

STATE OF
COLORADO

Eschberger - DNR, Amy <amy.eschberger@state.co.us>

Incomplete SO-04 Application / West Farm Pit / M-2008-078

Joshua Oliver <joliver@brannan1.com>

Wed, Feb 2, 2022 at 10:51 AM

To: "Eschberger - DNR, Amy" <amy.eschberger@state.co.us>

Cc: Karl Nyquist <karl@cacompanies.com>, Alex Schatz <aschatz@brannan1.com>, Curt Marvel <Cmarvel@brannan1.com>

Ms. Eschberger,

Please find the attached resubmittal for the West Farm SO-4.

You will see a hand delivered or mailed hard copy in the coming days.

Joshua Oliver

Environmental Manager



joliver@brannan1.com

O: 303.853.5159 |M: 303.472.1736 |F: 303.853.5233

From: Eschberger - DNR, Amy <amy.eschberger@state.co.us>**Sent:** Tuesday, February 01, 2022 8:35 AM**To:** Joshua Oliver <joliver@brannan1.com>**Cc:** Karl Nyquist <karl@cacompanies.com>; Alex Schatz <aschatz@brannan1.com>**Subject:** Re: [EXTERNAL] Fwd: Incomplete SO-04 Application / West Farm Pit / M-2008-078

Joshua,

Thanks for getting back with me. Yes, if you can at least email me the materials prior to the deadline, we can proceed with the application review. Please also mail a hard copy to our new address at:

DRMS Room 215

1001 E 62nd Ave

Denver, CO 80216

Best Regards,

Amy Eschberger

Environmental Protection Specialist

[Redacted signature block]

[Quoted text hidden]

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4 attachments



SO Cover Letter 2-1-22.pdf
114K



SO Transfer Application 1-31-22.pdf
693K



07115 Brannan West Farm Expansion Stability Report 1.28.22 - Signed with Appendices.pdf
8115K



Structure Agreements Mailed.pdf
2608K



February 1, 2022

Amy Eschberger
Division of Reclamation, Mining and Safety
1313 Sherman St., Room 215
Denver, CO 80203

Re: West Farm Pit (M-2008-078), Succession of Operators, SO-04

Ms. Eschberger:

Thank you for your guidance on the referenced SO-04 application for the West Farm Pit. Based on your letter dated January 4, 2022, this letter and the attached materials are intended to re-complete the application for this permit transfer.

As an overall comment, please note that Brannan took over this operation at the closing of its contract with the previous owner (GP Aggregates, LLC, and Prowers Aggregate Operators, LLC) on November 18, 2021. It is typical in such transactions that the prior owner carry the DRMS performance and financial warranties while the Succession of Operators is processed. But it is now critical that the prior owner be relieved of its warranty obligations.

Responding to each comment from the January 4 letter:

1. The "Application Form for Transfer of Mineral Permit and Succession of Operators – Administrative Information" is enclosed.
2. Both Permittee and Prospective Operator have initialed page 6.
3. Page 8 has been revised to reflect the suggested corrections: Date is adjusted to August 16, 2016, and "AM-2" is omitted.
4. The Agreement spanning pages 8 through 10 is now dated above signatures.
5. The Performance Warranty is revised as follows:
 - a. Reference is only to "M-2008-078" and not any specific amendment.
 - b. The Operator name is provided responsively on page 13.
 - c. A company seal is affixed (embossed).
 - d. Notary blocks reflect the full name of the Prospective Operator.
6. Brannan has initiated the structure letter process defined by Rule 6.4.19. Please see enclosed confirmation of the January 21, 2022, mailing conducted by Brannan. In the case of a 112 permit application, this would be sufficient for completeness.

Please also find enclosed an up-to-date geotechnical/stability analysis covering any structure for which Brannan is unable to obtain a structure agreement.

This Rule 6.4.19 process is redundant, to the extent that the relevant review occurred within the context of AM-02, and all structure agreements in place on November 18, 2022, were assigned by the Permittee to Brannan as Brannan simultaneously assumed these contracts. Brannan's initial SO-04 submittal contained the transactional documents demonstrating this transfer of responsibilities to the Prospective Operator.

The statute on succession of operators specifies that, "When one operator succeeds another at an uncompleted operation, the board shall release the first operator from all liability as to that operation and shall release all applicable performance and financial warranties as to such operation if the successor operator assumes all liability for the reclamation of the affected land and such obligation is covered by appropriate performance and financial warranties." The orderly transfer of liabilities is occurring as provided by law in this case.

7. The determination of "a Financial Warranty of a greater or lesser amount than the existing Financial Warranty" is part of the succession of operator process. Construction of new slurry wall was underway for Phases 2, 3 and 8 on November 18, 2021. Based on the then-anticipated completion of work by the end of 2021, we deemed it relevant that a likely reduction in the actual site reclamation obligation is pending.

Given ongoing work to complete leak testing, we acknowledge that the Division does not presently have any specific information demonstrating a substantial change in reclamation obligations. Brannan therefore expects to arrange for a financial warranty once we have resolved completeness issues, in the meantime waiving the 30-day review period for the convenience of the Division and permit parties.

Again, thank you for your guidance. Please contact me at joliver@brannan1.com or 303-853-5159 with any questions or comments.

Sincerely,

BRANNAN SAND AND GRAVEL COMPANY, LLC

A handwritten signature in dark ink, appearing to read "Josh Oliver", with a long horizontal flourish extending to the right.

Josh Oliver

cc: Karl Nyquist
J.C. Marvel, Jr.
Alex Schatz

encl: Revised SO-04 submittal packet
Structure letters (18) - Proof of mailing/List of owners
Geotechnical stability report

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106



REQUEST FOR TRANSFER OF MINERAL PERMIT AND SUCCESSION OF OPERATORS APPLICATION PACKET

The Mined Land Reclamation Board ("Board") has approved this Transfer of a Mineral Permit and Succession of Operators Application Packet pursuant to the Mined Land Reclamation Act (C.R.S. § 34-32-101 et. seq.) ("Hard Rock Act") and associated Rules (2 C.C.R. 407-1) ("Hard Rock Rules") and the Land Reclamation Act for the Extraction of Construction Materials (C.R.S. § 34-32.5-101 et. seq.) ("Construction Materials Act") and associated Rules (2 C.C.R. 407-4) ("Construction Materials Rules"). This Application Packet cannot be altered without the consent of the Board.

Applicability

This Transfer of a Mineral Permit and Succession of Operators Application Packet applies to mining operations where the current permitted mine operator ("Permittee") wishes to transfer the Reclamation Permit ("Permit"), along with all associated reclamation responsibilities and liabilities, to a Successor Operator ("Successor"). This process is referred to as a Succession of Operators ("SO").

Filing Requirements for SO Application

An SO Application is not complete until the Division of Reclamation, Mining and Safety ("Division") has received each of the six items listed below. The Board has authorized the Division to review SO Applications and to issue approvals and denials based on its review. The Division will not review incomplete Applications.

- 1) **Application Form:** An Application Form is included in this Application Packet. Please note that the Application Form must be fully completed, and must bear the original notarized signature of an authorized representative of BOTH the Permittee and the Prospective Successor.
- 2) **Application Fee:** If an Application concerns a Hard Rock or Designated Mining Operation, then a filing fee of \$115.00 must be submitted to the Division. See C.R.S. § 34-32-127(2)(a)(I)(L). If an Application concerns a Construction Materials operation, then a filing fee of \$144.00 must be submitted to the Division. See C.R.S. § 34-32.5-125(1)(a)(X). Make all checks payable to the "Colorado Division of Reclamation, Mining and Safety."

- 3) **Performance Warranty Form:** The party wishing to become Successor (“Prospective Successor”) must agree to assume all liability for the reclamation of affected land, and must provide a Performance Warranty covering the same. *See* C.R.S. §§ 34-32-119 and 34-32.5-119. A Performance Warranty Form is included in this Application Packet. The Performance Warranty Form must bear the original notarized signature of an authorized representative of the Prospective Successor.
- 4) **Financial Warranty:** The Prospective Successor must provide Financial Warranties sufficient to cover the cost of completing reclamation in compliance with the Permit, the applicable Act and Rules. *See* C.R.S. §§ 34-32-119 and 34-32.5-119. In order to ensure the adequacy of the Financial Warranties, the Division must recalculate the required Financial Warranty whenever it receives an SO Application. Depending upon the state of the operation and the outstanding reclamation work, the Successor may be required to post a higher (sometimes significantly) or lower Financial Warranty than the Permittee currently has in place.

The Division must act on all SO Applications within 30 days. *See* Hard Rock and Construction Materials Rule 1.12.1(2)(a). Since the Division cannot typically review the amount of the required Financial Warranty within this 30-day period, applicants have the following two options:

Applicants may waive their right to receive a decision within 30 days. If the applicants waive their right to a decision within 30 days, the Division will recalculate the required Financial Warranty *before* issuing its decision on the Application. As a result, the Prospective Successor will know, prior to becoming Successor, whether the current Financial Warranty is adequate to cover the reclamation liability, or if the Financial Warranty must be increased. In this case, the Prospective Successor must submit the full Financial Warranty as part of the Application.

Applicants may decide not to waive their right to a decision within 30 days. If the applicants choose not to waive their right to a 30-day review, the Division will review the Financial Warranty *after* issuing its decision on the Application. In this case, the Prospective Successor must submit a conditional replacement Financial Warranty in the amount of the Permittee’s current Financial Warranty as part of the Application.

If the Application is approved, the Division will conduct an inspection within 60 days to assess the amount of the reclamation liability. If the inspection reveals that the reclamation liability exceeds the amount of the conditional replacement Financial Warranty, the Successor must submit the difference within sixty days. Failure to meet this deadline may result in an enforcement action. If the inspection reveals that the reclamation liability is less than the conditional replacement Financial Warranty, the Successor may request a Financial Warranty reduction for release of the difference.

It is the applicants' right to receive a decision on their complete Application within 30 days. The applicants are free to choose whichever option they decide is best. Permittee and Prospective Successor must designate their decision on the attached Application Form.

- 5) **Demonstration of Legal Right to Enter:** All Permittees must provide a description of the basis for legal right of entry to the site and to conduct mining and reclamation. *See* Hard Rock and Construction Materials Rules 6.3.7 and 6.4.14. To comply with this requirement, the Prospective Successor must demonstrate that he/she/it has obtained a legal right of entry from any and all surface and mineral rights owners in the affected lands, independent of the current Permittee. *See* Hard Rock and Construction Materials Rules 6.3.7, 6.4.14, and 1.6.2(1)(e)(i). This may be a copy of an access lease, deed, abstract of title, current tax receipt, or a signed and notarized statement by the property owners stating that the Prospective Successor has a legal right to enter. *See* Hard Rock and Construction Materials Rule 6.3.7.
- 6) **Structure Agreements:** In many cases, operators must provide the Division copies of agreements to compensate the owners of any significant, valuable, and permanent man-made structures and utilities within 200 feet of the affected land ("Structure Agreements"). *See* Hard Rock Rules 6.3.12 and 6.4.20; Construction Materials Rules 6.3.12 and 6.4.19. If the Permittee was required to provide Structure Agreements, the Prospective Successor must obtain *new* Structure Agreements from each owner and provide copies of the same to the Division with the Application.

Application Review Process

The Division will grant an Application if it finds that all required information has been submitted, that the Prospective Successor is capable of assuming all responsibility for original permit by virtue of acceptable performance and Financial Warranties, and that the Prospective Successor has no outstanding violations. *See* C.R.S. §§ 34-32-119 and 34-32.5-119. If the Division does not act within 30 days from the date that a complete Application has been filed, the Application will be considered automatically approved. *See* Hard Rock and Construction Materials Rule 1.12.1(2). If an Application is denied, the Division will notify the Permittee and Prospective Successor no later than 10 days from the date it renders its decision. Both the Permittee and Prospective Successor may appeal a denial of an Application to the Board by submitting a written request for an administrative appeal hearing to the Board within 30 days of final decision date. *See* Hard Rock and Construction Materials Rule 1.4.11.

Application Checklist

- **Application Form:** Complete the form located on page 5.
- **Application Fee:** Include check payable to Colorado Division of Reclamation, Mining and Safety.
- **Performance Warranty:** Complete the form located on page 11.
- **Financial Warranty:** Submit the appropriate Financial Warranties or conditional replacement Financial Warranties using the forms posted on the Division's website (available online at <http://mining.state.co.us/Mineral%20Forms.htm>).
- **Demonstration of Legal Right to Enter:** Identify the owners of all surface and mineral rights, obtain the documentation described above, and submit to the Division.
- **Structure Agreements:** Obtain new Structure Agreements if Permittee had been required to do so.

STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106



APPLICATION FORM FOR TRANSFER OF MINERAL PERMIT AND SUCCESSION OF OPERATORS

ADMINISTRATIVE INFORMATION

Permit Information

Permit Number: M-2008-078
Operation Name: West Farm Pit

Permittee Information

Contact Person: Karl Nyquist
Company Name: Prowers Aggregate Operators, LLC
Street Address: 7991 Shaffer Parkway - Suite 200
City: Littleton
State: CO Zip: 80127
Phone: (303) 659-5100
Email (optional): _____

Prospective Successor Information

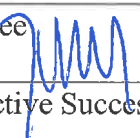
Contact Person: J.C. Marvel, Jr.
Company Name: Brannan Sand and Gravel Company, L.L.C.
Street Address: 2500 E. Brannan Way
City: Denver
State: CO Zip: 80229
Phone: (303) 534-1231
Email (optional): cmarvel@brannan1.com

Other Reclamation Permits held by Prospective Successor (if applicable):

M-2001-046, M-2016-030, M-2016-080, M-1980-183, M-2008-082, M-2004-067

DESIGNATION OF REVIEW TIMELINE

As explained above, the Permittee and Prospective Successor may waive their right to receive a decision on an Application within 30 days in order to allow the Division to calculate the required Financial Warranty before issuing its decision. Permittee and Prospective Successor must initial one of the following two options to designate their choice. If Permittee and Prospective Successor cannot agree, the Division will render its decision within 30 days.

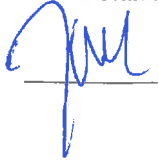
 _____ Permittee  _____ Prospective Successor	I have reviewed the information provided in this Application Packet, as well as the applicable Act and Rules. Having been fully informed, I wish to <u>WAIVE MY RIGHT TO A DECISION ON MY APPLICATION WITHIN 30 DAYS.</u>

_____ Permittee _____ Prospective Successor	I have reviewed the information provided in this Application Packet, as well as the applicable Act and Rules. Having been fully informed, I wish to <u>MAINTAIN MY RIGHT TO A DECISION ON MY APPLICATION WITHIN 30 DAYS.</u>

The Prospective Successor must provide an adequate Financial Warranty or *conditional* replacement Financial Warranty, consistent with the designation above. Hard Rock and Construction Materials Rule 4.3 describes the various acceptable types of Financial Warranties. Each Financial Warranty must be submitted on the Board's approved forms (available online at <http://mining.state.co.us/Mineral%20Forms.htm>).

DUE DILIGENCE CERTIFICATION

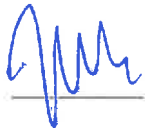
The Board wishes to ensure that Prospective Successors are fully informed of their duties and obligations should they become Successor to the Permit. Accordingly, the Prospective Successor must carefully review the items below and must initial indicating its agreement and understanding.



If the Application is approved, the Prospective Successor will assume all liability for the reclamation of the affected land, and for compliance with the Hard Rock Act and Rules or the Construction Materials Act and Rules, as applicable (available online at <http://mining.state.co.us/Rules%20and%20Regs.htm>). Successor will be liable for any pre-existing conditions or violations, whether known or unknown at the time of the SO. It is the Prospective Successor's sole responsibility to investigate the operation prior to filing an Application.



If the Application is approved, the Successor will be solely responsible for maintaining the mining and reclamation operations in compliance with the Reclamation Permit. The Permit includes the original approved Application, along with any and all subsequent revisions, amendments, and conversions thereto. It is not uncommon for a Permit to include dozens of documents that span many years. It is the Successor's sole responsibility to obtain a full and complete copy of the Permit and to understand the extent of his/her/its obligations thereunder. Permit documents may be purchased from the Division of Reclamation, Mining and Safety (the "Division") upon request or viewed on the Division's website at <http://drmsweblink.state.co.us/drmsweblink/search.aspx?dbid=0>



If the Application is approved, the Successor must submit Annual Fees and Annual Reports to the Division on the anniversary date of the Reclamation Permit. For hard rock and designated mining operations, consult C.R.S. § 34-32-127(2) for the amount of the Annual Fee. For construction materials operations, consult the C.R.S. § 34-32.5-125 for the amount of the Annual Fee. Required annual reporting information is described in Hard Rock and Construction Materials Rule 1.15 and in the Annual Report Form provided by the Division. Failure to submit Annual Fees or Annual Reports may result in enforcement action.

**APPLICANTS' AGREEMENT TO REQUEST TRANSFER
OF MINERAL PERMIT AND SUCCESSION OF OPERATORS**

WHEREAS, on August 16, 2016, Permit Number M-2008-078 ("Permit") was granted to Prowers Aggregate Operators, LLC ("Permittee"), pursuant to which Permit, Permittee has engaged in a mining operation located in Prowers County, Colorado.

WHEREAS, The Permit includes and incorporates any and all subsequent Amendments, Technical Revisions and/or Conversions.

WHEREAS, Permittee wishes to assign the entire Permit, along with all associated rights and responsibilities to Brannan Sand and Gravel Company, L.L.C. ("Prospective Successor"), and Prospective Successor wishes to become Successor Permittee under the Permit.

WHEREAS, Prospective Successor has inspected the mining and reclamation operations and is fully aware of the conditions thereof.

WHEREAS, Prospective Successor understands that the Reclamation Plan (the "Plan") is an integral part of the Permit and is required by law. Prospective Successor has had an opportunity to thoroughly review the Plan, understands that the Plan has not been completed and that, if Prospective Successor becomes Successor, he/she/it will assume full responsibility for the completion of the Plan.

NOW THEREFORE, Permittee and Prospective Successor hereby agree, for their own benefit and for the benefit of the State, as follows:

Prospective Successor agrees to accept all of the conditions of the Permit, including the condition that the operation remains in compliance with all applicable laws and regulations, and to perform all of the obligations of the Permittee under the Permit.

Prospective Successor agrees to complete the Plan, and to assume all liability for the same, as to all areas presently disturbed, as well as to all areas hereafter disturbed.

Prospective Successor agrees to submit to the Division of Reclamation, Mining and Safety ("Division"), Performance and Financial Warranties, as required by applicable law and regulations, which will be substituted for the Performance and Financial Warranties previously filed by the Permittee, if and when the Division approves a Transfer of Mineral Permit and Succession of Operators ("SO") and releases the latter Warranties.

Prospective Successor represents to the State that, to the best of its knowledge, information and belief, it is not in violation of any of the provisions of the Mined Land Reclamation Act (C.R.S. § 34-32-101 *et. seq.*) ("Hard Rock Act") and associated Rules (2 C.C.R. 407-1) ("Hard Rock Rules") or the Land Reclamation Act for the Extraction of

Construction Materials (C.R.S. § 34-32.5-101 *et. seq.*) ("Construction Materials Act") and associated Rules (2 C.C.R. 407-4) ("Construction Materials Rules"), with respect to any other operation conducted by the Prospective Successor in the State of Colorado.

Permittee and Prospective Successor hereby request that the Mined Land Reclamation Board ("Board") approves their SO Application, recognizes the Prospective Successor as Successor Operator under the Permit, accepts the Prospective Successor's Performance and Financial Warranties, and releases the current Permittee's Performance and Financial Warranties.

SIGNED, SEALED AND DATED this 1st day of February, 2022.

PERMITTEE

Prowers Aggregate Operators, LLC

Name of Permittee
By [Signature]
Signature of Officer
Manager
Title of Officer

PROSPECTIVE SUCCESSOR

Brannan Sand and Gravel Company, L.L.C.

Name of Prospective Successor
By [Signature]
Signature of Officer
CEO/President
Title of Officer

NOTARY FOR PERMITTEE

STATE OF Colorado)
COUNTY OF Douglas) ss.:



The foregoing instrument was acknowledged before me this 31st day of January, 2022,
by Karl Nyquist as Manager of Prowers Aggregate Operators, LLC

Notary Public [Signature]
My Commission Expires 5-15-24

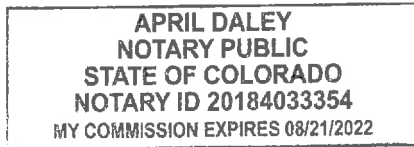
NOTARY FOR PROSPECTIVE SUCCESSOR

STATE OF Colorado)
COUNTY OF Adams) ss.:

The foregoing instrument was acknowledged before me this 1st day of February, 2022,
by J.C. Maxwell Jr. as CEO/President of Brannan Sand and Gravel Company
L.L.C.

Notary Public April Daley

My Commission Expires 8-21-22



STATE APPROVAL
[for completion by Division]

- (a) The Board hereby approves the transfer of permit number _____ from
_____ to _____.
- (b) The Board hereby recognizes _____ as Successor Operator under
such Permit.
- (c) The Board hereby accepts the Performance and Financial Warranties submitted by Successor and hereby
releases _____, as former Permittee from all obligations under
its Performance and Financial Warranties. The Board further releases all affected financial warrantors from
obligations under Financial Warranties associated with the former Permittee.

STATE OF COLORADO
DEPARTMENT OF NATURAL RESOURCES
MINED LAND RECLAMATION BOARD
DIVISION OF RECLAMATION, MINING AND SAFETY

By: _____
Division Director

Date Executed: _____

STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106



PERFORMANCE WARRANTY

Operator: Brannan Sand and Gravel Company, L.L.C.
Operation: West Farm Pit
Permit Number: M-2008-078

This form has been approved by the Mined Land Reclamation Board ("Board") pursuant to the Mined Land Reclamation Act (C.R.S. § 34-32-101 et. seq.) ("Hard Rock Act") and associated Rules (2 C.C.R. 407-1) ("Hard Rock Rules") and the Land Reclamation Act for the Extraction of Construction Materials (C.R.S. § 34-32.5-101 et. seq.) ("Construction Materials Act") and associated Rules (2 C.C.R. 407-4) ("Construction Materials Rules"). Any alteration or modification of this form, without approval by the Board shall result in the performance warranty being invalid and result in the voiding of any permit issued in conjunction with such invalid performance warranty and subject the operator to cease and desist orders and civil penalties for operating without a permit pursuant to sections 34-32-123, C.R.S. of the Hard Rock Act and 34-32.5-123, C.R.S. of Construction Materials Act.

KNOW ALL MEN BY THESE PRESENTS, THAT:

WHEREAS, the Colorado Mined Land Reclamation Act, C.R.S. § 34-32-101 et seq. (the "Hardrock Act"), as amended, and the Colorado Land Reclamation Act for the Extraction of Construction Materials, C.R.S. § 34-32.5-101 et seq. (the "Construction Materials Act"), as amended (collectively the "Acts"), provide that no permit may be issued until the Mined Land Reclamation Board (the "Board") receives a performance warranty consisting of the Operator's written promise to comply with the requirements of the Hardrock or Construction Materials Act, whichever is applicable.

WHEREAS, Brannan Sand and Gravel Company, L.L.C. (the "Operator"), has applied for a permit to conduct a mining operation known as West Farm Pit (the "Operation") on certain lands in Prowers County, Colorado. These lands are described in the permit application, as amended and supplemented, and are referred to herein as the "Affected Lands."

WHEREAS, in its application for the permit, the Operator has agreed to be bound by all requirements of the Hardrock or Construction Materials Act and all applicable rules and regulations of the Board, as amended from time to time.

WHEREAS, the Operator hereby gives the Board this performance warranty pursuant to C.R.S. §§ 34-32-117(2) or 34-32.5-117(2), and herein promises the Board that it will comply with all applicable requirements of the Hardrock or Construction Materials Act.

NOW, THEREFORE, The Operator hereby promises the Board that it will comply with all applicable requirements of the Hard Rock or Construction Materials Act and applicable rules and regulations of the Board.

The Operator hereby promises the Board that it will comply with all of the terms of the application for a permit, as amended and supplemented, as well as any conditions attached to the permit by the Board.

The Operator promises the Board, pursuant to C.R.S. §§ 34-32-112(1)(d) or 34-32.5-112(1)(b)(IV), that it has the lawful authority to enter upon the Affected Lands to conduct mining operations, including, but not limited to, reclamation. The Operator further recognizes the right of the Board to enter to reclaim lands affected by the Operation.

The description of lands herein is for convenience of reference only, and no error in such description, revision of the permitted mining area, or disturbance by the Operator of lands outside of the permitted mining area shall alter or diminish the Operator's obligation hereunder, which shall extend to the reclamation of all such lands disturbed.

The obligation of the Operator hereunder is such that, if the Operator shall successfully comply with the requirements of the Hardrock or Construction Materials Act, applicable rules and regulations, and the permit, then the Board, upon a finding that the Operator has so complied, shall release this performance warranty, and the Operator from its obligation hereunder. The obligation of the Operator hereunder shall continue until released by the Board in accordance with applicable law.

The Operator promises to be responsible for the cost of reclamation up to the amount established by the Board and has attached hereto its financial warranty, in accordance with C.R.S. §§ 34-32-117(3) or 34-32.5-117(3). The Operator agrees that it will maintain a financial warranty (or warranties) covering the Board's estimated costs of reclamation in good standing for the entire life of the permit. If the Operator is a unit of County or Municipal government, or is a department or division of State government, the Operator is not required to submit or post any other instrument of financial responsibility but hereby promises to be responsible for the cost of reclamation up to the amount specified by the Board.

If the Board determines that the Operator is in default under this performance warranty and has failed to cure such default, although written notice of such default and ample time to cure such default have been given, the Operator's financial warranty shall be subject to forfeiture.

This performance warranty may be executed in multiple copies, each of which shall be treated as an original, but together they constitute only one agreement, the validity and interpretation of which shall be governed by the laws of the State of Colorado. The provisions hereof shall bind and inure to the benefit of the parties hereto and their successors and assigns.

SIGNED, SEALED AND DATED this 1st day of February, 2022.

Brannan Sand and Gravel Company, L.L.C.

Operator

(SEAL)

By:

Title:

CEO/President

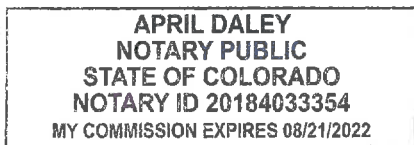
NOTARIZATION OF OPERATOR'S ACKNOWLEDGEMENT

STATE OF Colorado)

COUNTY OF Adams)

ss.:

The foregoing instrument was acknowledged before me this 1st day of February, 2022
by J.C. Maull Jr. as CEO/President of Brannan Sand and Gravel Company, L.L.C.



Notary Public

April Daley

My Commission Expires

8-21-22

STATE OF COLORADO
DEPARTMENT OF NATURAL RESOURCES
MINED LAND RECLAMATION BOARD
DIVISION OF RECLAMATION, MINING AND SAFETY

By: _____
Division Director

Date Executed: _____

Rev. 05/12

SLOPE STABILITY REPORT

FOR THE
WEST FARM GRAVEL PIT EXPANSION
PROWERS COUNTY, COLORADO

DECEMBER, 2020
REVISED APRIL, 2021

PREPARED FOR:

BRANNAN SAND AND GRAVEL COMPANY, LLC.
2500 E BRANNAN WAY
DENVER, CO 80229

PREPARED BY:

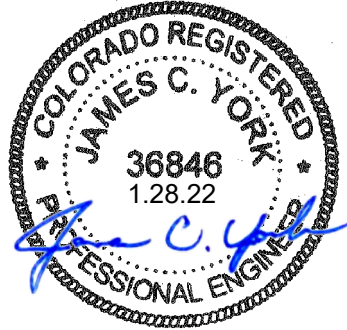


J&T Consulting, Inc.

305 DENVER AVENUE – SUITE D
FORT LUPTON, CO 80621
PHONE: 303-857-6222

CERTIFICATION:

I hereby certify this slope stability analysis for Brannan Sand and Gravel, the West Farm Gravel Pit Expansion, located in Prowers County, Colorado was prepared by me or under my direct supervision.



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

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I - INTRODUCTION

Brannan Sand and Gravel proposes to expand the existing West Farm Pit. The property is located east of the City of Lamar, Colorado. More specifically the property is located in the south $\frac{1}{2}$ of Section 26, south $\frac{1}{2}$ of Section 27, south $\frac{1}{2}$ of Section 28, south $\frac{1}{2}$ of Section 29, north $\frac{1}{2}$ of Section 32, southwest $\frac{1}{4}$ and north $\frac{1}{2}$ of Section 33, north $\frac{1}{2}$ of Section 34, north $\frac{1}{2}$ of Section 35, and the northwest $\frac{1}{4}$ of Section 36, Township 22 South, Range 46 West of the Sixth Prime Meridian, in Prowers County, Colorado. The property is bounded by private property on the east and west, Prowers County Road HH.5 on the south, and private property and the City of Lamar sewer lagoons on the north. United States Highway 50 is approximately one eighth 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 setback of 200 feet 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 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.

II - OVERVIEW

The DRMS mining plan proposes that the property will be mined in 9 phases. Phases 1, 2, and 9 were previously analyzed and addressed for the current permit area and have not been included in this analysis for the expansion. The mining of all phases will occur at 3H:1V slopes. Concurrent reclamation is planned such that the reclamation embankment will be constructed as the mining progresses.

III - GEOTECHNICAL DATA

Geotechnical gravel investigations for the property have been performed by Cesare, Inc. (CES), and Rocky Mountain Industrials, Inc. (RMI). J&T Consulting, Inc. (JT) estimated soil strength parameters based on the information from the CES report, and other stability analyses that have been performed on gravel mining operations located in similar soils. Table 1 below 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
Overburden	110	131	150	22
Sand and Gravel	110	131	0	35
Weathered Bedrock	125	141	100	18
Stable Bedrock	125	141	2000	20
Slurry Wall	100	110	0	45

IV - 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 several critical situations that may occur during the life of the embankment. For this project, fifteen cases were identified as critical during the mining operation. Static and pseudo-static conditions were analyzed in 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 0.06 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, $0.70 \times 0.06 = 0.042$ which was used in the models.

All mining side slopes will be 3H:1V.

Case 3-1 –Ditch Bank to the West of Phase 3.

The proposed setback for mining is 85 feet from the edge of the ditch bank. The mining depth was assumed to be 60 feet in this area based on the bore log information in the geotechnical investigations.

Case 3-2 – Edge of Highway Realignment Parcel to the East of Phase 3.

The proposed setback for mining is 75 feet from the edge of the parcel. The mining depth was assumed to be 65 feet in this area based on bore log information in the geotechnical investigations.

Case 3-3 – Edge of Highway Realignment Parcel to the North of Phase 3.

The proposed setback for mining is 65 feet from the edge of the parcel. The mining depth was assumed to be 56 feet in this area based on bore log information in the geotechnical investigations.

Case 4-1 – Electric Line/Poles to the East of Phase 4.

The proposed setback for mining is 75 feet from the lines/poles. The mining depth was assumed to be 43 feet in this area based on bore log information in the geotechnical investigations.

Case 4-2 – Ditch Bank to the South of Phase 4.

The proposed setback for mining is 85 feet from the edge of the ditch bank. The mining depth was assumed to be 54 feet in this area based on bore log information in the geotechnical investigations.

Case 5-1 – Edge of Conservation Easement to the East of Phase 5.

The proposed setback for mining is 55 feet from the edge of the easement. The mining depth was assumed to be 39 feet in this area based on bore log information in the geotechnical investigations.

Case 5-2 – Canal Bank to the South of Phase 5.

The proposed setback for mining is 75 feet from the edge of the canal bank. The mining depth was assumed to be 17 feet in this area based on bore log information in the geotechnical investigations.

Case 5-3 – Electric Line/Poles to the West of Phase 5.

The proposed setback for mining is 60 feet from the lines/poles. The mining depth was assumed to be 36 feet in this area based on bore log information in the geotechnical investigations.

Case 6-1 – Edge of Conservation Easement to the East of Phase 6.

The proposed setback for mining is 50 feet from the edge of the easement. The mining depth was assumed to be 41 feet in this area based on bore log information in the geotechnical investigations.

Case 6-2 – Canal Bank to the South of Phase 6.

The proposed setback for mining is 75 feet from the edge of the canal bank. The mining depth was assumed to be 25 feet in this area based on bore log information in the geotechnical investigations.

Case 7-1 – Electric/Gas Lines to the North of Phase 7.

The proposed setback for mining is 150 feet from the electric/gas lines. The mining depth was assumed to be 56 feet in this area based on bore log information in the geotechnical investigations.

Case 7-2 – Canal Bank to the South of Phase 7.

The proposed setback for mining is 80 feet from the edge of the canal bank. The mining depth was assumed to be 56 feet in this area based on bore log information in the geotechnical investigations.

Case 8-1 – Electric/Gas Lines to the North of Phase 8.

The proposed setback for mining is 145 feet from the electric/gas lines. The mining depth was assumed to be 37 feet in this area based on bore log information in the geotechnical investigations.

Case 8-2 – Electric Line/Poles West of Phase 8.

The proposed setback for mining is 60 feet from the electric line/poles. The mining depth was assumed to be 38 feet in this area based on bore log information in the geotechnical investigations.

Case 8-3 – County Road HH.5 to the South of Phase 8.

The proposed setback for mining is 75 feet from the edge of the road. The mining depth was assumed to be 29 feet in this area based on bore log information in the geotechnical investigations.

Case 8-4 – Edge of Highway Realignment Parcel to the East of Phase 8.

The proposed setback for mining is 50 feet from the edge of the parcel. The mining depth was assumed to be 36 feet in this area based on bore log information in the geotechnical investigations.

The cross-sections located in Appendix B show the proposed mining slope geometry, estimated phreatic surface, location of the man-made structures relative to the mining slope, and location of the most critical slope failure surface for each case.

V - METHODOLOGY

The mining embankment configuration shown in the computer analysis 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 current standards detailed in the Policies of the Mined Land Reclamation Board (MLRB).

VI - SLOPE STABILITY RESULTS

Per the current policies of the MLRB, critical structures with assumed soil strength values require minimum factors of safety of 1.5 and 1.3 for static and pseud-static analyses respectively. Non-critical structures with assumed soil strength values require minimum factors of safety of 1.3 and 1.15 for static and pseudo-static analyses respectively. Each case analyzed used the appropriate critical or non-critical factors of safety for the structure as shown in the analysis results tables below. The calculated safety factors exceed the minimum required and can be considered indicators of the

mining slope performance under the various conditions. The slopes were analyzed using full and rapid drawdown reservoir conditions. The results of the static condition and pseudo-static condition slope stability analyses are summarized in Table 2 and Table 3 below.

Table 2 – Static Condition Slope Stability Analysis Results

Description	Calculated Factor of Safety	Required Minimum Factor of Safety
Case 3-1 – Ditch Bank West of Phase 3 – Full Reservoir	3.47	1.5
Case 3-1 – Ditch Bank West of Phase 3 – Rapid Drawdown	1.85	1.5
Case 3-2 – Highway Parcel East of Phase 3 – Full Reservoir	2.82	1.3
Case 3-2 – Highway Parcel East of Phase 3 – Rapid Drawdown	1.47	1.3
Case 3-3 – Highway Parcel North of Phase 3 – Full Reservoir	2.62	1.3
Case 3-3 – Highway Parcel North of Phase 3 – Rapid Drawdown	1.37	1.3
Case 4-1 – Electric Line/Poles East of Phase 4 – Full Reservoir	3.15	1.5
Case 4-1 – Electric Line/Poles East of Phase 4 – Rapid Drawdown	1.73	1.5
Case 4-2 – Ditch Bank South of Phase 4 – Full Reservoir	3.11	1.5
Case 4-2 – Ditch Bank South of Phase 4 – Rapid Drawdown	1.66	1.5
Case 5-1 – Conservation Easement East of Phase 5 – Full Reservoir	2.55	1.3
Case 5-1 – Conservation Easement East of Phase 5 – Rapid Drawdown	1.39	1.3
Case 5-2 – Canal Bank South of Phase 5 – Full Reservoir	4.13	1.5
Case 5-2 – Canal Bank South of Phase 5 – Rapid Drawdown	2.69	1.5
Case 5-3 – Electric Line/Poles West of Phase 5 – Full Reservoir	2.96	1.5
Case 5-3 – Electric Line/Poles West of Phase 5 – Rapid Drawdown	1.64	1.5
Case 6-1 – Conservation Easement East of Phase 6 – Full Reservoir	2.60	1.3
Case 6-1 – Conservation Easement East of Phase 6 – Rapid Drawdown	1.39	1.3
Case 6-2 – Canal Bank South of Phase 6 – Full Reservoir	3.85	1.5
Case 6-2 – Canal Bank South of Phase 6 – Rapid Drawdown	2.31	1.5
Case 7-1 – Elec/Gas Lines North of Phase 7 – Full Reservoir	4.38	1.5
Case 7-1 – Elec/Gas Lines North of Phase 7 – Rapid Drawdown	2.40	1.5
Case 7-2 – Canal Bank South of Phase 7 – Full Reservoir	2.99	1.5
Case 7-2 – Canal Bank South of Phase 7 – Rapid Drawdown	1.58	1.5
Case 8-1 – Elec/Gas Lines North of Phase 8 – Full Reservoir	5.42	1.5
Case 8-1 – Elec/Gas Lines North of Phase 8 – Rapid Drawdown	3.15	1.5
Case 8-2 – Elec Line/Poles West of Phase 8 – Full Reservoir	2.93	1.5
Case 8-2 – Elec Line/Poles West of Phase 8 – Rapid Drawdown	1.61	1.5
Case 8-3 – County Road HH.5 South of Phase 8 – Full Reservoir	3.79	1.5
Case 8-3 – County Road HH.5 South of Phase 8 – Rapid Drawdown	2.21	1.5
Case 8-4 – Highway Parcel East of Phase 8 – Full Reservoir	2.82	1.3
Case 8-4 – Highway Parcel East of Phase 8 – Rapid Drawdown	1.59	1.3

Table 3 – Pseudo-Static Condition Slope Stability Analysis Results

Description	Calculated Factor of Safety	Required Minimum Factor of Safety
Case 3-1 – Ditch Bank West of Phase 3 – Full Reservoir	2.57	1.3
Case 3-1 – Ditch Bank West of Phase 3 – Rapid Drawdown	1.54	1.3
Case 3-2 – Highway Parcel East of Phase 3 – Full Reservoir	2.14	1.15
Case 3-2 – Highway Parcel East of Phase 3 – Rapid Drawdown	1.24	1.15
Case 3-3 – Highway Parcel North of Phase 3 – Full Reservoir	1.99	1.15
Case 3-3 – Highway Parcel North of Phase 3 – Rapid Drawdown	1.16	1.15
Case 4-1 – Electric Line/Poles East of Phase 4 – Full Reservoir	2.32	1.3
Case 4-1 – Electric Line/Poles East of Phase 4 – Rapid Drawdown	1.42	1.3
Case 4-2 – Ditch Bank South of Phase 4 – Full Reservoir	2.31	1.3
Case 4-2 – Ditch Bank South of Phase 4 – Rapid Drawdown	1.38	1.3
Case 5-1 – Conservation Easement East of Phase 5 – Full Reservoir	1.92	1.15
Case 5-1 – Conservation Easement East of Phase 5 – Rapid Drawdown	1.17	1.15
Case 5-2 – Canal Bank South of Phase 5 – Full Reservoir	2.72	1.3
Case 5-2 – Canal Bank South of Phase 5 – Rapid Drawdown	2.00	1.3
Case 5-3 – Electric Line/Poles West of Phase 5 – Full Reservoir	2.20	1.3
Case 5-3 – Electric Line/Poles West of Phase 5 – Rapid Drawdown	1.36	1.3
Case 6-1 – Conservation Easement East of Phase 6 – Full Reservoir	1.97	1.15
Case 6-1 – Conservation Easement East of Phase 6 – Rapid Drawdown	1.17	1.15
Case 6-2 – Canal Bank South of Phase 6 – Full Reservoir	2.68	1.3
Case 6-2 – Canal Bank South of Phase 6 – Rapid Drawdown	1.82	1.3
Case 7-1 – Elec/Gas Lines North of Phase 7 – Full Reservoir	3.05	1.3
Case 7-1 – Elec/Gas Lines North of Phase 7 – Rapid Drawdown	1.92	1.3
Case 7-2 – Canal Bank South of Phase 7 – Full Reservoir	2.23	1.3
Case 7-2 – Canal Bank South of Phase 7 – Rapid Drawdown	1.32	1.3
Case 8-1 – Elec/Gas Lines North of Phase 8 – Full Reservoir	3.55	1.3
Case 8-1 – Elec/Gas Lines North of Phase 8 – Rapid Drawdown	2.39	1.3
Case 8-2 – Elec Line/Poles West of Phase 8 – Full Reservoir	2.19	1.3
Case 8-2 – Elec Line/Poles West of Phase 8 – Rapid Drawdown	1.33	1.3
Case 8-3 – County Road HH.5 South of Phase 8 – Full Reservoir	2.70	1.3
Case 8-3 – County Road HH.5 South of Phase 8 – Rapid Drawdown	1.77	1.3
Case 8-4 – Highway Parcel East of Phase 8 – Full Reservoir	2.14	1.15
Case 8-4 – Highway Parcel East of Phase 8 – Rapid Drawdown	1.33	1.15

VII - CONCLUSIONS AND RECOMMENDATIONS

Case 3-1 – The resulting safety factors of 1.85 (static) and 1.54 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 3.47 (static) and 2.57 (pseudo-static) during a full reservoir condition also exceed the

minimum required MLRB safety factors for critical structures. The proposed setback of 85 feet from the edge of the ditch bank is satisfactory.

Case 3-2 – The resulting safety factors of 1.47 (static) and 1.24 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.3 (static) and 1.15 (pseudo-static) for non-critical structures. The resulting safety factors of 2.82 (static) and 2.14 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for non-critical structures. The proposed setback of 75 feet from the edge of the highway parcel is satisfactory.

Case 3-3 – The resulting safety factors of 1.37 (static) and 1.16 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.3 (static) and 1.15 (pseudo-static) for non-critical structures. The resulting safety factors of 2.62 (static) and 1.99 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for non-critical structures. The proposed setback of 65 feet from the edge of the highway parcel is satisfactory.

Case 4-1 – The resulting safety factors of 1.73 (static) and 1.42 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 3.15 (static) and 2.32 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 75 feet from the electric line/poles is satisfactory.

Case 4-2 – The resulting safety factors of 1.66 (static) and 1.38 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 3.11 (static) and 2.31 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 85 feet from the edge of the ditch bank is satisfactory.

Case 5-1 – The resulting safety factors of 1.39 (static) and 1.17 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.3 (static) and 1.15 (pseudo-static) for non-critical structures. The resulting safety factors of 2.55 (static) and 1.92 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for non-critical structures. The proposed setback of 55 feet from the edge of the conservation easement is satisfactory.

Case 5-2 – The resulting safety factors of 2.69 (static) and 2.00 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 4.13 (static) and 2.72 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 75 feet from the edge of the canal bank is satisfactory.

Case 5-3 – The resulting safety factors of 1.64 (static) and 1.36 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5

(static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 2.96 (static) and 2.20 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 60 feet from the electric line/poles is satisfactory.

Case 6-1 – The resulting safety factors of 1.39 (static) and 1.17 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.3 (static) and 1.15 (pseudo-static) for non-critical structures. The resulting safety factors of 2.60 (static) and 1.97 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for non-critical structures. The proposed setback of 50 feet from the edge of the conservation easement is satisfactory.

Case 6-2 – The resulting safety factors of 2.31 (static) and 1.82 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 3.85 (static) and 2.68 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 75 feet from the edge of the canal bank is satisfactory.

Case 7-1 – The resulting safety factors of 2.40 (static) and 1.92 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 4.38 (static) and 3.05 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 150 feet from the electric/gas lines is satisfactory.

Case 7-2 – The resulting safety factors of 1.58 (static) and 1.32 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 2.99 (static) and 2.23 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 80 feet from the edge of the canal bank is satisfactory.

Case 8-1 – The resulting safety factors of 3.15 (static) and 2.39 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 5.42 (static) and 3.55 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 145 feet from the electric/gas lines is satisfactory.

Case 8-2 – The resulting safety factors of 1.61 (static) and 1.33 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 2.93 (static) and 2.19 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 60 feet from the electric line/poles is satisfactory.

Case 8-3 – The resulting safety factors of 2.21 (static) and 1.77 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.5 (static) and 1.3 (pseudo-static) for critical structures. The resulting safety factors of 3.79 (static) and 2.70 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for critical structures. The proposed setback of 75 feet from the edge of road is satisfactory.

Case 8-4 – The resulting safety factors of 1.59 (static) and 1.33 (pseudo-static) during a rapid drawdown condition exceed the minimum required MLRB safety factors of 1.3 (static) and 1.15 (pseudo-static) for non-critical structures. The resulting safety factors of 2.82 (static) and 2.14 (pseudo-static) during a full reservoir condition also exceed the minimum required MLRB safety factors for non-critical structures. The proposed setback of 50 feet from the edge of the highway parcel 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 duration 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 during mining, then the inspection period could be reduced to once per 6 months after mining completion, or after every major precipitation event.

