26	74.00	40.50	324.21	325.22	1.575
59	15.17	0.06	248.53	74.00	41.17	323.22	324.20	1.575
60	15.52	0.18	248.53	74.00	43.33	317.05	318.08	1.575
61	13.79	0.00	248.00	74.00	39.50	326.25	327.27	1.575
62	16.21	0.43	250.11	74.00	46.09	314.03	315.02	1.575
63	15.52	0.18	249.58	74.00	42.96	321.18	322.16	1.575
64	15.52	0.18	248.79	74.00	42.57	320.19	321.14	1.575
65	15.86	0.31	249.05	74.00	43.98	317.14	318.08	1.575
66	13.10	0.00	248.00	74.00	38.78	328.30	329.31	1.575
67	15.52	0.18	248.00	74.00	42.19	319.19	320.12	1.575
68	15.17	0.06	248.53	74.00	41.84	321.12	322.16	1.575
69	15.86	0.31	250.37	74.00	44.83	318.09	319.10	1.575
70	14.14	0.00	248.00	74.00	39.53	326.28	327.27	1.575
71	16.21	0.43	248.53	74.00	45.00	313.11	314.00	1.575
72	16.21	0.43	249.84	74.00	45.85	314.05	315.02	1.575
73	13.79	0.00	248.26	74.00	39.41	327.28	328.29	1.575
74	15.86	0.31	249.32	74.00	44.55	316.07	317.06	1.575
75	15.86	0.31	248.26	74.00	43.59	316.15	317.06	1.576
76	16.21	0.43	248.79	74.00	45.24	313.09	314.00	1.576
77	14.83	0.00	248.26	74.00	40.17	325.26	326.24	1.576
78	14.48	0.00	248.53	74.00	40.04	326.27	327.27	1.576
79	15.86	0.31	250.11	74.00	44.93	317.06	318.08	1.576
80	15.17	0.06	248.79	74.00	41.74	322.15	323.18	1.576
81	15.17	0.06	248.26	74.00	40.93	323.24	324.20	1.576
82	15.17	0.06	248.00	74.00	42.02	319.06	320.12	1.576
83	15.52	0.18	248.53	74.00	43.67	315.99	317.06	1.576
84	15.17	0.06	249.05	74.00	41.32	324.23	325.22	1.576
85	14.83	0.00	248.00	74.00	40.92	322.13	323.18	1.576
86	12.76	0.00	248.00	74.00	38.42	329.33	330.33	1.576
87	15.52	0.18	250.11	74.00	43.10	322.19	323.18	1.576
88	15.52	0.18	248.26	74.00	43.43	316.02	317.06	1.576
89	15.86	0.31	249.84	74.00	45.02	316.03	317.06	1.576
90	13.79	0.00	248.53	74.00	39.65	327.27	328.29	1.576
91	16.21	0.43	250.89	74.00	46.47	315.02	316.04	1.576
92	15.17	0.06	249.05	74.00	41.65	323.18	324.20	1.576
93	15.52	0.18	249.58	74.00	43.29	320.12	321.14	1.576
94	15.86	0.31	249.58	74.00	44.12	318.16	319.10	1.576
95	13.79	0.00	248.00	74.00	39.17	327.30	328.29	1.576
96	15.86	0.31	249.58	74.00	44.45	317.10	318.08	1.576
97	15.52	0.18	249.32	74.00	42.72	321.20	322.16	1.576

98	14.48	0.00	248.79	74.00	40.28	326.25	327.27	1.576
99	14.48	0.00	248.00	74.00	40.56	323.15	324.20	1.576

Critical Failure Surface (circle 1)

Intersects: XL: 15.86 YL: 0.31 XR: 248.26 YR: 74.00

Centre: XC: 44.60 YC: 312.99 Radius: R: 314.00

Generated failure surface: (20 points)

15.86 0.31 29.01 -0.62 42.18 -1.00 55.35 -0.83 68.51 -0.10

81.63 1.18 94.68 3.01 107.64 5.38 120.49 8.30 133.21 11.75

145.77 15.73 158.15 20.24 170.33 25.26 182.29 30.79 194.01 36.82

205.47 43.33 216.64 50.32 227.51 57.77 238.06 65.67 248.26 74.00

Slice Geometry and Properties - Critical Failure Surface (circle 1, 40 slices)