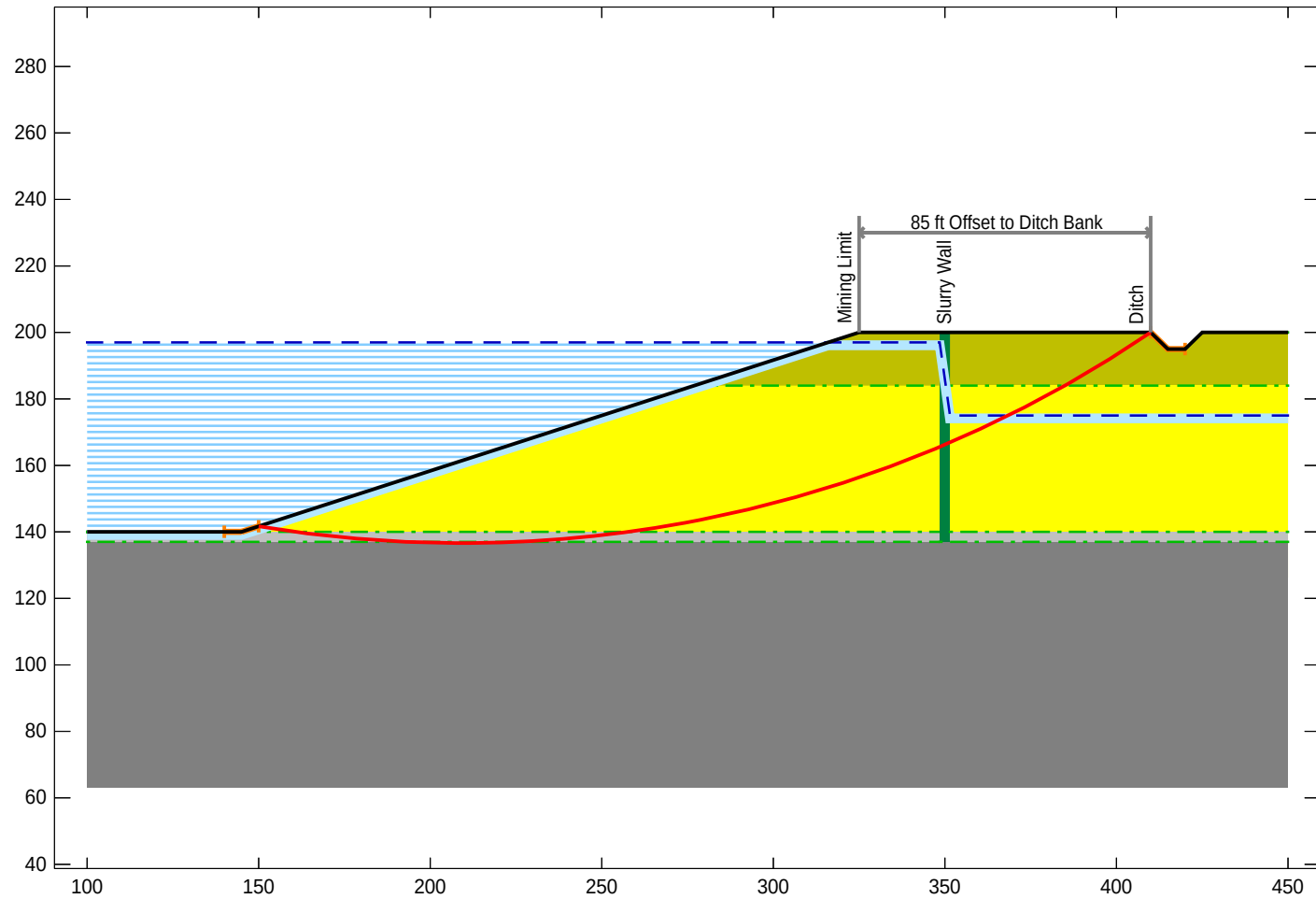
APPENDIX A



Job #	07115
Date	12.3.20
Drawn By	TPY
Designed By	TPY
Checked By	JCY
File	JT-2020 Brannan SS Case Map
Scale	1" = 800'

APPENDIX B





GALENA Version 7.2

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Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Spencer-Wright
Surface: Circular

Results

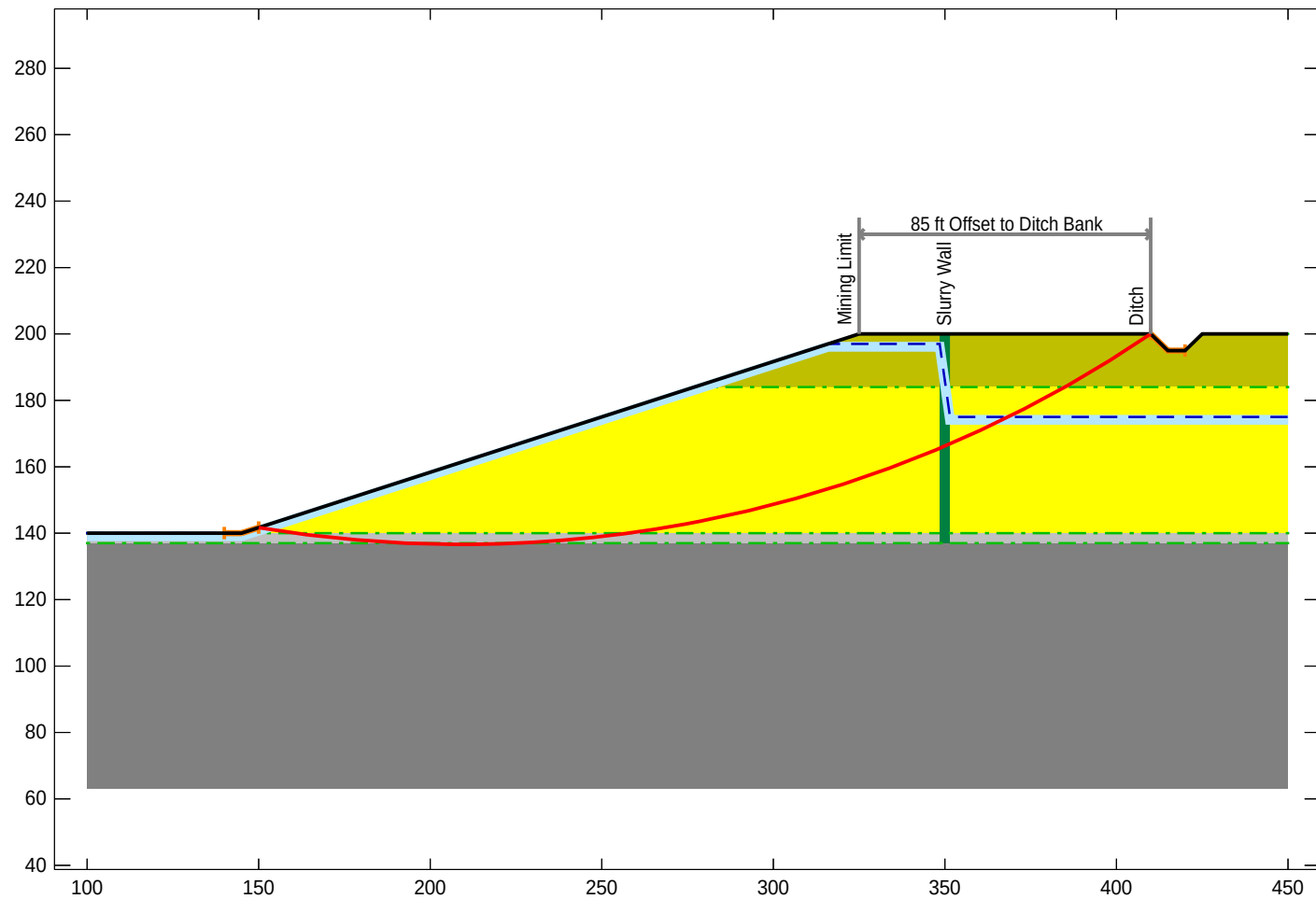
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Interslice Force (Final) Angle: 11.6°

Edited: 4 Dec 2020
Processed: 4 Dec 2020

Project West Farm Pit Expansion
Case 3-1 Full Reservoir

File: C:\Galena Models\Case 3-1\West Farm Expansion Case 3-1 Full Reservoir.gmf





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Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 1.85

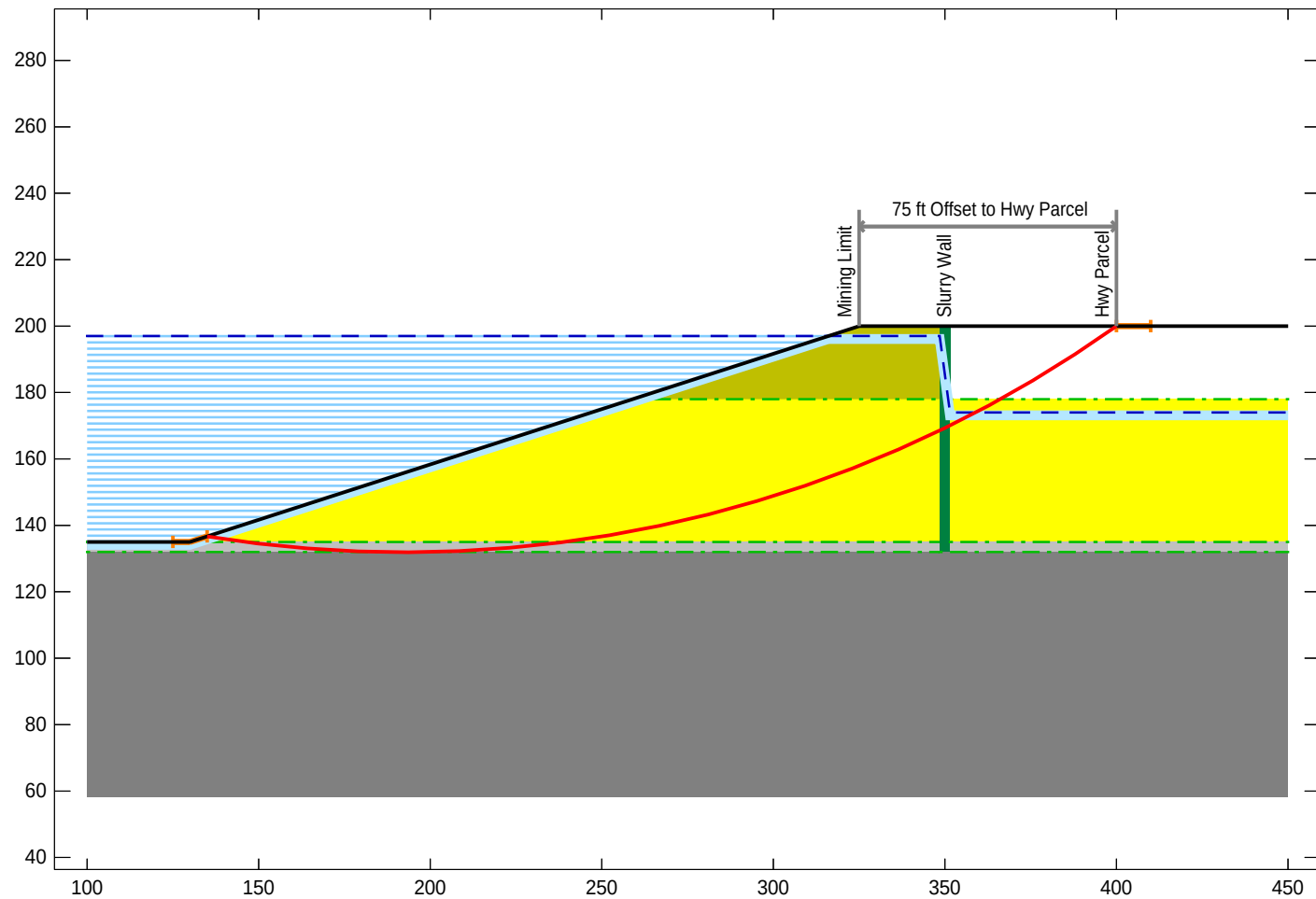
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Project West Farm Pit Expansion
Case 3-1 Rapid Drawdown

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Edited: 4 Dec 2020
Processed: 4 Dec 2020





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Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

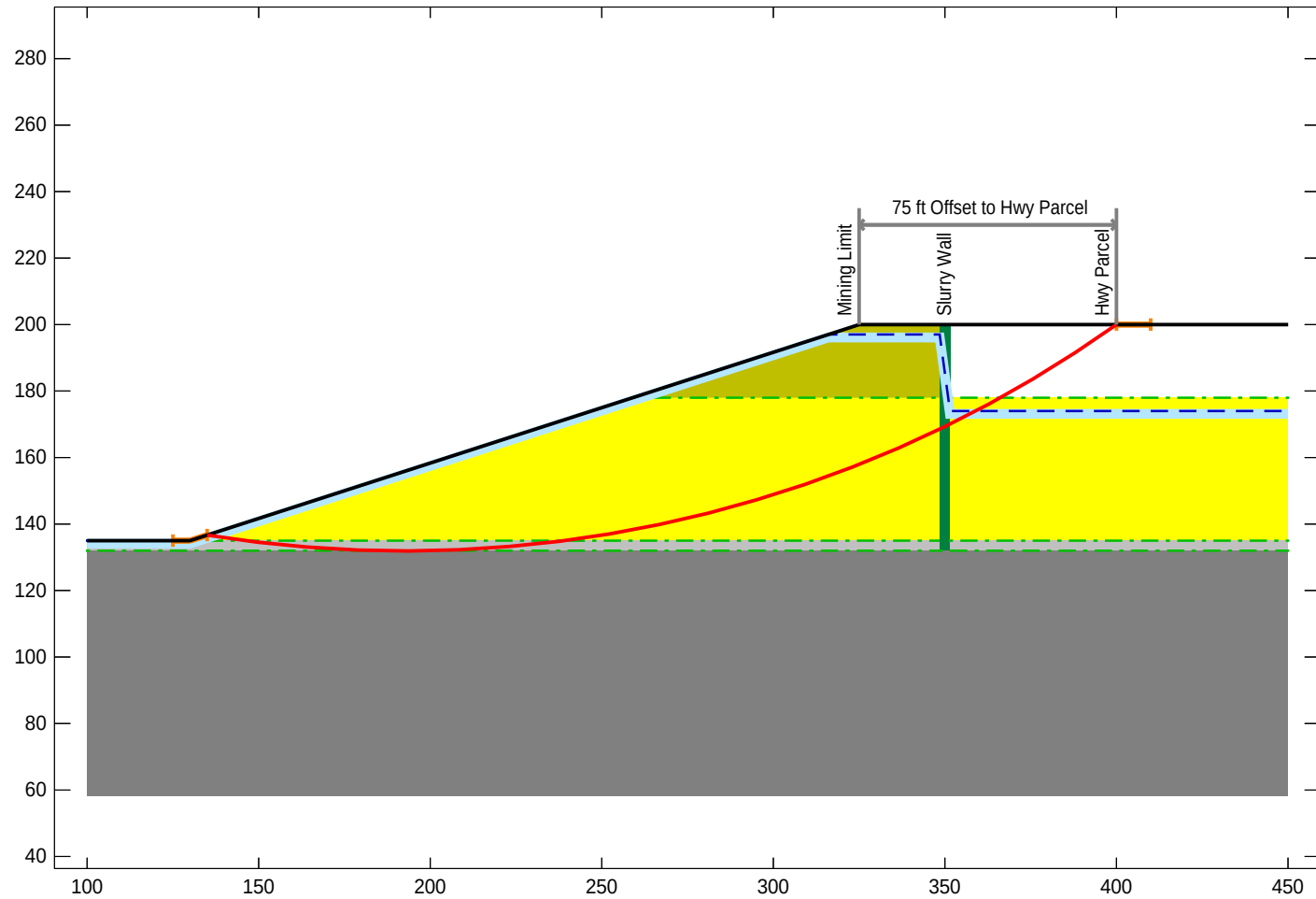
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Project West Farm Pit Expansion
Case 3-2 Full Reservoir

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Processed: 4 Dec 2020





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Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

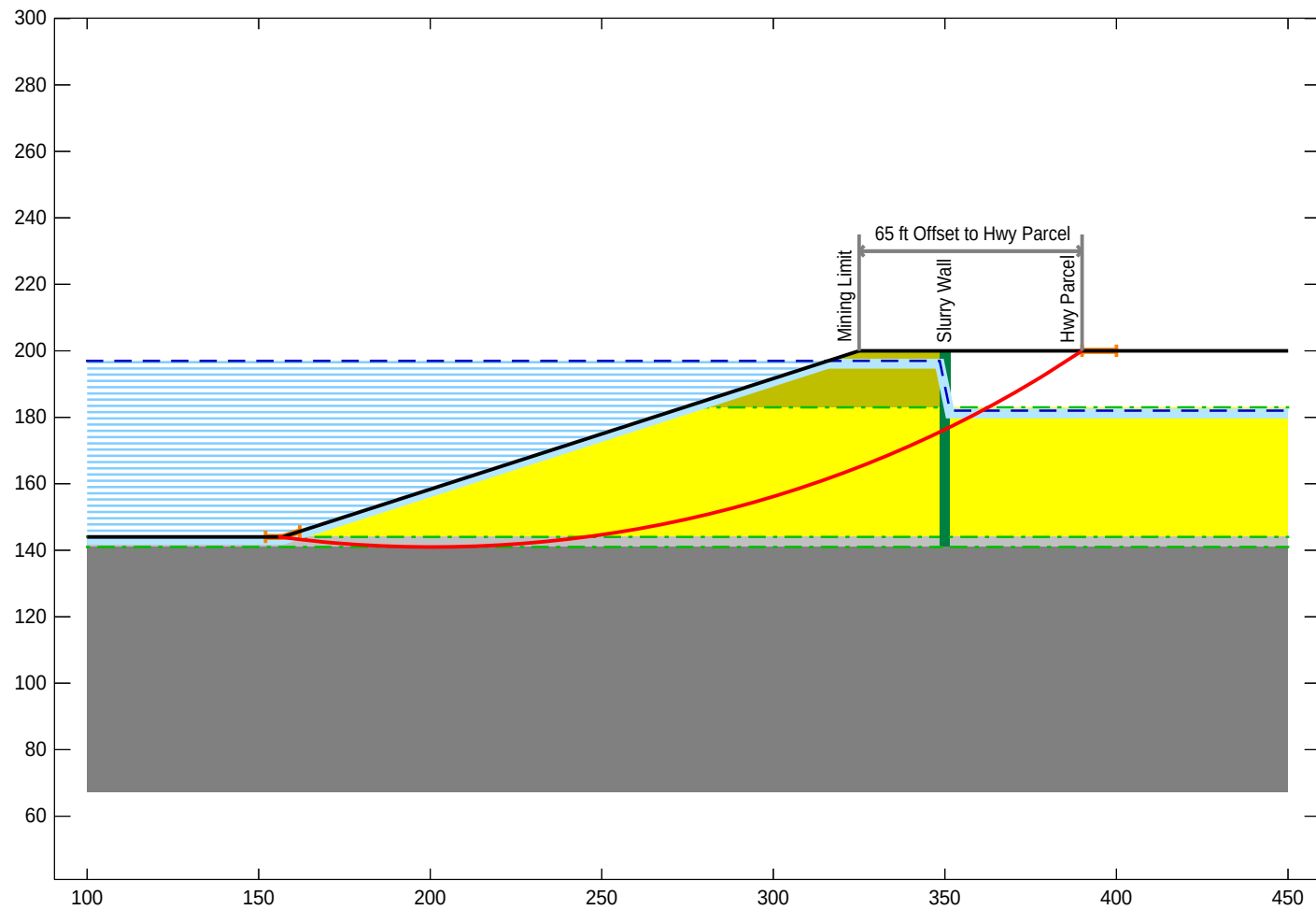
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Project West Farm Pit Expansion
Case 3-2 Rapid Drawdown

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Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

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Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

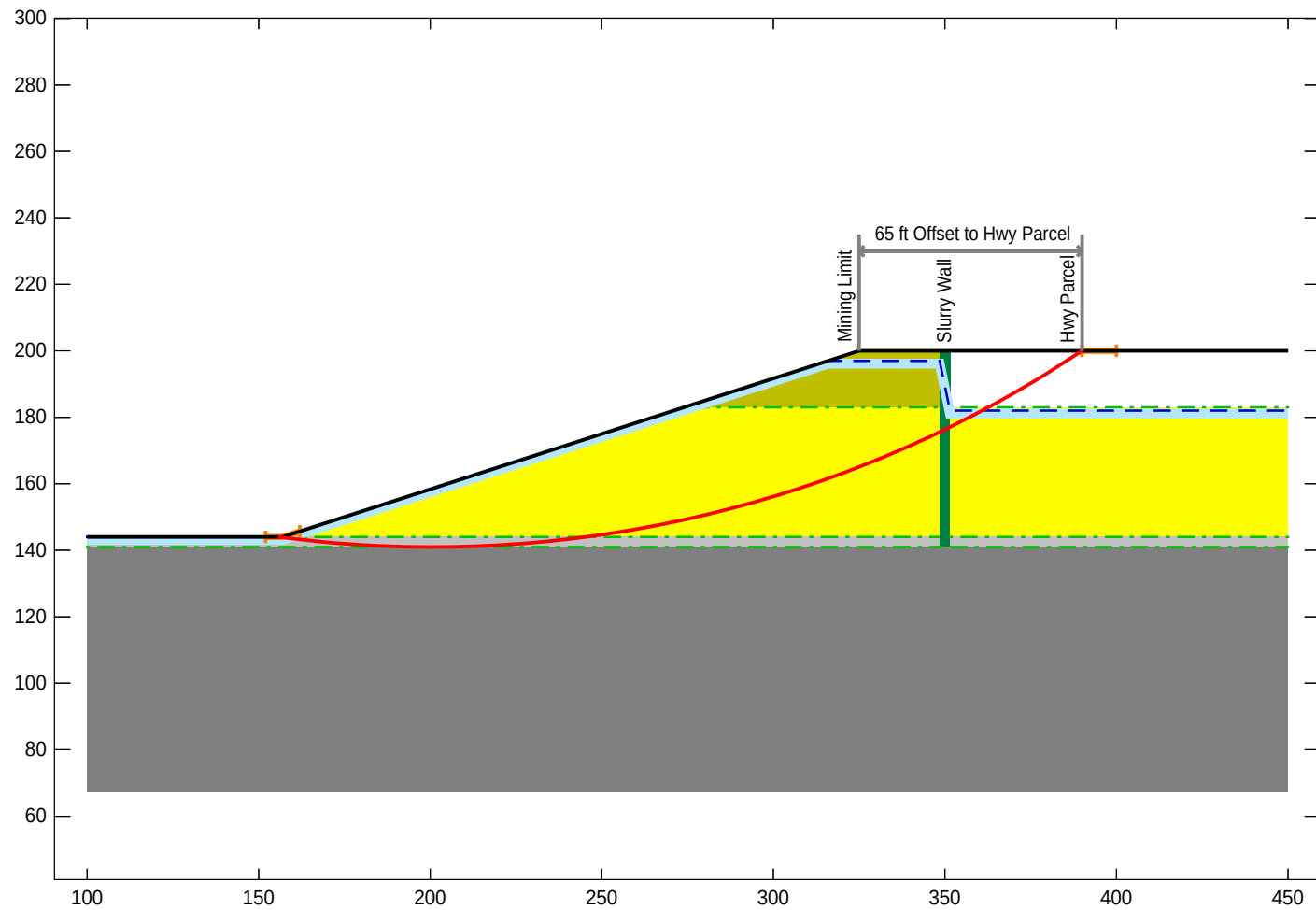
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Project West Farm Pit Expansion
Case 3-3 Full Reservoir

File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Full Reservoir.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

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Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

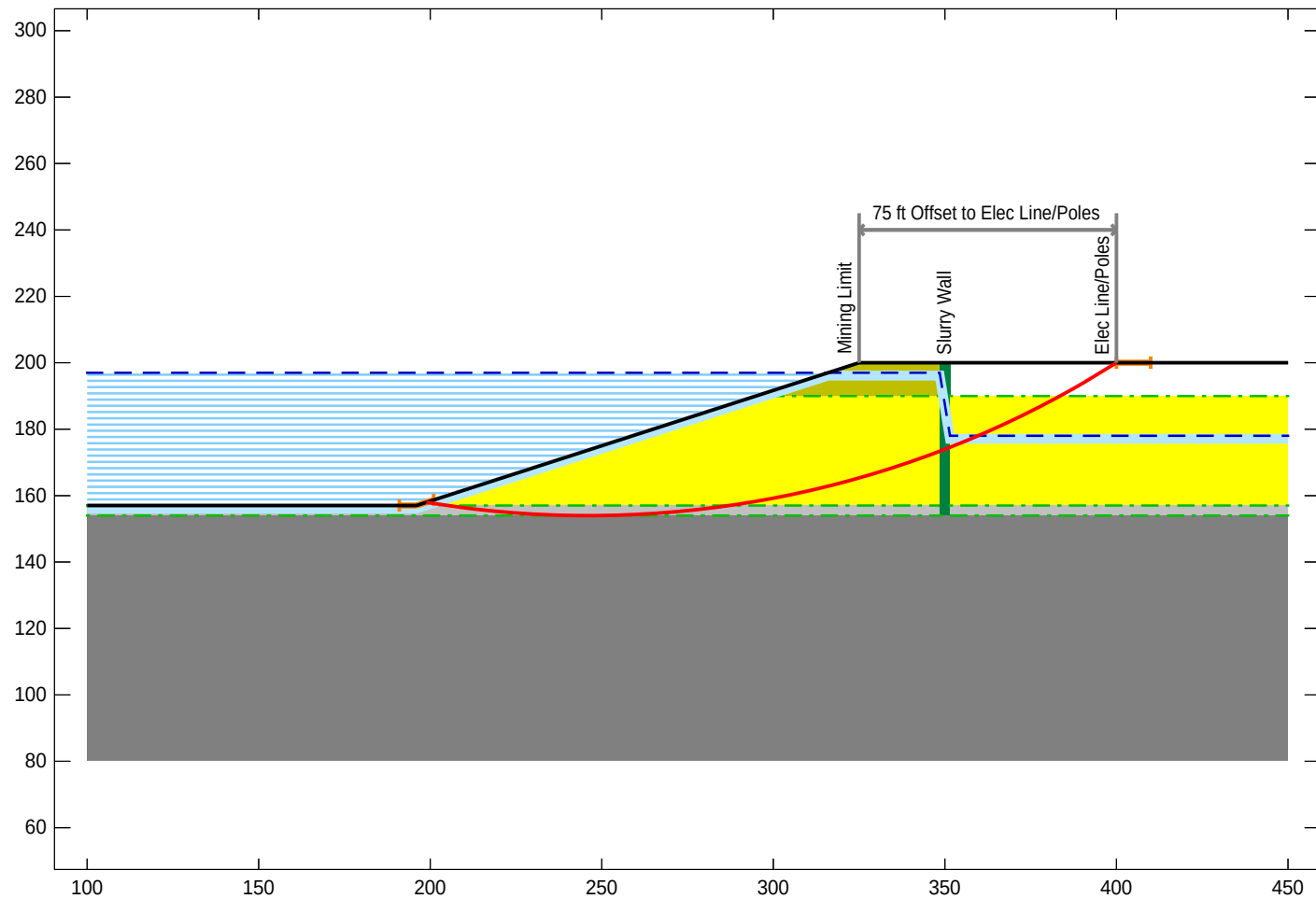
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Project West Farm Pit Expansion
Case 3-3 Rapid Drawdown

File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Rapid Drawdown.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

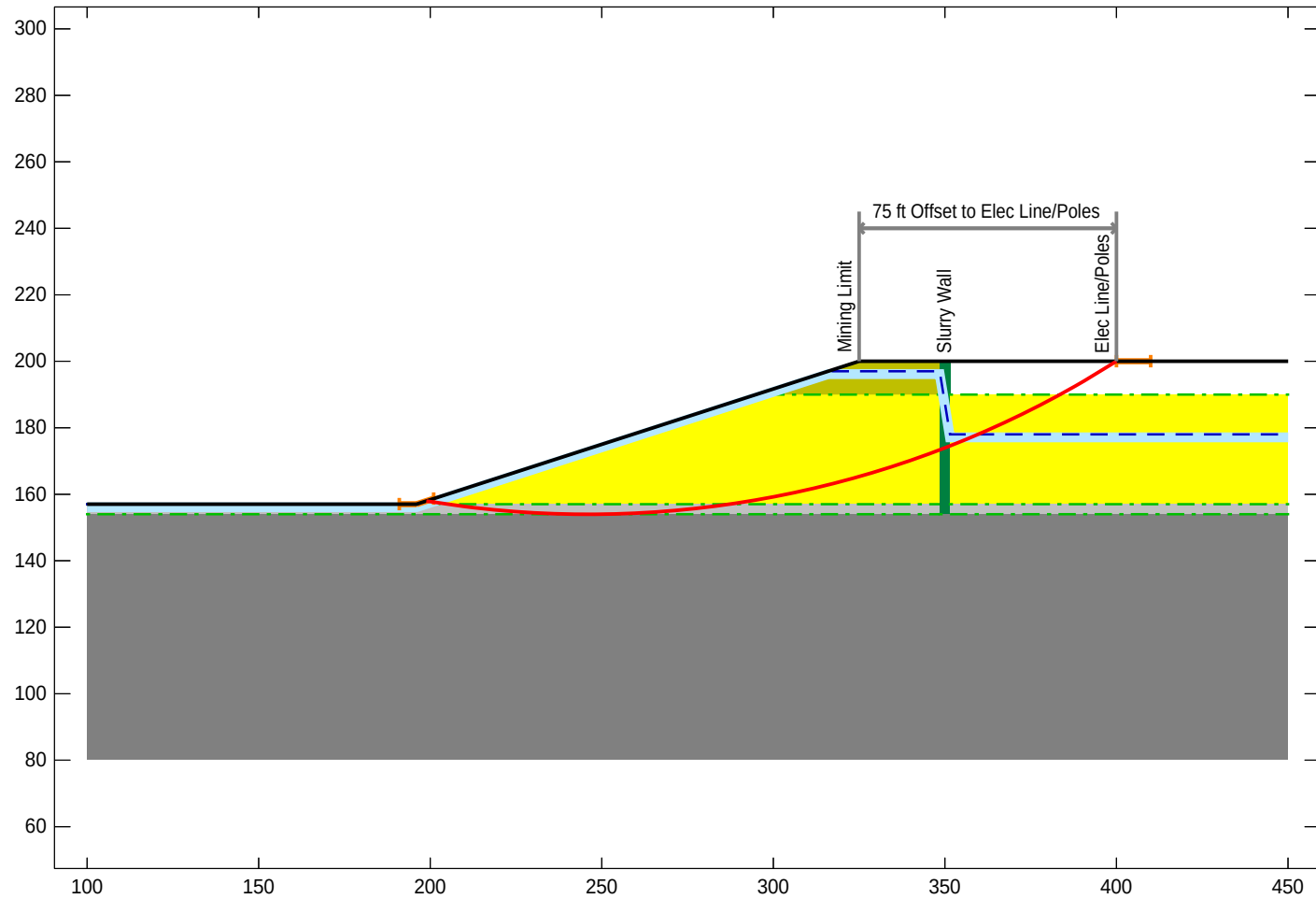
Critical Factor of Safety: 3.15

Project West Farm Pit Expansion
Case 4-1 Full Reservoir

File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Full Reservoir.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

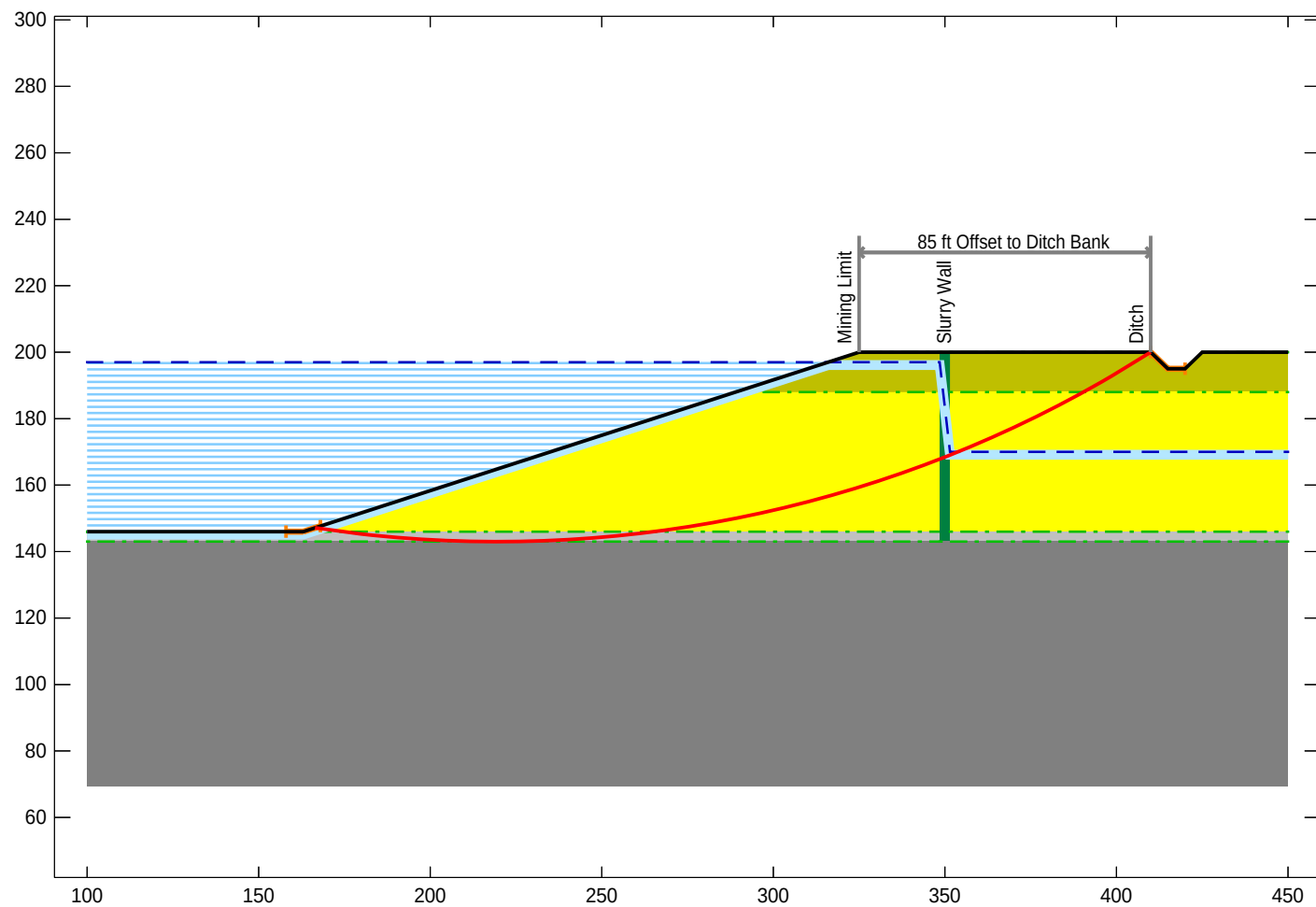
Critical Factor of Safety: 1.73

Project West Farm Pit Expansion
Case 4-1 Rapid Drawdown

File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Rapid Drawdown.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

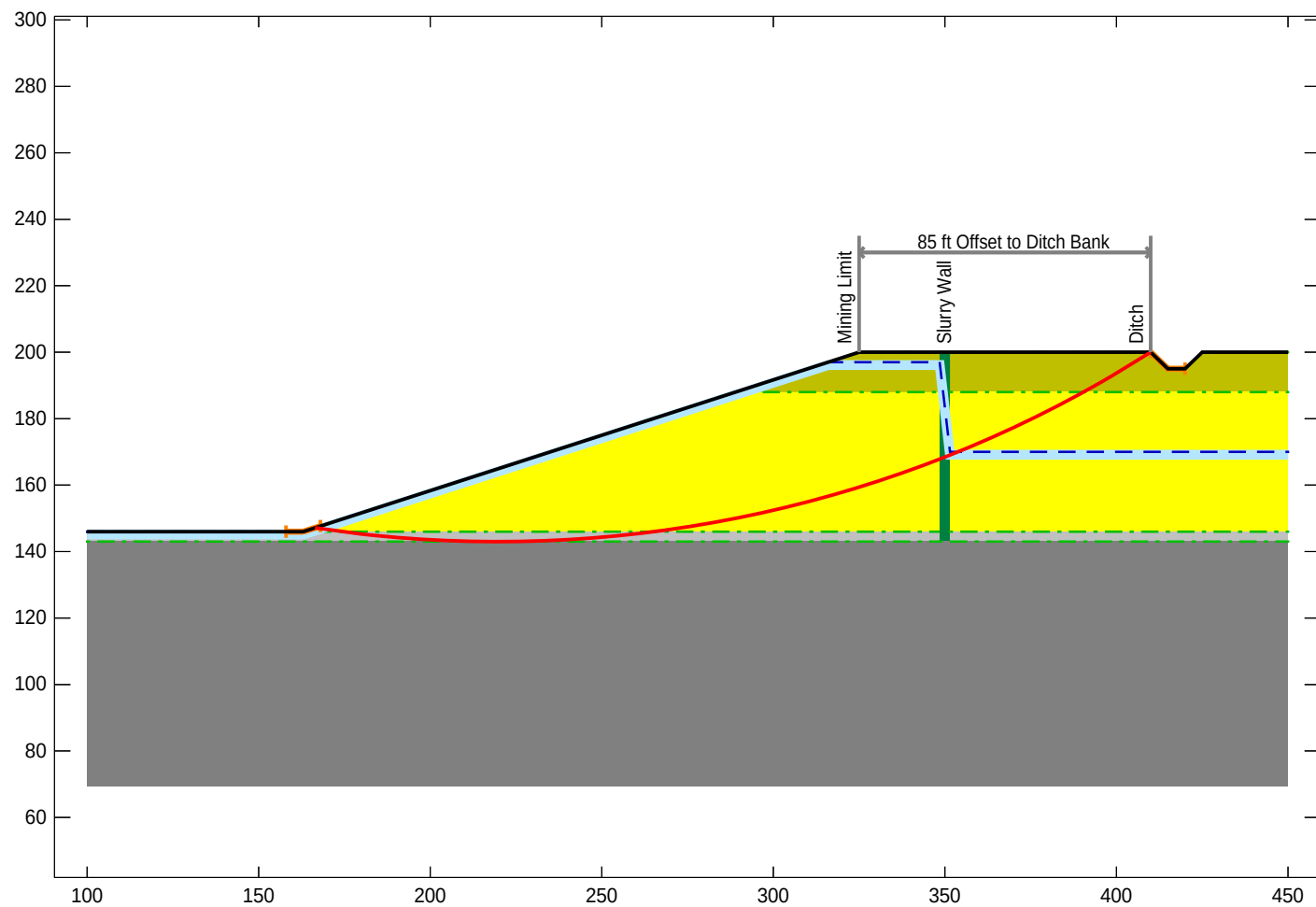
Critical Factor of Safety: 3.11

Project West Farm Pit Expansion
Case 4-2 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 4-2 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

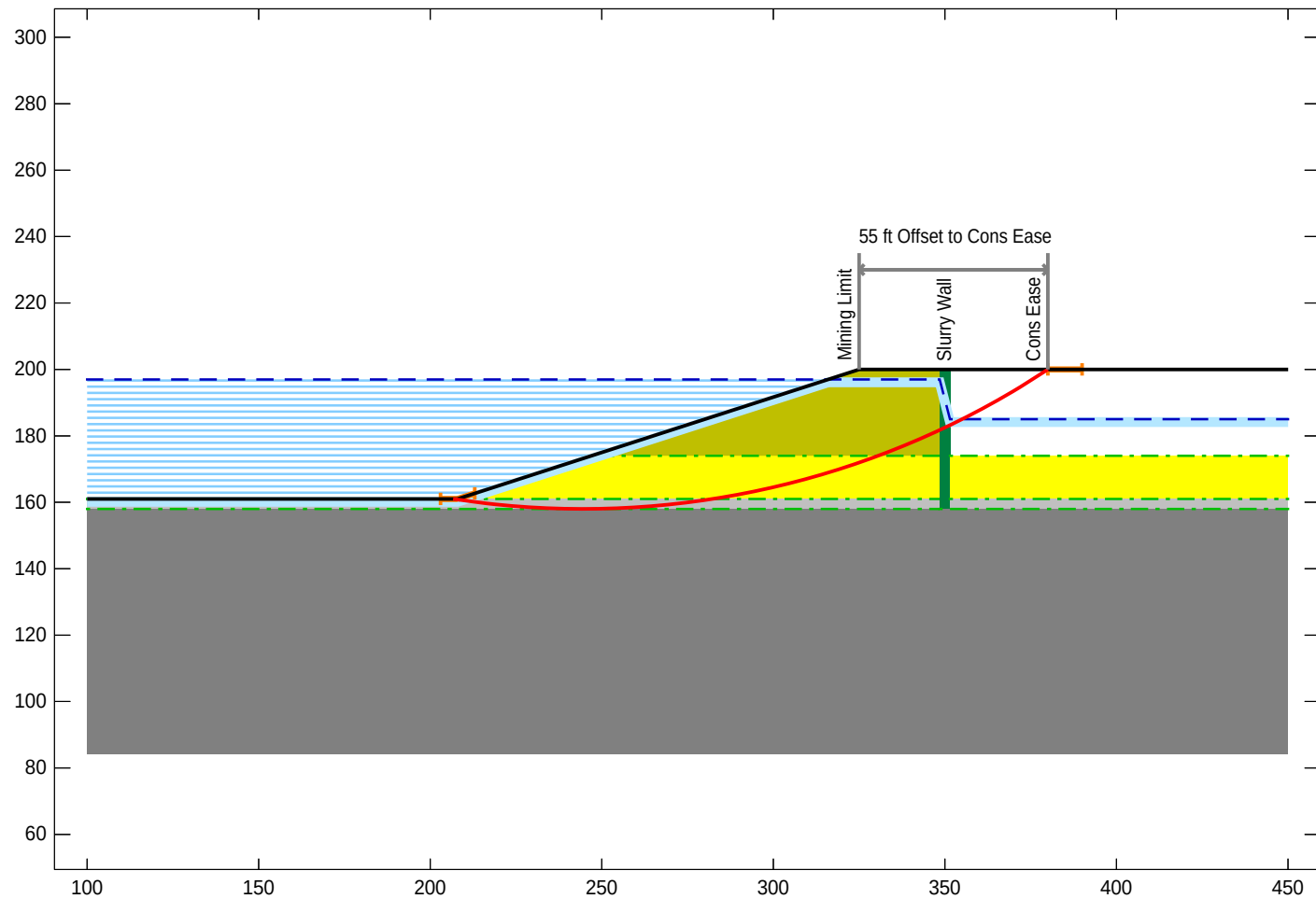
Critical Factor of Safety: 1.66

Project West Farm Pit Expansion
Case 4-2 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 4-2 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

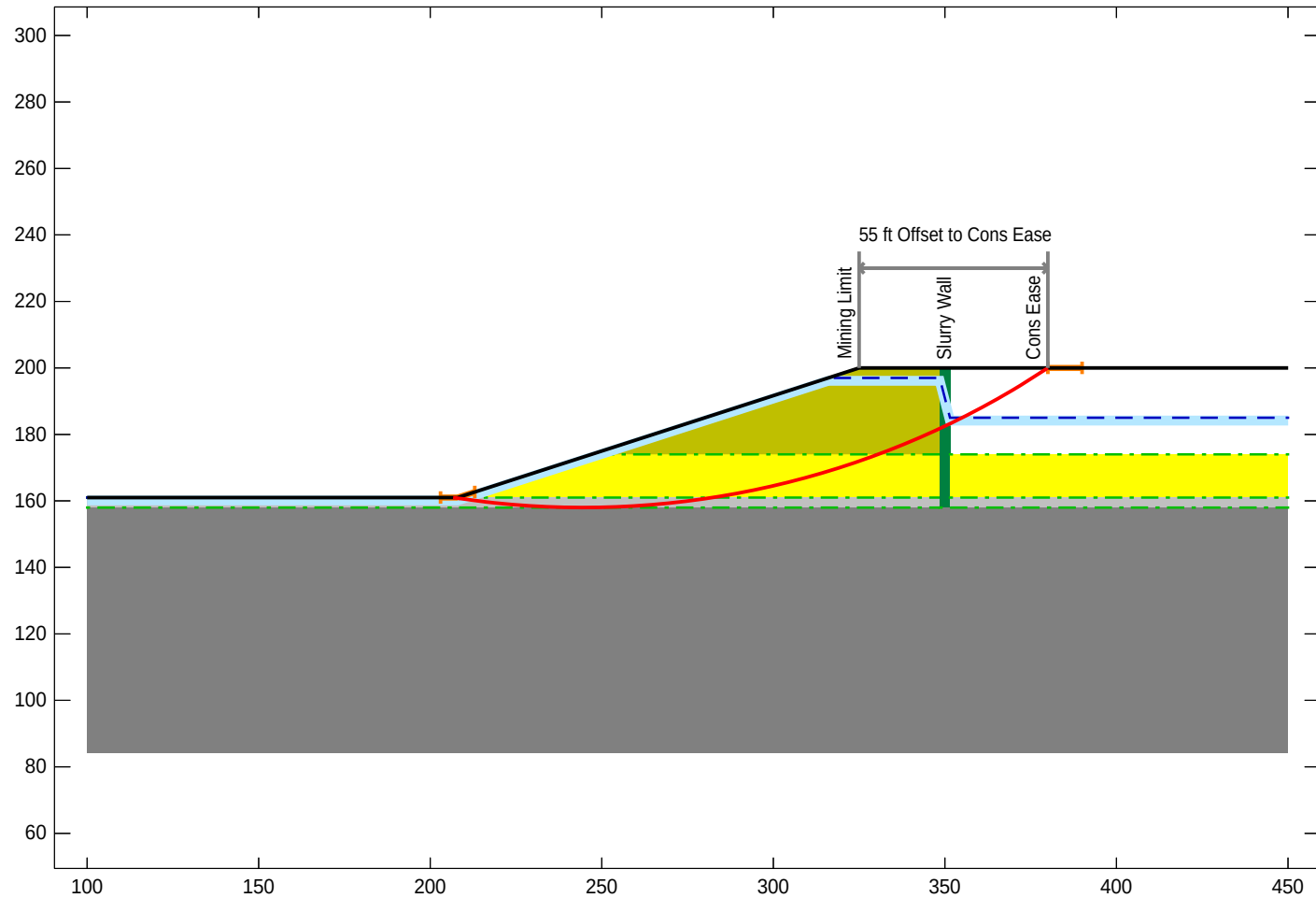
Critical Factor of Safety: 2.55

Project West Farm Pit Expansion
Case 5-1 Full Reservoir

File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Full Reservoir.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

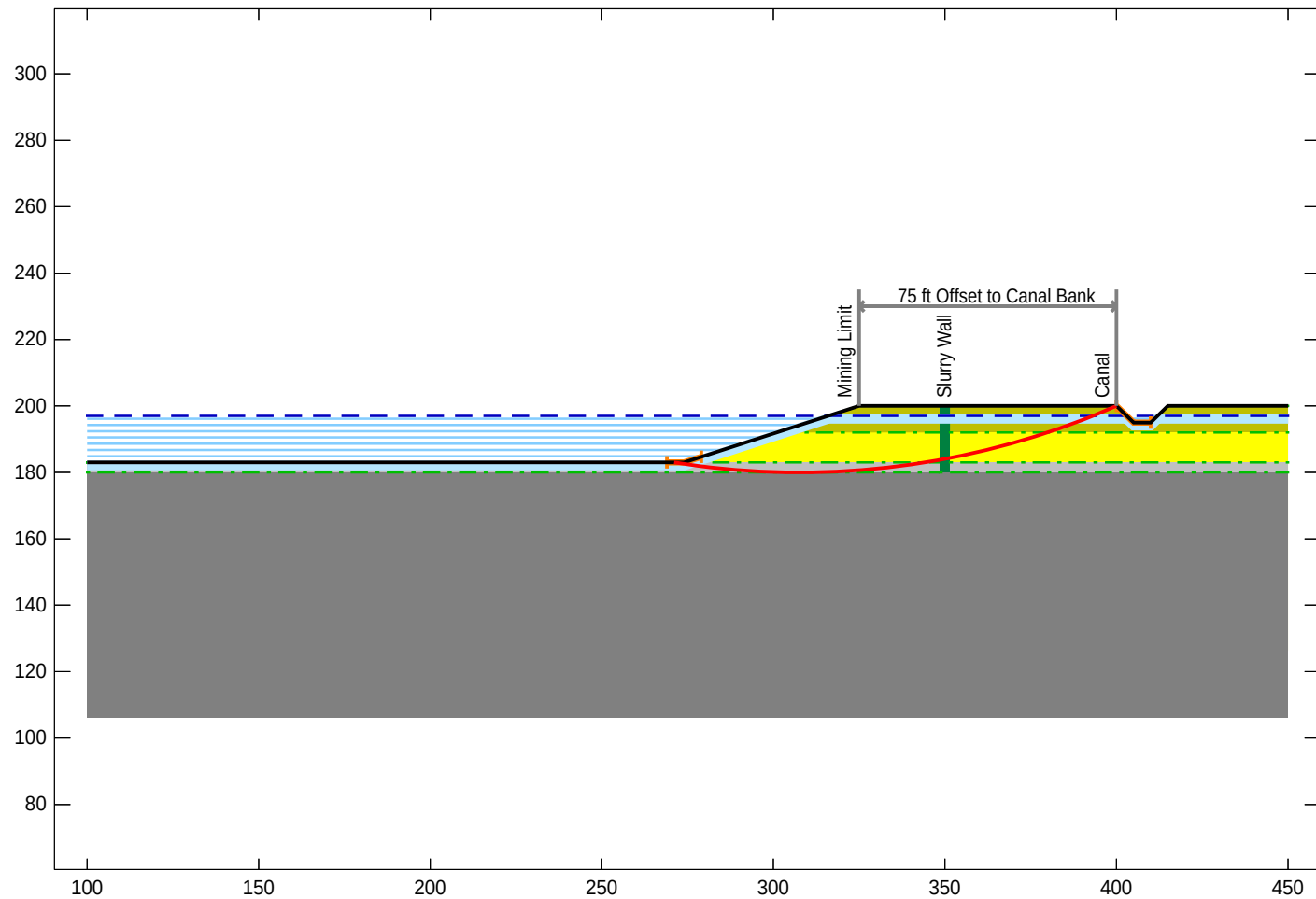
Critical Factor of Safety: 1.39

Project West Farm Pit Expansion
Case 5-1 Rapid Drawdown

File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Rapid Drawdown.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

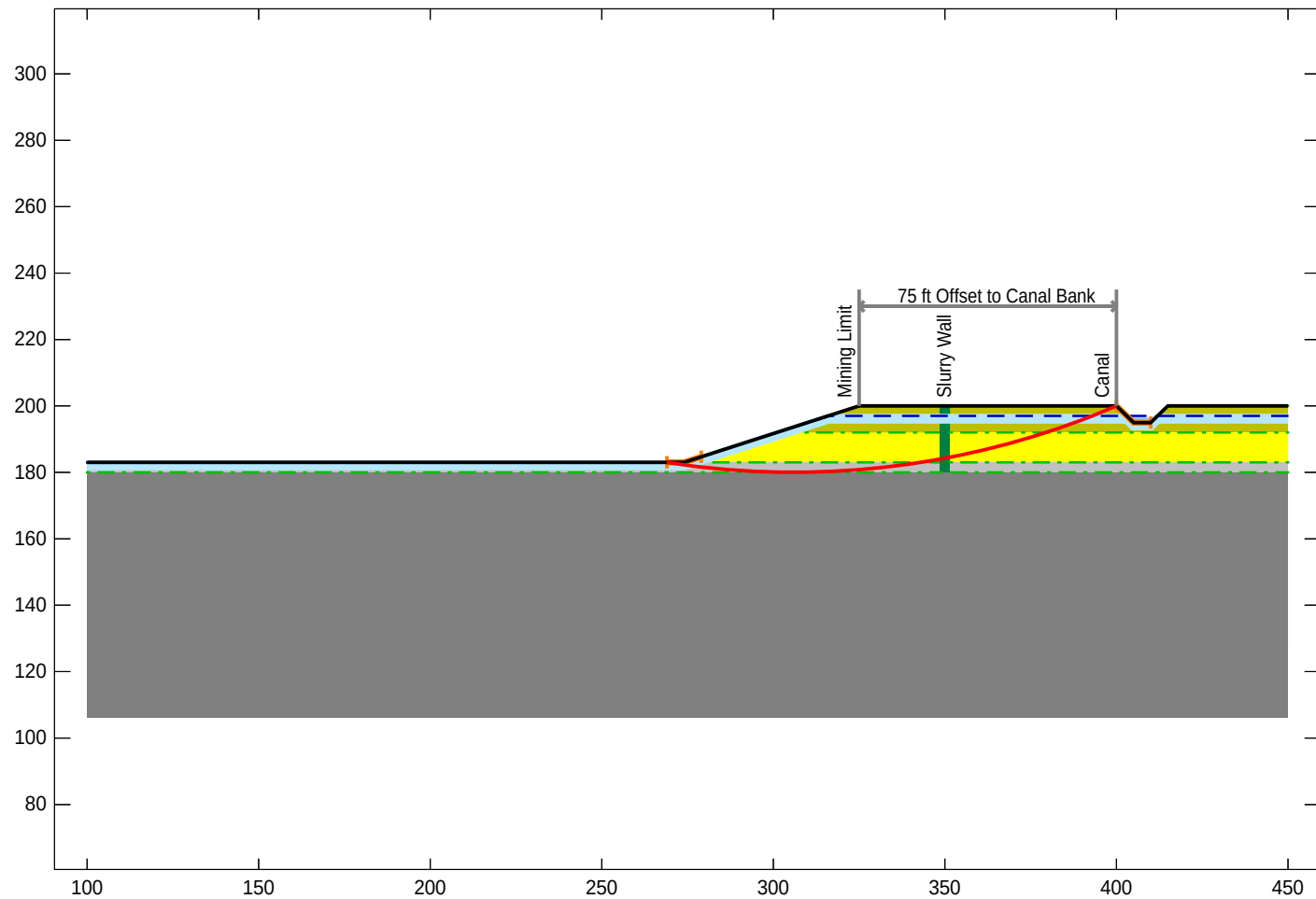
Critical Factor of Safety: 4.13

Project West Farm Pit Expansion
Case 5-2 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 5-2 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

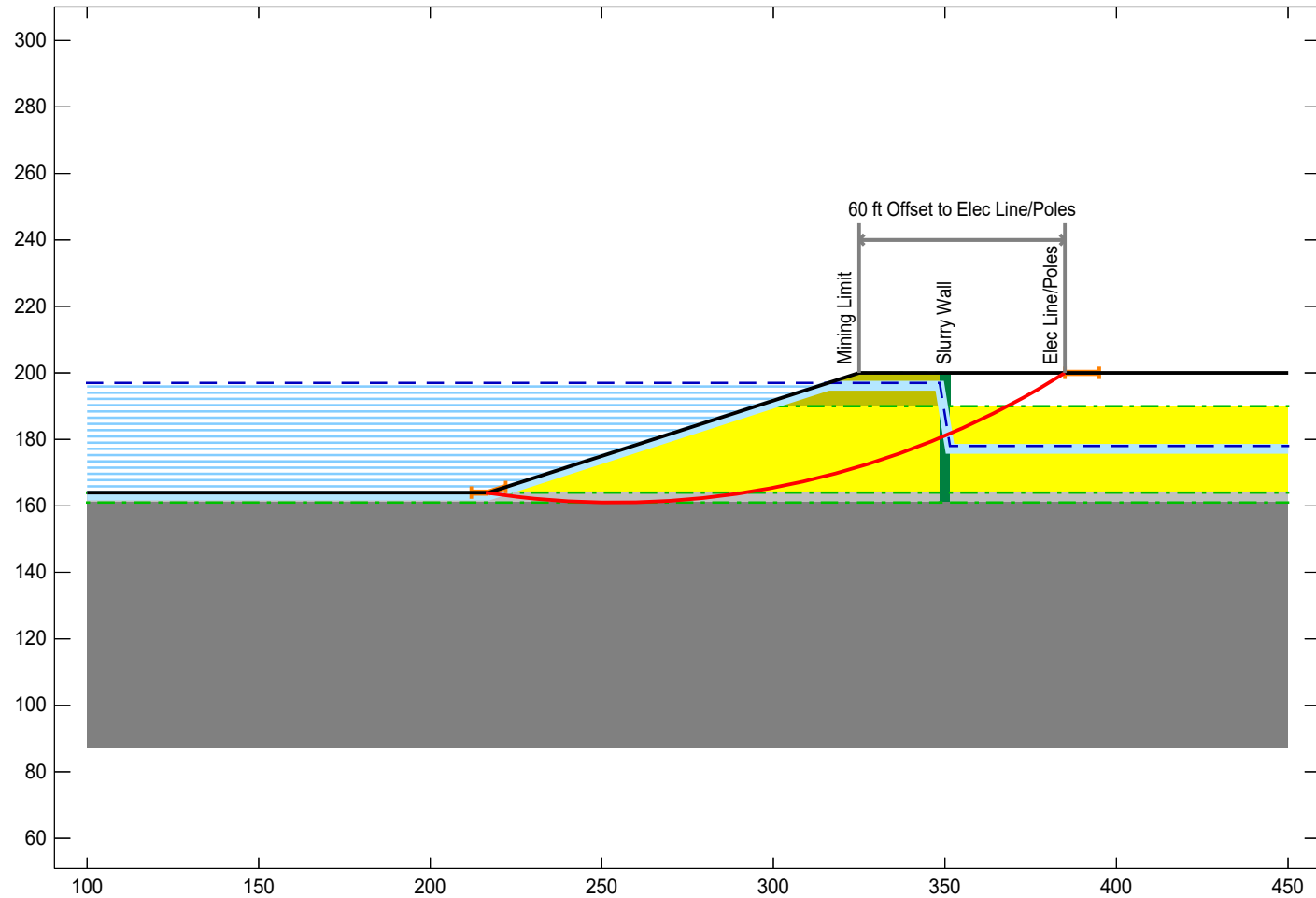
Critical Factor of Safety: 2.69

Project West Farm Pit Expansion
Case 5-2 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 5-2 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

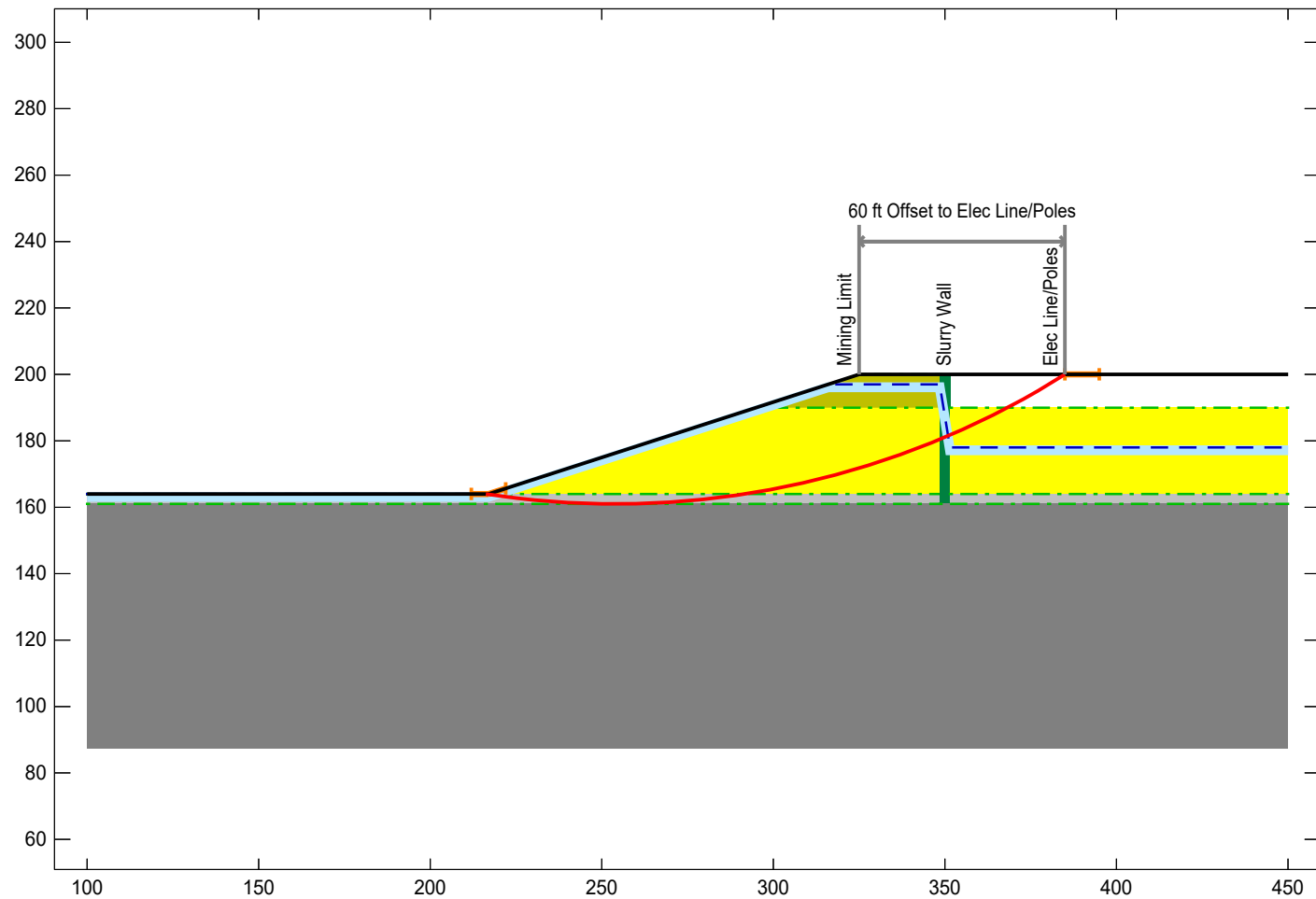
Critical Factor of Safety: 2.96

Project West Farm Pit Expansion
Case 5-3 Full Reservoir

File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Full Reservoir.gmf

Edited: 1 Apr 2021
Processed: 1 Apr 2021





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

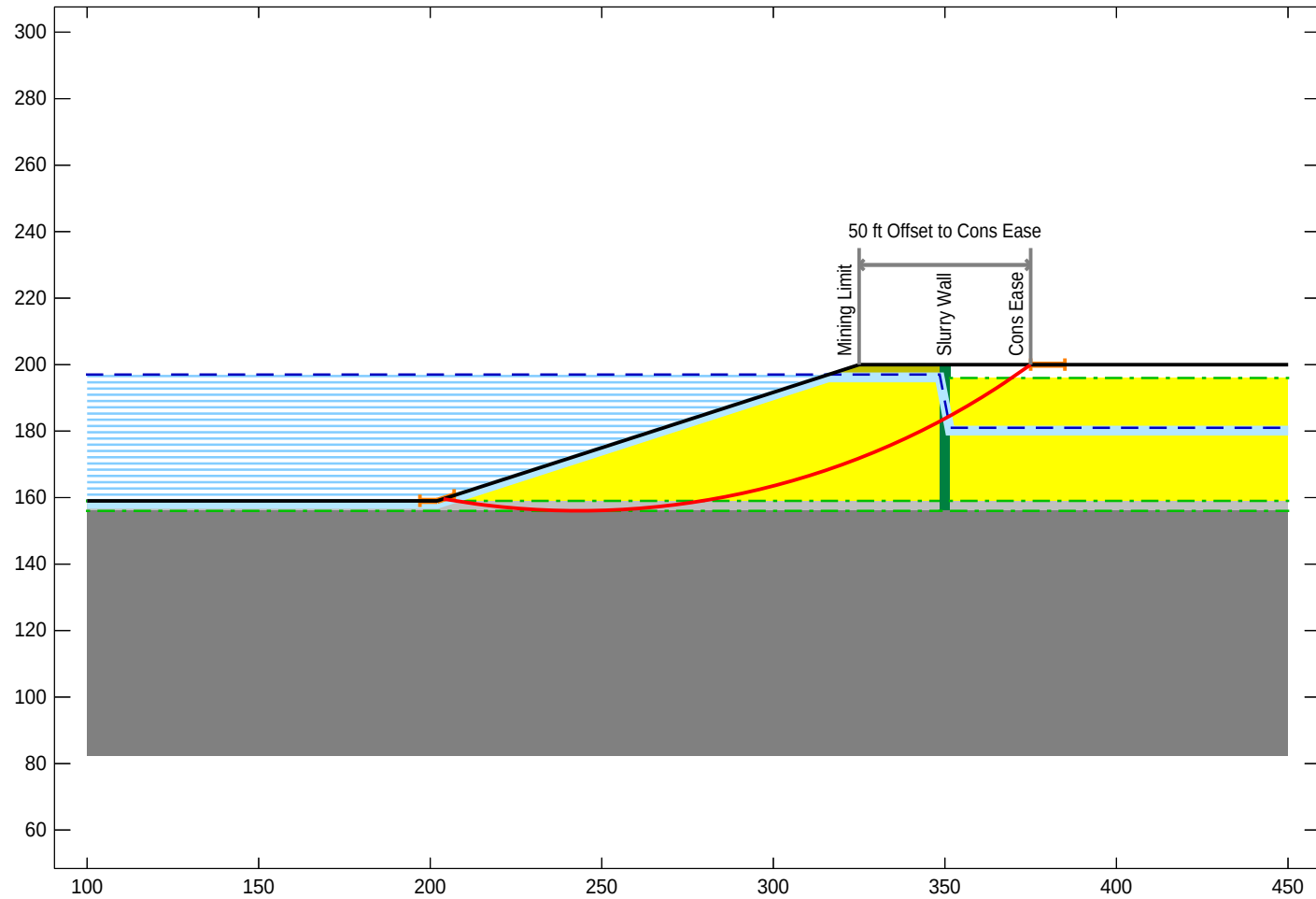
Critical Factor of Safety: 1.64

Project West Farm Pit Expansion
Case 5-3 Rapid Drawdown

File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Rapid Drawdown.gmf

Edited: 1 Apr 2021
Processed: 1 Apr 2021





Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 2.60

GALENA Version 7.2

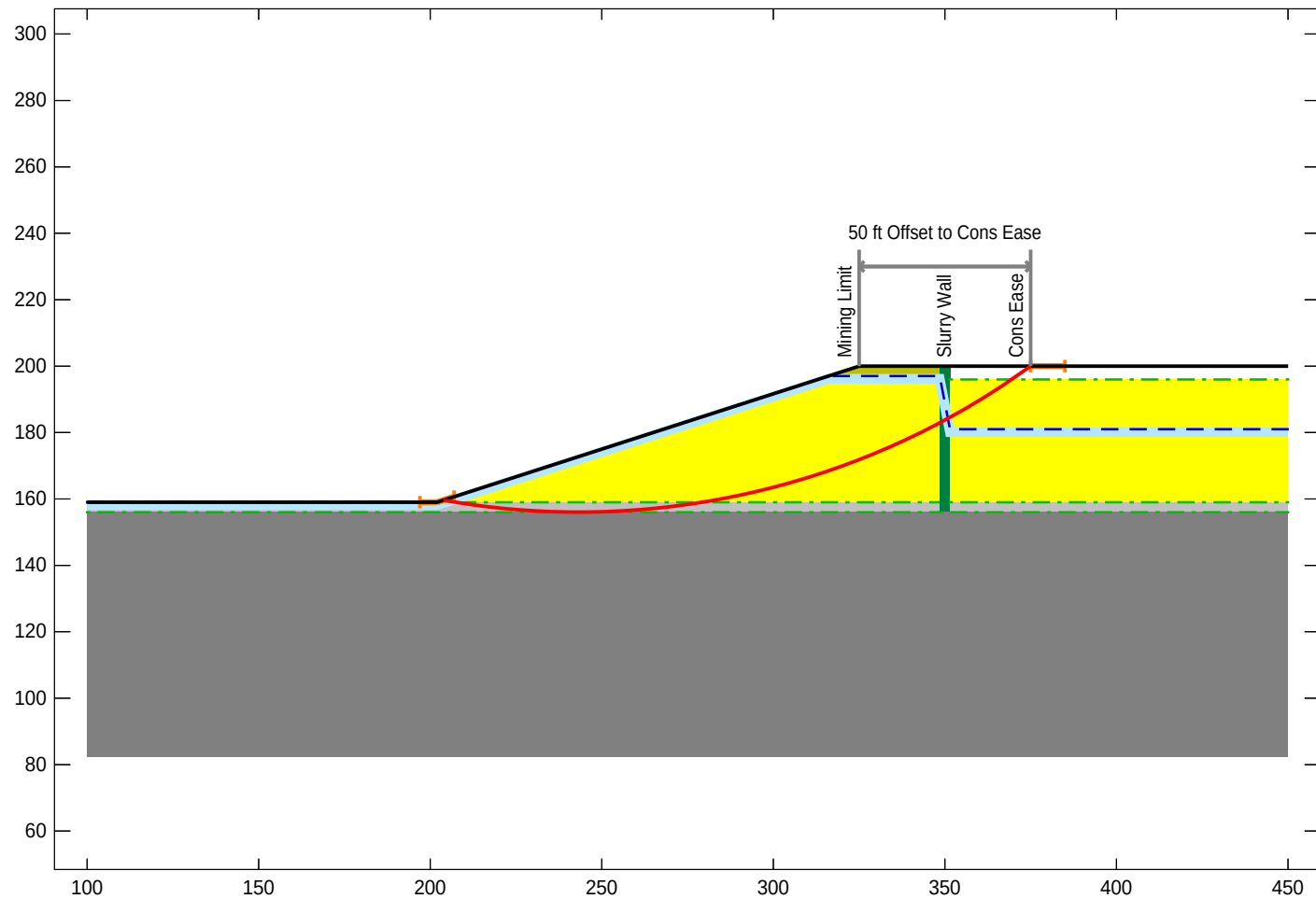
Licensed to: J & T Consulting

Project West Farm Pit Expansion
Case 6-1 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 6-1 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

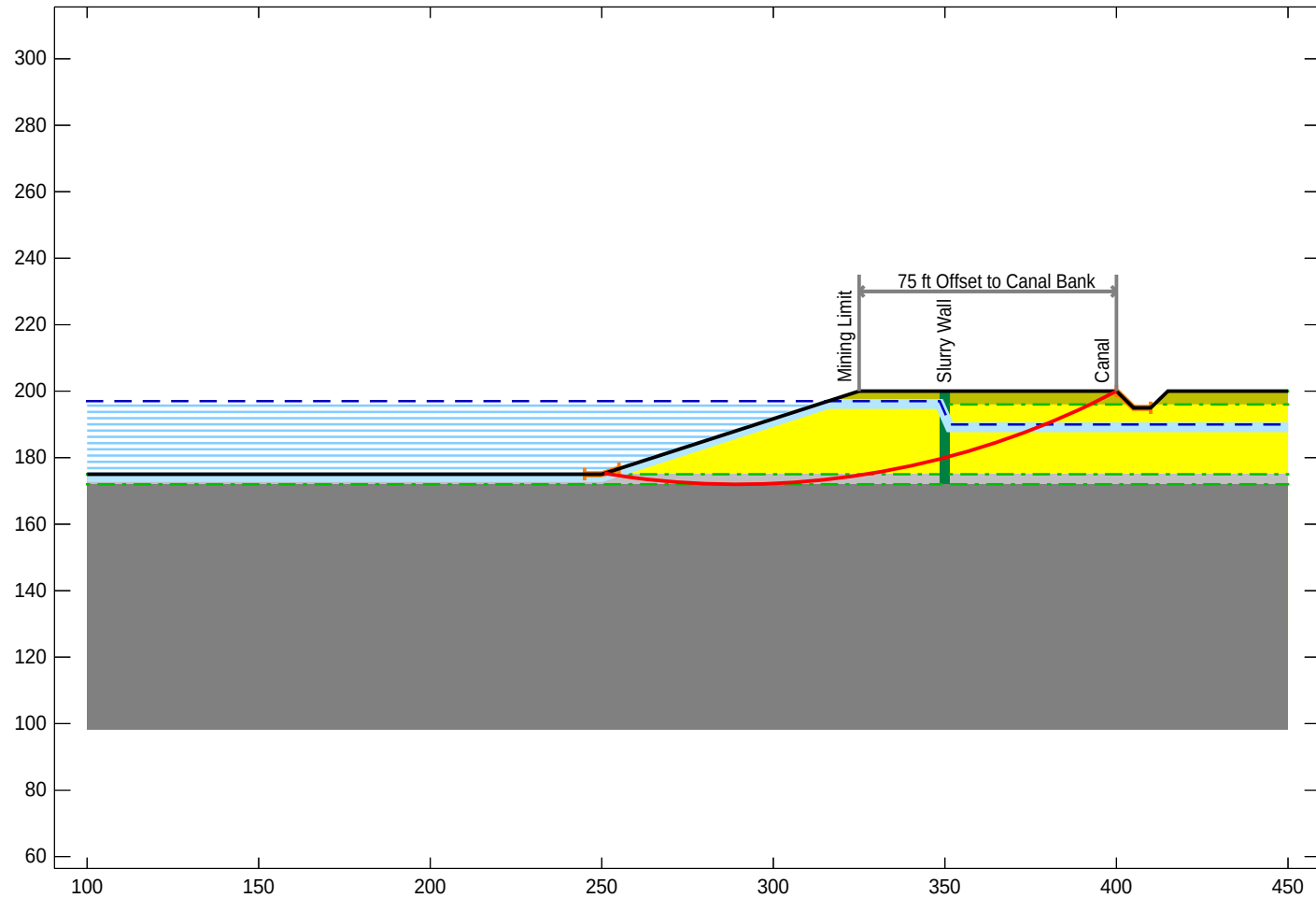
Critical Factor of Safety: 1.39

Project West Farm Pit Expansion
Case 6-1 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 6-1 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

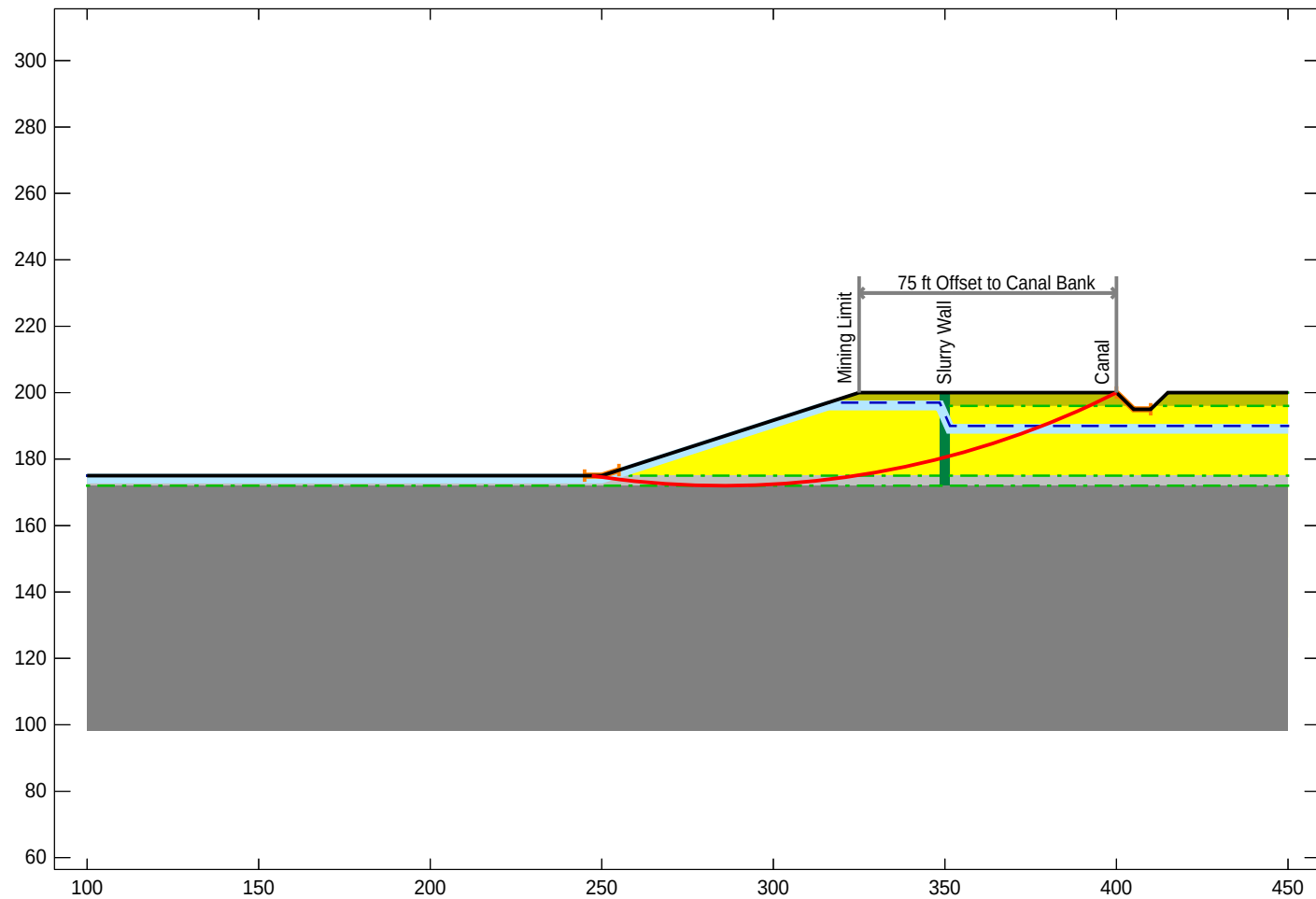
Critical Factor of Safety: 3.85

Project West Farm Pit Expansion
Case 6-2 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 6-2 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

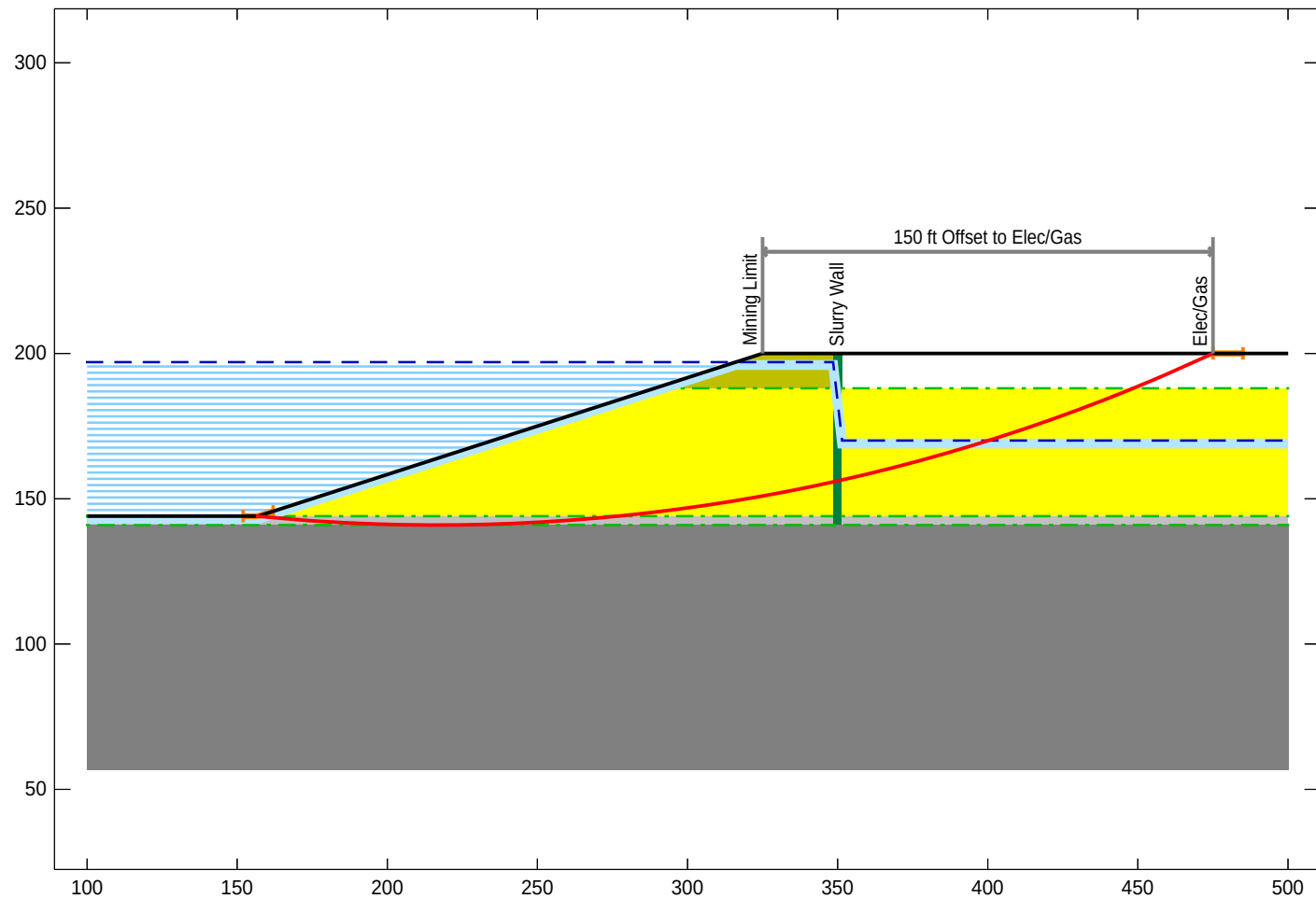
Critical Factor of Safety: 2.31

Project West Farm Pit Expansion
Case 6-2 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 6-2 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

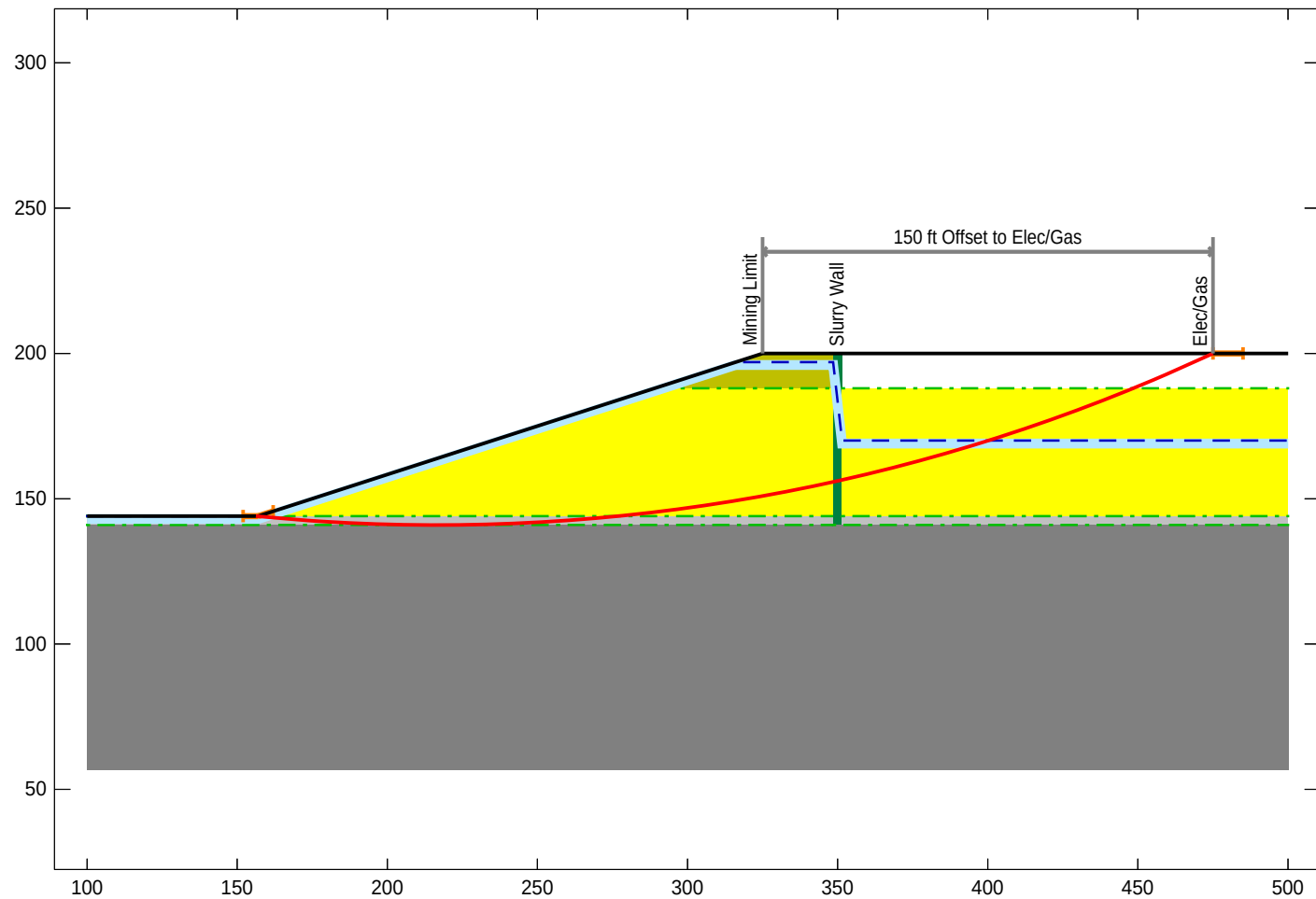
Critical Factor of Safety: 4.38

Project West Farm Pit Expansion
Case 7-1 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 7-1 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

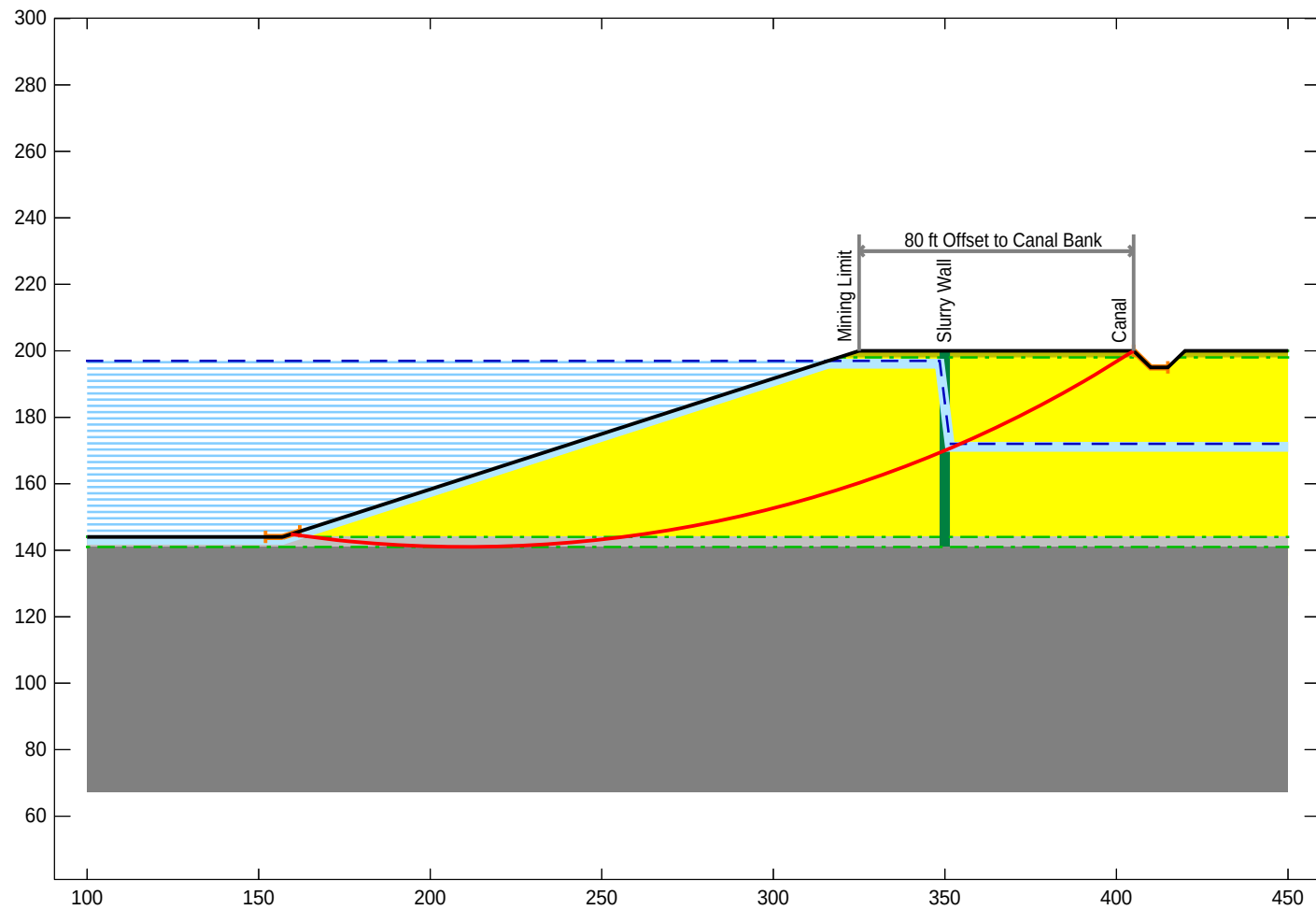
Critical Factor of Safety: 2.40

Project West Farm Pit Expansion
Case 7-1 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 7-1 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

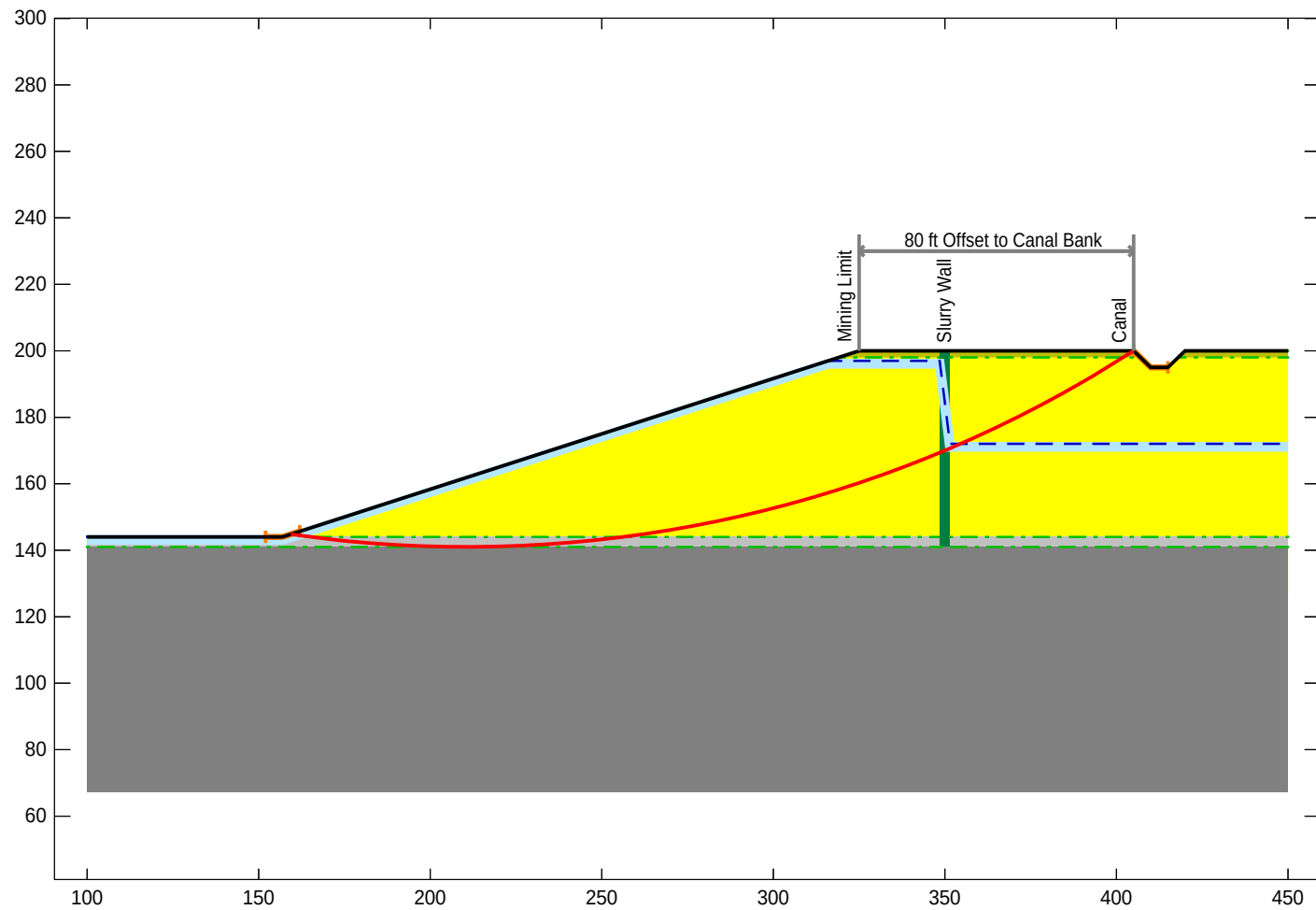
Critical Factor of Safety: 2.99

Project West Farm Pit Expansion
Case 7-2 Full Reservoir

File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Full Reservoir.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

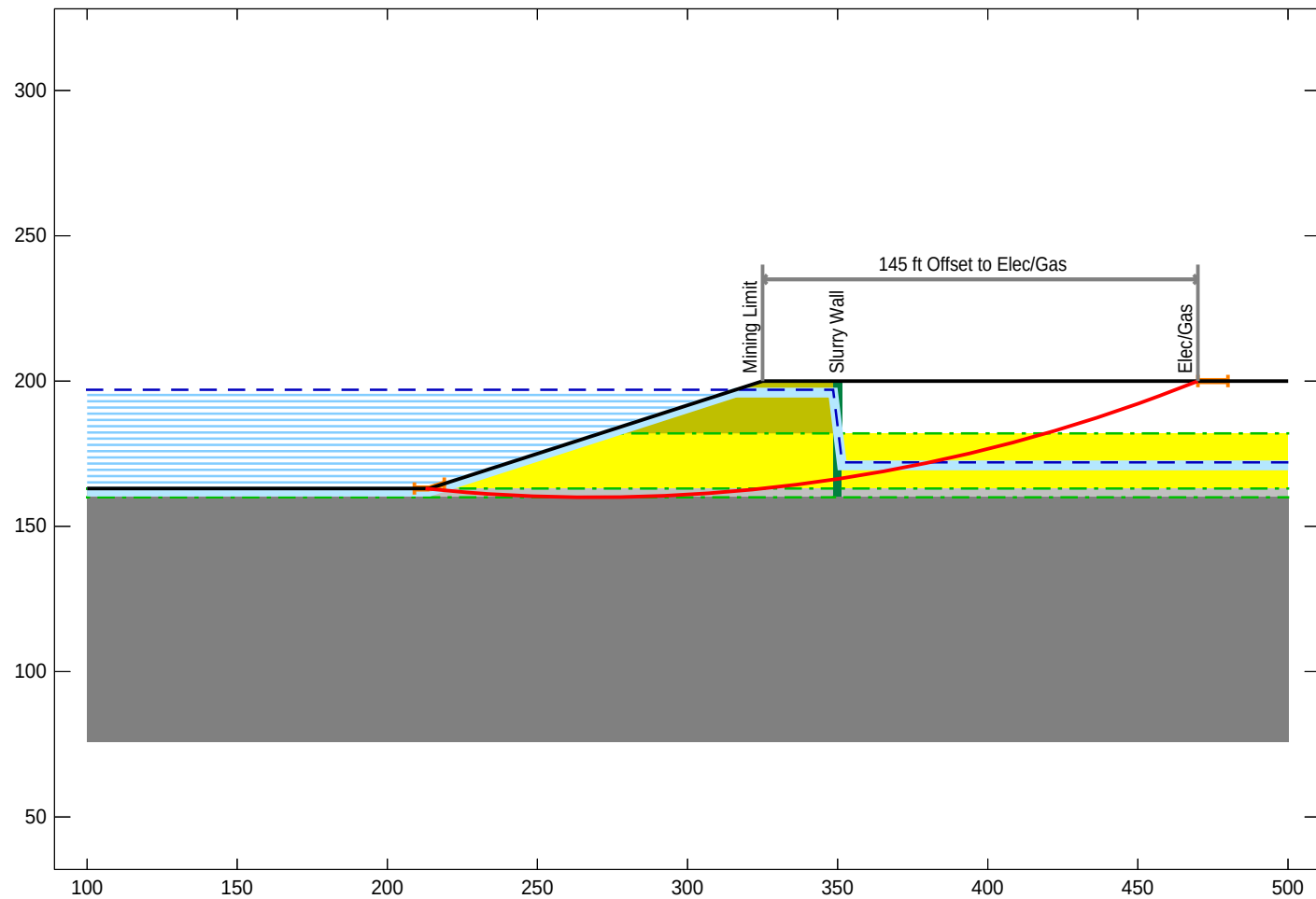
Critical Factor of Safety: 1.58

Project West Farm Pit Expansion
Case 7-2 Rapid Drawdown

File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Rapid Drawdown.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

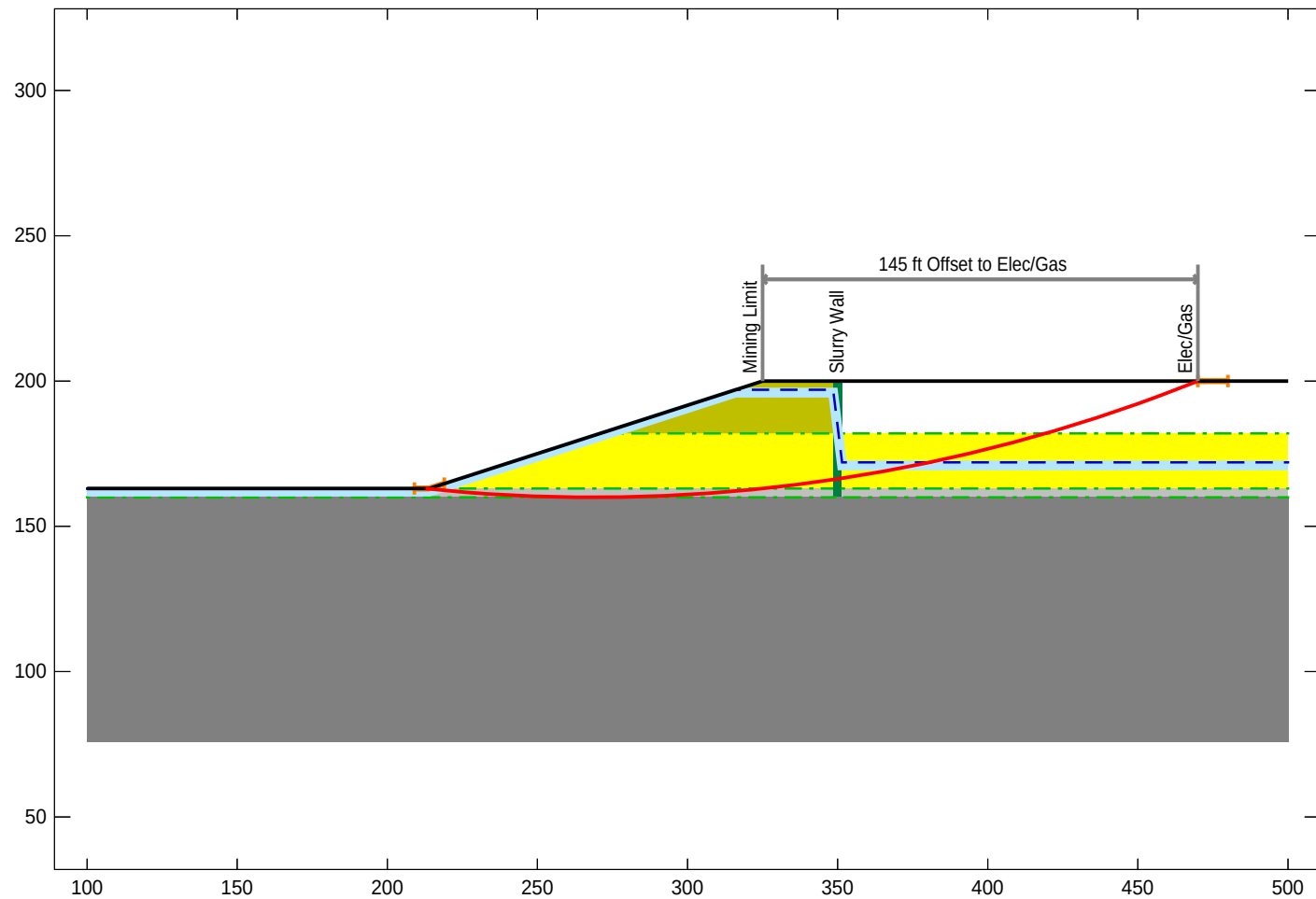
Critical Factor of Safety: 5.42

Project West Farm Pit Expansion
Case 8-1 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 8-1 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

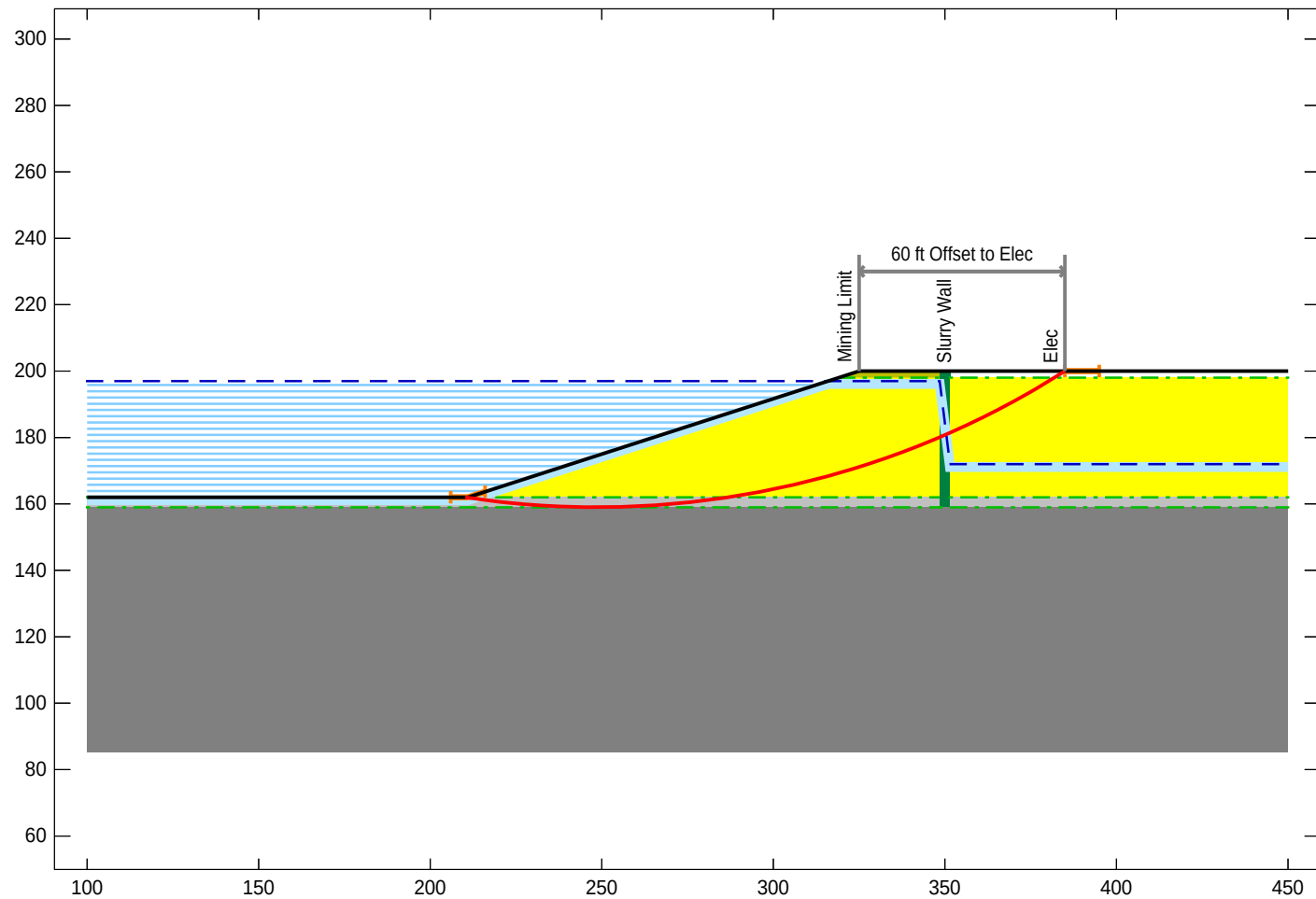
Critical Factor of Safety: 3.15

Project West Farm Pit Expansion
Case 8-1 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 8-1 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