Slice	X-S	Base					PoreWater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	15.86	4.06	-4.0	4.35	4.37	2	0.00	35.0	523.70	0.00	124.20	1.04
2	20.22	12.33	-4.0	4.40	4.41	3	0.00	16.0	1577.88	0.00	363.71	1.02
3	24.61	20.61	-4.0	4.40	4.41	3	0.00	16.0	2619.11	0.00	603.73	1.02
4	29.01	45.43	-1.6	6.58	6.59	3	0.00	16.0	5771.09	0.00	881.19	1.01
5	35.59	62.17	-1.6	6.58	6.59	3	0.00	16.0	7906.86	0.00	1207.30	1.01
6	42.17	78.09	0.8	6.59	6.59	3	0.00	16.0	9953.27	0.00	1506.67	1.00
7	48.76	93.03	0.8	6.59	6.59	3	0.00	16.0	11892.67	0.00	1800.23	1.00
8	55.35	106.87	3.2	6.58	6.59	3	0.00	16.0	13706.00	0.00	2062.56	0.99
9	61.93	119.95	3.2	6.58	6.59	3	0.00	16.0	15438.51	0.00	2323.28	0.99
10	68.51	19.37	5.6	1.00	1.01	3	0.00	16.0	2497.16	0.00	2452.41	0.99
11	69.51	122.81	5.6	6.06	6.09	2	0.00	35.0	15842.54	0.00	2506.24	0.96
12	75.57	132.35	5.6	6.06	6.09	2	0.00	35.0	17072.96	0.00	2700.89	0.96
13	81.63	152.33	8.0	6.52	6.59	2	0.00	35.0	19650.59	0.00	2834.24	0.95

14	88.15	161.59	8.0	6.52	6.59	2	0.00	35.0	20844.55	0.00	3006.45	0.95
15	94.68	168.75	10.4	6.48	6.59	2	0.00	35.0	21768.88	0.00	3104.90	0.94
16	101.16	176.07	10.4	6.48	6.59	2	0.00	35.0	22713.42	0.00	3239.62	0.94
17	107.64	180.89	12.8	6.43	6.59	2	0.00	35.0	23334.82	0.00	3297.45	0.93
18	114.06	186.28	12.8	6.43	6.59	2	0.00	35.0	24030.26	0.00	3395.72	0.93
19	120.49	188.75	15.2	6.36	6.59	2	0.00	35.0	24349.03	0.00	3415.13	0.92
20	126.85	192.23	15.2	6.36	6.59	2	0.00	35.0	24797.61	0.00	3478.04	0.92
21	133.21	192.38	17.6	6.28	6.59	2	0.00	35.0	24817.33	0.00	3461.20	0.92
22	139.49	193.98	17.6	6.28	6.59	2	0.00	35.0	25022.90	0.00	3489.87	0.92
23	145.77	191.89	20.0	6.19	6.59	2	0.00	35.0	24753.38	0.00	3438.92	0.92
24	151.96	191.64	20.0	6.19	6.59	2	0.00	35.0	24721.52	0.00	3434.49	0.92
25	158.15	187.41	22.4	6.09	6.59	2	0.00	35.0	24175.60	0.00	3351.58	0.91
26	164.24	185.38	22.4	6.09	6.59	2	0.00	35.0	23913.61	0.00	3315.26	0.91
27	170.33	179.14	24.8	5.98	6.59	2	0.00	35.0	23108.78	0.00	3202.58	0.91
28	176.31	175.39	24.8	5.98	6.59	2	0.00	35.0	22625.50	0.00	3135.61	0.91
29	182.29	167.31	27.2	5.86	6.59	2	0.00	35.0	21583.08	0.00	2995.39	0.91
30	188.15	161.93	27.2	5.86	6.59	2	0.00	35.0	20889.05	0.00	2899.07	0.91
31	194.01	152.20	29.6	5.73	6.59	2	0.00	35.0	19634.36	0.00	2733.63	0.92
32	199.74	145.28	29.6	5.73	6.59	2	0.00	35.0	18741.42	0.00	2609.32	0.92
33	205.47	134.13	32.0	5.59	6.59	2	0.00	35.0	17303.35	0.00	2421.08	0.92
34	211.05	125.77	32.0	5.59	6.59	2	0.00	35.0	16224.94	0.00	2270.19	0.92
35	216.64	111.96	34.4	5.36	6.50	2	0.00	35.0	14442.49	0.00	2062.93	0.93
36	222.00	99.84	34.4	5.51	6.68	2	0.00	35.0	12879.72	0.00	1789.69	0.93
37	227.51	75.20	36.8	5.27	6.59	2	0.00	35.0	9700.20	0.00	1378.24	0.94

38	232.78	54.37	36.8	5.27	6.59	2	0.00	35.0	7013.34	0.00	996.48	0.94
39	238.06	31.90	39.2	5.10	6.59	2	0.00	35.0	4114.98	0.00	590.81	0.95
40	243.16	10.63	39.2	5.10	6.59	2	0.00	35.0	1371.67	0.00	196.94	0.95

X-S Area: 4991.69 Path Length: 250.37 X-S Weight: 643328.19