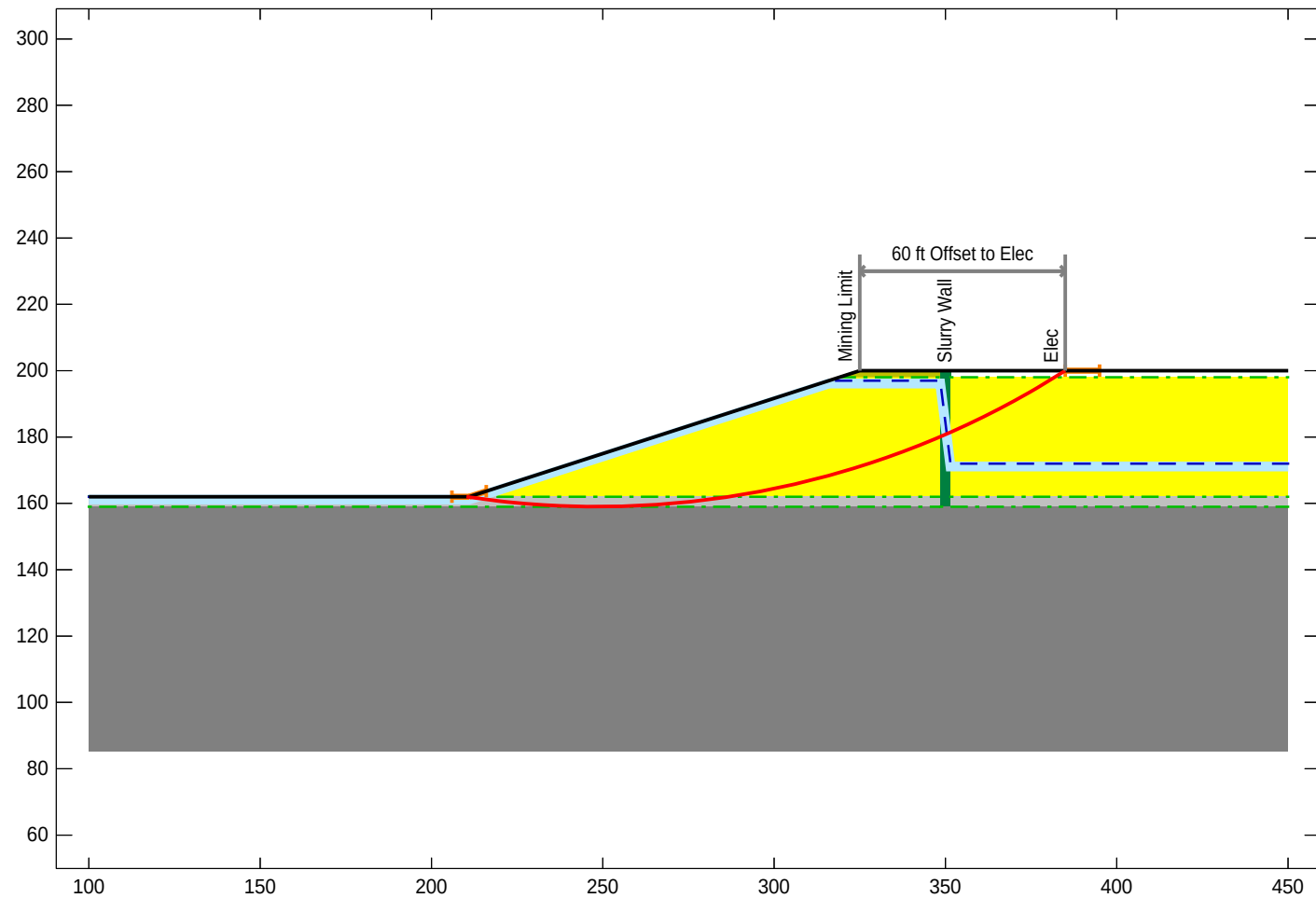
Critical Factor of Safety: 2.93

Project West Farm Pit Expansion
Case 8-2 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 8-2 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

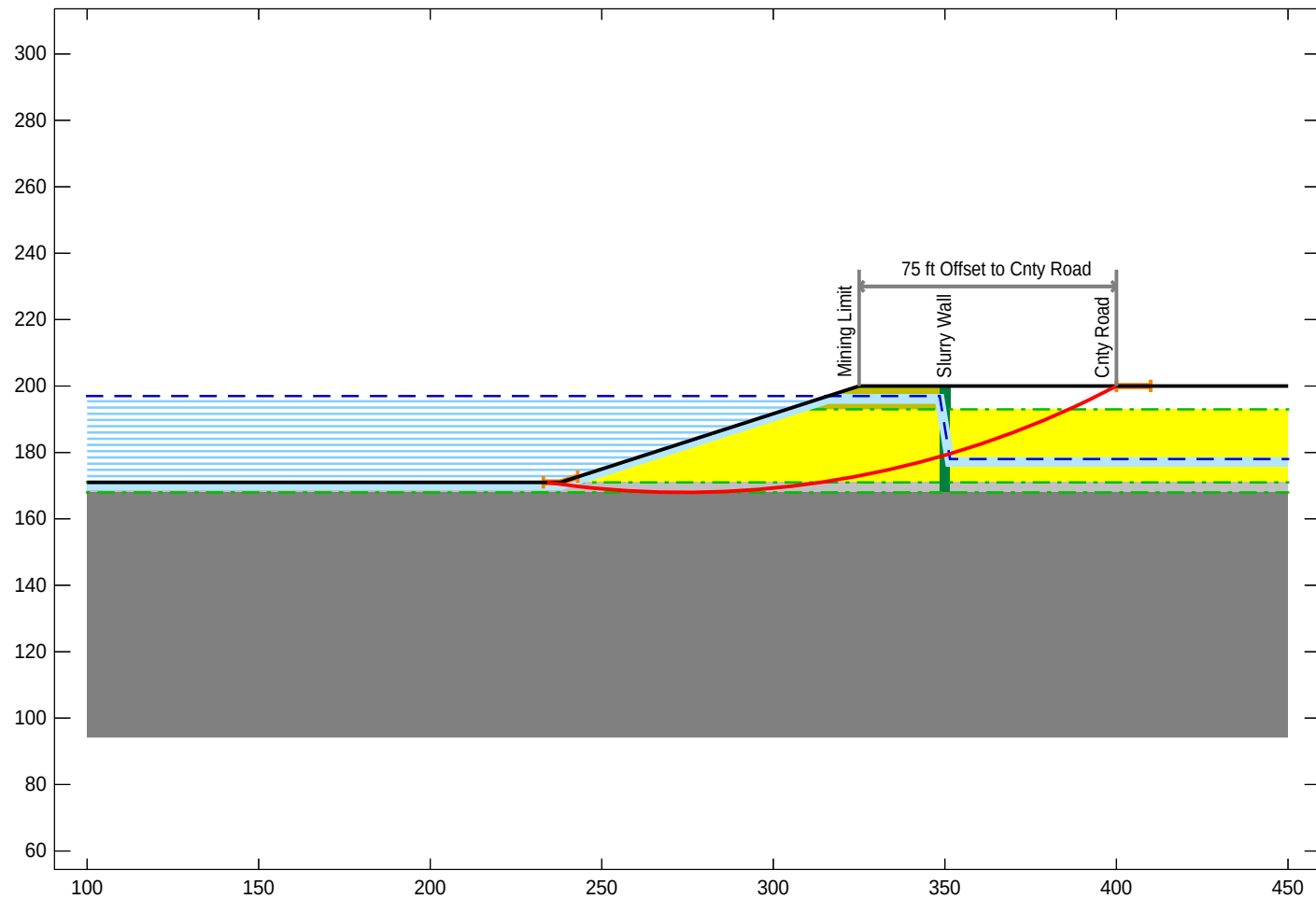
Critical Factor of Safety: 1.61

Project West Farm Pit Expansion
Case 8-2 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 8-2 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

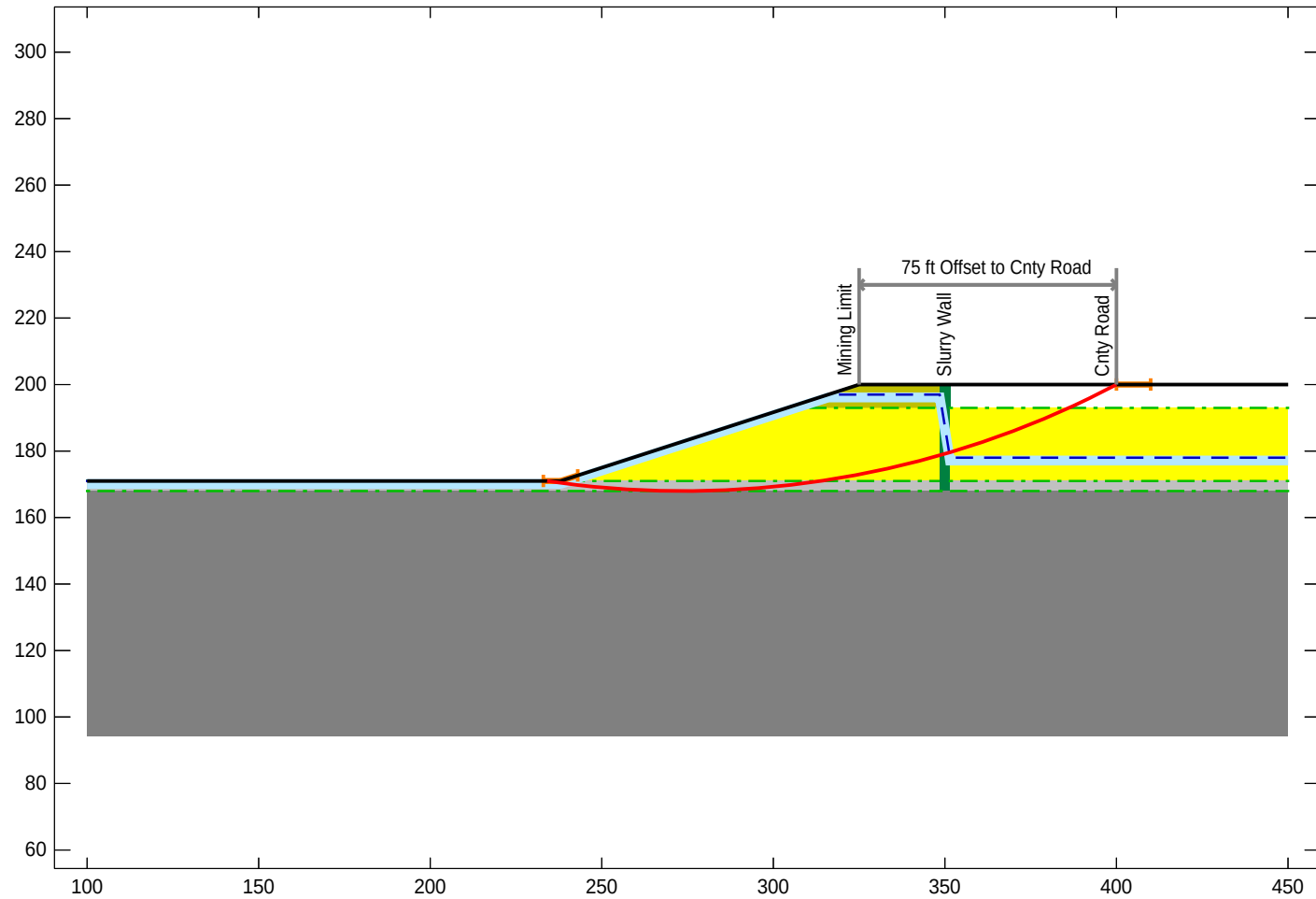
Critical Factor of Safety: 3.79

Project West Farm Pit Expansion
Case 8-3 Full Reservoir

File: C:\Galena Models\West Farm Expansion Case 8-3 Full Reservoir.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

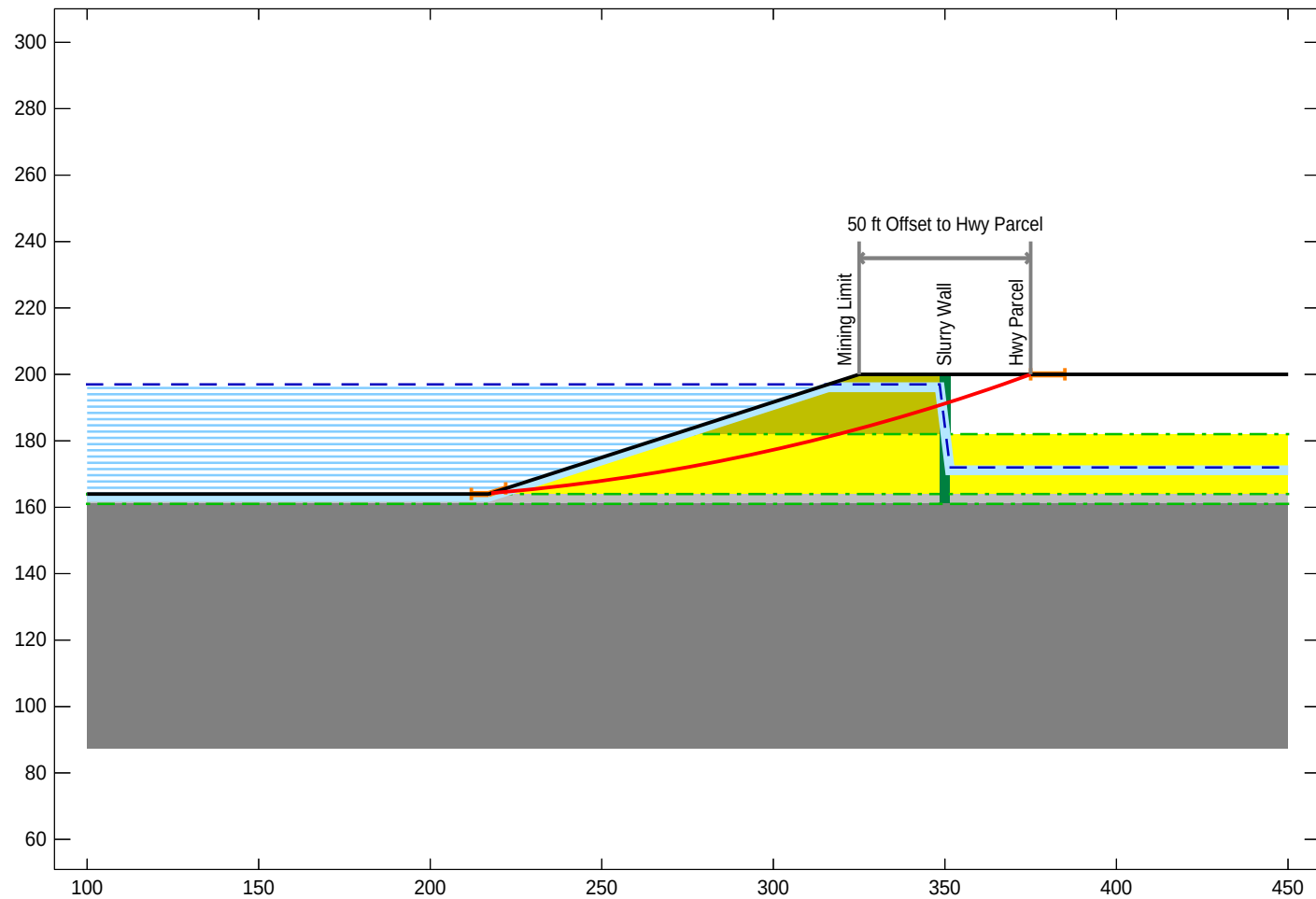
Critical Factor of Safety: 2.21

Project West Farm Pit Expansion
Case 8-3 Rapid Drawdown

File: C:\Galena Models\West Farm Expansion Case 8-3 Rapid Drawdown.gmf

Edited: 2 Dec 2020
Processed: 2 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

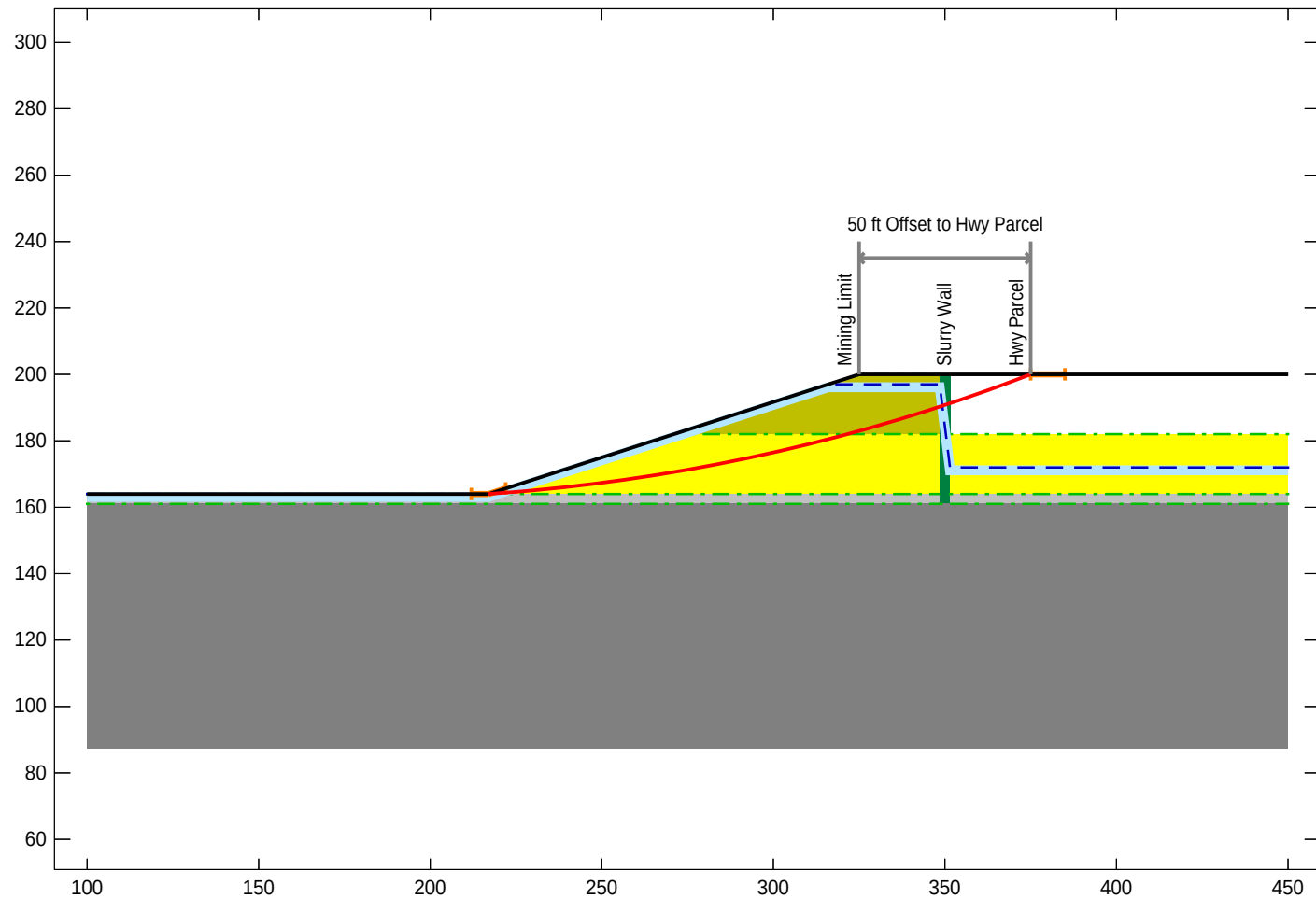
Critical Factor of Safety: 2.82

Project West Farm Pit Expansion
Case 8-4 Full Reservoir

File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Full Reservoir.gmf

Edited: 3 Dec 2020
Processed: 3 Dec 2020





Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

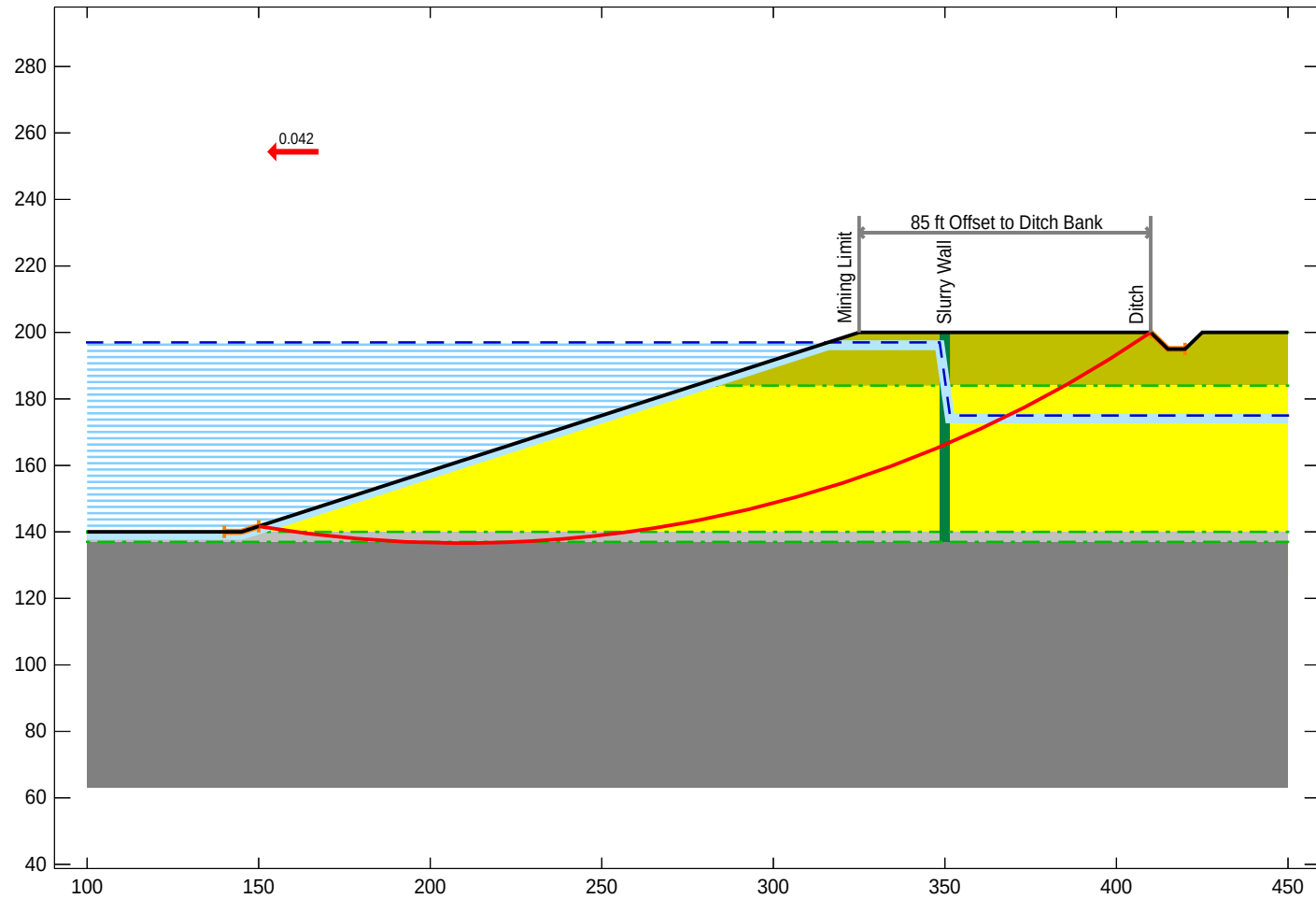
Critical Factor of Safety: 1.59

Project West Farm Pit Expansion
Case 8-4 Rapid Drawdown

File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Rapid Drawdown.gmf

Edited: 3 Dec 2020
Processed: 3 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 2.57

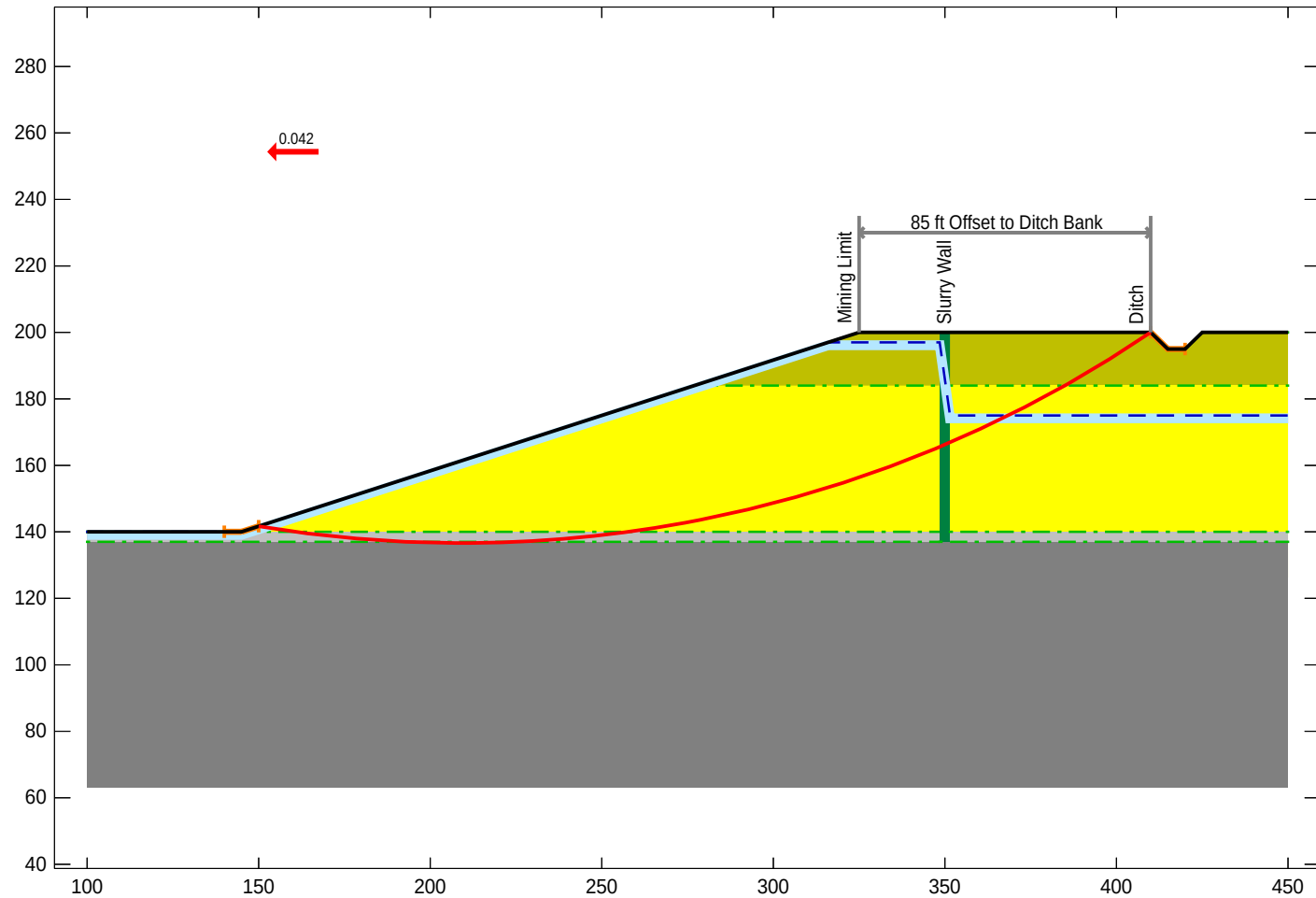
Interslice Force (Final) Angle: 11.0°

Project West Farm Pit Expansion
Case 3-1 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 3-1\West Farm Expansion Case 3-1 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Spencer-Wright

Surface: Circular

Results

Critical Factor of Safety: 1.54

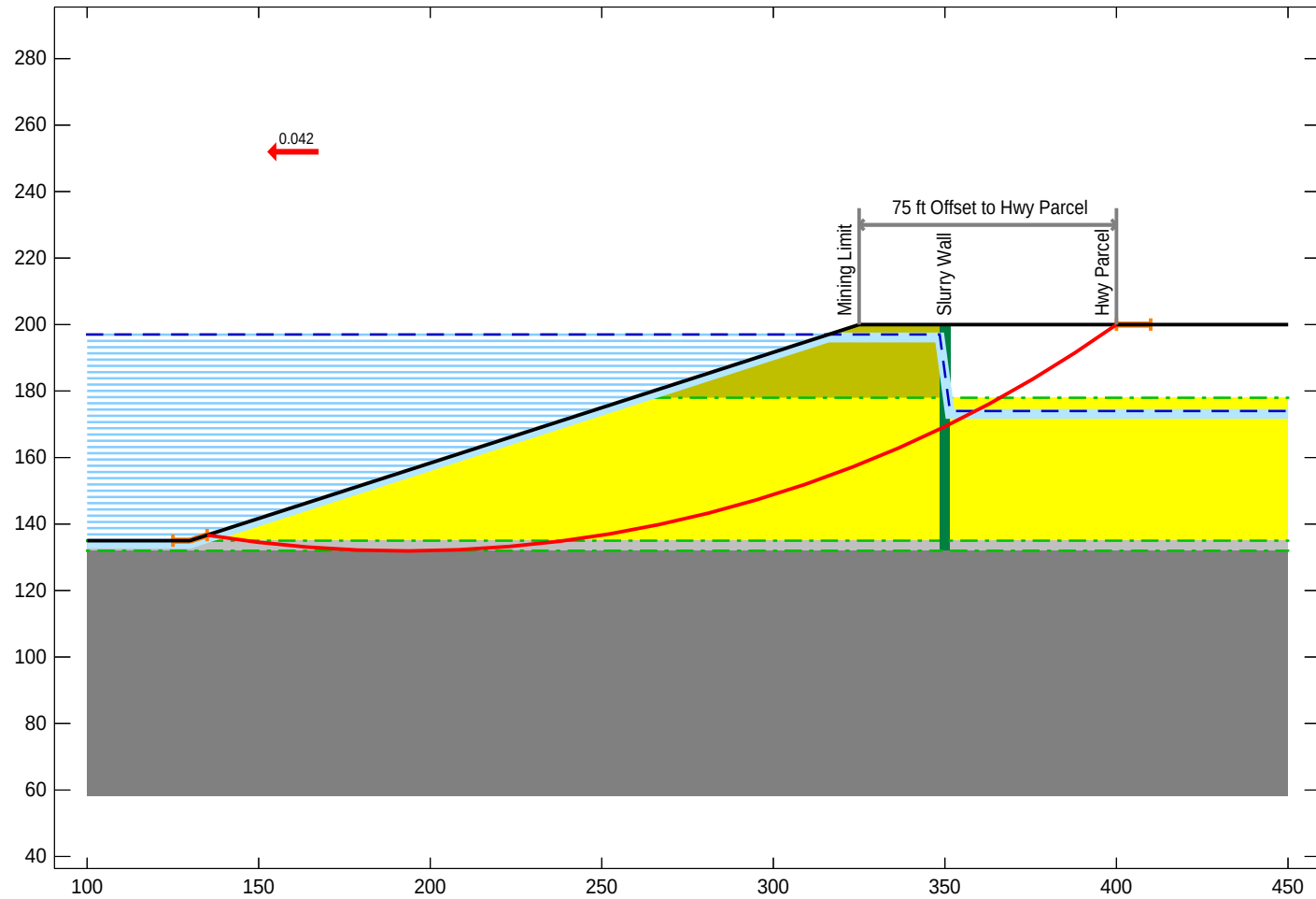
Interslice Force (Final) Angle: 10.6°

Project West Farm Pit Expansion
Case 3-1 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 3-1\West Farm Expansion Case 3-1 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

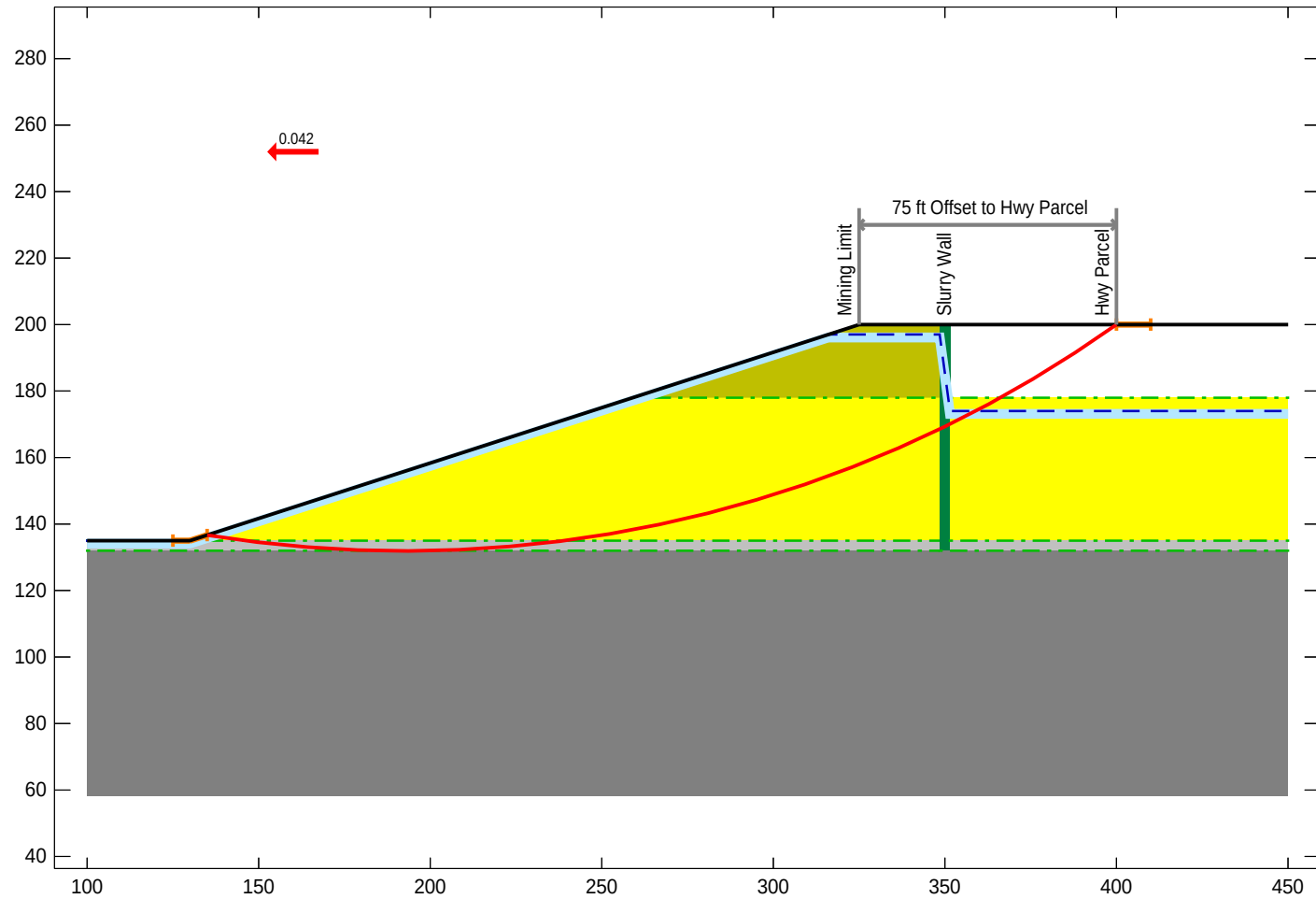
Critical Factor of Safety: 2.14

Project West Farm Pit Expansion
Case 3-2 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 3-2\West Farm Expansion Case 3-2 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

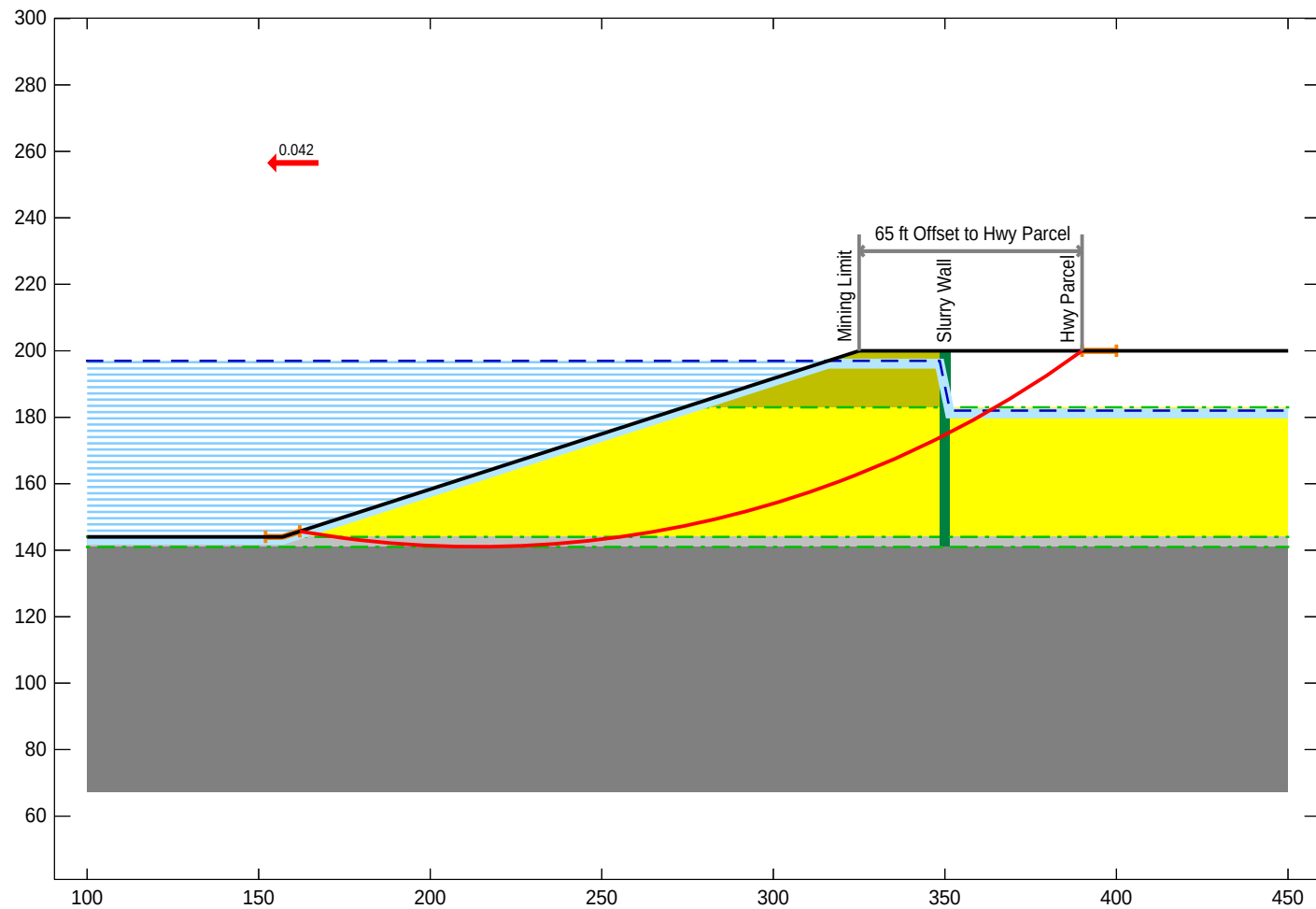
Critical Factor of Safety: 1.24

Project West Farm Pit Expansion
Case 3-2 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 3-2\West Farm Expansion Case 3-2 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

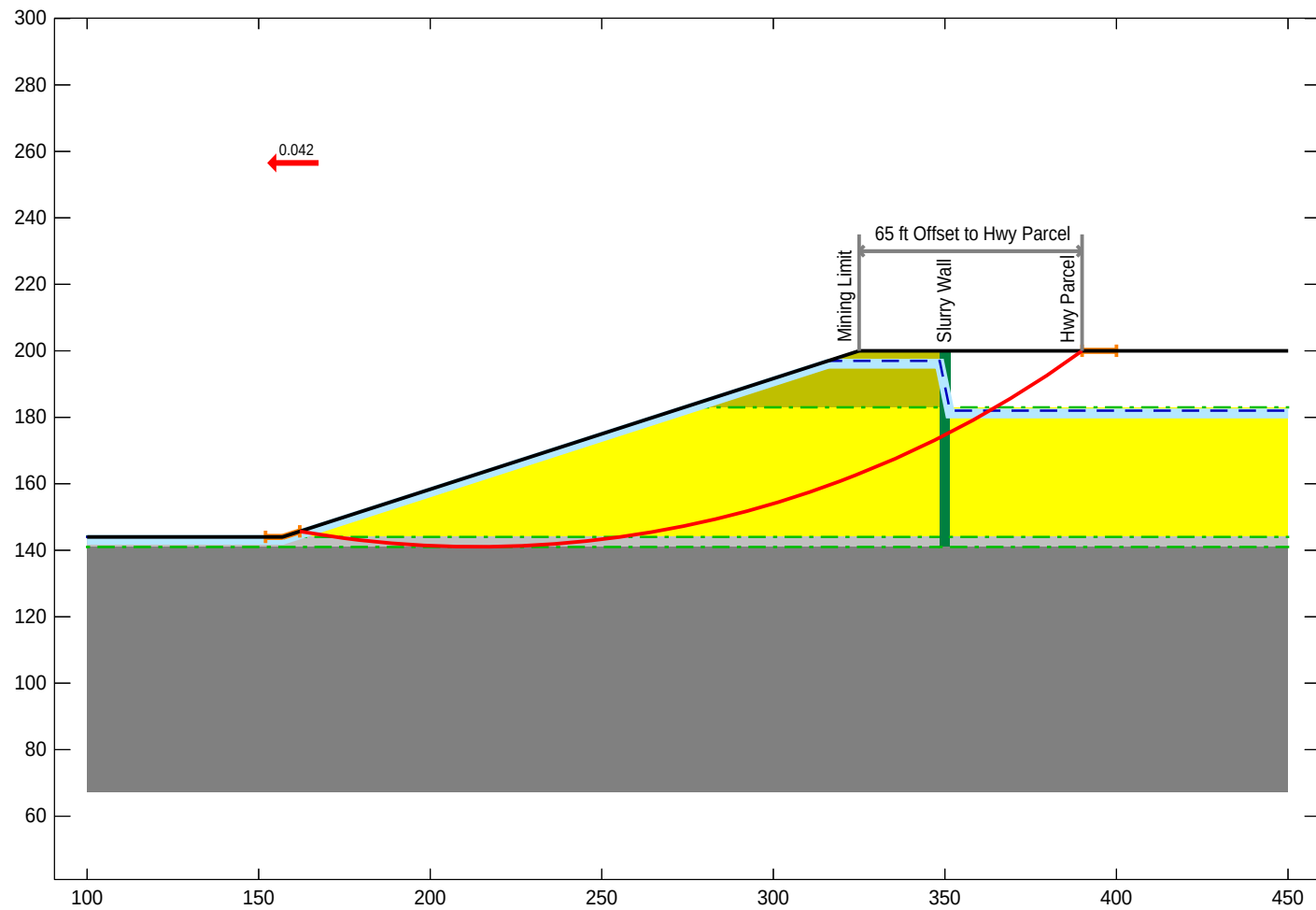
Critical Factor of Safety: 1.99

Project West Farm Pit Expansion
Case 3-3 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

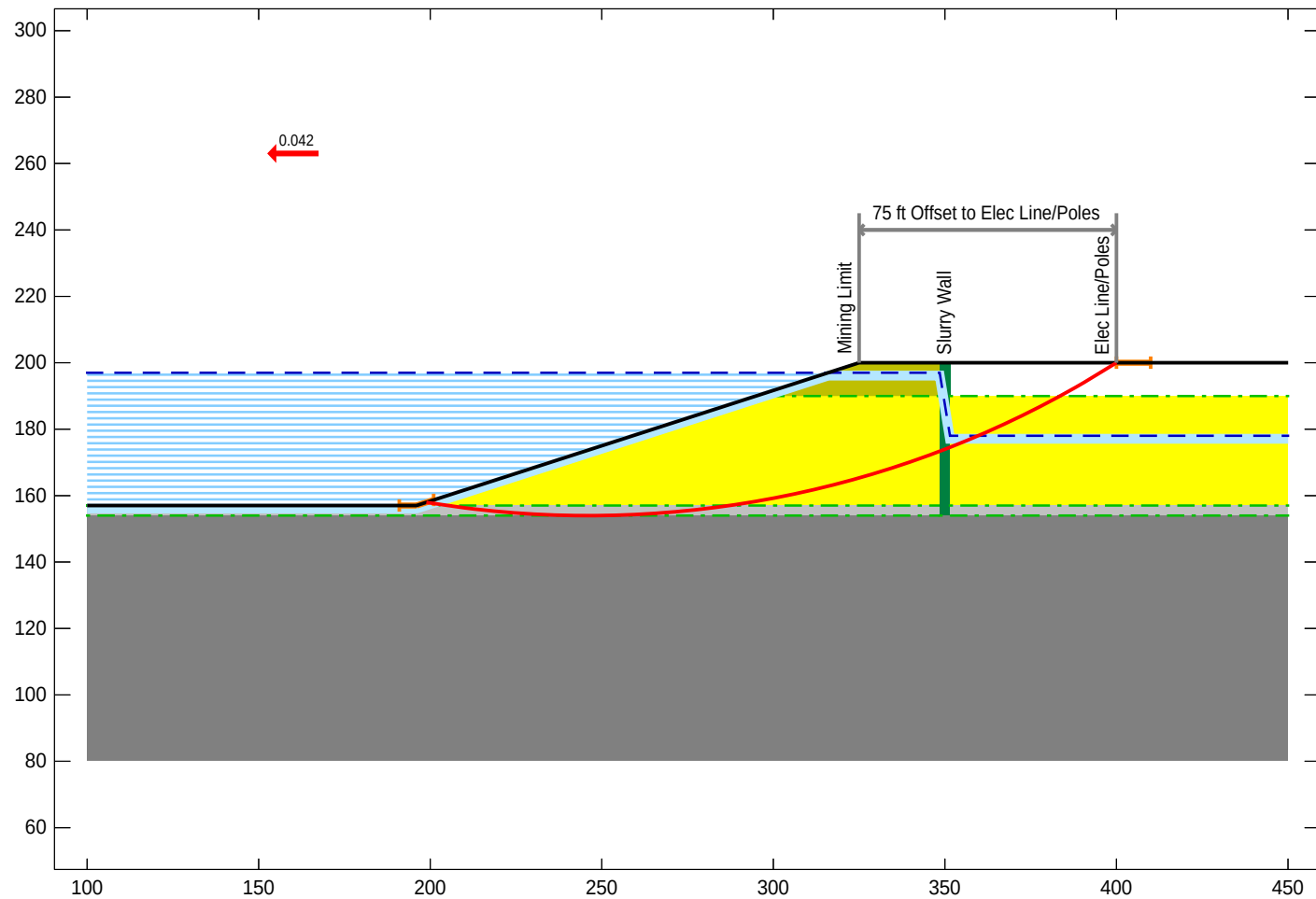
Critical Factor of Safety: 1.16

Project West Farm Pit Expansion
Case 3-3 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

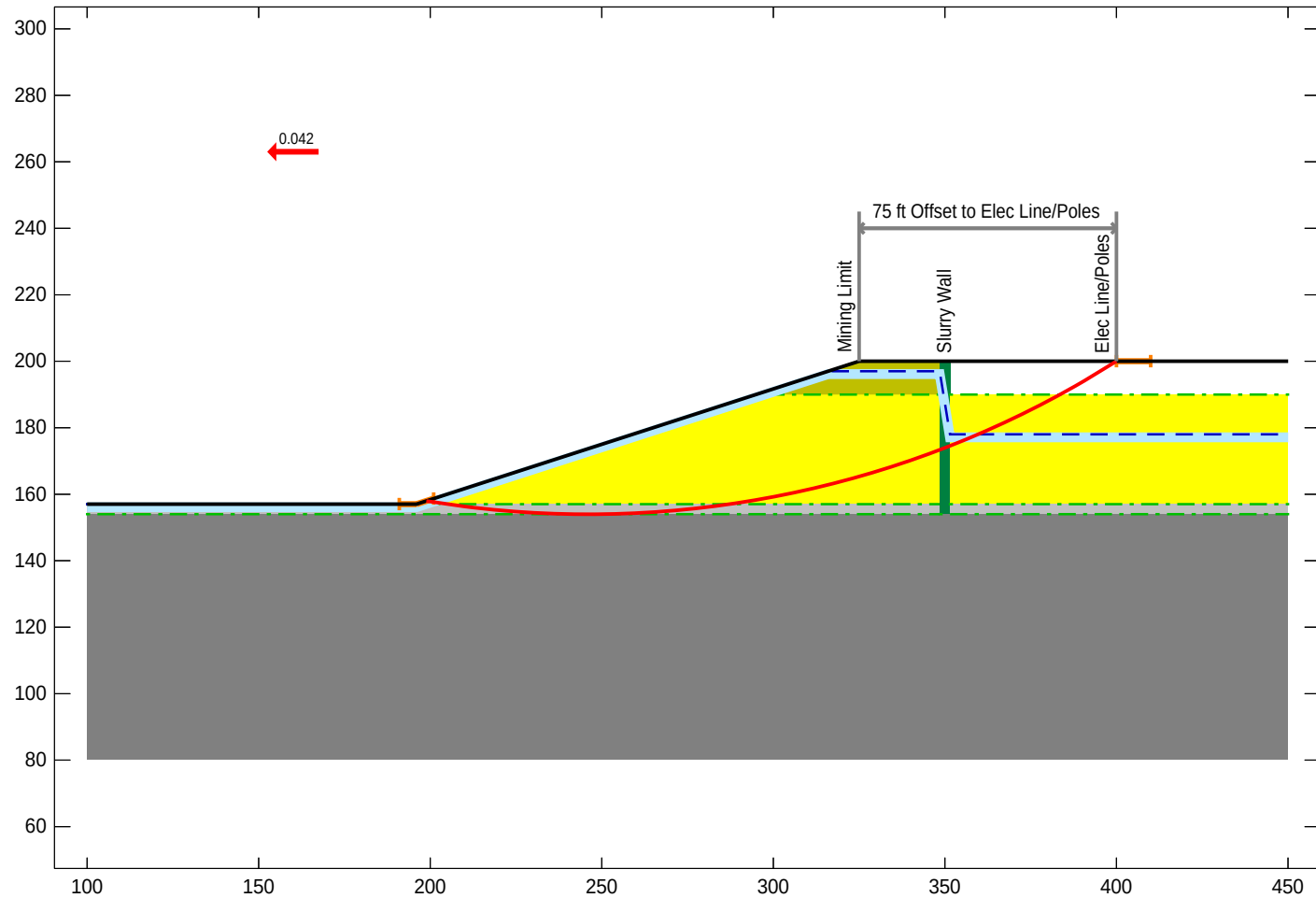
Critical Factor of Safety: 2.32

Project West Farm Pit Expansion
Case 4-1 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

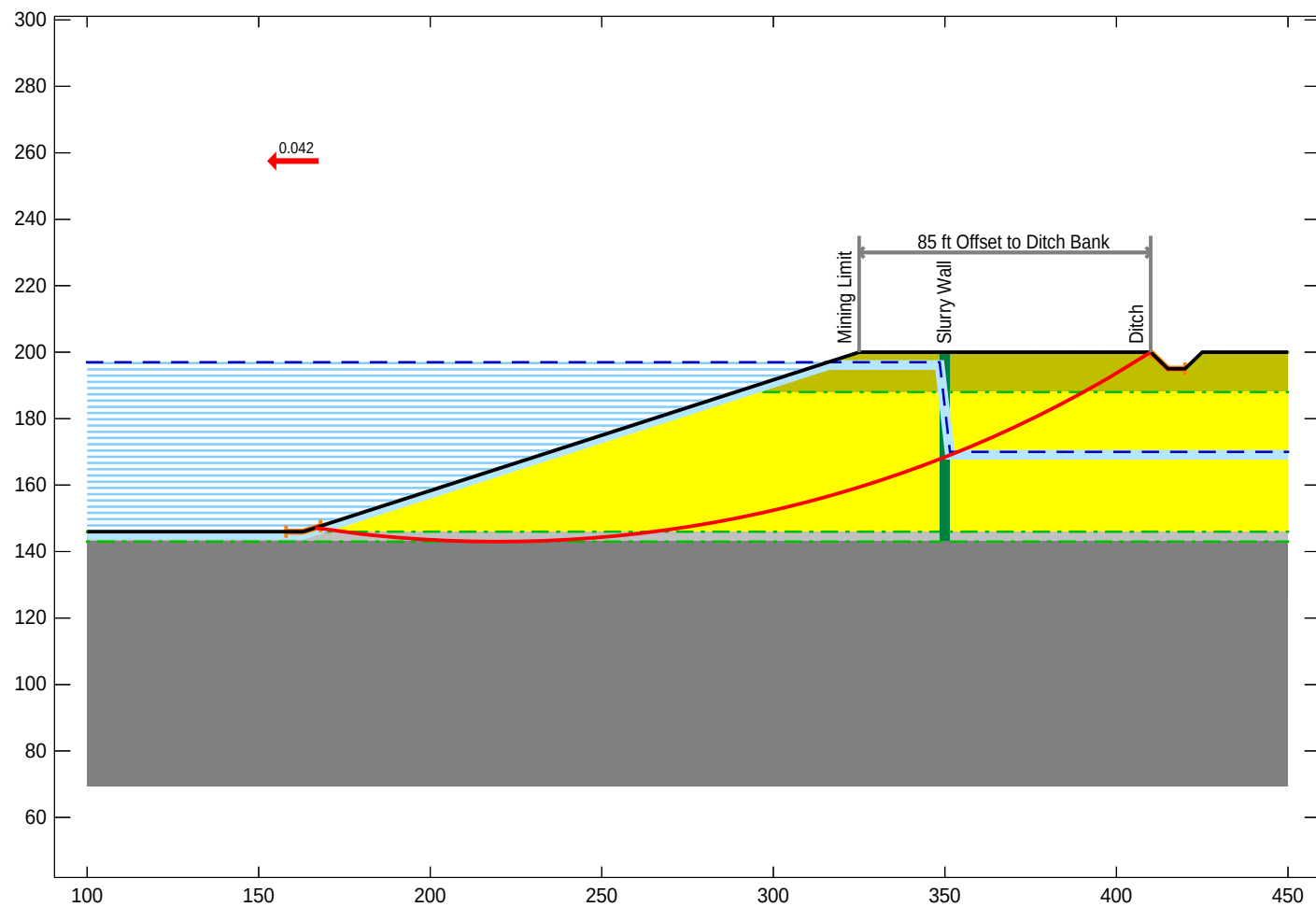
Critical Factor of Safety: 1.42

Project West Farm Pit Expansion
Case 4-1 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

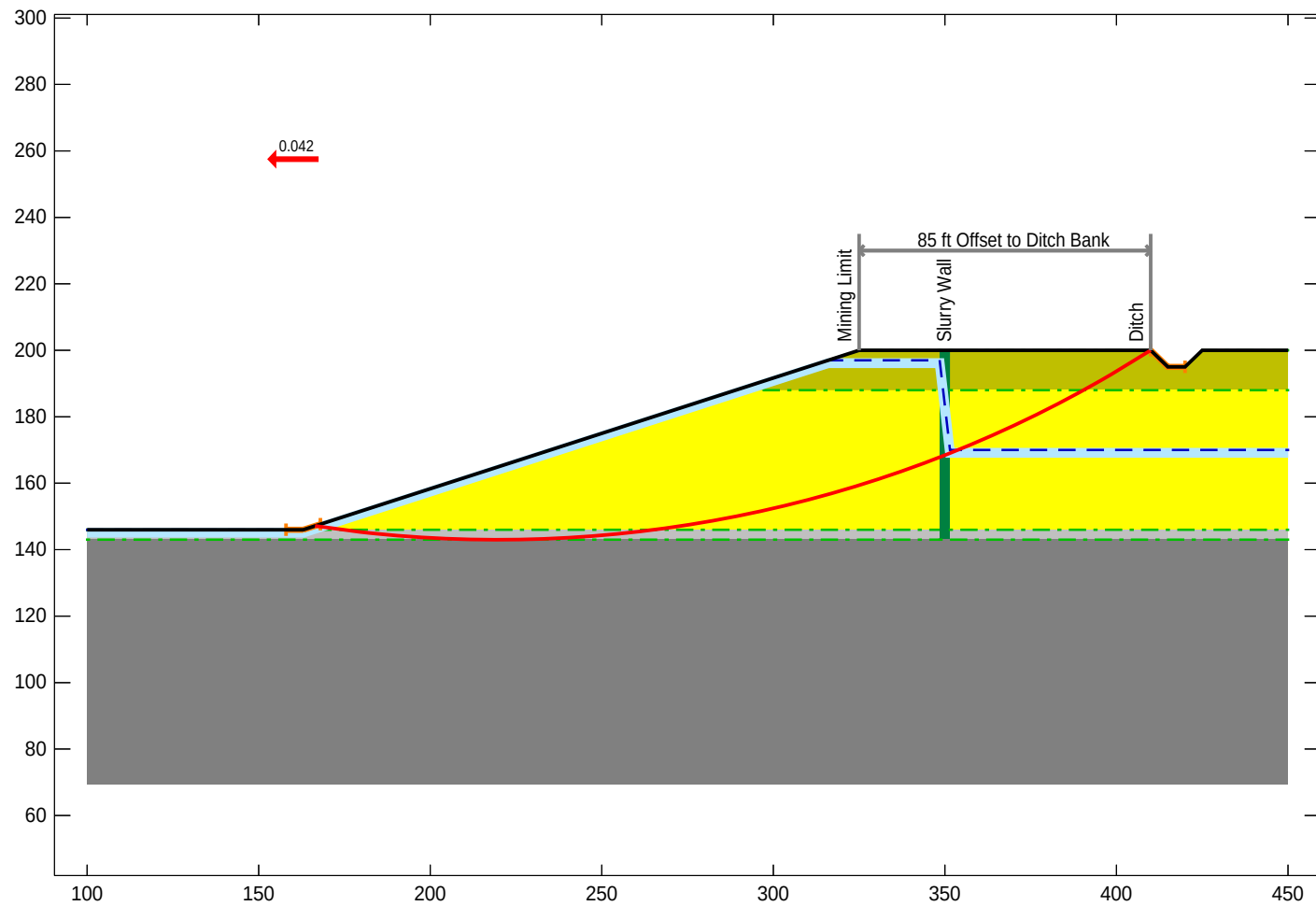
Critical Factor of Safety: 2.31

Project West Farm Pit Expansion
Case 4-2 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 4-2\West Farm Expansion Case 4-2 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

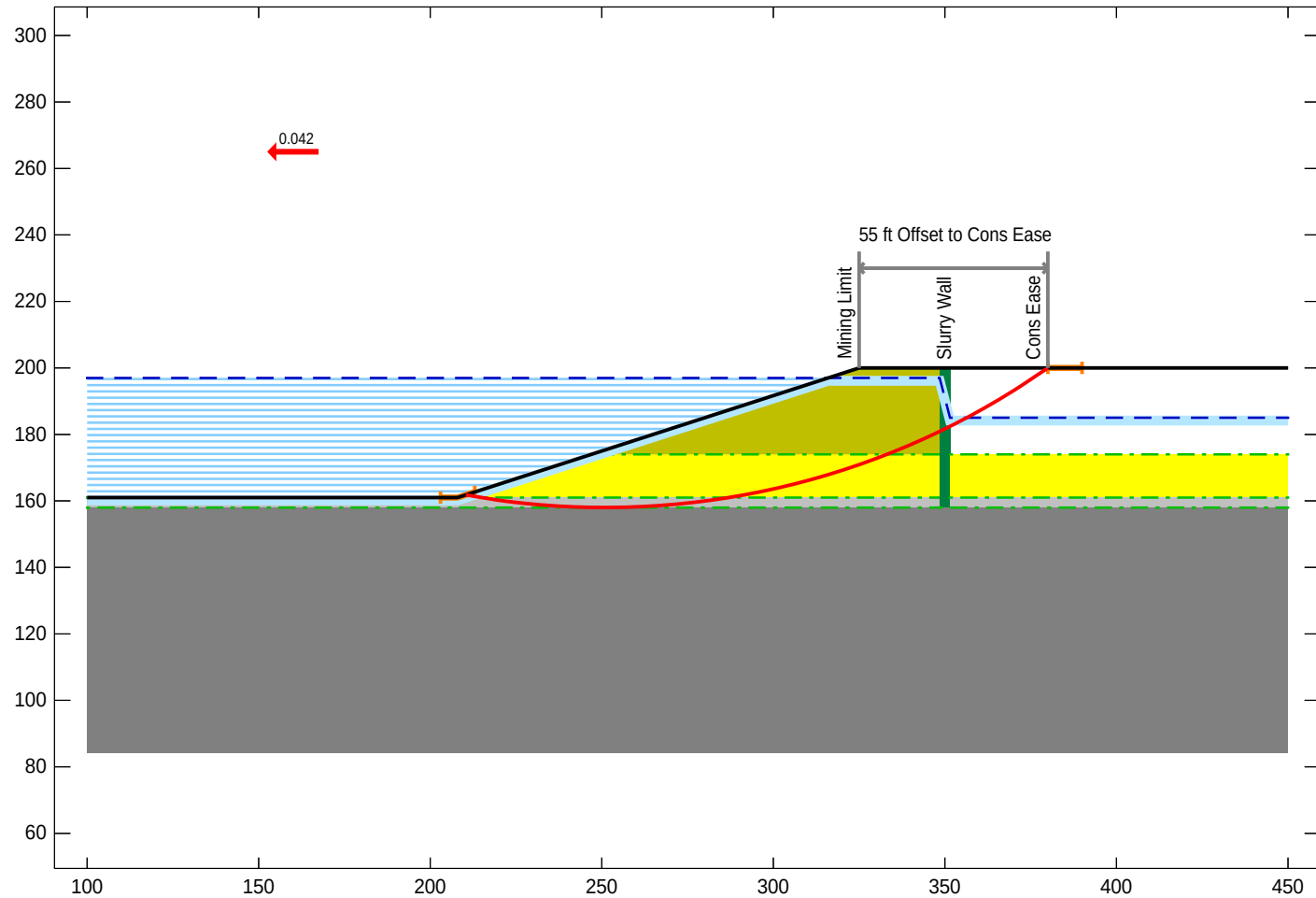
Critical Factor of Safety: 1.38

Project West Farm Pit Expansion
Case 4-2 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 4-2\West Farm Expansion Case 4-2 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

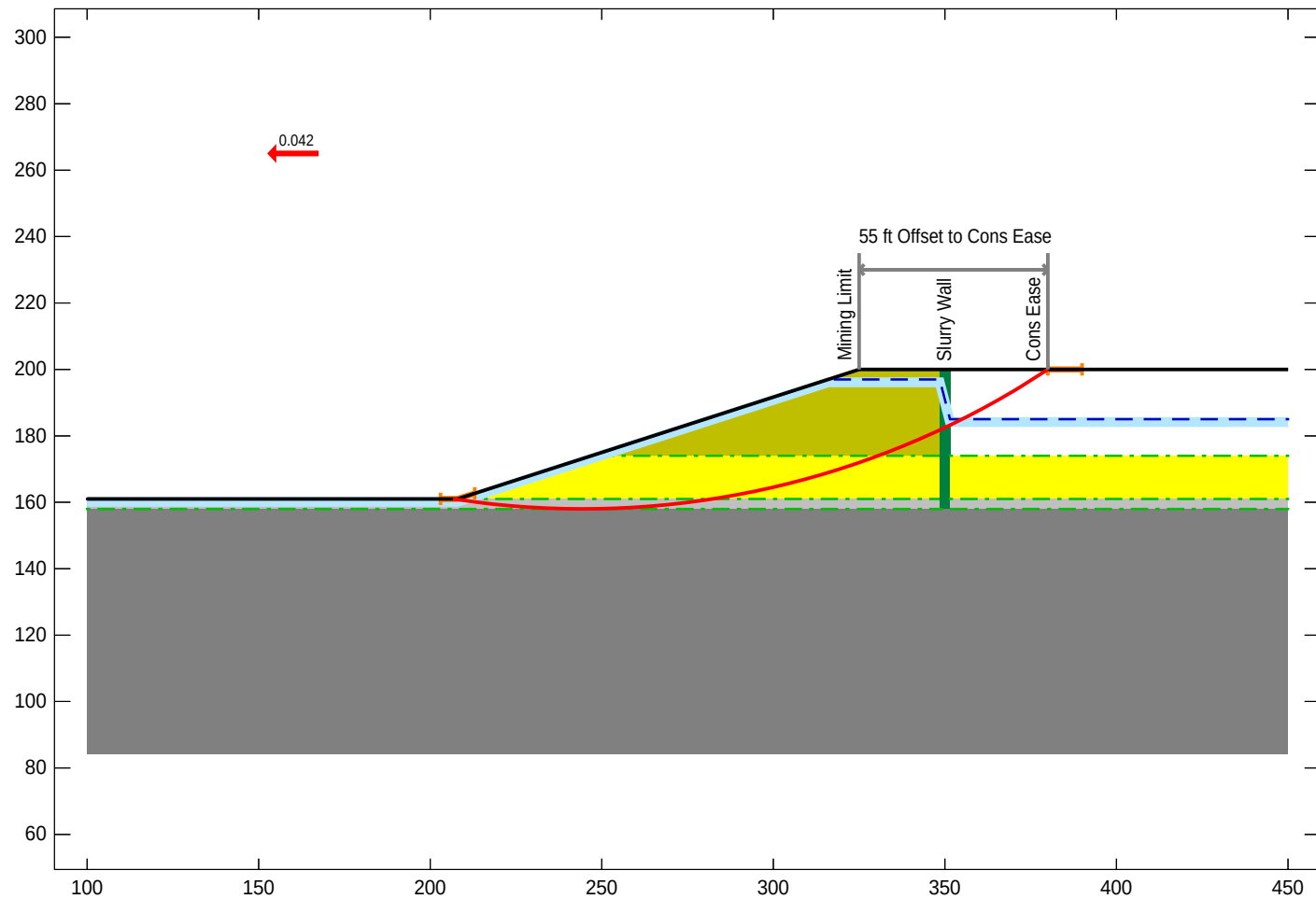
Critical Factor of Safety: 1.92

Project West Farm Pit Expansion
Case 5-1 Full Reservoir

File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

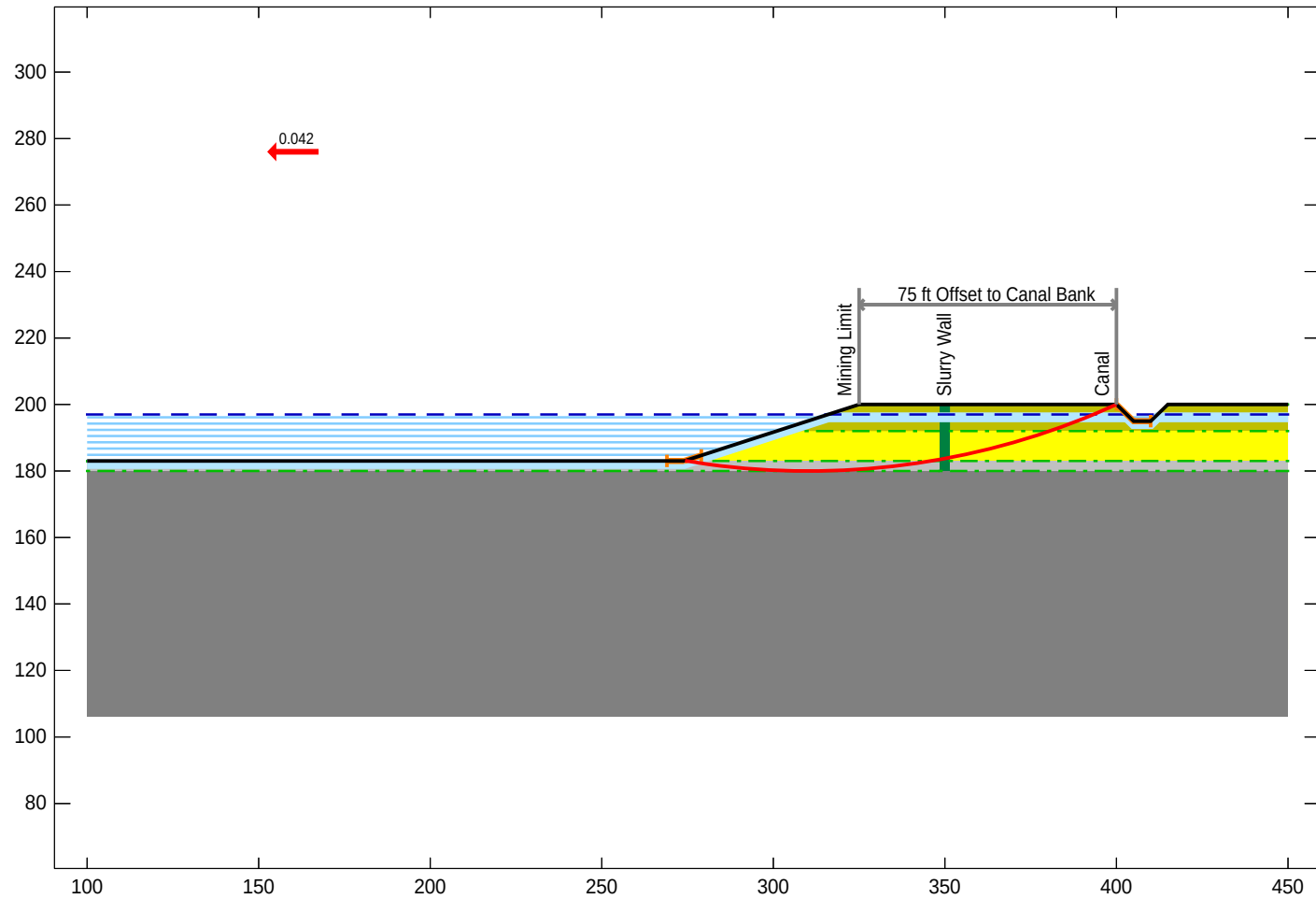
Critical Factor of Safety: 1.17

Project West Farm Pit Expansion
Case 5-1 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

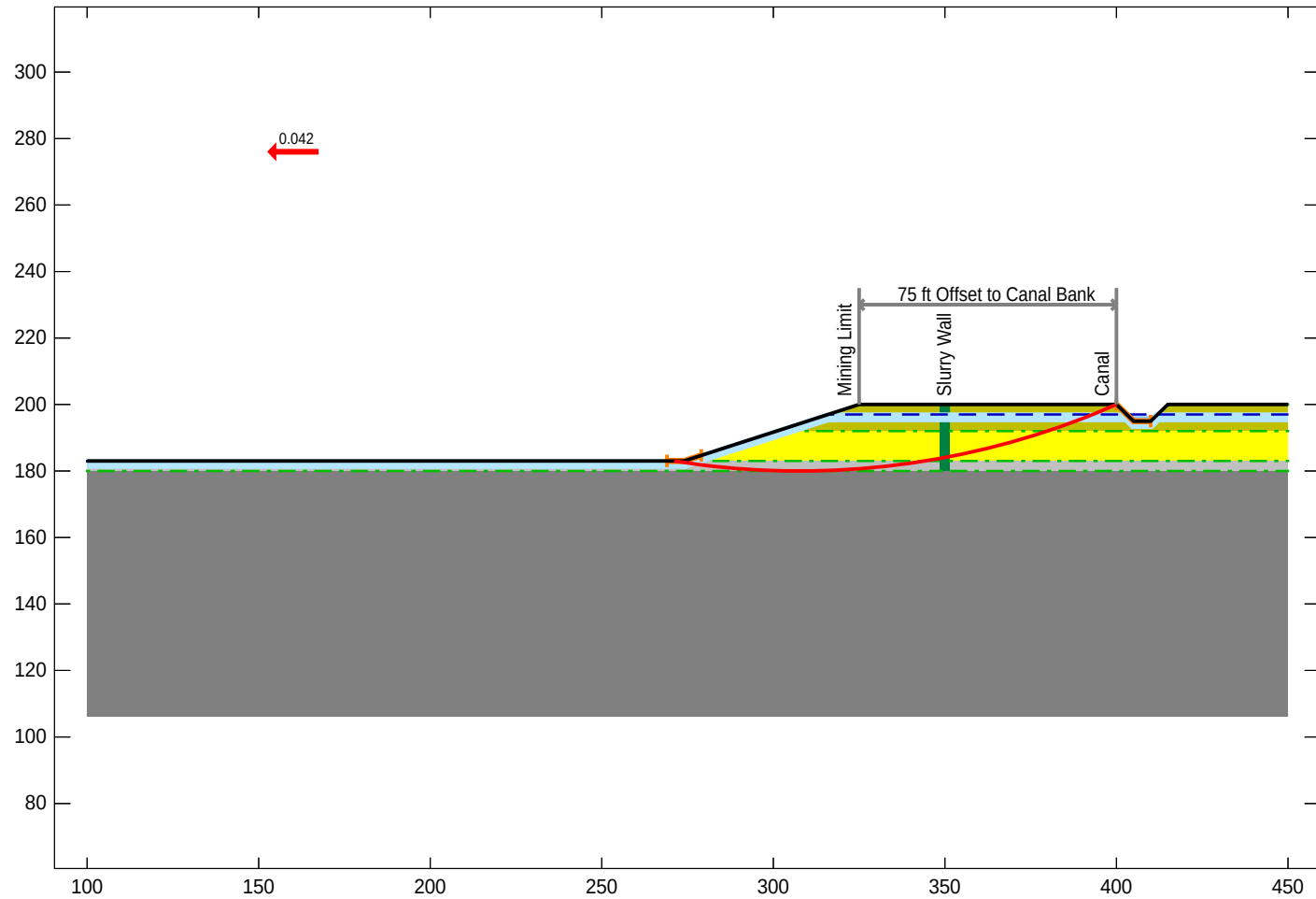
Critical Factor of Safety: 2.72

Project West Farm Pit Expansion
Case 5-2 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 5-2\West Farm Expansion Case 5-2 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

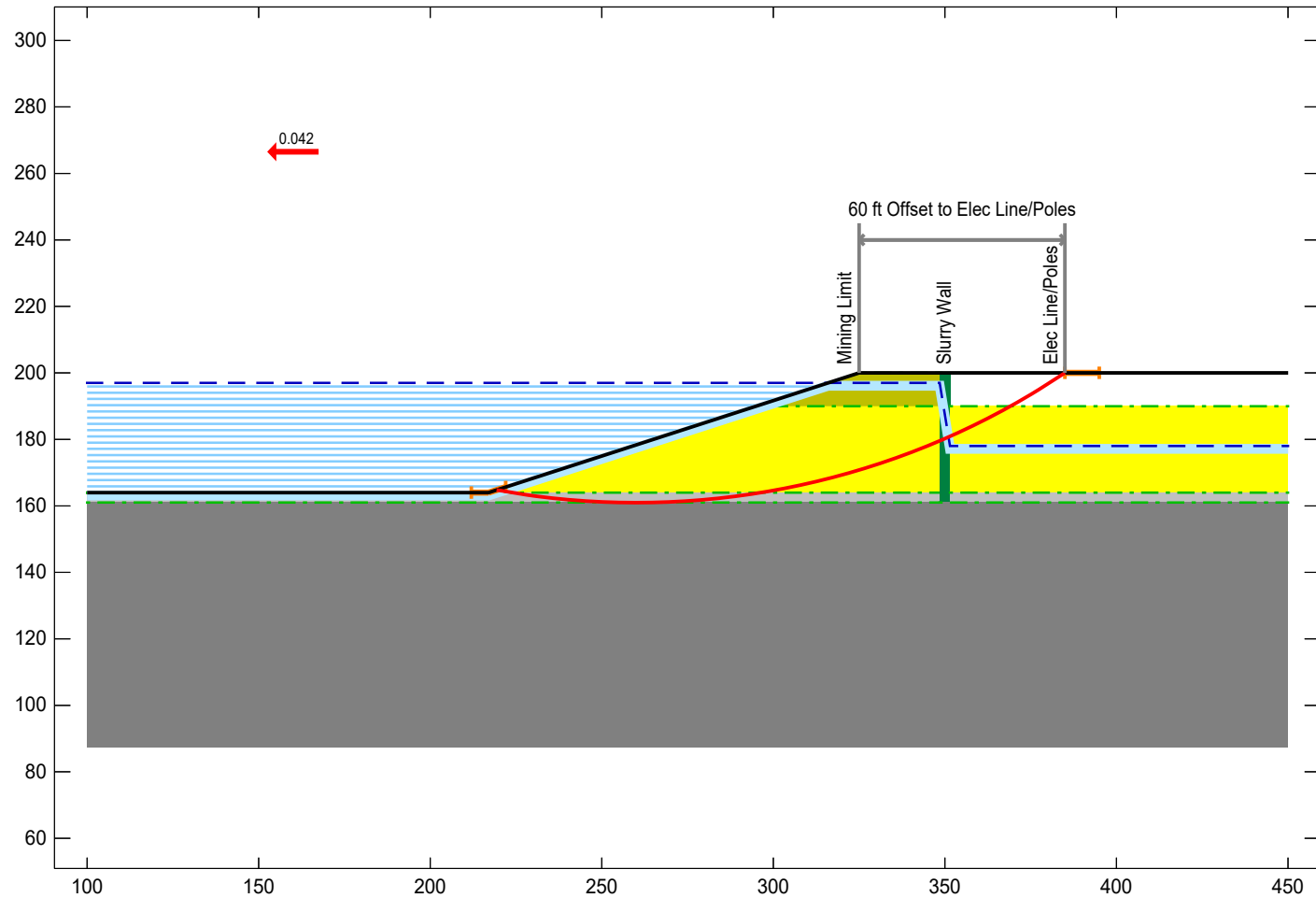
Critical Factor of Safety: 2.00

Project West Farm Pit Expansion
Case 5-2 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 5-2\West Farm Expansion Case 5-2 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

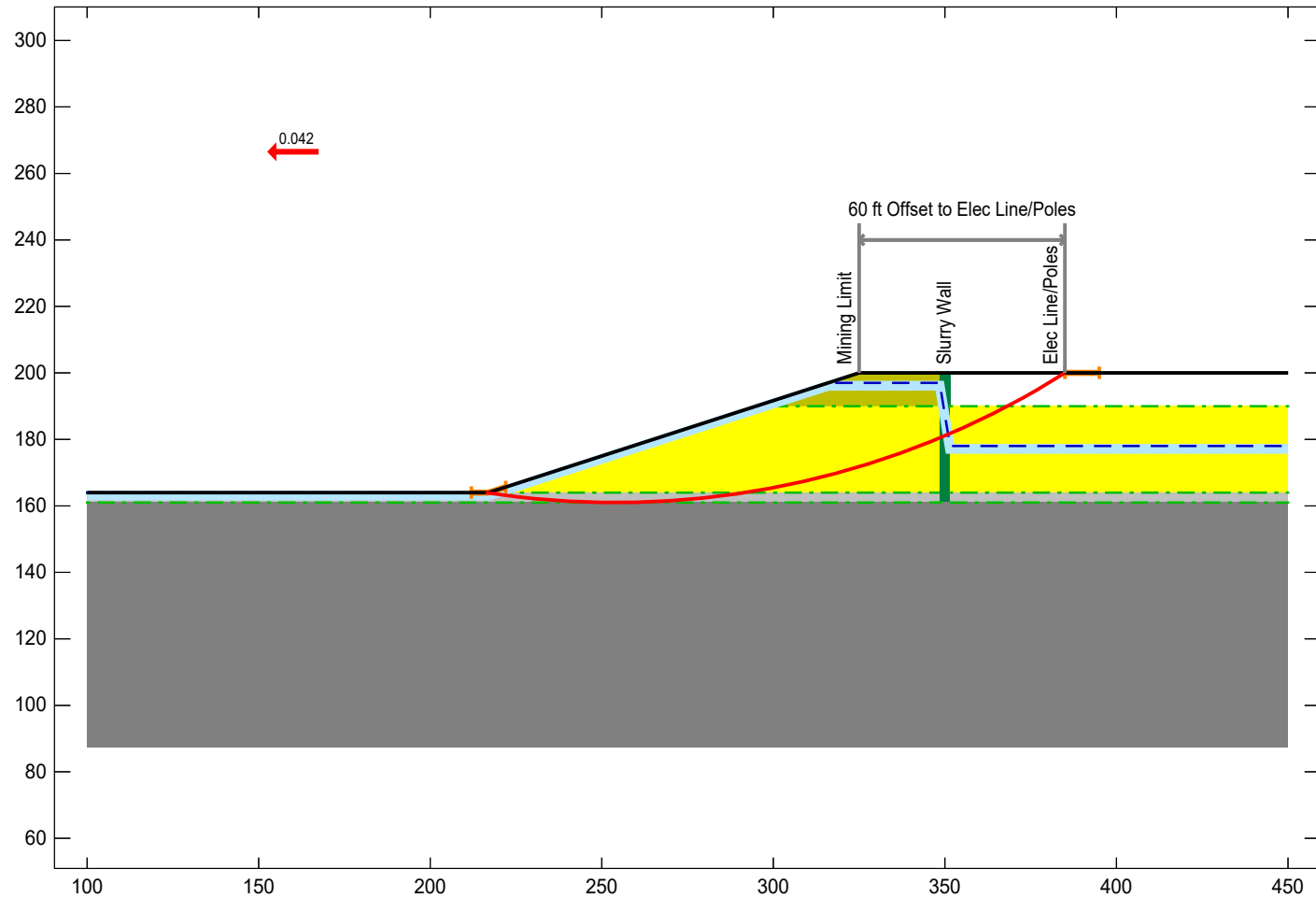
Critical Factor of Safety: 2.20

Project West Farm Pit Expansion
Case 5-3 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Full Reservoir-EQ.gmf

Edited: 1 Apr 2021
Processed: 1 Apr 2021





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

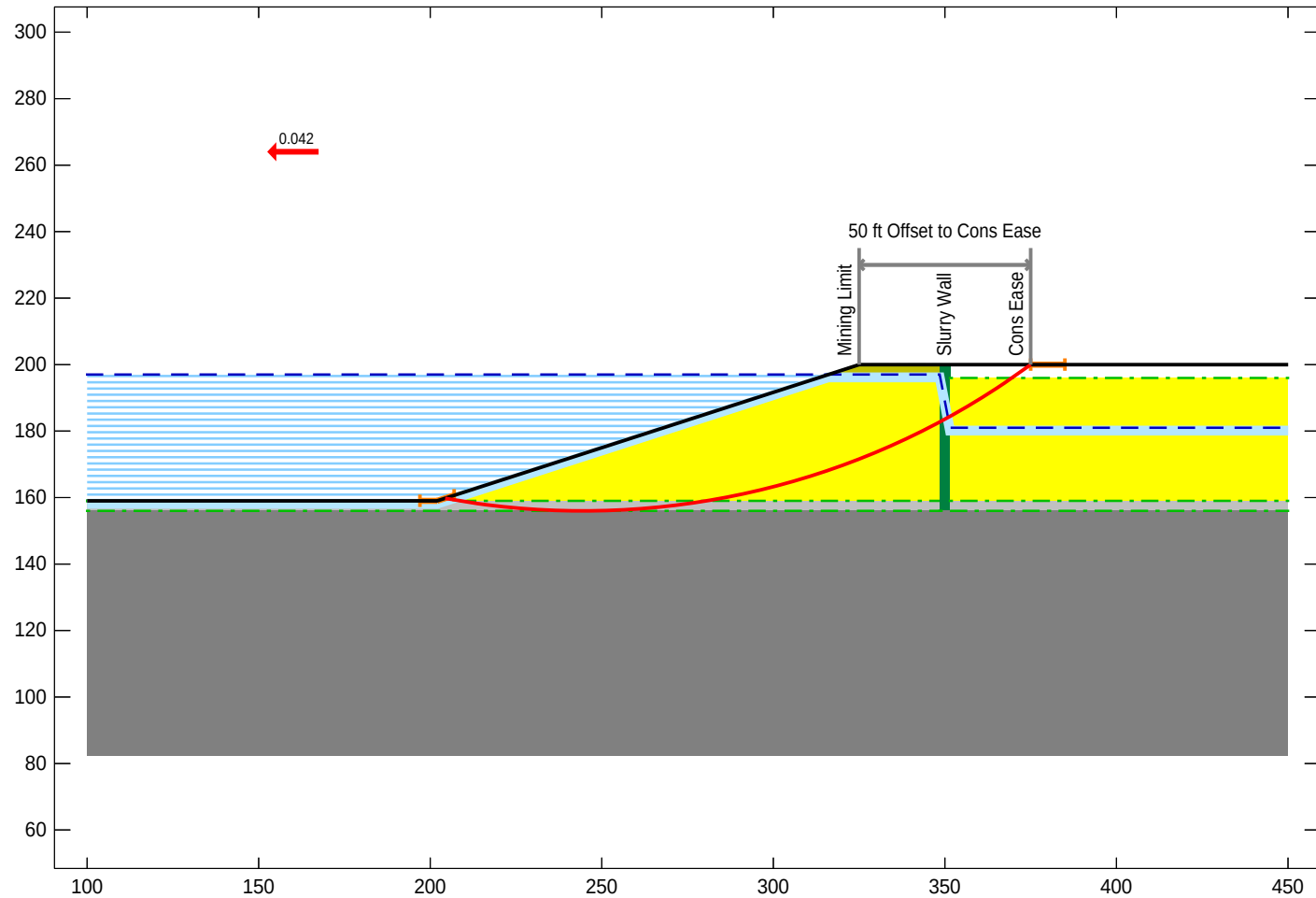
Critical Factor of Safety: 1.36

Project West Farm Pit Expansion
Case 5-3 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Rapid Drawdown-EQ.gmf

Edited: 1 Apr 2021
Processed: 1 Apr 2021





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

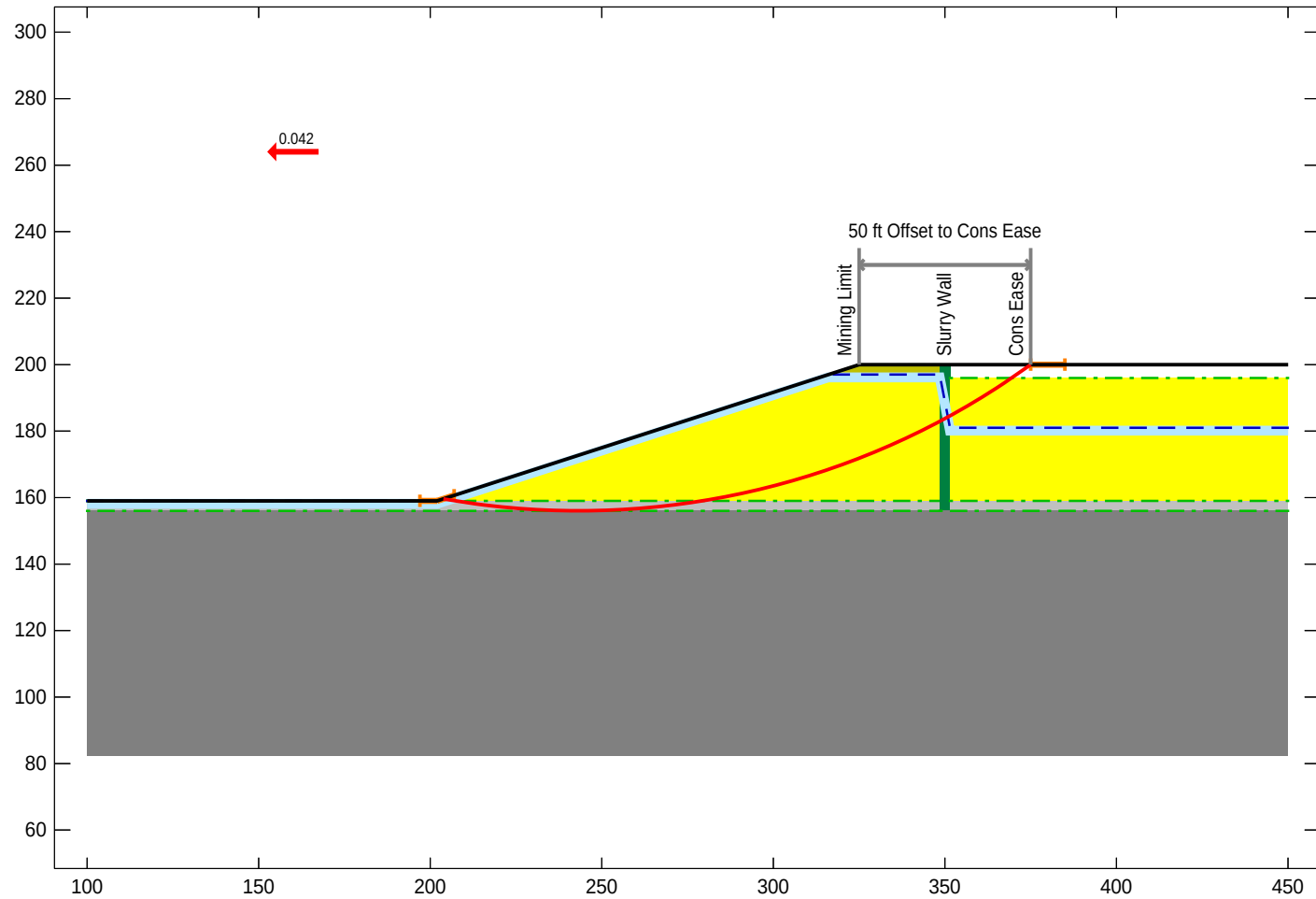
Critical Factor of Safety: 1.97

Project West Farm Pit Expansion
Case 6-1 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 6-1\West Farm Expansion Case 6-1 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

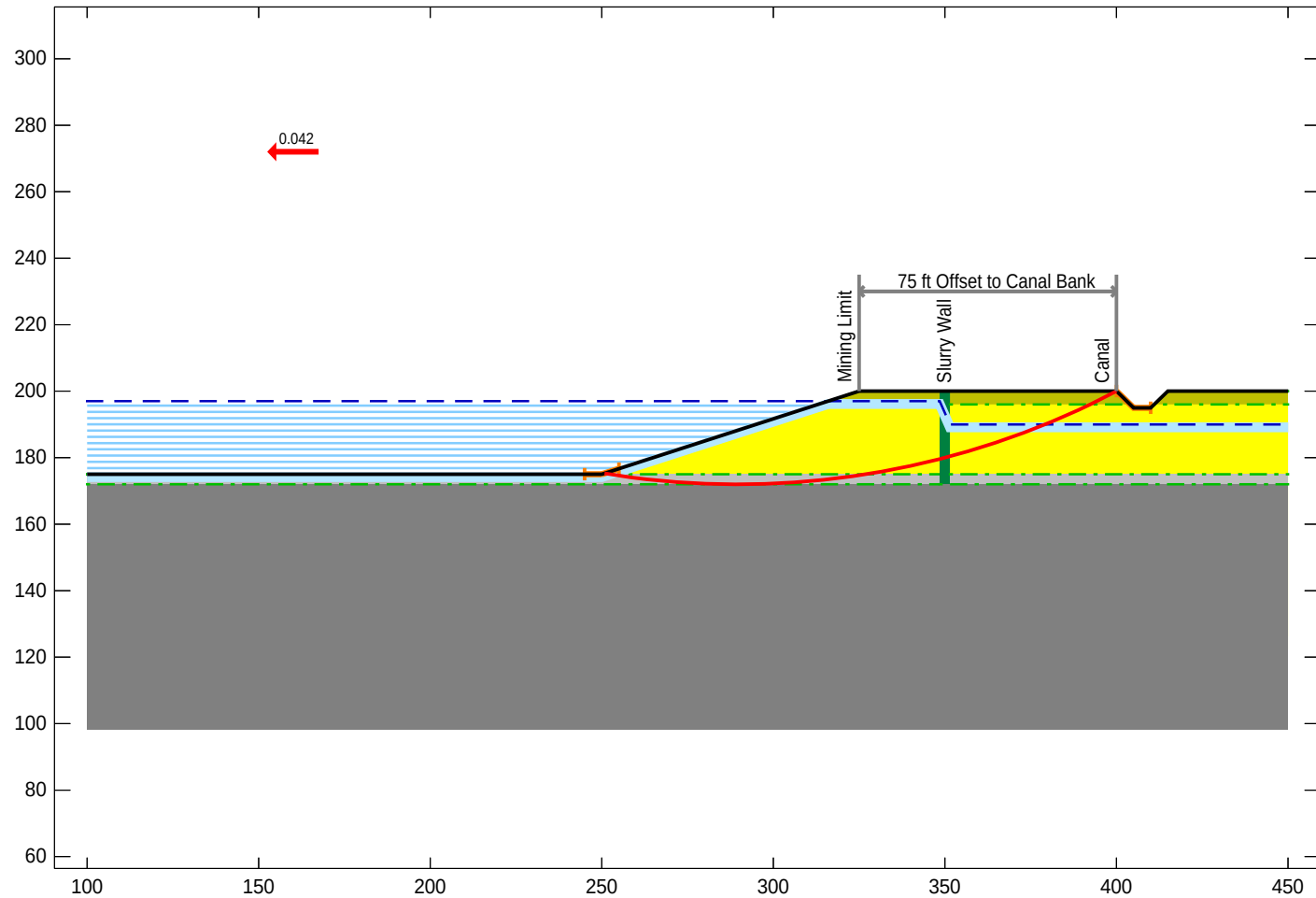
Critical Factor of Safety: 1.17

Project West Farm Pit Expansion
Case 6-1 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 6-1\West Farm Expansion Case 6-1 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

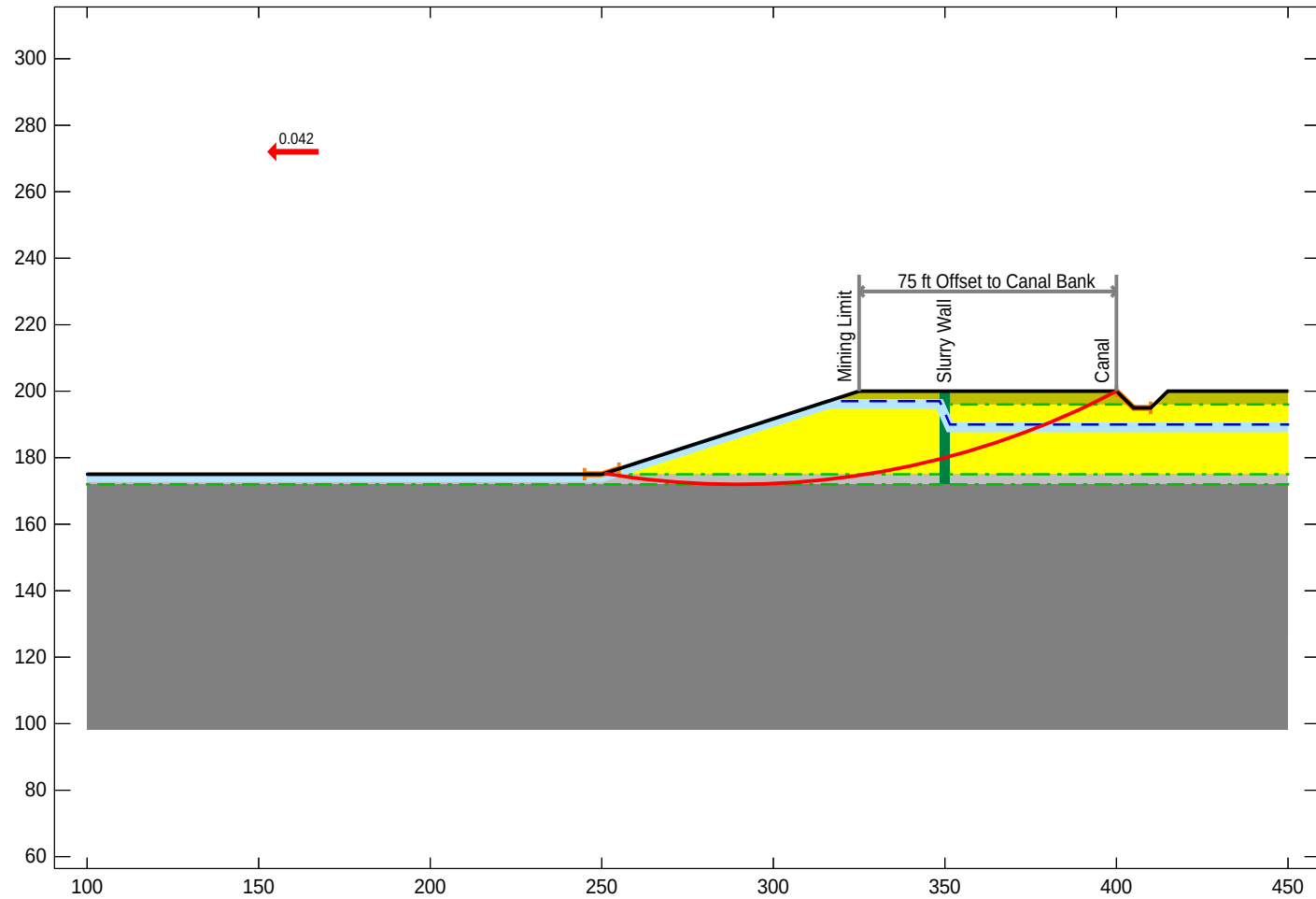
Critical Factor of Safety: 2.68

Project West Farm Pit Expansion
Case 6-2 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 6-2\West Farm Expansion Case 6-2 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

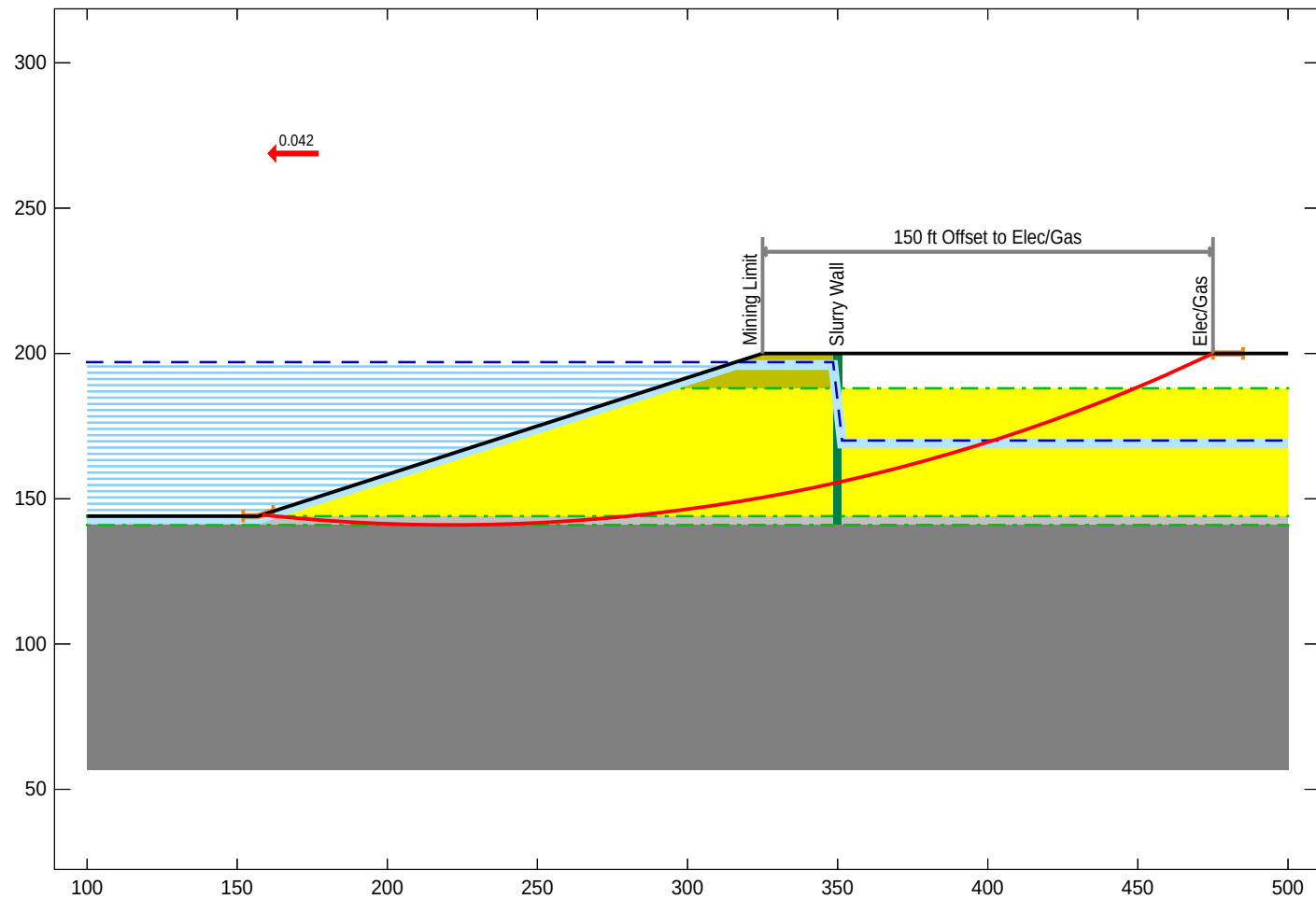
Critical Factor of Safety: 1.82

Project West Farm Pit Expansion
Case 6-2 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 6-2\West Farm Expansion Case 6-2 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

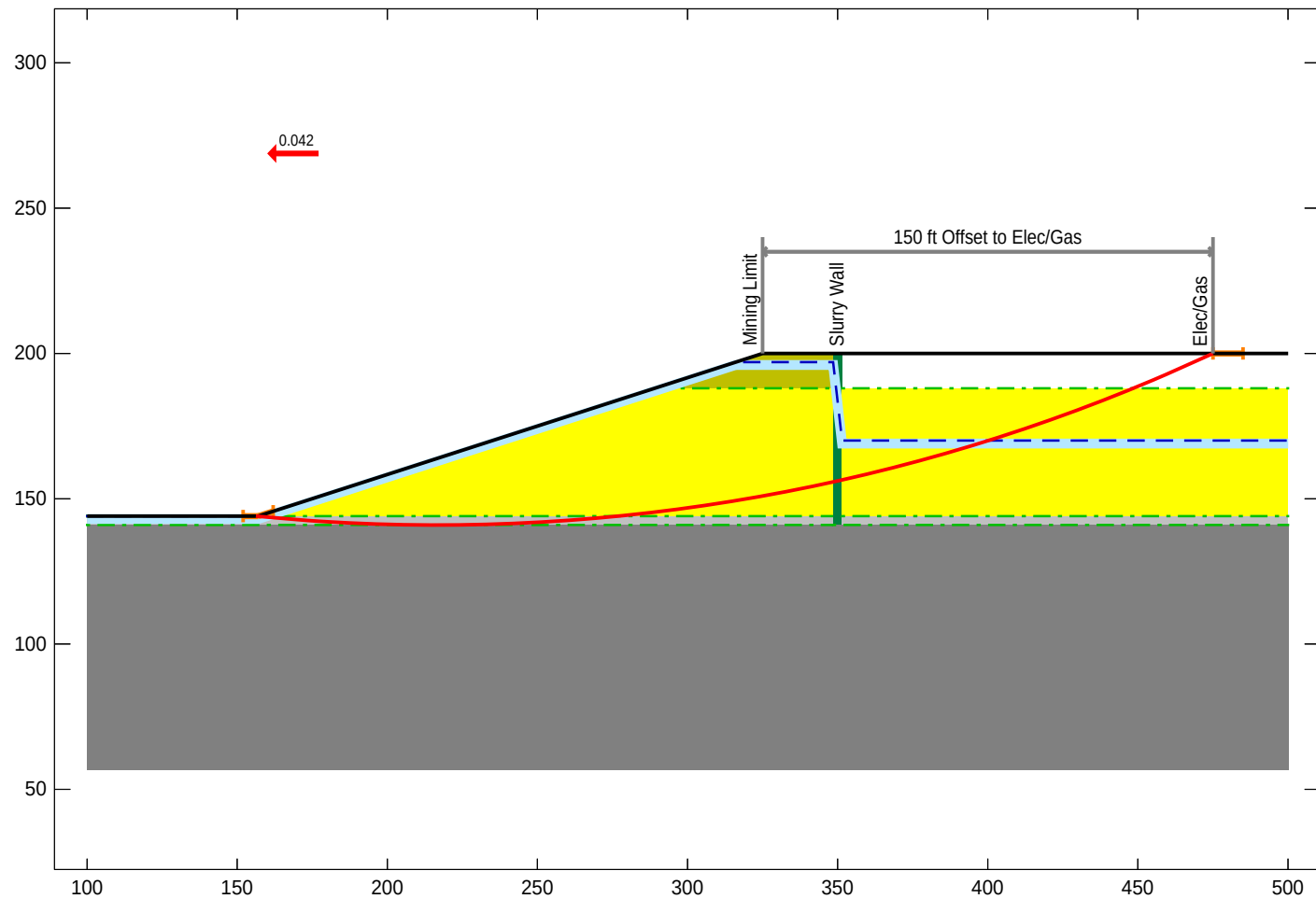
Critical Factor of Safety: 3.05

Project West Farm Pit Expansion
Case 7-1 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 7-1\West Farm Expansion Case 7-1 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

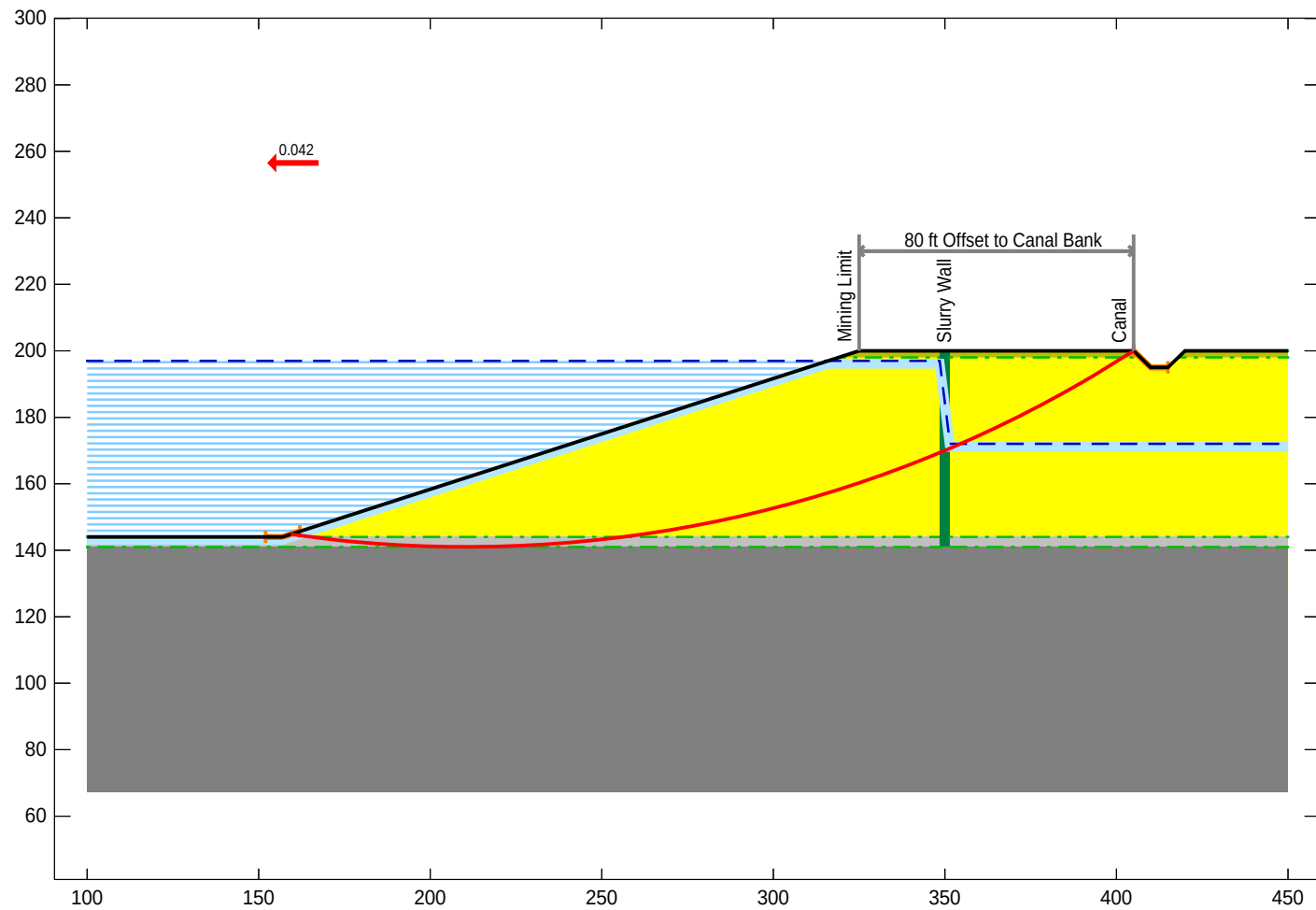
Critical Factor of Safety: 1.92

Project West Farm Pit Expansion
Case 7-1 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 7-1\West Farm Expansion Case 7-1 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

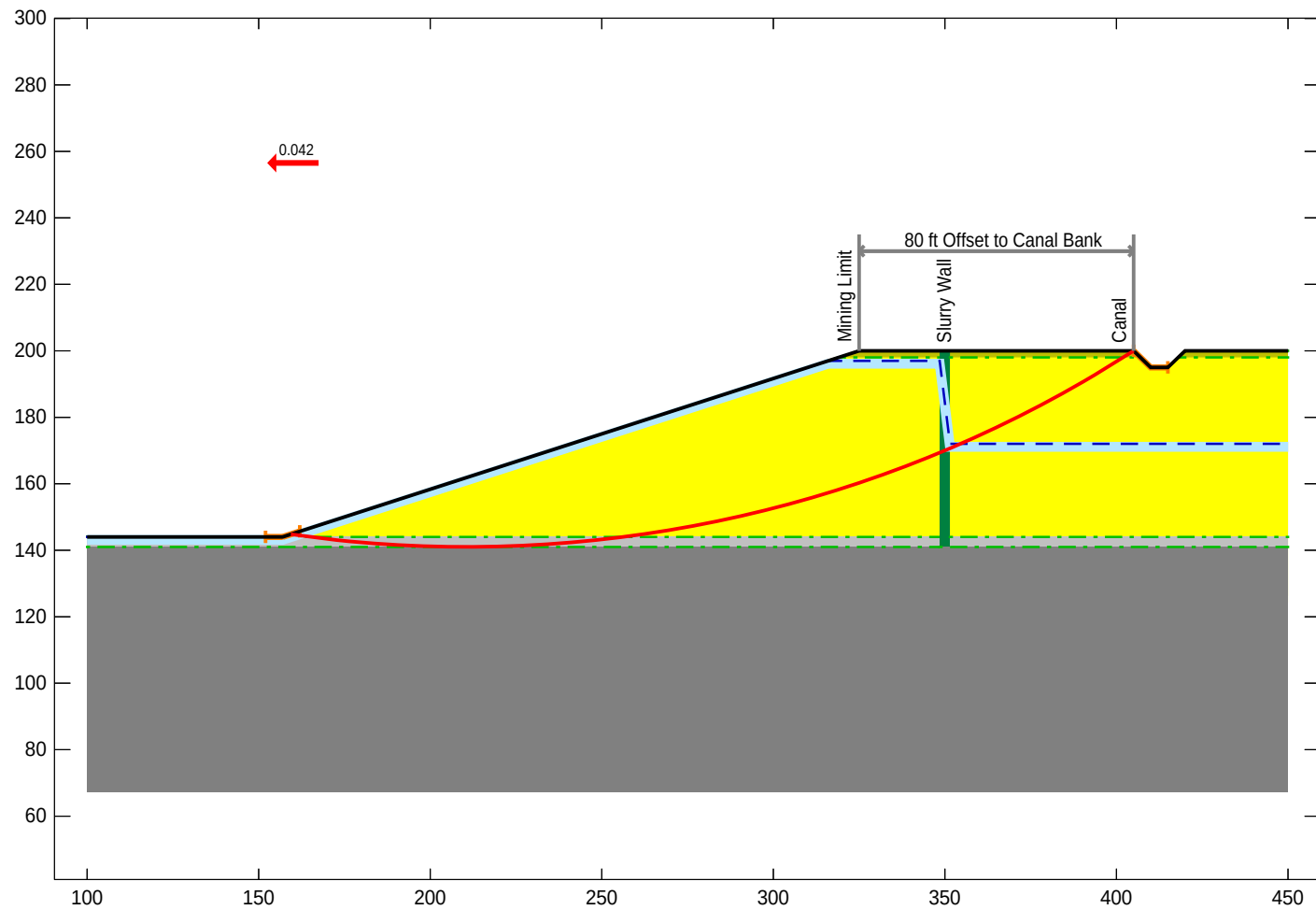
Critical Factor of Safety: 2.23

Project West Farm Pit Expansion
Case 7-2 Full Reservoir

File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

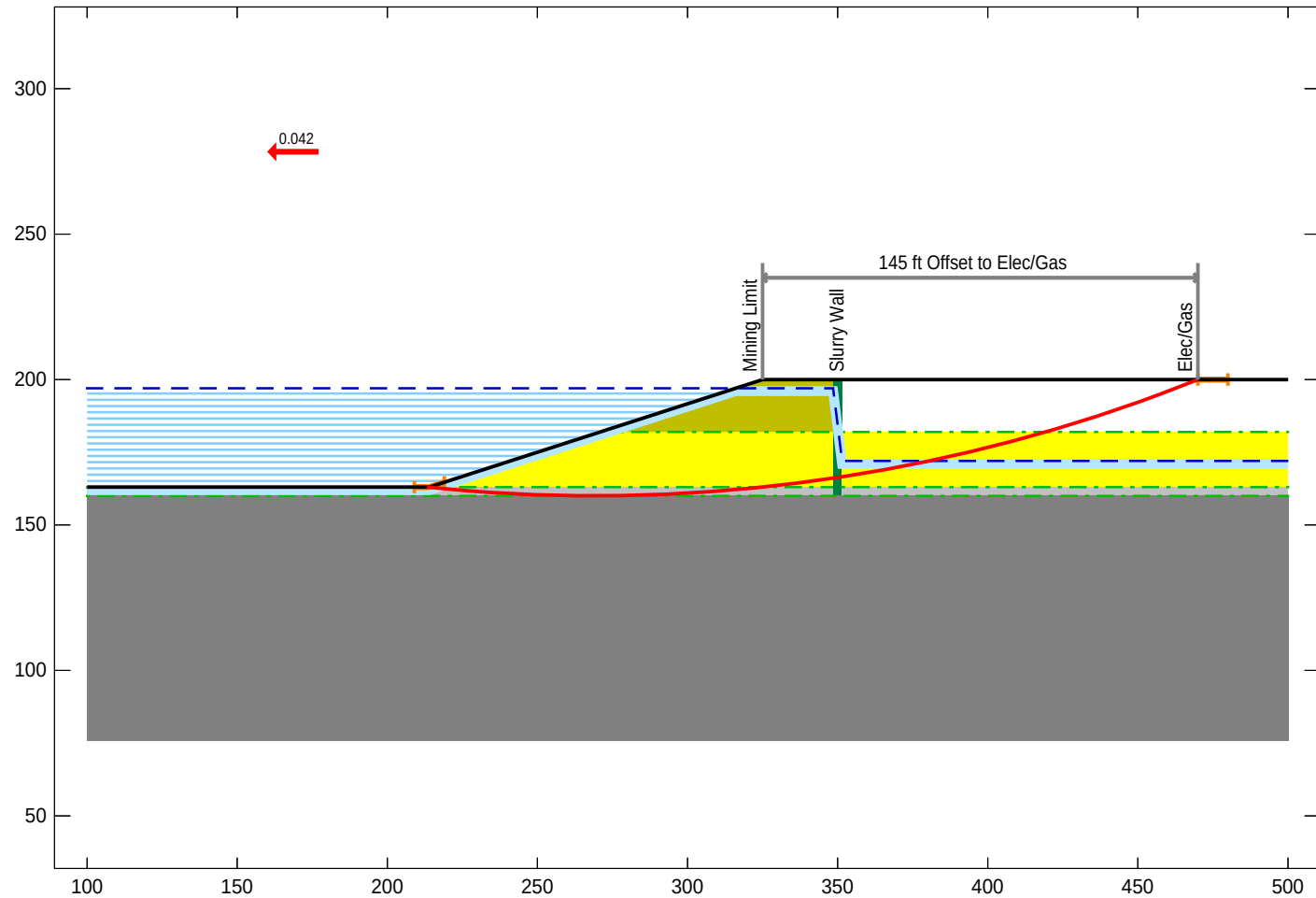
Critical Factor of Safety: 1.32

Project West Farm Pit Expansion
Case 7-2 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

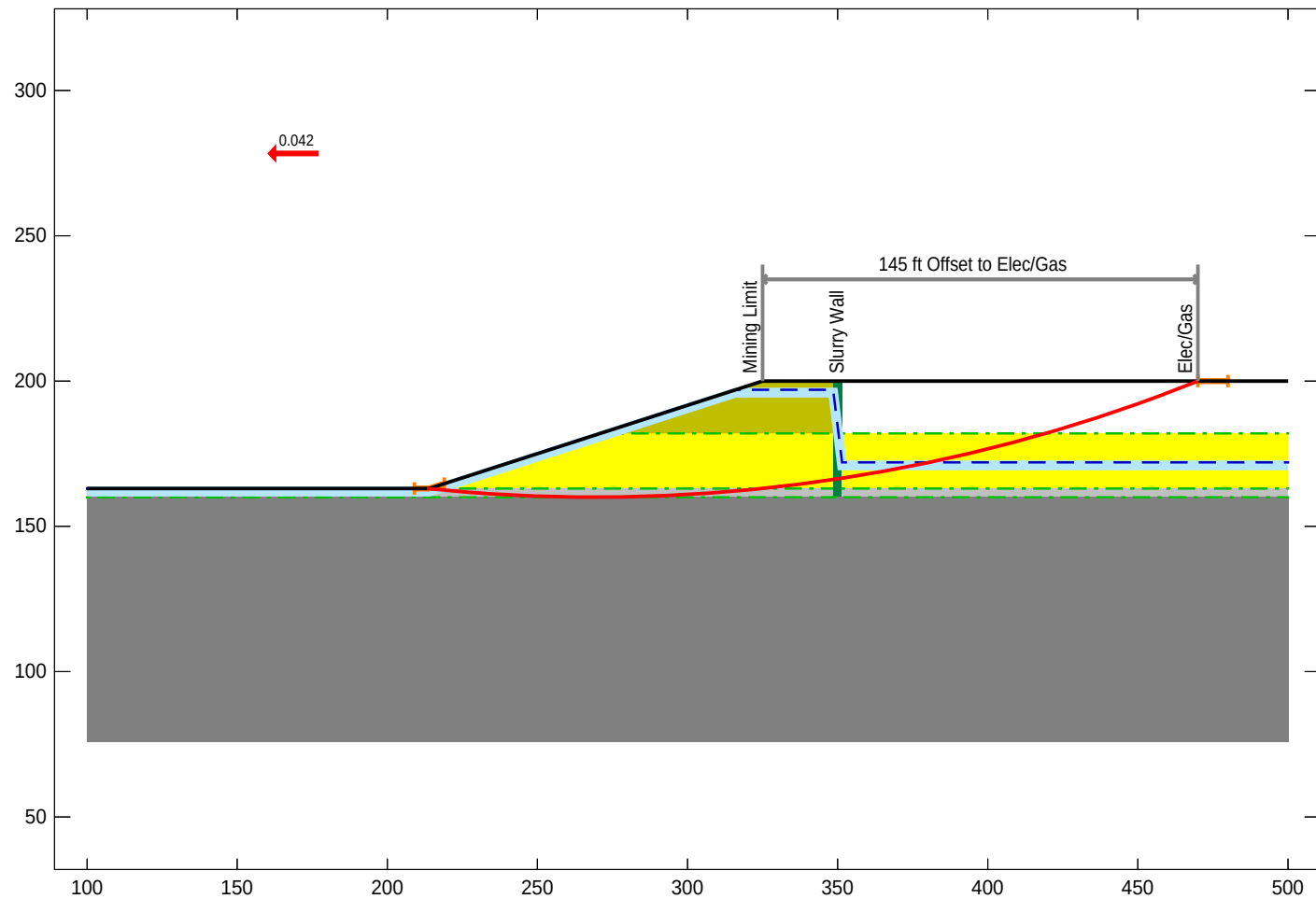
Critical Factor of Safety: 3.55

Project West Farm Pit Expansion
Case 8-1 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 8-1\West Farm Expansion Case 8-1 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

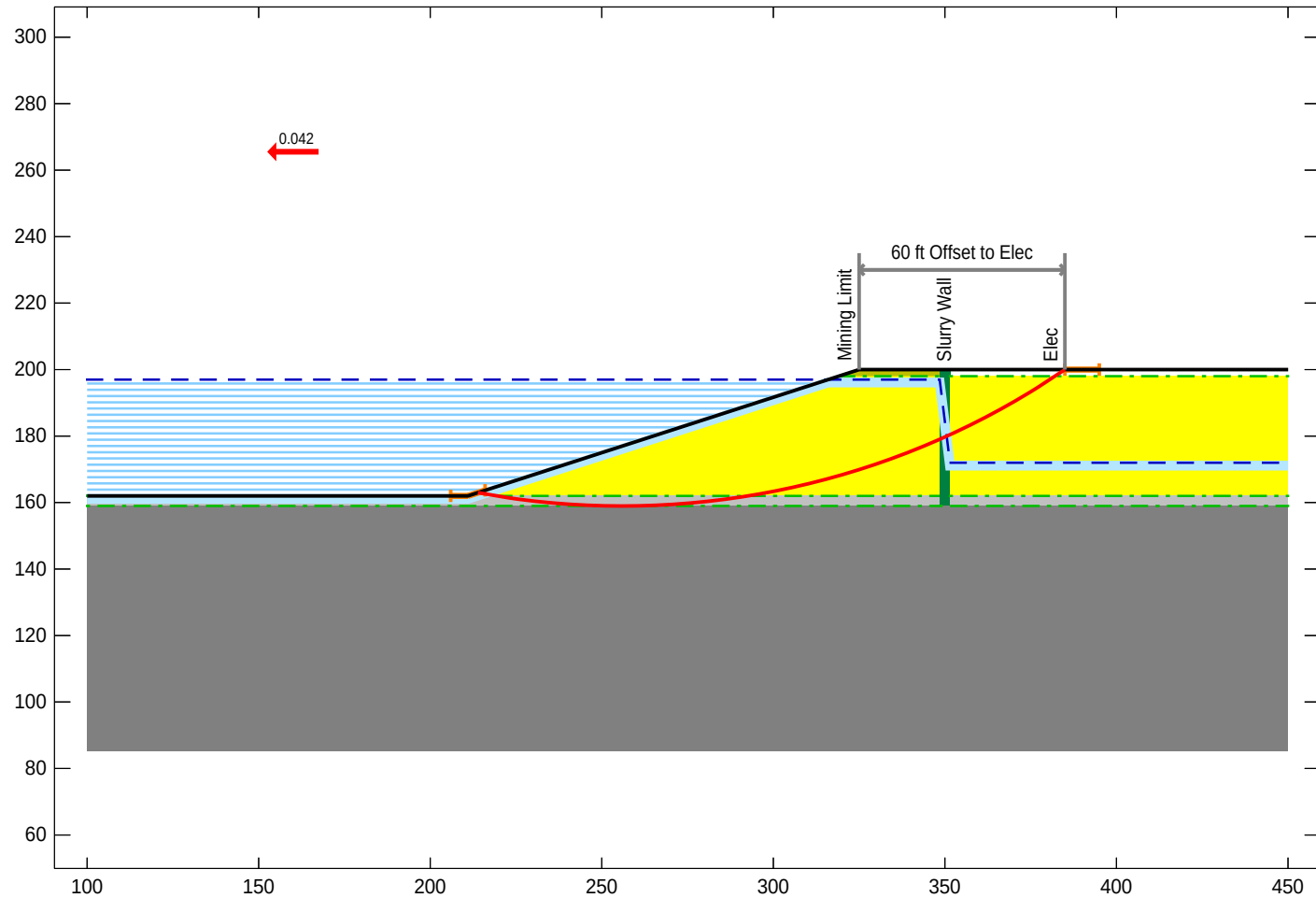
Critical Factor of Safety: 2.39

Project West Farm Pit Expansion
Case 8-1 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 8-1\West Farm Expansion Case 8-1 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

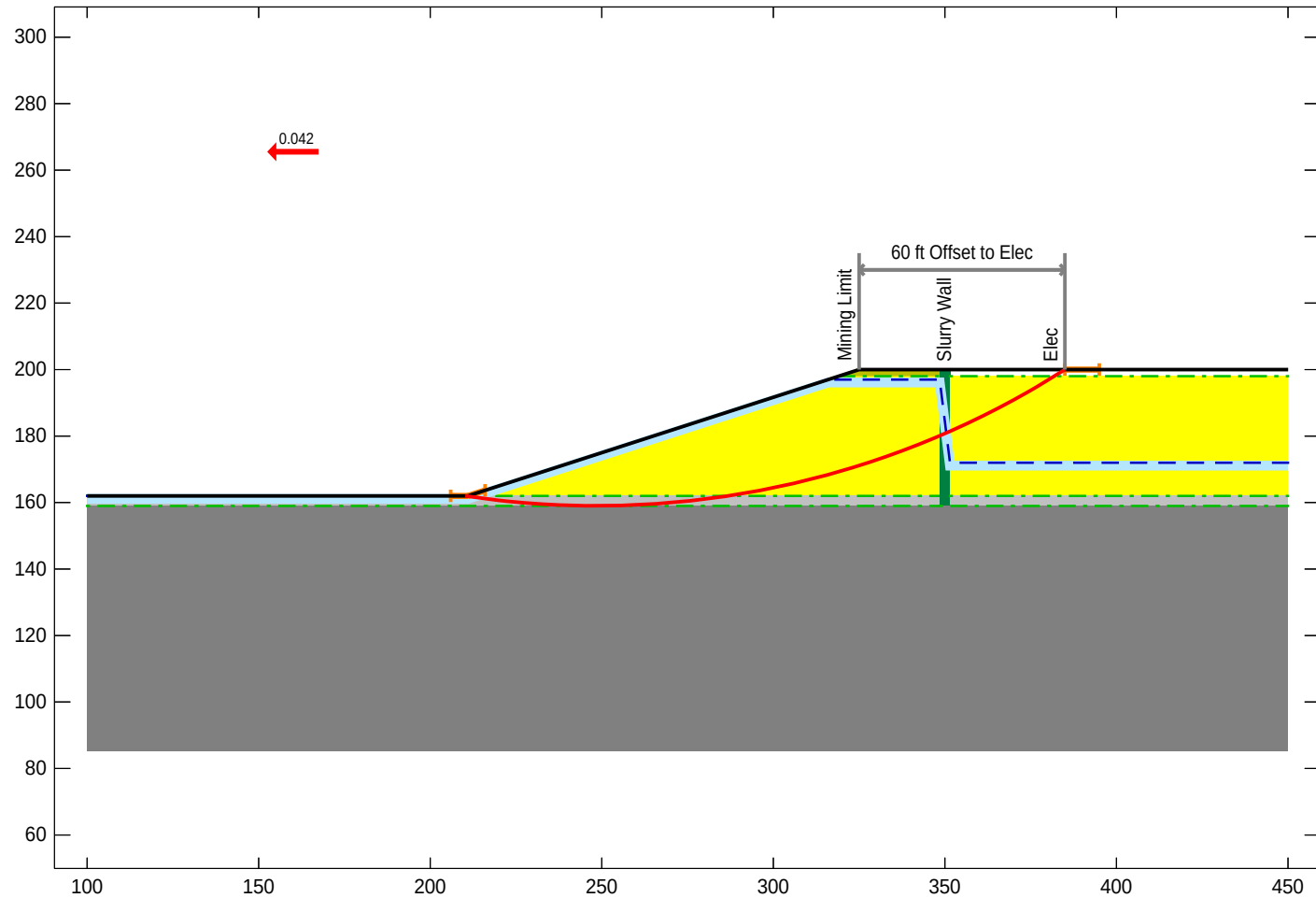
Critical Factor of Safety: 2.19

Project West Farm Pit Expansion
Case 8-2 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 8-2\West Farm Expansion Case 8-2 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

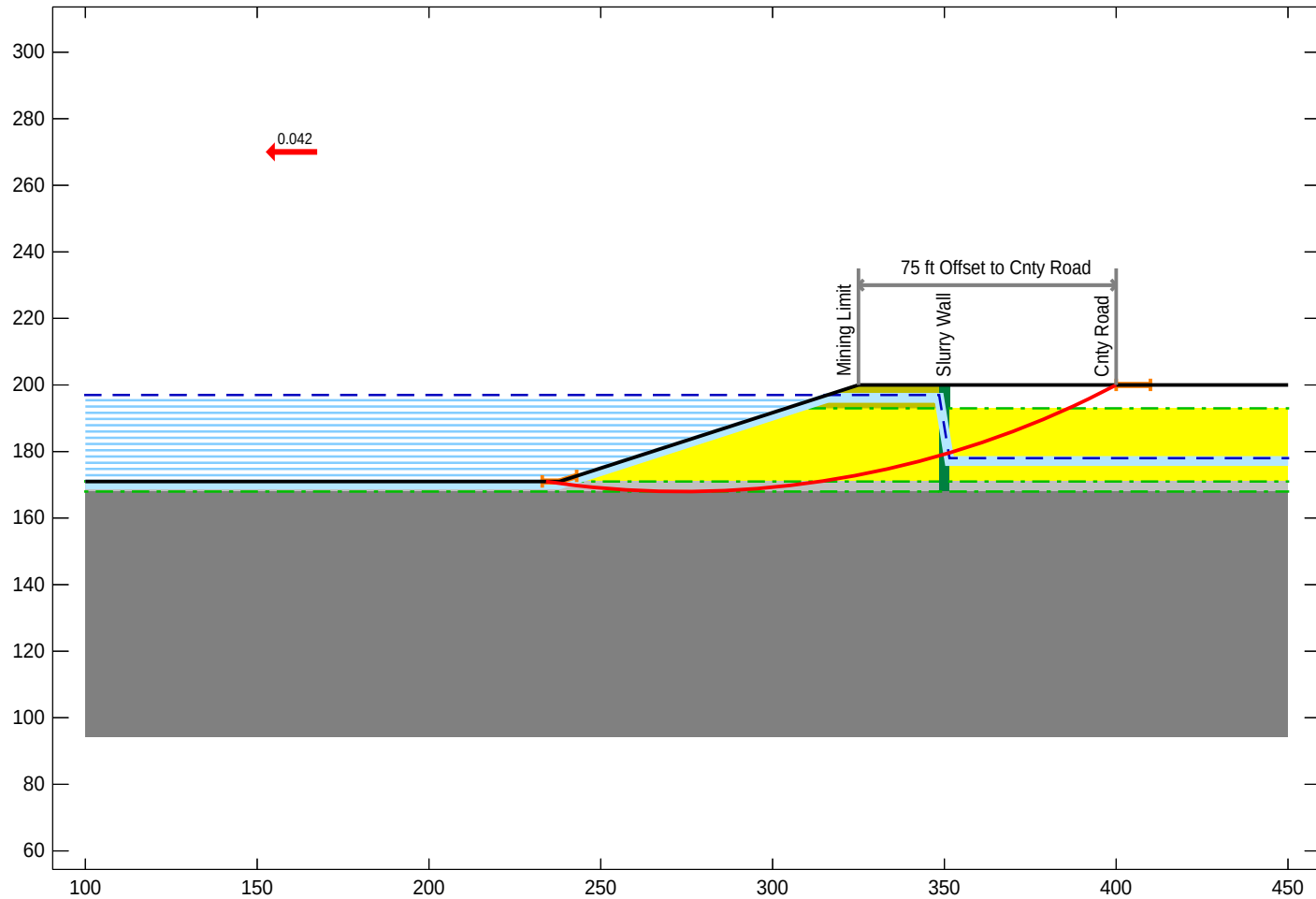
Critical Factor of Safety: 1.33

Project West Farm Pit Expansion
Case 8-2 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 8-2\West Farm Expansion Case 8-2 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

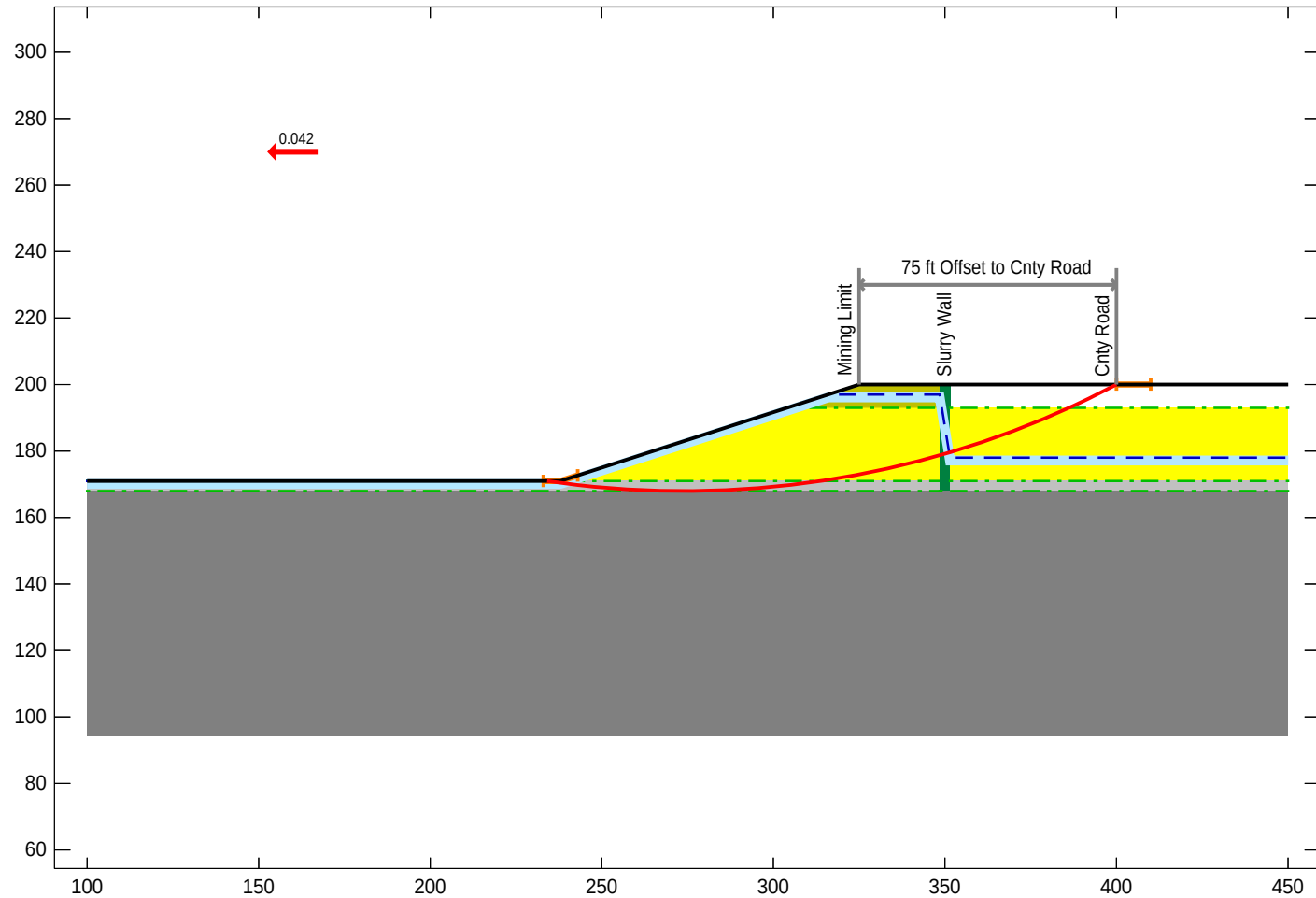
Critical Factor of Safety: 2.70

Project West Farm Pit Expansion
Case 8-3 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 8-3\West Farm Expansion Case 8-3 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

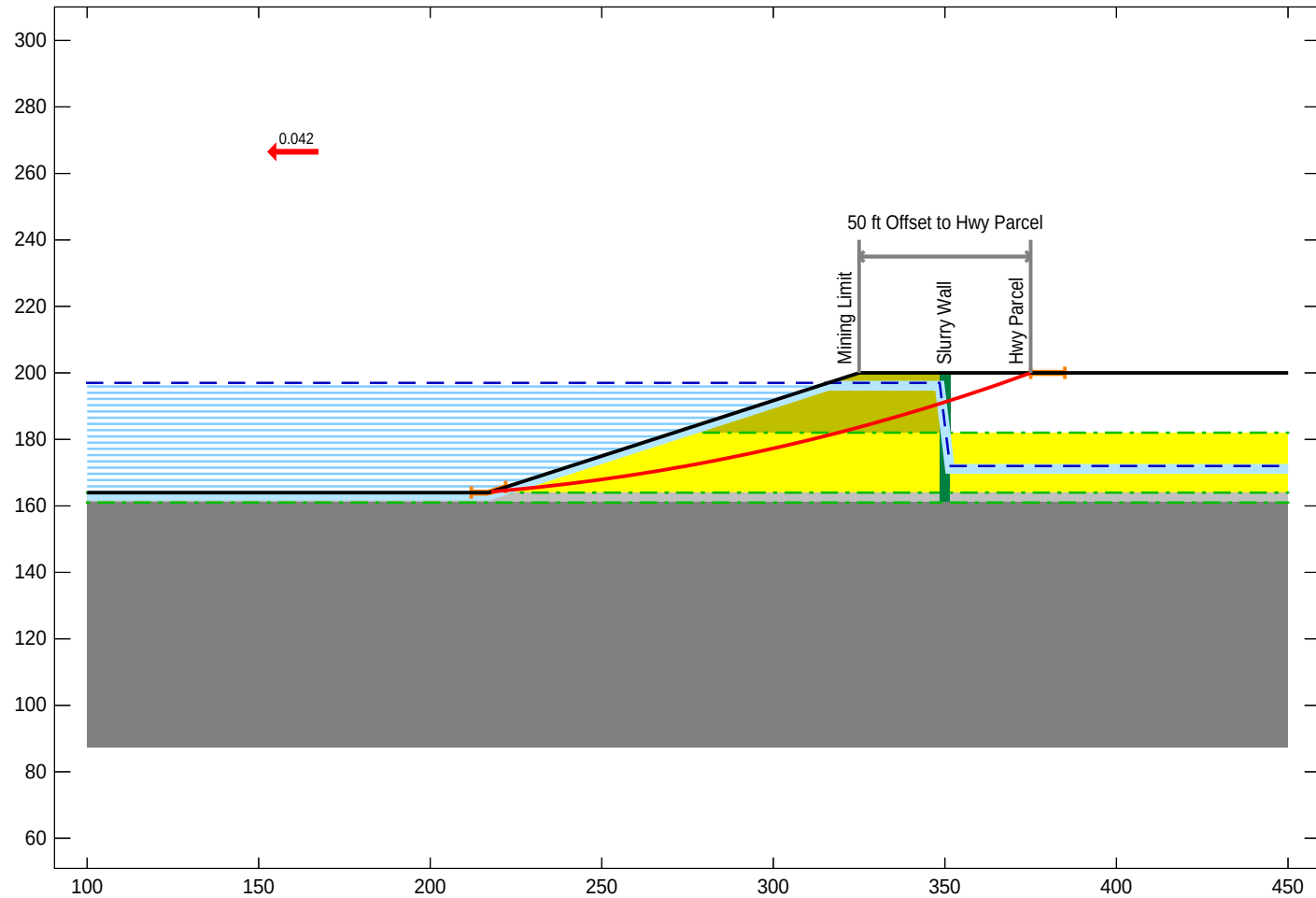
Critical Factor of Safety: 1.77

Project West Farm Pit Expansion
Case 8-3 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 8-3\West Farm Expansion Case 8-3 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

1: Overburden

2: Sand and Gravel

3: Weathered Bedrock

4: Stable Bedrock

5: Slurry Wall

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

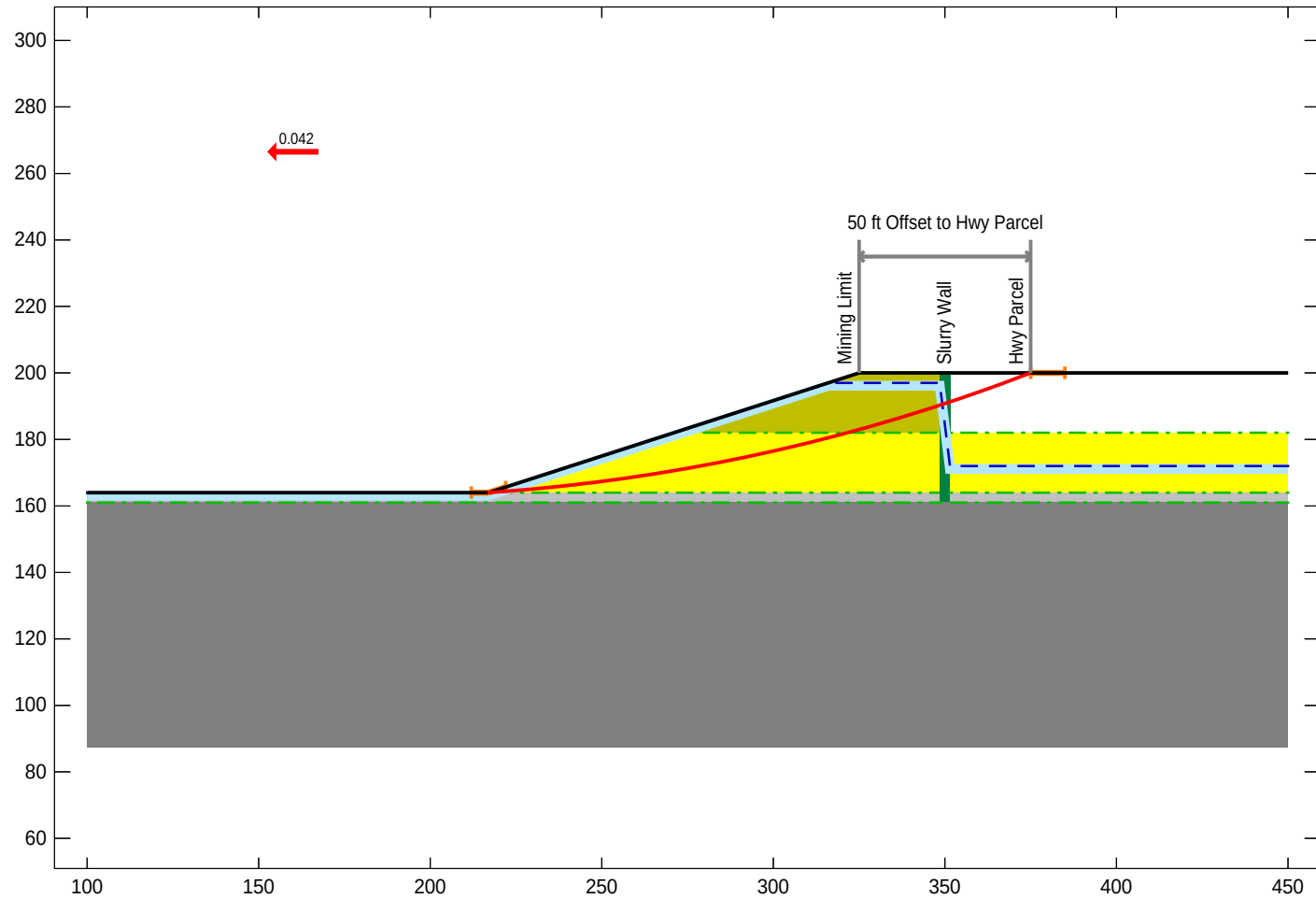
Critical Factor of Safety: 2.14

Project West Farm Pit Expansion
Case 8-4 Full Reservoir - Pseudostatic

File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Full Reservoir-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020





GALENA Version 7.2

Licensed to: J & T Consulting

Material Keys

- 1: Overburden
- 2: Sand and Gravel
- 3: Weathered Bedrock
- 4: Stable Bedrock
- 5: Slurry Wall

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.33

Project West Farm Pit Expansion
Case 8-4 Rapid Drawdown - Pseudostatic

File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Rapid Drawdown-EQ.gmf

Edited: 4 Dec 2020
Processed: 4 Dec 2020



APPENDIX C

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 3-1\West Farm Expansion Case 3-1 Full Reservoir.gmf

Processed: 04 Dec 2020 12:23:00

DATA: Analysis 1 - Case 3-1 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    184.00      348.50    184.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    140.00      348.50    140.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    137.00      348.50    137.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    184.00      450.00    184.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    140.00      450.00    140.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    137.00      450.00    137.00

```

Slope Surface (8 points)

```

-----
100.00    140.00      145.00    140.00      325.00    200.00      410.00    200.00
415.00    195.00
420.00    195.00      425.00    200.00      450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00      145.00    197.00      316.00    197.00      348.50    197.00
351.50    175.00
450.00    175.00

```

Failure Surface

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

```

Intersects: XL: 145.00    YL: 140.00    XR: 415.00    YR: 195.00
Centre: XC: 238.36    YC: 371.91    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 3-1 Full Reservoir

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.891 Final Angle of Interslice Forces (Theta): 10.1 degrees

Analysis Summary

There were: 19859 successful analyses from a total of 20001 trial failure surfaces (Theta filter applied)
127 analyses that failed to produce a valid result
15 analyses rejected due to Theta being outside valid range

Critical (minimum) Factor of Safety: 3.47 degrees Final Angle of Interslice Forces: 11.6 degrees

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	Theta
1	150.00	141.67	410.00	200.00	209.15	486.63	350.00	3.471	11.6
<-- Critical Surface									
2	149.47	141.49	410.00	200.00	208.84	486.42	350.00	3.573	11.6
3	150.00	141.67	410.00	200.00	210.11	482.32	345.92	3.580	11.6
4	150.00	141.67	410.53	199.47	210.17	486.46	350.00	3.582	11.5
5	148.95	141.32	410.00	200.00	208.54	486.21	350.00	3.676	11.5
6	149.47	141.49	410.00	200.00	209.81	482.11	345.92	3.684	11.5
7	149.47	141.49	410.53	199.47	209.87	486.24	350.00	3.686	11.5
8	150.00	141.67	411.05	198.95	211.20	486.28	350.00	3.690	11.4
9	150.00	141.67	410.53	199.47	211.13	482.14	345.92	3.695	11.5
10	150.00	141.67	410.00	200.00	211.08	478.00	341.84	3.696	11.5
11	148.95	141.32	410.00	200.00	209.51	481.89	345.92	3.766	11.5
12	149.47	141.49	410.53	199.47	210.83	481.93	345.92	3.768	11.4
13	148.95	141.32	410.53	199.47	209.56	486.03	350.00	3.776	11.5
14	149.47	141.49	410.00	200.00	210.78	477.79	341.84	3.777	11.5
15	148.42	141.14	410.00	200.00	208.24	485.99	350.00	3.777	11.5
16	149.47	141.49	411.05	198.95	210.89	486.06	350.00	3.780	11.4
17	150.00	141.67	411.58	198.42	212.22	486.09	350.00	3.783	11.3
18	150.00	141.67	410.53	199.47	212.09	477.82	341.84	3.785	11.5
19	150.00	141.67	410.00	200.00	212.06	473.67	337.76	3.788	11.5
20	150.00	141.67	411.05	198.95	212.14	481.96	345.92	3.791	11.4
21	148.42	141.14	410.00	200.00	209.21	481.68	345.92	3.846	11.4
22	148.95	141.32	410.00	200.00	210.48	477.57	341.84	3.846	11.4
23	148.42	141.14	410.53	199.47	209.26	485.81	350.00	3.848	11.4
24	147.89	140.96	410.00	200.00	207.93	485.78	350.00	3.850	11.4
25	148.95	141.32	410.53	199.47	210.52	481.71	345.92	3.854	11.4
26	149.47	141.49	410.00	200.00	211.75	473.45	337.76	3.856	11.5
27	150.00	141.67	410.53	199.47	213.05	473.48	337.76	3.857	11.4
28	149.47	141.49	410.53	199.47	211.79	477.60	341.84	3.860	11.4
29	148.95	141.32	411.05	198.95	210.58	485.85	350.00	3.861	11.3
30	150.00	141.67	410.00	200.00	213.03	469.33	333.67	3.863	11.5
31	150.00	141.67	411.05	198.95	213.09	477.63	341.84	3.863	11.4
32	149.47	141.49	411.05	198.95	211.84	481.74	345.92	3.866	11.4
33	150.00	141.67	411.58	198.42	213.15	481.77	345.92	3.868	11.3
34	149.47	141.49	411.58	198.42	211.91	485.88	350.00	3.872	11.3
35	150.00	141.67	412.11	197.89	213.24	485.91	350.00	3.877	11.2
36	148.42	141.14	410.53	199.47	210.22	481.49	345.92	3.914	11.4
37	148.42	141.14	410.00	200.00	210.18	477.35	341.84	3.914	11.4
38	148.95	141.32	410.00	200.00	211.45	473.24	337.76	3.917	11.4
39	147.37	140.79	410.00	200.00	207.63	485.56	350.00	3.918	11.3
40	147.89	140.96	410.53	199.47	208.95	485.60	350.00	3.921	11.3
41	148.95	141.32	410.53	199.47	211.48	477.38	341.84	3.923	11.4
42	149.47	141.49	410.53	199.47	212.75	473.27	337.76	3.925	11.4
43	149.47	141.49	410.00	200.00	212.73	469.11	333.67	3.930	11.4
44	150.00	141.67	410.53	199.47	214.01	469.14	333.67	3.931	11.4
45	148.95	141.32	411.05	198.95	211.53	481.53	345.92	3.931	11.3
46	147.89	140.96	410.00	200.00	208.90	481.46	345.92	3.931	11.4
47	149.47	141.49	411.05	198.95	212.79	477.41	341.84	3.932	11.3
48	148.42	141.14	411.05	198.95	210.27	485.63	350.00	3.932	11.3
49	150.00	141.67	411.05	198.95	214.04	473.29	337.76	3.936	11.3
50	150.00	141.67	410.00	200.00	214.00	464.98	329.59	3.937	11.4
51	148.95	141.32	411.58	198.42	211.60	485.66	350.00	3.938	11.2
52	149.47	141.49	411.58	198.42	212.85	481.56	345.92	3.938	11.3
53	150.00	141.67	411.58	198.42	214.09	477.44	341.84	3.941	11.3
54	149.47	141.49	412.11	197.89	212.92	485.69	350.00	3.946	11.2
55	150.00	141.67	412.11	197.89	214.16	481.58	345.92	3.950	11.2
56	150.00	141.67	412.63	197.37	214.25	485.72	350.00	3.961	11.1
57	146.84	140.61	410.00	200.00	207.33	485.35	350.00	3.971	11.3
58	147.37	140.79	410.00	200.00	208.60	481.24	345.92	3.972	11.3
59	147.89	140.96	410.00	200.00	209.88	477.14	341.84	3.976	11.4
60	147.37	140.79	410.53	199.47	208.65	485.38	350.00	3.977	11.3
61	147.89	140.96	410.53	199.47	209.91	481.28	345.92	3.979	11.3

62	148.42	141.14	410.00	200.00	211.15	473.02	337.76	3.982	11.4
63	148.95	141.32	410.53	199.47	212.45	473.05	337.76	3.992	11.4
64	148.95	141.32	410.00	200.00	212.43	468.89	333.67	3.996	11.4
65	148.42	141.14	410.53	199.47	211.18	477.17	341.84	3.996	11.3
66	149.47	141.49	410.53	199.47	213.71	468.92	333.67	3.997	11.4
67	148.95	141.32	411.05	198.95	212.48	477.20	341.84	4.000	11.3
68	147.89	140.96	411.05	198.95	209.97	485.42	350.00	4.002	11.2
69	149.47	141.49	410.00	200.00	213.71	464.76	329.59	4.003	11.4
70	149.47	141.49	411.05	198.95	213.74	473.08	337.76	4.003	11.3
71	150.00	141.67	410.53	199.47	214.98	464.79	329.59	4.004	11.4
72	148.95	141.32	411.58	198.42	212.54	481.34	345.92	4.007	11.2
73	148.42	141.14	411.58	198.42	211.29	485.45	350.00	4.007	11.2
74	149.47	141.49	411.58	198.42	213.79	477.22	341.84	4.009	11.2
75	150.00	141.67	411.05	198.95	215.00	468.95	333.67	4.010	11.3
76	150.00	141.67	410.00	200.00	214.98	460.62	325.51	4.012	11.4
77	148.95	141.32	412.11	197.89	212.61	485.48	350.00	4.014	11.1
78	148.42	141.14	411.05	198.95	211.23	481.31	345.92	4.014	11.2
79	150.00	141.67	411.58	198.42	215.04	473.10	337.76	4.015	11.2
80	149.47	141.49	412.11	197.89	213.85	481.37	345.92	4.017	11.2
81	150.00	141.67	412.11	197.89	215.09	477.25	341.84	4.022	11.2
82	146.32	140.44	410.00	200.00	207.02	485.13	350.00	4.024	11.3
83	146.84	140.61	410.00	200.00	208.30	481.03	345.92	4.025	11.3
84	147.37	140.79	410.00	200.00	209.58	476.92	341.84	4.028	11.3
85	149.47	141.49	412.63	197.37	213.94	485.50	350.00	4.029	11.1
86	146.84	140.61	410.53	199.47	208.34	485.17	350.00	4.029	11.3
87	147.37	140.79	410.53	199.47	209.61	481.06	345.92	4.031	11.3
88	147.89	140.96	410.00	200.00	210.86	472.80	337.76	4.033	11.3
89	150.00	141.67	412.63	197.37	215.17	481.39	345.92	4.033	11.1
90	147.89	140.96	410.53	199.47	210.88	476.95	341.84	4.036	11.3
91	148.42	141.14	410.00	200.00	212.13	468.67	333.67	4.041	11.4
92	150.00	141.67	413.16	196.84	215.27	485.53	350.00	4.047	11.0
93	148.42	141.14	410.53	199.47	212.15	472.83	337.76	4.051	11.3
94	147.37	140.79	411.05	198.95	209.66	485.20	350.00	4.052	11.2
95	147.89	140.96	411.05	198.95	210.92	481.09	345.92	4.058	11.2
96	148.95	141.32	410.00	200.00	213.41	464.54	329.59	4.058	11.4
97	148.95	141.32	410.53	199.47	213.41	468.70	333.67	4.059	11.4
98	149.47	141.49	410.53	199.47	214.68	464.57	329.59	4.060	11.3
99	148.42	141.14	411.05	198.95	212.18	476.98	341.84	4.063	11.2

Critical Failure Surface (circle 1)

Intersects:	XL:	150.00	YL:	141.67	XR:	410.00	YR:	200.00	
Centre:	XC:	209.15	YC:	486.63			Radius:	R:	350.00
Generated failure surface: (20 points)									
150.00	141.67	164.23	139.53	178.53	137.97	192.88	137.01		
207.26	136.64								
221.65	136.86	236.01	137.67	250.33	139.06	264.58	141.05		
278.73	143.62								
292.77	146.77	306.67	150.49	320.40	154.78	333.94	159.64		
347.27	165.04								
360.37	170.99	373.22	177.47	385.78	184.47	398.05	191.99		
410.00	200.00								

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

Slice	X-S		Base							PoreWater
--- Left Hand Side ---										
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Side Force	l/h	l'/h								
1	150.00	7.43	-8.6	5.54	5.60	2	0.00	35.0	973.02	19495.48
0.00	0.00	0.00								
2	155.54	22.28	-8.6	5.54	5.60	2	0.00	35.0	2919.06	19786.90
204.11	0.37	0.33								
3	161.08	19.24	-8.6	3.14	3.18	3	100.00	18.0	2527.80	11351.65
816.43	0.28	0.33								
4	164.23	60.51	-6.2	7.15	7.19	3	100.00	18.0	7988.23	25970.75
1270.72	0.27	0.33								
5	171.38	83.11	-6.2	7.15	7.19	3	100.00	18.0	11004.08	26319.23
2412.03	0.27	0.33								
6	178.53	105.06	-3.8	7.18	7.19	3	100.00	18.0	13925.87	26601.95
3902.84	0.26	0.33								
7	185.71	125.69	-3.8	7.18	7.19	3	100.00	18.0	16662.71	26818.19
5382.64	0.26	0.33								
8	192.88	145.55	-1.5	7.19	7.19	4	2000.00	20.0	19289.14	26968.17
7110.08	0.26	0.33								
9	200.07	164.13	-1.5	7.19	7.19	4	2000.00	20.0	21736.16	27051.94
12877.47	0.19	0.33								
10	207.26	181.68	0.9	7.19	7.19	4	2000.00	20.0	24038.50	27068.96
18822.10	0.17	0.33								
11	214.46	198.14	0.9	7.19	7.19	4	2000.00	20.0	26186.69	27020.03
24310.48	0.17	0.33								
12	221.65	74.22	3.2	2.56	2.56	4	2000.00	20.0	9801.83	9593.58
29903.32	0.17	0.33								

13	224.20	178.42	3.2	5.90	5.91	3	100.00	18.0	23540.01	22078.80
31675.07	0.17	0.33								
14	230.11	188.07	3.2	5.90	5.91	3	100.00	18.0	24785.29	21956.06
32323.35	0.18	0.33								
15	236.01	239.94	5.6	7.16	7.19	3	100.00	18.0	31574.48	26475.69
32996.17	0.20	0.33								
16	243.17	252.02	5.6	7.16	7.19	3	100.00	18.0	33106.47	26161.74
33138.68	0.21	0.33								
17	250.33	246.42	7.9	6.71	6.78	3	100.00	18.0	32312.57	24312.66
33278.00	0.22	0.33								
18	257.05	286.87	7.9	7.53	7.61	2	0.00	35.0	37580.42	26805.45
32701.57	0.23	0.33								
19	264.58	243.95	10.3	6.21	6.31	2	0.00	35.0	31957.90	21814.91
33936.59	0.22	0.33								
20	270.79	249.81	10.3	6.21	6.31	2	0.00	35.0	32724.78	21370.80
34271.58	0.22	0.33								
21	277.00	70.78	10.3	1.73	1.76	2	0.00	35.0	9272.79	5886.85
34614.61	0.22	0.33								
22	278.73	290.16	12.6	7.02	7.19	2	0.00	35.0	38010.50	23606.50
34711.79	0.22	0.33								
23	285.75	295.52	12.6	7.02	7.19	2	0.00	35.0	38713.56	22899.59
34275.25	0.21	0.33								
24	292.77	296.78	15.0	6.95	7.19	2	0.00	35.0	38878.67	22128.33
33830.62	0.21	0.33								
25	299.72	299.94	15.0	6.95	7.19	2	0.00	35.0	39292.07	21292.65
32542.71	0.20	0.33								
26	306.67	202.73	17.4	4.67	4.89	2	0.00	35.0	26557.53	13965.53
31241.12	0.20	0.33								
27	311.33	203.18	17.4	4.67	4.89	2	0.00	35.0	26616.86	13520.61
29793.29	0.20	0.33								
28	316.00	191.93	17.4	4.40	4.61	2	0.00	35.0	25142.83	12336.92
28342.23	0.19	0.33								
29	320.40	200.74	19.7	4.60	4.89	2	0.00	35.0	26296.94	12624.72
26950.58	0.19	0.33								
30	325.00	191.20	19.7	4.47	4.75	2	0.00	35.0	25047.47	11784.59
24866.21	0.19	0.33								
31	329.47	184.04	19.7	4.47	4.75	2	0.00	35.0	24109.33	11309.89
22848.12	0.20	0.33								
32	333.94	260.07	22.1	6.67	7.19	2	0.00	35.0	34068.55	16164.19
20901.12	0.21	0.33								
33	340.61	242.05	22.1	6.67	7.19	2	0.00	35.0	31708.66	14951.24
17370.59	0.23	0.33								
34	347.27	42.51	24.4	1.23	1.35	2	0.00	35.0	5568.55	2661.15
14068.62	0.26	0.33								
35	348.50	101.16	24.4	3.00	3.29	5	0.00	45.0	11127.93	4054.54
13360.15	0.27	0.33								
36	351.50	142.12	24.4	4.44	4.87	2	0.00	35.0	18617.37	2138.27
13205.87	0.27	0.33								
37	355.94	133.18	24.4	4.44	4.87	2	0.00	35.0	17446.50	1525.74
12146.56	0.27	0.33								
38	360.37	214.64	26.8	7.95	8.90	2	0.00	35.0	28117.44	1114.02
11225.36	0.27	0.33								
39	368.32	116.35	26.8	4.90	5.48	2	0.00	35.0	15241.26	0.00
9342.50	0.28	0.33								
40	373.22	122.41	29.1	5.86	6.71	2	0.00	35.0	16036.07	0.00
8387.96	0.27	0.27								
41	379.07	103.29	29.1	5.86	6.71	2	0.00	35.0	13530.70	0.00
6971.22	0.26	0.26								
42	384.93	92.08	31.2	6.56	7.67	1	150.00	22.0	12062.60	0.00
5684.33	0.25	0.25								
43	391.49	65.73	31.5	6.56	7.69	1	150.00	22.0	8610.42	0.00
3432.75	0.26	0.26								
44	398.05	35.90	33.8	5.97	7.19	1	150.00	22.0	4702.75	0.00
1695.99	0.27	0.27								
45	404.03	11.97	33.8	5.97	7.19	1	150.00	22.0	1567.59	0.00
479.20	0.35	0.35								
RHS	410.00	-----		-----					-----	
55.89	0.00	0.00								
X-S Area:		7183.01	Path Length:		273.34	X-S Weight:		940979.94		

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 3-1\West Farm Expansion Case 3-1 Rapid Drawdown.gmf

Processed: 04 Dec 2020 11:59:36

DATA: Analysis 1 - Case 3-1 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    184.00        348.50    184.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    140.00        348.50    140.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    137.00        348.50    137.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    184.00        450.00    184.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    140.00        450.00    140.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    137.00        450.00    137.00

```

Slope Surface (8 points)

```

-----
100.00    140.00        145.00    140.00        325.00    200.00        410.00    200.00
415.00    195.00
420.00    195.00        425.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    140.00        145.00    140.00        316.00    197.00        348.50    197.00
351.50    175.00
450.00    175.00

```

Failure Surface

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

```

Intersects: XL: 145.00    YL: 140.00    XR: 415.00    YR: 195.00
Centre: XC: 238.36    YC: 371.91    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 3-1 Rapid Drawdown

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.633 Final Angle of Interslice Forces (Theta): 10.2 degrees

Analysis Summary

There were: 18665 successful analyses from a total of 20001 trial failure surfaces (Theta filter applied)
9 analyses that failed to produce a valid result
1327 analyses rejected due to Theta being outside valid range

Critical (minimum) Factor of Safety: 1.85 Final Angle of Interslice Forces: 11.0 degrees

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	Theta
1	150.00	141.67	410.00	200.00	209.15	486.63	350.00	1.853	11.0
<-- Critical Surface									
2	149.47	141.49	410.00	200.00	208.84	486.42	350.00	1.910	11.0
3	150.00	141.67	410.00	200.00	210.11	482.32	345.92	1.914	11.0
4	150.00	141.67	410.53	199.47	210.17	486.46	350.00	1.915	10.9
5	148.95	141.32	410.00	200.00	208.54	486.21	350.00	1.968	11.0
6	149.47	141.49	410.00	200.00	209.81	482.11	345.92	1.973	11.0
7	149.47	141.49	410.53	199.47	209.87	486.24	350.00	1.973	10.9
8	150.00	141.67	411.05	198.95	211.20	486.28	350.00	1.976	10.9
9	150.00	141.67	410.53	199.47	211.13	482.14	345.92	1.979	10.9
10	150.00	141.67	410.00	200.00	211.08	478.00	341.84	1.980	11.0
11	148.95	141.32	410.00	200.00	209.51	481.89	345.92	2.020	10.9
12	149.47	141.49	410.53	199.47	210.83	481.93	345.92	2.020	10.9
13	149.47	141.49	410.00	200.00	210.78	477.79	341.84	2.026	11.0
14	148.42	141.14	410.00	200.00	208.24	485.99	350.00	2.026	10.9
15	149.47	141.49	411.05	198.95	210.89	486.06	350.00	2.026	10.9
16	148.95	141.32	410.53	199.47	209.56	486.03	350.00	2.027	10.9
17	150.00	141.67	411.58	198.42	212.22	486.09	350.00	2.029	10.8
18	150.00	141.67	410.00	200.00	212.06	473.67	337.76	2.029	11.0
19	150.00	141.67	410.53	199.47	212.09	477.82	341.84	2.030	10.9
20	150.00	141.67	411.05	198.95	212.14	481.96	345.92	2.033	10.9
21	148.42	141.14	410.00	200.00	209.21	481.68	345.92	2.064	10.9
22	148.95	141.32	410.00	200.00	210.48	477.57	341.84	2.065	10.9
23	147.89	140.96	410.00	200.00	207.93	485.78	350.00	2.067	10.9
24	148.42	141.14	410.53	199.47	209.26	485.81	350.00	2.067	10.9
25	148.95	141.32	410.53	199.47	210.52	481.71	345.92	2.068	10.9
26	149.47	141.49	410.00	200.00	211.75	473.45	337.76	2.070	11.0
27	150.00	141.67	410.53	199.47	213.05	473.48	337.76	2.071	10.9
28	149.47	141.49	410.53	199.47	211.79	477.60	341.84	2.071	10.9
29	150.00	141.67	410.00	200.00	213.03	469.33	333.67	2.072	11.0
30	148.95	141.32	411.05	198.95	210.58	485.85	350.00	2.072	10.8
31	150.00	141.67	411.05	198.95	213.09	477.63	341.84	2.074	10.9
32	149.47	141.49	411.05	198.95	211.84	481.74	345.92	2.075	10.9
33	150.00	141.67	411.58	198.42	213.15	481.77	345.92	2.077	10.8
34	149.47	141.49	411.58	198.42	211.91	485.88	350.00	2.078	10.8
35	150.00	141.67	412.11	197.89	213.24	485.91	350.00	2.081	10.8
36	148.42	141.14	410.00	200.00	210.18	477.35	341.84	2.103	10.9
37	148.95	141.32	410.00	200.00	211.45	473.24	337.76	2.104	10.9
38	147.37	140.79	410.00	200.00	207.63	485.56	350.00	2.105	10.8
39	148.42	141.14	410.53	199.47	210.22	481.49	345.92	2.105	10.9
40	148.95	141.32	410.53	199.47	211.48	477.38	341.84	2.107	10.9
41	147.89	140.96	410.53	199.47	208.95	485.60	350.00	2.108	10.8
42	149.47	141.49	410.53	199.47	212.75	473.27	337.76	2.109	10.9
43	149.47	141.49	410.00	200.00	212.73	469.11	333.67	2.109	10.9
44	148.95	141.32	411.05	198.95	211.53	481.53	345.92	2.111	10.8
45	148.42	141.14	411.05	198.95	210.27	485.63	350.00	2.111	10.8
46	147.89	140.96	410.00	200.00	208.90	481.46	345.92	2.113	10.9
47	149.47	141.49	411.05	198.95	212.79	477.41	341.84	2.113	10.8
48	150.00	141.67	410.53	199.47	214.01	469.14	333.67	2.113	10.9
49	150.00	141.67	410.00	200.00	214.00	464.98	329.59	2.114	11.0
50	148.95	141.32	411.58	198.42	211.60	485.66	350.00	2.115	10.8
51	150.00	141.67	411.05	198.95	214.04	473.29	337.76	2.116	10.9
52	149.47	141.49	411.58	198.42	212.85	481.56	345.92	2.116	10.8
53	150.00	141.67	411.58	198.42	214.09	477.44	341.84	2.118	10.8
54	149.47	141.49	412.11	197.89	212.92	485.69	350.00	2.120	10.7
55	150.00	141.67	412.11	197.89	214.16	481.58	345.92	2.122	10.8
56	150.00	141.67	412.63	197.37	214.25	485.72	350.00	2.128	10.7
57	146.84	140.61	410.00	200.00	207.33	485.35	350.00	2.135	10.8
58	147.37	140.79	410.00	200.00	208.60	481.24	345.92	2.135	10.9
59	147.89	140.96	410.00	200.00	209.88	477.14	341.84	2.138	10.9
60	147.37	140.79	410.53	199.47	208.65	485.38	350.00	2.140	10.8
61	148.42	141.14	410.00	200.00	211.15	473.02	337.76	2.141	10.9

62	147.89	140.96	410.53	199.47	209.91	481.28	345.92	2.141	10.8
63	148.95	141.32	410.53	199.47	212.45	473.05	337.76	2.146	10.9
64	148.42	141.14	410.53	199.47	211.18	477.17	341.84	2.148	10.8
65	148.95	141.32	410.00	200.00	212.43	468.89	333.67	2.149	10.9
66	149.47	141.49	410.53	199.47	213.71	468.92	333.67	2.150	10.9
67	147.89	140.96	411.05	198.95	209.97	485.42	350.00	2.150	10.8
68	149.47	141.49	410.00	200.00	213.71	464.76	329.59	2.150	11.0
69	148.95	141.32	411.05	198.95	212.48	477.20	341.84	2.150	10.8
70	149.47	141.49	411.05	198.95	213.74	473.08	337.76	2.153	10.8
71	148.42	141.14	411.58	198.42	211.29	485.45	350.00	2.154	10.7
72	148.95	141.32	411.58	198.42	212.54	481.34	345.92	2.154	10.8
73	150.00	141.67	410.53	199.47	214.98	464.79	329.59	2.155	10.9
74	149.47	141.49	411.58	198.42	213.79	477.22	341.84	2.156	10.8
75	150.00	141.67	410.00	200.00	214.98	460.62	325.51	2.156	11.0
76	150.00	141.67	411.05	198.95	215.00	468.95	333.67	2.157	10.9
77	148.42	141.14	411.05	198.95	211.23	481.31	345.92	2.158	10.8
78	148.95	141.32	412.11	197.89	212.61	485.48	350.00	2.158	10.7
79	150.00	141.67	411.58	198.42	215.04	473.10	337.76	2.159	10.8
80	149.47	141.49	412.11	197.89	213.85	481.37	345.92	2.160	10.7
81	150.00	141.67	412.11	197.89	215.09	477.25	341.84	2.163	10.8
82	146.32	140.44	410.00	200.00	207.02	485.13	350.00	2.164	10.8
83	146.84	140.61	410.00	200.00	208.30	481.03	345.92	2.165	10.8
84	149.47	141.49	412.63	197.37	213.94	485.50	350.00	2.166	10.7
85	147.37	140.79	410.00	200.00	209.58	476.92	341.84	2.167	10.9
86	150.00	141.67	412.63	197.37	215.17	481.39	345.92	2.168	10.7
87	146.84	140.61	410.53	199.47	208.34	485.17	350.00	2.169	10.8
88	147.89	140.96	410.00	200.00	210.86	472.80	337.76	2.170	10.9
89	147.37	140.79	410.53	199.47	209.61	481.06	345.92	2.170	10.8
90	147.89	140.96	410.53	199.47	210.88	476.95	341.84	2.173	10.8
91	150.00	141.67	413.16	196.84	215.27	485.53	350.00	2.175	10.6
92	148.42	141.14	410.00	200.00	212.13	468.67	333.67	2.175	10.9
93	148.42	141.14	410.53	199.47	212.15	472.83	337.76	2.179	10.9
94	147.37	140.79	411.05	198.95	209.66	485.20	350.00	2.179	10.8
95	148.95	141.32	410.00	200.00	213.41	464.54	329.59	2.181	10.9
96	147.89	140.96	411.05	198.95	210.92	481.09	345.92	2.182	10.8
97	148.95	141.32	410.53	199.47	213.41	468.70	333.67	2.184	10.9
98	149.47	141.49	410.00	200.00	214.69	460.40	325.51	2.185	11.0
99	148.42	141.14	411.05	198.95	212.18	476.98	341.84	2.185	10.8

Critical Failure Surface (circle 1)

Intersects: XL:	150.00	YL:	141.67	XR:	410.00	YR:	200.00		
Centre: XC:	209.15	YC:	486.63			Radius: R:	350.00		
Generated failure surface: (20 points)									
150.00	141.67	164.23	139.53	178.53	137.97	192.88	137.01		
207.26	136.64								
221.65	136.86	236.01	137.67	250.33	139.06	264.58	141.05		
278.73	143.62								
292.77	146.77	306.67	150.49	320.40	154.78	333.94	159.64		
347.27	165.04								
360.37	170.99	373.22	177.47	385.78	184.47	398.05	191.99		
410.00	200.00								

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

Slice	X-S		Base							PoreWater
--- Left Hand Side ---										
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Side Force	l/h	l'/h								
1	150.00	7.43	-8.6	5.54	5.60	2	0.00	35.0	973.02	468.70
0.00	0.00	0.00								
2	155.54	22.28	-8.6	5.54	5.60	2	0.00	35.0	2919.06	1406.08
381.38	0.36	0.33								
3	161.08	19.24	-8.6	3.14	3.18	3	100.00	18.0	2527.80	1214.04
1525.53	0.27	0.33								
4	164.23	60.51	-6.2	7.15	7.19	3	100.00	18.0	7988.23	3797.95
2339.38	0.27	0.33								
5	171.38	83.11	-6.2	7.15	7.19	3	100.00	18.0	11004.08	5216.34
4396.49	0.26	0.33								
6	178.53	105.06	-3.8	7.18	7.19	3	100.00	18.0	13925.87	6570.67
7080.19	0.26	0.33								
7	185.71	125.69	-3.8	7.18	7.19	3	100.00	18.0	16662.71	7860.75
9781.69	0.25	0.33								
8	192.88	145.55	-1.5	7.19	7.19	4	2000.00	20.0	19289.14	9085.58
12940.89	0.25	0.33								
9	200.07	164.13	-1.5	7.19	7.19	4	2000.00	20.0	21736.16	10245.19
23883.54	0.18	0.33								
10	207.26	181.68	0.9	7.19	7.19	4	2000.00	20.0	24038.50	11338.39
35162.64	0.16	0.33								
11	214.46	198.14	0.9	7.19	7.19	4	2000.00	20.0	26186.69	12365.50
45621.41	0.16	0.33								
12	221.65	74.22	3.2	2.56	2.56	4	2000.00	20.0	9801.83	4638.92
56277.05	0.16	0.33								

13	224.20	178.42	3.2	5.90	5.91	3	100.00	18.0	23540.01	11150.91
59665.96	0.16	0.33								
14	230.11	188.07	3.2	5.90	5.91	3	100.00	18.0	24785.29	11754.39
60965.54	0.17	0.33								
15	236.01	239.94	5.6	7.16	7.19	3	100.00	18.0	31574.48	15043.65
62301.58	0.18	0.33								
16	243.17	252.02	5.6	7.16	7.19	3	100.00	18.0	33106.47	15800.83
62663.10	0.19	0.33								
17	250.33	246.42	7.9	6.71	6.78	3	100.00	18.0	32312.57	15525.32
62978.46	0.20	0.33								
18	257.05	286.87	7.9	7.53	7.61	2	0.00	35.0	37580.42	18073.96
61889.77	0.21	0.33								
19	264.58	243.95	10.3	6.21	6.31	2	0.00	35.0	31957.90	15471.55
64066.83	0.20	0.33								
20	270.79	249.81	10.3	6.21	6.31	2	0.00	35.0	32724.78	15842.81
64402.92	0.20	0.33								
21	277.00	70.78	10.3	1.73	1.76	2	0.00	35.0	9272.79	4489.17
64743.05	0.20	0.33								
22	278.73	290.16	12.6	7.02	7.19	2	0.00	35.0	38010.50	18555.86
64839.38	0.20	0.33								
23	285.75	295.52	12.6	7.02	7.19	2	0.00	35.0	38713.56	18899.09
63539.22	0.19	0.33								
24	292.77	296.78	15.0	6.95	7.19	2	0.00	35.0	38878.67	19172.66
62214.98	0.19	0.33								
25	299.72	299.94	15.0	6.95	7.19	2	0.00	35.0	39292.07	19376.53
59174.75	0.18	0.33								
26	306.67	202.73	17.4	4.67	4.89	2	0.00	35.0	26557.53	13253.74
56102.19	0.18	0.33								
27	311.33	203.18	17.4	4.67	4.89	2	0.00	35.0	26616.86	13283.34
52868.44	0.18	0.33								
28	316.00	191.93	17.4	4.40	4.61	2	0.00	35.0	25142.83	12336.92
49627.47	0.17	0.33								
29	320.40	200.74	19.7	4.60	4.89	2	0.00	35.0	26296.94	12624.72
46642.94	0.17	0.33								
30	325.00	191.20	19.7	4.47	4.75	2	0.00	35.0	25047.47	11784.59
42547.72	0.17	0.33								
31	329.47	184.04	19.7	4.47	4.75	2	0.00	35.0	24109.33	11309.89
38733.88	0.18	0.33								
32	333.94	260.07	22.1	6.67	7.19	2	0.00	35.0	34068.55	16164.19
35074.99	0.18	0.33								
33	340.61	242.05	22.1	6.67	7.19	2	0.00	35.0	31708.66	14951.24
28459.33	0.20	0.33								
34	347.27	42.51	24.4	1.23	1.35	2	0.00	35.0	5568.55	2661.15
22335.38	0.23	0.33								
35	348.50	101.16	24.4	3.00	3.29	5	0.00	45.0	11127.93	4054.54
21023.30	0.24	0.33								
36	351.50	142.12	24.4	4.44	4.87	2	0.00	35.0	18617.37	2138.27
19822.17	0.24	0.33								
37	355.94	133.18	24.4	4.44	4.87	2	0.00	35.0	17446.50	1525.74
17845.45	0.24	0.33								
38	360.37	214.64	26.8	7.95	8.90	2	0.00	35.0	28117.44	1114.02
16163.51	0.24	0.33								
39	368.32	116.35	26.8	4.90	5.48	2	0.00	35.0	15241.26	0.00
12786.44	0.25	0.33								
40	373.22	122.41	29.1	5.86	6.71	2	0.00	35.0	16036.07	0.00
11170.23	0.24	0.24								
41	379.07	103.29	29.1	5.86	6.71	2	0.00	35.0	13530.70	0.00
8819.79	0.23	0.23								
42	384.93	92.08	31.2	6.56	7.67	1	150.00	22.0	12062.60	0.00
6836.54	0.21	0.21								
43	391.49	65.73	31.5	6.56	7.69	1	150.00	22.0	8610.42	0.00
3508.58	0.20	0.20								
44	398.05	35.90	33.8	5.97	7.19	1	150.00	22.0	4702.75	0.00
1265.76	0.20	0.20								
45	404.03	11.97	33.8	5.97	7.19	1	150.00	22.0	1567.59	0.00
88.98	0.36	0.36								
RHS	410.00	-----		-----					-----	
82.71	0.00	0.00								
X-S Area:		7183.01	Path Length:		273.34	X-S Weight:		940979.94		

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 3-2\West Farm Expansion Case 3-2 Full Reservoir.gmf

Processed: 04 Dec 2020 12:30:52

DATA: Analysis 1 - Case 3-2 Full Reservoir

Material Properties (5 materials)

```

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

```

Water Properties

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

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Material Profiles (9 profiles)

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-----
Profile: 1 (2 points)  Material beneath: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    178.00      348.50    178.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    135.00      348.50    135.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    132.00      348.50    132.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    178.00      450.00    178.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    135.00      450.00    135.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    132.00      450.00    132.00

```

Slope Surface (4 points)

```

-----
100.00    135.00    130.00    135.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00    130.00    197.00    316.00    197.00    348.50    197.00
351.50    174.00
450.00    174.00

```

Failure Surface

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

```

Intersects: XL: 130.00  YL: 135.00  XR: 405.00  YR: 200.00
Centre: XC: 220.06  YC: 368.22  Radius: R: 250.00

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Variable Restraints

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Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 3-2 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.403

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.82

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	135.00	136.67	400.00	200.00	192.56	481.90	350.00	2.818	
Critical Surface									
2	135.00	136.67	400.53	200.00	192.99	481.83	350.00	2.935	
3	135.00	136.67	401.05	200.00	193.42	481.76	350.00	3.042	
4	134.47	136.49	400.00	200.00	192.27	481.69	350.00	3.118	
5	135.00	136.67	400.00	200.00	193.59	477.59	345.92	3.140	
6	135.00	136.67	401.58	200.00	193.84	481.68	350.00	3.154	
7	134.47	136.49	400.53	200.00	192.70	481.61	350.00	3.165	
8	135.00	136.67	400.53	200.00	194.02	477.51	345.92	3.183	
9	135.00	136.67	402.11	200.00	194.27	481.61	350.00	3.200	
10	134.47	136.49	401.05	200.00	193.12	481.54	350.00	3.208	
11	135.00	136.67	401.05	200.00	194.44	477.44	345.92	3.217	
12	133.95	136.32	400.00	200.00	191.98	481.47	350.00	3.233	
13	134.47	136.49	400.00	200.00	193.30	477.37	345.92	3.238	
14	135.00	136.67	402.63	200.00	194.70	481.54	350.00	3.240	
15	135.00	136.67	400.00	200.00	194.62	473.26	341.84	3.248	
16	134.47	136.49	401.58	200.00	193.55	481.47	350.00	3.250	
17	135.00	136.67	401.58	200.00	194.87	477.36	345.92	3.260	
18	133.95	136.32	400.53	200.00	192.41	481.40	350.00	3.271	
19	134.47	136.49	400.53	200.00	193.73	477.30	345.92	3.278	
20	135.00	136.67	400.53	200.00	195.05	473.19	341.84	3.278	
21	135.00	136.67	403.16	200.00	195.12	481.46	350.00	3.280	
22	134.47	136.49	402.11	200.00	193.98	481.40	350.00	3.294	
23	133.95	136.32	401.05	200.00	192.83	481.33	350.00	3.301	
24	135.00	136.67	402.11	200.00	195.30	477.29	345.92	3.303	
25	134.47	136.49	401.05	200.00	194.15	477.22	345.92	3.309	
26	135.00	136.67	403.68	200.00	195.55	481.39	350.00	3.320	
27	135.00	136.67	401.05	200.00	195.47	473.11	341.84	3.321	
28	133.42	136.14	400.00	200.00	191.69	481.26	350.00	3.327	
29	133.95	136.32	400.00	200.00	193.01	477.15	345.92	3.332	
30	134.47	136.49	402.63	200.00	194.41	481.32	350.00	3.333	
31	134.47	136.49	400.00	200.00	194.33	473.05	341.84	3.340	
32	135.00	136.67	402.63	200.00	195.72	477.21	345.92	3.343	
33	133.95	136.32	401.58	200.00	193.26	481.25	350.00	3.343	
34	134.47	136.49	401.58	200.00	194.58	477.15	345.92	3.352	
35	135.00	136.67	400.00	200.00	195.66	468.93	337.76	3.353	
36	135.00	136.67	404.21	200.00	195.97	481.31	350.00	3.359	
37	133.42	136.14	400.53	200.00	192.11	481.18	350.00	3.365	
38	135.00	136.67	401.58	200.00	195.90	473.03	341.84	3.365	
39	133.95	136.32	400.53	200.00	193.44	477.08	345.92	3.370	
40	134.47	136.49	403.16	200.00	194.83	481.25	350.00	3.372	
41	134.47	136.49	400.53	200.00	194.76	472.97	341.84	3.380	
42	135.00	136.67	403.16	200.00	196.15	477.14	345.92	3.382	
43	135.00	136.67	400.53	200.00	196.08	468.85	337.76	3.384	
44	133.95	136.32	402.11	200.00	193.69	481.18	350.00	3.386	
45	133.42	136.14	401.05	200.00	192.54	481.11	350.00	3.393	
46	134.47	136.49	402.11	200.00	195.01	477.07	345.92	3.395	
47	135.00	136.67	404.74	200.00	196.40	481.24	350.00	3.399	
48	133.95	136.32	401.05	200.00	193.86	477.01	345.92	3.400	
49	135.00	136.67	402.11	200.00	196.32	472.96	341.84	3.407	
50	134.47	136.49	403.68	200.00	195.26	481.17	350.00	3.411	
51	134.47	136.49	401.05	200.00	195.18	472.89	341.84	3.412	
52	132.89	135.96	400.00	200.00	191.40	481.04	350.00	3.420	
53	135.00	136.67	403.68	200.00	196.57	477.06	345.92	3.422	
54	133.42	136.14	400.00	200.00	192.72	476.94	345.92	3.424	
55	133.95	136.32	402.63	200.00	194.11	481.11	350.00	3.425	
56	135.00	136.67	401.05	200.00	196.51	468.77	337.76	3.428	
57	133.95	136.32	400.00	200.00	194.05	472.83	341.84	3.432	
58	134.47	136.49	402.63	200.00	195.43	477.00	345.92	3.434	
59	133.42	136.14	401.58	200.00	192.97	481.04	350.00	3.434	
60	135.00	136.67	405.26	200.00	196.82	481.16	350.00	3.439	
61	133.95	136.32	401.58	200.00	194.29	476.93	345.92	3.442	
62	134.47	136.49	400.00	200.00	195.37	468.71	337.76	3.444	
63	135.00	136.67	402.63	200.00	196.75	472.88	341.84	3.447	
64	134.47	136.49	404.21	200.00	195.68	481.10	350.00	3.450	
65	135.00	136.67	400.00	200.00	196.70	464.59	333.67	3.453	
66	134.47	136.49	401.58	200.00	195.61	472.82	341.84	3.455	
67	132.89	135.96	400.53	200.00	191.82	480.97	350.00	3.457	
68	133.42	136.14	400.53	200.00	193.15	476.86	345.92	3.461	

69	135.00	136.67	404.21	200.00	196.99	476.98	345.92	3.462
70	133.95	136.32	403.16	200.00	194.54	481.03	350.00	3.463
71	134.47	136.49	400.53	200.00	195.80	468.63	337.76	3.468
72	133.95	136.32	400.53	200.00	194.47	472.75	341.84	3.470
73	135.00	136.67	401.58	200.00	196.93	468.70	337.76	3.473
74	134.47	136.49	403.16	200.00	195.85	476.92	345.92	3.473
75	133.42	136.14	402.11	200.00	193.40	480.96	350.00	3.476
76	135.00	136.67	400.53	200.00	197.12	464.51	333.67	3.478
77	135.00	136.67	405.79	200.00	197.25	481.09	350.00	3.478
78	133.95	136.32	402.11	200.00	194.71	476.85	345.92	3.485
79	135.00	136.67	403.16	200.00	197.17	472.80	341.84	3.487
80	135.00	136.67	402.11	200.00	197.35	468.62	337.76	3.488
81	134.47	136.49	404.74	200.00	196.11	481.02	350.00	3.489
82	133.42	136.14	401.05	200.00	193.57	476.79	345.92	3.490
83	132.89	135.96	401.05	200.00	192.25	480.90	350.00	3.494
84	133.95	136.32	401.05	200.00	194.90	472.68	341.84	3.496
85	134.47	136.49	402.11	200.00	196.03	472.74	341.84	3.497
86	133.95	136.32	403.68	200.00	194.96	480.96	350.00	3.502
87	135.00	136.67	404.74	200.00	197.42	476.91	345.92	3.502
88	134.47	136.49	401.05	200.00	196.22	468.55	337.76	3.503
89	135.00	136.67	401.05	200.00	197.54	464.43	333.67	3.509
90	135.00	136.67	403.68	200.00	197.59	472.72	341.84	3.510
91	133.42	136.14	400.00	200.00	193.76	472.61	341.84	3.510
92	134.47	136.49	403.68	200.00	196.28	476.84	345.92	3.512
93	134.47	136.49	402.63	200.00	196.46	472.66	341.84	3.512
94	132.89	135.96	400.00	200.00	192.43	476.72	345.92	3.514
95	133.42	136.14	402.63	200.00	193.82	480.89	350.00	3.515
96	133.95	136.32	400.00	200.00	195.08	468.49	337.76	3.517
97	135.00	136.67	406.32	200.00	197.67	481.01	350.00	3.518
98	134.47	136.49	400.00	200.00	196.41	464.37	333.67	3.521
99	132.37	135.79	400.00	200.00	191.11	480.83	350.00	3.523

Critical Failure Surface (circle 1)

Intersects:	XL:	135.00	YL:	136.67	XR:	400.00	YR:	200.00	
	Centre:	XC:	192.56	YC:	481.90		Radius:	R:	350.00
Generated failure surface: (20 points)									
135.00	136.67		149.58	134.55		164.23	133.05	178.93	132.17
193.66	131.90								
208.38	132.26		223.08	133.23		237.72	134.83	252.28	137.03
266.74	139.85								
281.06	143.28		295.23	147.30		309.22	151.91	322.99	157.11
336.54	162.89								
349.84	169.23		362.85	176.12		375.57	183.56	387.96	191.52
400.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 46 slices)

Slice	X-S		Base						PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	135.00	7.88	-8.3	5.74	5.80	2	0.00	35.0	1032.78	21988.64
3888.54	1.05									
2	140.74	23.65	-8.3	5.74	5.80	2	0.00	35.0	3098.32	22290.28
4136.02	1.05									
3	146.48	19.29	-8.3	3.10	3.13	3	100.00	18.0	2534.55	12143.42
4325.28	1.03									
4	149.58	62.79	-5.8	7.33	7.36	3	100.00	18.0	8285.52	28869.15
4527.25	1.02									
5	156.90	86.17	-5.8	7.33	7.36	3	100.00	18.0	11404.15	29214.04
4803.28	1.02									
6	164.23	108.83	-3.4	7.35	7.36	3	100.00	18.0	14416.55	29488.14
5050.99	1.01									
7	171.58	130.09	-3.4	7.35	7.36	3	100.00	18.0	17233.82	29691.11
5282.75	1.01									
8	178.93	92.92	-1.0	4.66	4.66	3	100.00	18.0	12306.16	18847.86
5449.76	1.00									
9	183.58	100.53	-1.0	4.66	4.66	3	100.00	18.0	13307.16	18872.08
5568.20	1.00									
10	188.24	126.54	-1.0	5.42	5.42	4	2000.00	20.0	16741.32	21986.35
5708.83	1.00									
11	193.66	100.06	1.4	4.01	4.01	4	2000.00	20.0	13230.05	16292.34
5777.57	1.00									
12	197.67	141.30	1.4	5.36	5.36	3	100.00	18.0	18668.02	21707.42
5885.28	1.00									
13	203.02	150.17	1.4	5.36	5.36	3	100.00	18.0	19822.74	21664.12
5989.17	1.00									
14	208.38	219.32	3.8	7.35	7.36	3	100.00	18.0	28914.99	29637.84
6079.12	0.99									
15	215.73	233.74	3.8	7.35	7.36	3	100.00	18.0	30767.44	29413.73
6177.41	0.99									
16	223.08	246.08	6.2	7.32	7.36	3	100.00	18.0	32336.82	29119.15

6241.13	0.99										
17	230.40	258.12	6.2	7.32	7.36	3	100.00	18.0	33855.18	28753.18	
6294.96	0.99										
18	237.72	41.37	8.6	1.14	1.16	3	100.00	18.0	5420.76	4480.43	
6309.29	0.99										
19	238.86	247.55	8.6	6.71	6.79	2	0.00	35.0	32429.22	26038.18	
6276.31	0.97										
20	245.57	255.73	8.6	6.71	6.79	2	0.00	35.0	33501.08	25607.57	
6293.47	0.97										
21	252.28	263.39	11.0	6.72	6.85	2	0.00	35.0	34504.15	25341.48	
6265.31	0.97										
22	259.00	310.91	11.0	7.74	7.88	2	0.00	35.0	40728.71	28475.59	
6242.85	0.97										
23	266.74	294.12	13.4	7.16	7.36	2	0.00	35.0	38529.83	25867.44	
6171.76	0.97										
24	273.90	298.96	13.4	7.16	7.36	2	0.00	35.0	39163.99	25080.95	
6108.70	0.97										
25	281.06	299.33	15.9	7.08	7.36	2	0.00	35.0	39211.62	24225.67	
5997.17	0.97										
26	288.14	301.80	15.9	7.08	7.36	2	0.00	35.0	39536.35	23301.37	
5894.05	0.97										
27	295.23	299.23	18.3	6.99	7.36	2	0.00	35.0	39199.63	22308.78	
5742.23	0.97										
28	302.22	299.40	18.3	6.99	7.36	2	0.00	35.0	39221.07	21248.34	
5599.69	0.97										
29	309.22	289.54	20.7	6.78	7.25	2	0.00	35.0	37930.29	19822.94	
5409.96	0.98										
30	316.00	296.38	20.7	6.99	7.48	2	0.00	35.0	38826.37	19223.55	
5295.20	0.98										
31	322.99	84.46	23.1	2.01	2.18	2	0.00	35.0	11064.48	5366.65	
5225.56	0.98										
32	325.00	235.50	23.1	5.77	6.27	2	0.00	35.0	30850.04	14799.71	
5058.90	0.98										
33	330.77	221.30	23.1	5.77	6.27	2	0.00	35.0	28989.81	13836.47	
4752.78	0.98										
34	336.54	213.33	25.5	5.98	6.62	2	0.00	35.0	27946.20	13508.32	
4395.51	0.99										
35	342.52	196.29	25.5	5.98	6.62	2	0.00	35.0	25713.38	12330.00	
4042.73	0.99										
36	348.50	41.58	25.5	1.34	1.48	5	0.00	45.0	4574.30	2123.32	
3132.19	0.95										
37	349.84	50.42	27.9	1.66	1.88	5	0.00	45.0	5546.33	1256.36	
2914.07	0.95										
38	351.50	205.22	27.9	7.34	8.31	2	0.00	35.0	26884.19	1008.56	
3249.10	1.00										
39	358.84	99.98	27.9	4.01	4.54	2	0.00	35.0	13097.46	0.00	
2886.93	1.00										
40	362.85	73.60	30.3	3.21	3.72	2	0.00	35.0	9641.88	0.00	
2623.63	1.01										
41	366.06	97.95	30.3	4.75	5.51	1	150.00	22.0	12831.62	0.00	
2462.34	1.07										
42	370.81	84.74	30.3	4.75	5.51	1	150.00	22.0	11101.17	0.00	
2126.42	1.07										
43	375.57	89.52	32.7	6.19	7.36	1	150.00	22.0	11726.94	0.00	
1701.93	1.09										
44	381.76	64.85	32.7	6.19	7.36	1	150.00	22.0	8495.58	0.00	
1224.33	1.09										
45	387.96	38.29	35.1	6.02	7.36	1	150.00	22.0	5015.73	0.00	
722.53	1.11										
46	393.98	12.76	35.1	6.02	7.36	1	150.00	22.0	1671.90	0.00	
218.15	1.11										

X-S Area:

7415.01

Path Length:

279.84

X-S Weight:

971309.69

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 3-2\West Farm Expansion Case 3-2 Rapid Drawdown.gmf

Processed: 04 Dec 2020 12:28:45

DATA: Analysis 1 - Case 3-2 Rapid Drawdown

Material Properties (5 materials)

```

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

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-----
Profile: 1 (2 points)  Material beneath: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    178.00      348.50    178.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    135.00      348.50    135.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    132.00      348.50    132.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    178.00      450.00    178.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    135.00      450.00    135.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    132.00      450.00    132.00

```

Slope Surface (4 points)

```

-----
100.00    135.00    130.00    135.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    135.00    130.00    135.00    316.00    197.00    348.50    197.00
351.50    174.00
450.00    174.00

```

Failure Surface

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

```

Intersects: XL: 130.00  YL: 135.00  XR: 405.00  YR: 200.00
Centre: XC: 220.06  YC: 368.22  Radius: R: 250.00

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Variable Restraints

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Parameter descriptor:      XL      XR      R
Range of variation:      10.00   10.00   200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 3-2 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.364

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	135.00	136.67	400.00	200.00	192.56	481.90	350.00	1.473	
Critical Surface									
2	135.00	136.67	400.53	200.00	192.99	481.83	350.00	1.540	
3	135.00	136.67	401.05	200.00	193.42	481.76	350.00	1.604	
4	134.47	136.49	400.00	200.00	192.27	481.69	350.00	1.646	
5	135.00	136.67	400.00	200.00	193.59	477.59	345.92	1.658	
6	135.00	136.67	401.58	200.00	193.84	481.68	350.00	1.668	
7	134.47	136.49	400.53	200.00	192.70	481.61	350.00	1.673	
8	135.00	136.67	400.53	200.00	194.02	477.51	345.92	1.683	
9	135.00	136.67	402.11	200.00	194.27	481.61	350.00	1.694	
10	134.47	136.49	401.05	200.00	193.12	481.54	350.00	1.700	
11	135.00	136.67	401.05	200.00	194.44	477.44	345.92	1.704	
12	133.95	136.32	400.00	200.00	191.98	481.47	350.00	1.711	
13	134.47	136.49	400.00	200.00	193.30	477.37	345.92	1.715	
14	135.00	136.67	402.63	200.00	194.70	481.54	350.00	1.716	
15	135.00	136.67	400.00	200.00	194.62	473.26	341.84	1.720	
16	134.47	136.49	401.58	200.00	193.55	481.47	350.00	1.723	
17	135.00	136.67	401.58	200.00	194.87	477.36	345.92	1.728	
18	133.95	136.32	400.53	200.00	192.41	481.40	350.00	1.734	
19	134.47	136.49	400.53	200.00	193.73	477.30	345.92	1.737	
20	135.00	136.67	403.16	200.00	195.12	481.46	350.00	1.739	
21	135.00	136.67	400.53	200.00	195.05	473.19	341.84	1.740	
22	134.47	136.49	402.11	200.00	193.98	481.40	350.00	1.747	
23	135.00	136.67	402.11	200.00	195.30	477.29	345.92	1.752	
24	133.95	136.32	401.05	200.00	192.83	481.33	350.00	1.753	
25	134.47	136.49	401.05	200.00	194.15	477.22	345.92	1.757	
26	135.00	136.67	403.68	200.00	195.55	481.39	350.00	1.762	
27	135.00	136.67	401.05	200.00	195.47	473.11	341.84	1.764	
28	133.42	136.14	400.00	200.00	191.69	481.26	350.00	1.765	
29	133.95	136.32	400.00	200.00	193.01	477.15	345.92	1.768	
30	134.47	136.49	402.63	200.00	194.41	481.32	350.00	1.770	
31	134.47	136.49	400.00	200.00	194.33	473.05	341.84	1.773	
32	135.00	136.67	402.63	200.00	195.72	477.21	345.92	1.775	
33	133.95	136.32	401.58	200.00	193.26	481.25	350.00	1.776	
34	135.00	136.67	400.00	200.00	195.66	468.93	337.76	1.780	
35	134.47	136.49	401.58	200.00	194.58	477.15	345.92	1.781	
36	135.00	136.67	404.21	200.00	195.97	481.31	350.00	1.785	
37	133.42	136.14	400.53	200.00	192.11	481.18	350.00	1.787	
38	135.00	136.67	401.58	200.00	195.90	473.03	341.84	1.788	
39	133.95	136.32	400.53	200.00	193.44	477.08	345.92	1.790	
40	134.47	136.49	403.16	200.00	194.83	481.25	350.00	1.792	
41	134.47	136.49	400.53	200.00	194.76	472.97	341.84	1.795	
42	135.00	136.67	403.16	200.00	196.15	477.14	345.92	1.798	
43	133.95	136.32	402.11	200.00	193.69	481.18	350.00	1.800	
44	135.00	136.67	400.53	200.00	196.08	468.85	337.76	1.800	
45	134.47	136.49	402.11	200.00	195.01	477.07	345.92	1.805	
46	133.42	136.14	401.05	200.00	192.54	481.11	350.00	1.806	
47	135.00	136.67	404.74	200.00	196.40	481.24	350.00	1.808	
48	133.95	136.32	401.05	200.00	193.86	477.01	345.92	1.809	
49	135.00	136.67	402.11	200.00	196.32	472.96	341.84	1.812	
50	134.47	136.49	403.68	200.00	195.26	481.17	350.00	1.814	
51	134.47	136.49	401.05	200.00	195.18	472.89	341.84	1.816	
52	132.89	135.96	400.00	200.00	191.40	481.04	350.00	1.818	
53	133.42	136.14	400.00	200.00	192.72	476.94	345.92	1.820	
54	135.00	136.67	403.68	200.00	196.57	477.06	345.92	1.821	
55	133.95	136.32	402.63	200.00	194.11	481.11	350.00	1.822	
56	135.00	136.67	401.05	200.00	196.51	468.77	337.76	1.824	
57	133.95	136.32	400.00	200.00	194.05	472.83	341.84	1.825	
58	134.47	136.49	402.63	200.00	195.43	477.00	345.92	1.827	
59	133.42	136.14	401.58	200.00	192.97	481.04	350.00	1.828	
60	135.00	136.67	405.26	200.00	196.82	481.16	350.00	1.830	
61	134.47	136.49	400.00	200.00	195.37	468.71	337.76	1.832	
62	133.95	136.32	401.58	200.00	194.29	476.93	345.92	1.832	
63	135.00	136.67	402.63	200.00	196.75	472.88	341.84	1.834	
64	134.47	136.49	404.21	200.00	195.68	481.10	350.00	1.837	
65	135.00	136.67	400.00	200.00	196.70	464.59	333.67	1.837	
66	132.89	135.96	400.53	200.00	191.82	480.97	350.00	1.839	
67	134.47	136.49	401.58	200.00	195.61	472.82	341.84	1.839	
68	133.42	136.14	400.53	200.00	193.15	476.86	345.92	1.842	

69	135.00	136.67	404.21	200.00	196.99	476.98	345.92	1.844
70	133.95	136.32	403.16	200.00	194.54	481.03	350.00	1.844
71	133.95	136.32	400.53	200.00	194.47	472.75	341.84	1.847
72	134.47	136.49	400.53	200.00	195.80	468.63	337.76	1.848
73	135.00	136.67	401.58	200.00	196.93	468.70	337.76	1.849
74	134.47	136.49	403.16	200.00	195.85	476.92	345.92	1.849
75	133.42	136.14	402.11	200.00	193.40	480.96	350.00	1.851
76	135.00	136.67	405.79	200.00	197.25	481.09	350.00	1.853
77	135.00	136.67	400.53	200.00	197.12	464.51	333.67	1.853
78	133.95	136.32	402.11	200.00	194.71	476.85	345.92	1.856
79	135.00	136.67	402.11	200.00	197.35	468.62	337.76	1.857
80	135.00	136.67	403.16	200.00	197.17	472.80	341.84	1.857
81	134.47	136.49	404.74	200.00	196.11	481.02	350.00	1.859
82	132.89	135.96	401.05	200.00	192.25	480.90	350.00	1.860
83	133.42	136.14	401.05	200.00	193.57	476.79	345.92	1.861
84	134.47	136.49	402.11	200.00	196.03	472.74	341.84	1.863
85	133.95	136.32	401.05	200.00	194.90	472.68	341.84	1.864
86	133.95	136.32	403.68	200.00	194.96	480.96	350.00	1.866
87	135.00	136.67	404.74	200.00	197.42	476.91	345.92	1.866
88	134.47	136.49	401.05	200.00	196.22	468.55	337.76	1.867
89	133.42	136.14	400.00	200.00	193.76	472.61	341.84	1.869
90	135.00	136.67	403.68	200.00	197.59	472.72	341.84	1.870
91	135.00	136.67	401.05	200.00	197.54	464.43	333.67	1.870
92	132.89	135.96	400.00	200.00	192.43	476.72	345.92	1.871
93	134.47	136.49	402.63	200.00	196.46	472.66	341.84	1.871
94	134.47	136.49	403.68	200.00	196.28	476.84	345.92	1.872
95	133.42	136.14	402.63	200.00	193.82	480.89	350.00	1.873
96	133.95	136.32	400.00	200.00	195.08	468.49	337.76	1.873
97	134.47	136.49	400.00	200.00	196.41	464.37	333.67	1.875
98	135.00	136.67	406.32	200.00	197.67	481.01	350.00	1.876
99	132.37	135.79	400.00	200.00	191.11	480.83	350.00	1.876

Critical Failure Surface (circle 1)

Intersects:	XL:	135.00	YL:	136.67	XR:	400.00	YR:	200.00	
	Centre:	XC:	192.56	YC:	481.90		Radius:	R:	350.00
Generated failure surface: (20 points)									
135.00	136.67		149.58	134.55		164.23	133.05	178.93	132.17
193.66	131.90								
208.38	132.26		223.08	133.23		237.72	134.83	252.28	137.03
266.74	139.85								
281.06	143.28		295.23	147.30		309.22	151.91	322.99	157.11
336.54	162.89								
349.84	169.23		362.85	176.12		375.57	183.56	387.96	191.52
400.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 46 slices)

Slice	X-S		Base							PoreWater
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	135.00	7.88	-8.3	5.74	5.80	2	0.00	35.0	1032.78	497.11
186.90	1.09									
2	140.74	23.65	-8.3	5.74	5.80	2	0.00	35.0	3098.32	1491.31
560.70	1.09									
3	146.48	19.29	-8.3	3.10	3.13	3	100.00	18.0	2534.55	1216.61
843.32	1.04									
4	149.58	62.79	-5.8	7.33	7.36	3	100.00	18.0	8285.52	3938.42
1151.91	1.03									
5	156.90	86.17	-5.8	7.33	7.36	3	100.00	18.0	11404.15	5405.38
1582.85	1.03									
6	164.23	108.83	-3.4	7.35	7.36	3	100.00	18.0	14416.55	6803.34
1979.25	1.02									
7	171.58	130.09	-3.4	7.35	7.36	3	100.00	18.0	17233.82	8132.24
2365.22	1.02									
8	178.93	92.92	-1.0	4.66	4.66	3	100.00	18.0	12306.16	5799.05
2650.34	1.00									
9	183.58	100.53	-1.0	4.66	4.66	3	100.00	18.0	13307.16	6274.09
2865.82	1.00									
10	188.24	126.54	-1.0	5.42	5.42	4	2000.00	20.0	16741.32	7897.11
3122.91	1.00									
11	193.66	100.06	1.4	4.01	4.01	4	2000.00	20.0	13230.05	6245.50
3254.08	0.99									
12	197.67	141.30	1.4	5.36	5.36	3	100.00	18.0	18668.02	8819.94
3474.24	0.99									
13	203.02	150.17	1.4	5.36	5.36	3	100.00	18.0	19822.74	9373.44
3689.25	0.99									
14	208.38	219.32	3.8	7.35	7.36	3	100.00	18.0	28914.99	13715.94
3900.76	0.99									
15	215.73	233.74	3.8	7.35	7.36	3	100.00	18.0	30767.44	14617.37
4151.00	0.99									
16	223.08	246.08	6.2	7.32	7.36	3	100.00	18.0	32336.82	15446.05

4355.41	0.98										
17	230.40	258.12	6.2	7.32	7.36	3	100.00	18.0	33855.18	16201.50	
4560.36	0.98										
18	237.72	41.37	8.6	1.14	1.16	3	100.00	18.0	5420.76	2611.11	
4650.53	0.98										
19	238.86	247.55	8.6	6.71	6.79	2	0.00	35.0	32429.22	15623.64	
4663.31	0.94										
20	245.57	255.73	8.6	6.71	6.79	2	0.00	35.0	33501.08	16140.03	
4817.45	0.94										
21	252.28	263.39	11.0	6.72	6.85	2	0.00	35.0	34504.15	16744.89	
4905.99	0.93										
22	259.00	310.91	11.0	7.74	7.88	2	0.00	35.0	40728.71	19765.68	
5031.23	0.93										
23	266.74	294.12	13.4	7.16	7.36	2	0.00	35.0	38529.83	18870.01	
5092.03	0.92										
24	273.90	298.96	13.4	7.16	7.36	2	0.00	35.0	39163.99	19180.58	
5175.81	0.92										
25	281.06	299.33	15.9	7.08	7.36	2	0.00	35.0	39211.62	19416.35	
5190.36	0.92										
26	288.14	301.80	15.9	7.08	7.36	2	0.00	35.0	39536.35	19577.15	
5233.32	0.92										
27	295.23	299.23	18.3	6.99	7.36	2	0.00	35.0	39199.63	19662.73	
5207.28	0.91										
28	302.22	299.40	18.3	6.99	7.36	2	0.00	35.0	39221.07	19673.47	
5210.10	0.91										
29	309.22	289.54	20.7	6.78	7.25	2	0.00	35.0	37930.29	19311.22	
5145.03	0.91										
30	316.00	296.38	20.7	6.99	7.48	2	0.00	35.0	38826.37	19223.55	
5097.39	0.91										
31	322.99	84.46	23.1	2.01	2.18	2	0.00	35.0	11064.48	5366.65	
5003.27	0.90										
32	325.00	235.50	23.1	5.77	6.27	2	0.00	35.0	30850.04	14799.71	
4841.70	0.90										
33	330.77	221.30	23.1	5.77	6.27	2	0.00	35.0	28989.81	13836.47	
4547.85	0.90										
34	336.54	213.33	25.5	5.98	6.62	2	0.00	35.0	27946.20	13508.32	
4187.63	0.90										
35	342.52	196.29	25.5	5.98	6.62	2	0.00	35.0	25713.38	12330.00	
3850.28	0.90										
36	348.50	41.58	25.5	1.34	1.48	5	0.00	45.0	4574.30	2123.32	
2933.75	0.84										
37	349.84	50.42	27.9	1.66	1.88	5	0.00	45.0	5546.33	1256.36	
2630.44	0.83										
38	351.50	205.22	27.9	7.34	8.31	2	0.00	35.0	26884.19	1008.56	
2948.74	0.90										
39	358.84	99.98	27.9	4.01	4.54	2	0.00	35.0	13097.46	0.00	
2609.69	0.90										
40	362.85	73.60	30.3	3.21	3.72	2	0.00	35.0	9641.88	0.00	
2351.15	0.91										
41	366.06	97.95	30.3	4.75	5.51	1	150.00	22.0	12831.62	0.00	
2275.33	1.00										
42	370.81	84.74	30.3	4.75	5.51	1	150.00	22.0	11101.17	0.00	
1961.57	1.00										
43	375.57	89.52	32.7	6.19	7.36	1	150.00	22.0	11726.94	0.00	
1553.58	1.01										
44	381.76	64.85	32.7	6.19	7.36	1	150.00	22.0	8495.58	0.00	
1110.16	1.01										
45	387.96	38.29	35.1	6.02	7.36	1	150.00	22.0	5015.73	0.00	
638.02	1.02										
46	393.98	12.76	35.1	6.02	7.36	1	150.00	22.0	1671.90	0.00	
172.61	1.02										

X-S Area:

7415.01

Path Length:

279.84

X-S Weight:

971309.69

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Full Reservoir.gmf

Processed: 04 Dec 2020 12:35:25

DATA: Analysis 1 - Case 3-3 Full Reservoir

Material Properties (5 materials)

```

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

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-----
Profile: 1 (2 points)   Material beneath: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    183.00        348.50    183.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    144.00        348.50    144.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    141.00        348.50    141.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    183.00        450.00    183.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    144.00        450.00    144.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    141.00        450.00    141.00

```

Slope Surface (4 points)

```

-----
100.00    144.00    157.00    144.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00    157.00    197.00    316.00    197.00    348.50    197.00
351.50    182.00
450.00    182.00

```

Failure Surface

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

```

Intersects: XL: 157.00    YL: 144.00    XR: 395.00    YR: 200.00
Centre: XC: 226.05    YC: 384.27    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 3-3 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.449

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.62

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	155.68	144.00	390.00	200.00	200.51	474.65	333.67	2.623	
Critical Surface									
2	158.32	144.44	390.00	200.00	204.54	462.53	321.43	2.623	
3	162.00	145.67	390.00	200.00	213.78	433.91	292.86	2.623	
4	159.89	144.96	390.00	200.00	208.50	450.30	309.18	2.623	
5	160.42	145.14	390.00	200.00	209.82	446.22	305.10	2.624	
6	161.47	145.49	390.00	200.00	212.46	438.02	296.94	2.624	
7	160.95	145.32	390.00	200.00	211.14	442.12	301.02	2.624	
8	157.79	144.26	390.00	200.00	203.22	466.59	325.51	2.624	
9	158.84	144.61	390.00	200.00	205.86	458.46	317.35	2.625	
10	154.11	144.00	390.00	200.00	199.24	478.73	337.76	2.625	
11	157.26	144.09	390.00	200.00	201.90	470.64	329.59	2.626	
12	156.21	144.00	390.00	200.00	200.60	474.71	333.67	2.626	
13	152.53	144.00	390.00	200.00	197.97	482.80	341.84	2.627	
14	157.79	144.26	390.53	200.00	203.66	466.53	325.51	2.628	
15	161.47	145.49	390.53	200.00	212.89	437.94	296.94	2.628	
16	159.37	144.79	390.53	200.00	207.61	454.32	313.27	2.628	
17	159.89	144.96	390.53	200.00	208.93	450.24	309.18	2.628	
18	160.42	145.14	390.53	200.00	210.25	446.15	305.10	2.628	
19	160.95	145.32	390.53	200.00	211.57	442.05	301.02	2.628	
20	154.63	144.00	390.00	200.00	199.32	478.79	337.76	2.629	
21	159.37	144.79	390.00	200.00	207.18	454.38	313.27	2.629	
22	157.26	144.09	390.53	200.00	202.34	470.58	329.59	2.630	
23	158.32	144.44	390.53	200.00	204.97	462.46	321.43	2.630	
24	156.74	144.00	390.00	200.00	200.68	474.77	333.67	2.630	
25	156.21	144.00	390.53	200.00	201.04	474.65	333.67	2.630	
26	153.05	144.00	390.00	200.00	198.06	482.86	341.84	2.631	
27	155.16	144.00	390.00	200.00	199.41	478.84	337.76	2.632	
28	154.63	144.00	390.53	200.00	199.76	478.73	337.76	2.633	
29	158.32	144.44	391.05	200.00	205.41	462.40	321.43	2.633	
30	158.84	144.61	391.05	200.00	206.73	458.33	317.35	2.633	
31	159.37	144.79	391.05	200.00	208.04	454.25	313.27	2.633	
32	158.84	144.61	390.53	200.00	206.29	458.39	317.35	2.634	
33	156.74	144.00	390.53	200.00	201.12	474.71	333.67	2.634	
34	153.58	144.00	390.00	200.00	198.14	482.92	341.84	2.635	
35	153.05	144.00	390.53	200.00	198.50	482.80	341.84	2.635	
36	160.42	145.14	390.00	200.00	208.79	450.52	309.18	2.636	
37	155.68	144.00	390.00	200.00	199.49	478.90	337.76	2.636	
38	155.16	144.00	390.53	200.00	199.85	478.79	337.76	2.636	
39	159.89	144.96	390.00	200.00	207.47	454.60	313.27	2.637	
40	152.00	144.00	390.00	200.00	196.88	486.99	345.92	2.637	
41	161.47	145.49	390.00	200.00	211.43	442.34	301.02	2.637	
42	159.37	144.79	390.00	200.00	206.15	458.67	317.35	2.637	
43	162.00	145.67	390.00	200.00	212.75	438.24	296.94	2.637	
44	158.84	144.61	390.00	200.00	204.83	462.74	321.43	2.638	
45	158.32	144.44	390.00	200.00	203.51	466.80	325.51	2.638	
46	157.79	144.26	390.00	200.00	202.19	470.85	329.59	2.638	
47	154.11	144.00	390.00	200.00	198.23	482.98	341.84	2.638	
48	156.74	144.00	391.05	200.00	201.56	474.65	333.67	2.638	
49	153.58	144.00	390.53	200.00	198.58	482.86	341.84	2.639	
50	157.26	144.09	390.00	200.00	200.87	474.90	333.67	2.639	
51	156.21	144.00	390.00	200.00	199.58	478.96	337.76	2.639	
52	155.68	144.00	390.53	200.00	199.94	478.84	337.76	2.640	
53	155.16	144.00	391.05	200.00	200.29	478.73	337.76	2.640	
54	159.89	144.96	390.53	200.00	207.91	454.53	313.27	2.640	
55	152.53	144.00	390.00	200.00	196.97	487.05	345.92	2.640	
56	159.37	144.79	390.53	200.00	206.59	458.60	317.35	2.641	
57	152.00	144.00	390.53	200.00	197.32	486.94	345.92	2.641	
58	160.95	145.32	390.00	200.00	210.11	446.43	305.10	2.641	
59	160.95	145.32	390.53	200.00	210.54	446.36	305.10	2.641	
60	158.84	144.61	390.53	200.00	205.27	462.67	321.43	2.641	
61	154.63	144.00	390.00	200.00	198.31	483.03	341.84	2.642	
62	161.47	145.49	390.53	200.00	211.86	442.26	301.02	2.642	
63	158.32	144.44	390.53	200.00	203.95	466.73	325.51	2.642	
64	162.00	145.67	390.53	200.00	213.18	438.16	296.94	2.642	
65	157.79	144.26	390.53	200.00	202.63	470.79	329.59	2.642	
66	154.11	144.00	390.53	200.00	198.67	482.92	341.84	2.642	
67	153.58	144.00	391.05	200.00	199.02	482.80	341.84	2.642	
68	156.74	144.00	390.00	200.00	199.66	479.02	337.76	2.643	

69	157.26	144.09	390.53	200.00	201.32	474.84	333.67	2.643
70	153.05	144.00	390.00	200.00	197.05	487.11	345.92	2.644
71	156.21	144.00	390.53	200.00	200.02	478.90	337.76	2.644
72	155.68	144.00	391.05	200.00	200.38	478.79	337.76	2.644
73	152.53	144.00	390.53	200.00	197.41	486.99	345.92	2.644
74	152.00	144.00	391.05	200.00	197.76	486.88	345.92	2.645
75	158.84	144.61	391.05	200.00	205.71	462.61	321.43	2.645
76	155.16	144.00	390.00	200.00	198.40	483.09	341.84	2.645
77	159.37	144.79	391.05	200.00	207.02	458.54	317.35	2.645
78	160.42	145.14	390.53	200.00	209.22	450.45	309.18	2.645
79	158.32	144.44	391.05	200.00	204.39	466.67	325.51	2.646
80	160.42	145.14	391.05	200.00	209.66	450.38	309.18	2.646
81	154.63	144.00	390.53	200.00	198.75	482.98	341.84	2.646
82	160.95	145.32	391.05	200.00	210.97	446.29	305.10	2.646
83	157.79	144.26	391.05	200.00	203.07	470.73	329.59	2.646
84	154.11	144.00	391.05	200.00	199.11	482.86	341.84	2.646
85	153.58	144.00	390.00	200.00	197.14	487.16	345.92	2.647
86	156.74	144.00	390.53	200.00	200.11	478.96	337.76	2.647
87	157.26	144.09	391.05	200.00	201.76	474.78	333.67	2.648
88	156.21	144.00	391.05	200.00	200.46	478.84	337.76	2.648
89	153.05	144.00	390.53	200.00	197.50	487.05	345.92	2.648
90	155.68	144.00	391.58	200.00	200.82	478.73	337.76	2.648
91	155.68	144.00	390.00	200.00	198.48	483.15	341.84	2.648
92	152.53	144.00	391.05	200.00	197.85	486.94	345.92	2.649
93	158.32	144.44	391.58	200.00	204.83	466.61	325.51	2.649
94	155.16	144.00	390.53	200.00	198.84	483.03	341.84	2.649
95	152.00	144.00	390.00	200.00	195.89	491.24	350.00	2.649
96	159.89	144.96	391.58	200.00	208.77	454.39	313.27	2.650
97	157.79	144.26	391.58	200.00	203.51	470.67	329.59	2.650
98	159.89	144.96	391.05	200.00	208.34	454.46	313.27	2.650
99	154.63	144.00	391.05	200.00	199.20	482.92	341.84	2.650

Critical Failure Surface (circle 1)

Intersects:	XL:	155.68	YL:	144.00	XR:	390.00	YR:	200.00	
	Centre:	XC:	200.51	YC:	474.65		Radius:	R:	333.67
Generated failure surface: (20 points)									
	155.68	144.00		168.57	142.51		181.50	141.52	194.47
	207.44	141.05							
	220.40	141.57		233.33	142.59		246.21	144.12	259.03
	271.75	148.67							
	284.37	151.68		296.86	155.19		309.20	159.17	321.38
	333.38	168.57							
	345.17	173.97		356.75	179.82		368.09	186.11	379.18
	390.00	200.00							192.84

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	155.68	0.10	-6.6	1.32	1.32	3	100.00	18.0	14.14	4386.99
3322.51	1.02									
2	157.00	8.40	-6.6	5.79	5.82	3	100.00	18.0	1128.28	19437.30
3448.07	1.02									
3	162.79	23.43	-6.6	5.79	5.82	3	100.00	18.0	3136.19	19680.74
3677.52	1.02									
4	168.57	43.16	-4.4	6.47	6.49	3	100.00	18.0	5767.14	22154.59
3898.56	1.01									
5	175.04	60.31	-4.4	6.47	6.49	3	100.00	18.0	8044.98	22355.03
4118.06	1.01									
6	181.50	76.82	-2.2	6.48	6.49	3	100.00	18.0	10232.61	22504.25
4314.27	1.01									
7	187.99	92.40	-2.2	6.48	6.49	3	100.00	18.0	12289.45	22602.80
4497.59	1.01									
8	194.47	107.25	0.1	6.49	6.49	3	100.00	18.0	14241.96	22650.60
4656.02	1.00									
9	200.95	121.22	0.1	6.49	6.49	3	100.00	18.0	16071.06	22647.12
4803.10	1.00									
10	207.44	134.25	2.3	6.48	6.49	3	100.00	18.0	17769.79	22592.64
4923.92	1.00									
11	213.92	146.56	2.3	6.48	6.49	3	100.00	18.0	19365.60	22487.19
5034.72	1.00									
12	220.40	157.67	4.5	6.47	6.49	3	100.00	18.0	20795.87	22330.70
5118.12	0.99									
13	226.87	168.30	4.5	6.47	6.49	3	100.00	18.0	22154.29	22123.38
5192.68	0.99									
14	233.33	163.15	6.8	5.94	5.98	3	100.00	18.0	21435.21	20160.04
5237.38	0.99									
15	239.27	170.72	6.8	5.94	5.98	3	100.00	18.0	22384.83	19897.71
5272.75	0.99									
16	245.20	29.83	6.8	1.01	1.02	2	0.00	35.0	3908.24	3363.18

5265.71	0.98										
17	246.21	193.34	9.0	6.41	6.49	2	0.00	35.0	25327.14	21196.84	
5254.53	0.97										
18	252.62	200.53	9.0	6.41	6.49	2	0.00	35.0	26269.06	20786.81	
5265.19	0.97										
19	259.03	205.45	11.2	6.36	6.49	2	0.00	35.0	26913.59	20326.56	
5237.83	0.97										
20	265.39	210.91	11.2	6.36	6.49	2	0.00	35.0	27629.84	19816.07	
5215.11	0.97										
21	271.75	75.80	13.4	2.25	2.31	2	0.00	35.0	9930.33	6938.68	
5171.45	0.97										
22	274.00	176.43	13.4	5.18	5.33	2	0.00	35.0	23111.70	15687.24	
5138.63	0.97										
23	279.18	178.96	13.4	5.18	5.33	2	0.00	35.0	23443.71	15275.31	
5092.86	0.97										
24	284.37	218.18	15.7	6.24	6.49	2	0.00	35.0	28581.12	17986.04	
5002.74	0.97										
25	290.61	220.24	15.7	6.24	6.49	2	0.00	35.0	28851.05	17277.09	
4914.49	0.97										
26	296.86	218.89	17.9	6.17	6.49	2	0.00	35.0	28674.02	16519.26	
4786.64	0.97										
27	303.03	219.28	17.9	6.17	6.49	2	0.00	35.0	28725.84	15712.53	
4666.32	0.97										
28	309.20	241.03	20.1	6.80	7.24	2	0.00	35.0	31574.74	16530.18	
4497.64	0.97										
29	316.00	189.63	20.1	5.38	5.73	2	0.00	35.0	24841.66	12281.74	
4396.77	0.97										
30	321.38	126.75	22.4	3.62	3.91	2	0.00	35.0	16604.32	7966.40	
4334.69	0.97										
31	325.00	142.48	22.4	4.19	4.53	2	0.00	35.0	18664.39	8764.90	
4206.50	0.97										
32	329.19	135.26	22.4	4.19	4.53	2	0.00	35.0	17719.31	8278.15	
3992.57	0.97										
33	333.38	177.43	24.6	5.90	6.49	2	0.00	35.0	23243.21	10960.59	
3695.74	0.98										
34	339.28	161.52	24.6	5.90	6.49	2	0.00	35.0	21158.67	9868.70	
3362.46	0.98										
35	345.17	83.80	26.8	3.33	3.73	2	0.00	35.0	10977.40	5160.93	
3072.79	0.99										
36	348.50	70.79	26.8	3.00	3.36	5	0.00	45.0	7786.81	2746.84	
2308.32	0.94										
37	351.50	112.98	26.8	5.25	5.88	2	0.00	35.0	14799.79	1289.38	
2509.10	0.99										
38	356.75	75.15	29.0	3.94	4.50	2	0.00	35.0	9844.29	306.86	
2187.08	1.00										
39	360.69	31.53	29.0	1.80	2.06	2	0.00	35.0	4130.04	0.00	
1996.60	1.00										
40	362.49	86.55	29.0	5.60	6.41	1	150.00	22.0	11338.40	0.00	
1834.61	1.05										
41	368.09	67.67	31.3	5.54	6.49	1	150.00	22.0	8865.35	0.00	
1430.51	1.07										
42	373.64	49.01	31.3	5.54	6.49	1	150.00	22.0	6420.71	0.00	
1027.30	1.07										
43	379.18	29.04	33.5	5.41	6.49	1	150.00	22.0	3803.81	0.00	
603.84	1.09										
44	384.59	9.68	33.5	5.41	6.49	1	150.00	22.0	1267.93	0.00	
178.38	1.09										

X-S Area:	5411.85	Path Length:	246.47	X-S Weight:	709237.94

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Rapid Drawdown.gmf

Processed: 04 Dec 2020 12:34:30

DATA: Analysis 1 - Case 3-3 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    183.00      348.50    183.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    144.00      348.50    144.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    141.00      348.50    141.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    183.00      450.00    183.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    144.00      450.00    144.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    141.00      450.00    141.00

```

Slope Surface (4 points)

```

-----
100.00    144.00    157.00    144.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    144.00    157.00    144.00    316.00    197.00    348.50    197.00
351.50    182.00
450.00    182.00

```

Failure Surface

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

```

Intersects: XL: 157.00  YL: 144.00  XR: 395.00  YR: 200.00
Centre: XC: 226.05  YC: 384.27  Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 3-3 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.417

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.37

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	155.68	144.00	390.00	200.00	200.51	474.65	333.67	1.373	
Critical Surface									
2	158.32	144.44	390.00	200.00	204.54	462.53	321.43	1.373	
3	162.00	145.67	390.00	200.00	213.78	433.91	292.86	1.373	
4	159.89	144.96	390.00	200.00	208.50	450.30	309.18	1.374	
5	161.47	145.49	390.00	200.00	212.46	438.02	296.94	1.374	
6	160.42	145.14	390.00	200.00	209.82	446.22	305.10	1.374	
7	160.95	145.32	390.00	200.00	211.14	442.12	301.02	1.374	
8	157.79	144.26	390.00	200.00	203.22	466.59	325.51	1.374	
9	158.84	144.61	390.00	200.00	205.86	458.46	317.35	1.374	
10	154.11	144.00	390.00	200.00	199.24	478.73	337.76	1.374	
11	157.26	144.09	390.00	200.00	201.90	470.64	329.59	1.375	
12	156.21	144.00	390.00	200.00	200.60	474.71	333.67	1.375	
13	152.53	144.00	390.00	200.00	197.97	482.80	341.84	1.376	
14	157.79	144.26	390.53	200.00	203.66	466.53	325.51	1.376	
15	161.47	145.49	390.53	200.00	212.89	437.94	296.94	1.376	
16	159.37	144.79	390.53	200.00	207.61	454.32	313.27	1.376	
17	159.89	144.96	390.53	200.00	208.93	450.24	309.18	1.376	
18	160.95	145.32	390.53	200.00	211.57	442.05	301.02	1.376	
19	160.42	145.14	390.53	200.00	210.25	446.15	305.10	1.376	
20	159.37	144.79	390.00	200.00	207.18	454.38	313.27	1.377	
21	154.63	144.00	390.00	200.00	199.32	478.79	337.76	1.377	
22	157.26	144.09	390.53	200.00	202.34	470.58	329.59	1.377	
23	158.32	144.44	390.53	200.00	204.97	462.46	321.43	1.377	
24	156.74	144.00	390.00	200.00	200.68	474.77	333.67	1.378	
25	156.21	144.00	390.53	200.00	201.04	474.65	333.67	1.378	
26	153.05	144.00	390.00	200.00	198.06	482.86	341.84	1.378	
27	155.16	144.00	390.00	200.00	199.41	478.84	337.76	1.379	
28	158.32	144.44	391.05	200.00	205.41	462.40	321.43	1.379	
29	158.84	144.61	391.05	200.00	206.73	458.33	317.35	1.379	
30	154.63	144.00	390.53	200.00	199.76	478.73	337.76	1.379	
31	159.37	144.79	391.05	200.00	208.04	454.25	313.27	1.379	
32	158.84	144.61	390.53	200.00	206.29	458.39	317.35	1.380	
33	156.74	144.00	390.53	200.00	201.12	474.71	333.67	1.380	
34	153.58	144.00	390.00	200.00	198.14	482.92	341.84	1.380	
35	153.05	144.00	390.53	200.00	198.50	482.80	341.84	1.380	
36	160.42	145.14	390.00	200.00	208.79	450.52	309.18	1.381	
37	155.68	144.00	390.00	200.00	199.49	478.90	337.76	1.381	
38	155.16	144.00	390.53	200.00	199.85	478.79	337.76	1.381	
39	159.89	144.96	390.00	200.00	207.47	454.60	313.27	1.381	
40	161.47	145.49	390.00	200.00	211.43	442.34	301.02	1.382	
41	152.00	144.00	390.00	200.00	196.88	486.99	345.92	1.382	
42	159.37	144.79	390.00	200.00	206.15	458.67	317.35	1.382	
43	162.00	145.67	390.00	200.00	212.75	438.24	296.94	1.382	
44	158.84	144.61	390.00	200.00	204.83	462.74	321.43	1.382	
45	158.32	144.44	390.00	200.00	203.51	466.80	325.51	1.382	
46	157.79	144.26	390.00	200.00	202.19	470.85	329.59	1.382	
47	154.11	144.00	390.00	200.00	198.23	482.98	341.84	1.382	
48	156.74	144.00	391.05	200.00	201.56	474.65	333.67	1.382	
49	153.58	144.00	390.53	200.00	198.58	482.86	341.84	1.383	
50	157.26	144.09	390.00	200.00	200.87	474.90	333.67	1.383	
51	156.21	144.00	390.00	200.00	199.58	478.96	337.76	1.383	
52	155.68	144.00	390.53	200.00	199.94	478.84	337.76	1.384	
53	159.89	144.96	390.53	200.00	207.91	454.53	313.27	1.384	
54	155.16	144.00	391.05	200.00	200.29	478.73	337.76	1.384	
55	152.53	144.00	390.00	200.00	196.97	487.05	345.92	1.384	
56	159.37	144.79	390.53	200.00	206.59	458.60	317.35	1.384	
57	160.95	145.32	390.00	200.00	210.11	446.43	305.10	1.384	
58	152.00	144.00	390.53	200.00	197.32	486.94	345.92	1.384	
59	160.95	145.32	390.53	200.00	210.54	446.36	305.10	1.384	
60	158.84	144.61	390.53	200.00	205.27	462.67	321.43	1.384	
61	161.47	145.49	390.53	200.00	211.86	442.26	301.02	1.384	
62	158.32	144.44	390.53	200.00	203.95	466.73	325.51	1.384	
63	154.63	144.00	390.00	200.00	198.31	483.03	341.84	1.385	
64	162.00	145.67	390.53	200.00	213.18	438.16	296.94	1.385	
65	157.79	144.26	390.53	200.00	202.63	470.79	329.59	1.385	
66	154.11	144.00	390.53	200.00	198.67	482.92	341.84	1.385	
67	153.58	144.00	391.05	200.00	199.02	482.80	341.84	1.385	
68	156.74	144.00	390.00	200.00	199.66	479.02	337.76	1.385	

69	157.26	144.09	390.53	200.00	201.32	474.84	333.67	1.386
70	156.21	144.00	390.53	200.00	200.02	478.90	337.76	1.386
71	153.05	144.00	390.00	200.00	197.05	487.11	345.92	1.386
72	155.68	144.00	391.05	200.00	200.38	478.79	337.76	1.386
73	152.53	144.00	390.53	200.00	197.41	486.99	345.92	1.386
74	158.84	144.61	391.05	200.00	205.71	462.61	321.43	1.386
75	152.00	144.00	391.05	200.00	197.76	486.88	345.92	1.386
76	160.42	145.14	390.53	200.00	209.22	450.45	309.18	1.386
77	159.37	144.79	391.05	200.00	207.02	458.54	317.35	1.387
78	155.16	144.00	390.00	200.00	198.40	483.09	341.84	1.387
79	160.42	145.14	391.05	200.00	209.66	450.38	309.18	1.387
80	158.32	144.44	391.05	200.00	204.39	466.67	325.51	1.387
81	160.95	145.32	391.05	200.00	210.97	446.29	305.10	1.387
82	154.63	144.00	390.53	200.00	198.75	482.98	341.84	1.387
83	157.79	144.26	391.05	200.00	203.07	470.73	329.59	1.387
84	154.11	144.00	391.05	200.00	199.11	482.86	341.84	1.387
85	153.58	144.00	390.00	200.00	197.14	487.16	345.92	1.388
86	156.74	144.00	390.53	200.00	200.11	478.96	337.76	1.388
87	157.26	144.09	391.05	200.00	201.76	474.78	333.67	1.388
88	162.00	145.67	391.05	200.00	213.61	438.09	296.94	1.388
89	161.47	145.49	391.05	200.00	212.29	442.19	301.02	1.388
90	156.21	144.00	391.05	200.00	200.46	478.84	337.76	1.388
91	155.68	144.00	391.58	200.00	200.82	478.73	337.76	1.388
92	153.05	144.00	390.53	200.00	197.50	487.05	345.92	1.388
93	155.68	144.00	390.00	200.00	198.48	483.15	341.84	1.389
94	152.53	144.00	391.05	200.00	197.85	486.94	345.92	1.389
95	158.32	144.44	391.58	200.00	204.83	466.61	325.51	1.389
96	155.16	144.00	390.53	200.00	198.84	483.03	341.84	1.389
97	159.89	144.96	391.05	200.00	208.34	454.46	313.27	1.389
98	159.89	144.96	391.58	200.00	208.77	454.39	313.27	1.389
99	152.00	144.00	390.00	200.00	195.89	491.24	350.00	1.389

Critical Failure Surface (circle 1)

Intersects:	XL:	155.68	YL:	144.00	XR:	390.00	YR:	200.00	
	Centre:	XC:	200.51	YC:	474.65		Radius:	R:	333.67
Generated failure surface: (20 points)									
155.68	144.00		168.57	142.51		181.50	141.52	194.47	141.03
207.44	141.05								
220.40	141.57		233.33	142.59		246.21	144.12	259.03	146.15
271.75	148.67								
284.37	151.68		296.86	155.19		309.20	159.17	321.38	163.64
333.38	168.57								
345.17	173.97		356.75	179.82		368.09	186.11	379.18	192.84
390.00	200.00								

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	155.68	0.10	-6.6	1.32	1.32	3	100.00	18.0	14.14	6.30
19.59	1.04									
2	157.00	8.40	-6.6	5.79	5.82	3	100.00	18.0	1128.28	527.51
206.65	1.04									
3	162.79	23.43	-6.6	5.79	5.82	3	100.00	18.0	3136.19	1471.76
558.95	1.04									
4	168.57	43.16	-4.4	6.47	6.49	3	100.00	18.0	5767.14	2701.38
906.23	1.02									
5	175.04	60.31	-4.4	6.47	6.49	3	100.00	18.0	8044.98	3774.27
1261.90	1.02									
6	181.50	76.82	-2.2	6.48	6.49	3	100.00	18.0	10232.61	4797.13
1589.08	1.01									
7	187.99	92.40	-2.2	6.48	6.49	3	100.00	18.0	12289.45	5770.04
1907.93	1.01									
8	194.47	107.25	0.1	6.49	6.49	3	100.00	18.0	14241.96	6692.33
2195.36	1.00									
9	200.95	121.22	0.1	6.49	6.49	3	100.00	18.0	16071.06	7563.87
2477.33	1.00									
10	207.44	134.25	2.3	6.48	6.49	3	100.00	18.0	17769.79	8384.03
2725.39	0.99									
11	213.92	146.56	2.3	6.48	6.49	3	100.00	18.0	19365.60	9152.84
2970.42	0.99									
12	220.40	157.67	4.5	6.47	6.49	3	100.00	18.0	20795.87	9869.67
3179.50	0.98									
13	226.87	168.30	4.5	6.47	6.49	3	100.00	18.0	22154.29	10534.59
3387.60	0.98									
14	233.33	163.15	6.8	5.94	5.98	3	100.00	18.0	21435.21	10251.77
3551.36	0.98									
15	239.27	170.72	6.8	5.94	5.98	3	100.00	18.0	22384.83	10727.30
3709.17	0.98									
16	245.20	29.83	6.8	1.01	1.02	2	0.00	35.0	3908.24	1874.66

3750.34	0.95										
17	246.21	193.34	9.0	6.41	6.49	2	0.00	35.0	25327.14	12214.14	
3798.96	0.94										
18	252.62	200.53	9.0	6.41	6.49	2	0.00	35.0	26269.06	12668.39	
3940.24	0.94										
19	259.03	205.45	11.2	6.36	6.49	2	0.00	35.0	26913.59	13069.42	
4026.89	0.93										
20	265.39	210.91	11.2	6.36	6.49	2	0.00	35.0	27629.84	13417.23	
4134.06	0.93										
21	271.75	75.80	13.4	2.25	2.31	2	0.00	35.0	9930.33	4863.39	
4162.01	0.92										
22	274.00	176.43	13.4	5.18	5.33	2	0.00	35.0	23111.70	11318.97	
4205.33	0.92										
23	279.18	178.96	13.4	5.18	5.33	2	0.00	35.0	23443.71	11481.58	
4265.74	0.92										
24	284.37	218.18	15.7	6.24	6.49	2	0.00	35.0	28581.12	14139.65	
4276.77	0.91										
25	290.61	220.24	15.7	6.24	6.49	2	0.00	35.0	28851.05	14273.19	
4317.16	0.91										
26	296.86	218.89	17.9	6.17	6.49	2	0.00	35.0	28674.02	14352.95	
4301.76	0.90										
27	303.03	219.28	17.9	6.17	6.49	2	0.00	35.0	28725.84	14378.89	
4309.55	0.90										
28	309.20	241.03	20.1	6.80	7.24	2	0.00	35.0	31574.74	16018.08	
4260.78	0.90										
29	316.00	189.63	20.1	5.38	5.73	2	0.00	35.0	24841.66	12281.74	
4227.75	0.90										
30	321.38	126.75	22.4	3.62	3.91	2	0.00	35.0	16604.32	7966.40	
4144.81	0.89										
31	325.00	142.48	22.4	4.19	4.53	2	0.00	35.0	18664.39	8764.90	
4018.94	0.89										
32	329.19	135.26	22.4	4.19	4.53	2	0.00	35.0	17719.31	8278.15	
3813.79	0.89										
33	333.38	177.43	24.6	5.90	6.49	2	0.00	35.0	23243.21	10960.59	
3514.99	0.89										
34	339.28	161.52	24.6	5.90	6.49	2	0.00	35.0	21158.67	9868.70	
3196.58	0.89										
35	345.17	83.80	26.8	3.33	3.73	2	0.00	35.0	10977.40	5160.93	
2908.04	0.89										
36	348.50	70.79	26.8	3.00	3.36	5	0.00	45.0	7786.81	2746.84	
2117.22	0.82										
37	351.50	112.98	26.8	5.25	5.88	2	0.00	35.0	14799.79	1289.38	
2285.57	0.89										
38	356.75	75.15	29.0	3.94	4.50	2	0.00	35.0	9844.29	306.86	
1964.36	0.89										
39	360.69	31.53	29.0	1.80	2.06	2	0.00	35.0	4130.04	0.00	
1786.74	0.89										
40	362.49	86.55	29.0	5.60	6.41	1	150.00	22.0	11338.40	0.00	
1687.06	0.98										
41	368.09	67.67	31.3	5.54	6.49	1	150.00	22.0	8865.35	0.00	
1300.41	0.99										
42	373.64	49.01	31.3	5.54	6.49	1	150.00	22.0	6420.71	0.00	
926.31	0.99										
43	379.18	29.04	33.5	5.41	6.49	1	150.00	22.0	3803.81	0.00	
528.13	1.00										
44	384.59	9.68	33.5	5.41	6.49	1	150.00	22.0	1267.93	0.00	
135.71	1.00										

X-S Area:	5411.85	Path Length:	246.47	X-S Weight:	709237.94

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Full Reservoir.gmf

Processed: 04 Dec 2020 12:42:11

DATA: Analysis 1 - Case 4-1 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    190.00      348.50    190.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    157.00      348.50    157.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    154.00      348.50    154.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    190.00      450.00    190.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    157.00      450.00    157.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    154.00      450.00    154.00

```

Slope Surface (4 points)

```

-----
100.00    157.00    196.00    157.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00    196.00    197.00    316.00    197.00    348.50    197.00
351.50    178.00
450.00    178.00

```

Failure Surface

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

```

Intersects: XL: 196.00  YL: 157.00  XR: 405.00  YR: 200.00
Centre: XC: 254.94  YC: 399.95  Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00   10.00   200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 4-1 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 5.414

Analysis Summary

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

Critical (minimum) Factor of Safety: 3.15

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	198.89	157.96	400.00	200.00	246.02	434.59	280.61	3.152	
Critical Surface									
2	199.95	158.32	400.00	200.00	248.45	426.41	272.45	3.162	
3	194.68	157.00	400.00	200.00	237.72	463.17	309.18	3.162	
4	199.42	158.14	400.00	200.00	247.24	430.51	276.53	3.163	
5	198.37	157.79	400.00	200.00	243.91	442.95	288.78	3.167	
6	195.21	157.00	400.00	200.00	237.82	463.23	309.18	3.168	
7	193.63	157.00	400.00	200.00	236.64	467.30	313.27	3.168	
8	192.05	157.00	400.00	200.00	235.47	471.36	317.35	3.169	
9	196.26	157.09	400.00	200.00	239.02	459.18	305.10	3.170	
10	197.32	157.44	400.53	200.00	241.89	451.01	296.94	3.170	
11	196.79	157.26	400.00	200.00	240.24	455.13	301.02	3.170	
12	198.89	157.96	400.00	200.00	245.12	438.88	284.69	3.171	
13	197.32	157.44	400.00	200.00	241.47	451.08	296.94	3.173	
14	195.74	157.00	400.00	200.00	237.92	463.29	309.18	3.173	
15	194.16	157.00	400.00	200.00	236.74	467.36	313.27	3.173	
16	192.58	157.00	400.00	200.00	235.56	471.42	317.35	3.174	
17	197.84	157.61	400.53	200.00	243.11	446.95	292.86	3.174	
18	195.21	157.00	400.53	200.00	238.25	463.17	309.18	3.175	
19	191.00	157.00	400.00	200.00	234.40	475.49	321.43	3.175	
20	197.84	157.61	400.00	200.00	242.69	447.02	292.86	3.175	
21	199.42	158.14	400.00	200.00	246.34	434.80	280.61	3.176	
22	195.74	157.00	401.05	200.00	238.77	463.17	309.18	3.176	
23	196.26	157.09	400.53	200.00	239.45	459.12	305.10	3.177	
24	196.79	157.26	400.53	200.00	240.67	455.07	301.02	3.177	
25	194.68	157.00	400.00	200.00	236.83	467.42	313.27	3.178	
26	193.11	157.00	400.00	200.00	235.66	471.48	317.35	3.178	
27	198.37	157.79	400.53	200.00	244.33	442.88	288.78	3.179	
28	191.53	157.00	400.00	200.00	234.49	475.54	321.43	3.179	
29	199.95	158.32	400.00	200.00	247.56	430.72	276.53	3.180	
30	195.74	157.00	400.53	200.00	238.35	463.23	309.18	3.180	
31	194.16	157.00	400.53	200.00	237.17	467.30	313.27	3.180	
32	192.58	157.00	400.53	200.00	235.99	471.36	317.35	3.181	
33	191.00	157.00	400.53	200.00	234.83	475.43	321.43	3.182	
34	197.32	157.44	401.05	200.00	242.31	450.95	296.94	3.182	
35	195.21	157.00	400.00	200.00	236.93	467.48	313.27	3.183	
36	198.89	157.96	400.53	200.00	245.54	438.81	284.69	3.183	
37	200.47	158.49	400.00	200.00	248.77	426.62	272.45	3.183	
38	193.63	157.00	400.00	200.00	235.76	471.54	317.35	3.183	
39	192.05	157.00	400.00	200.00	234.59	475.60	321.43	3.184	
40	198.37	157.79	400.00	200.00	243.01	447.22	292.86	3.185	
41	196.26	157.09	400.00	200.00	238.13	463.42	309.18	3.185	
42	194.68	157.00	400.53	200.00	237.26	467.36	313.27	3.185	
43	193.11	157.00	400.53	200.00	236.09	471.42	317.35	3.186	
44	197.84	157.61	401.05	200.00	243.53	446.89	292.86	3.186	
45	191.53	157.00	400.53	200.00	234.92	475.49	321.43	3.186	
46	199.42	158.14	400.53	200.00	246.76	434.73	280.61	3.186	
47	196.79	157.26	400.00	200.00	239.35	459.38	305.10	3.186	
48	197.32	157.44	400.53	200.00	241.00	455.27	301.02	3.187	
49	195.74	157.00	400.00	200.00	237.02	467.53	313.27	3.188	
50	199.95	158.32	400.53	200.00	247.97	430.64	276.53	3.188	
51	194.16	157.00	400.00	200.00	235.85	471.60	317.35	3.188	
52	192.58	157.00	400.00	200.00	234.69	475.66	321.43	3.189	
53	198.37	157.79	401.05	200.00	244.75	442.82	288.78	3.189	
54	197.32	157.44	400.00	200.00	240.57	455.33	301.02	3.189	
55	198.89	157.96	400.00	200.00	244.23	443.16	288.78	3.190	
56	191.00	157.00	400.00	200.00	233.53	479.72	325.51	3.190	
57	195.21	157.00	400.53	200.00	237.36	467.42	313.27	3.190	
58	196.26	157.09	401.05	200.00	238.99	463.31	309.18	3.190	
59	193.63	157.00	400.53	200.00	236.19	471.48	317.35	3.191	
60	198.89	157.96	401.05	200.00	245.96	438.74	284.69	3.191	
61	192.05	157.00	400.53	200.00	235.02	475.54	321.43	3.191	
62	197.84	157.61	400.53	200.00	242.22	451.22	296.94	3.191	
63	201.00	158.67	400.00	200.00	249.99	422.53	268.37	3.191	
64	199.42	158.14	401.05	200.00	247.18	434.66	280.61	3.192	
65	197.84	157.61	400.00	200.00	241.79	451.28	296.94	3.192	
66	194.68	157.00	401.05	200.00	237.69	467.30	313.27	3.192	
67	196.26	157.09	400.53	200.00	238.56	463.36	309.18	3.192	
68	194.68	157.00	400.00	200.00	235.95	471.65	317.35	3.193	

69	193.11	157.00	401.05	200.00	236.52	471.36	317.35	3.193
70	201.00	158.67	400.53	200.00	250.40	422.45	268.37	3.193
71	193.11	157.00	400.00	200.00	234.78	475.72	321.43	3.193
72	191.53	157.00	401.05	200.00	235.35	475.43	321.43	3.193
73	196.79	157.26	401.05	200.00	240.21	459.26	305.10	3.194
74	196.79	157.26	400.53	200.00	239.78	459.32	305.10	3.194
75	191.53	157.00	400.00	200.00	233.62	479.78	325.51	3.194
76	199.42	158.14	400.00	200.00	245.45	439.09	284.69	3.195
77	195.74	157.00	400.53	200.00	237.46	467.48	313.27	3.195
78	194.16	157.00	400.53	200.00	236.28	471.54	317.35	3.195
79	200.47	158.49	400.53	200.00	249.19	426.55	272.45	3.196
80	192.58	157.00	400.53	200.00	235.12	475.60	321.43	3.196
81	195.21	157.00	401.58	200.00	238.22	467.30	313.27	3.196
82	198.37	157.79	400.53	200.00	243.43	447.16	292.86	3.196
83	195.21	157.00	400.00	200.00	236.04	471.71	317.35	3.197
84	191.00	157.00	400.53	200.00	233.96	479.66	325.51	3.197
85	195.21	157.00	401.05	200.00	237.79	467.36	313.27	3.197
86	193.63	157.00	400.00	200.00	234.87	475.77	321.43	3.198
87	193.63	157.00	401.05	200.00	236.62	471.42	317.35	3.198
88	200.47	158.49	401.05	200.00	249.60	426.47	272.45	3.198
89	197.32	157.44	401.05	200.00	241.42	455.21	301.02	3.198
90	192.05	157.00	401.05	200.00	235.45	475.49	321.43	3.198
91	192.05	157.00	400.00	200.00	233.72	479.83	325.51	3.199
92	196.26	157.09	400.00	200.00	237.24	467.66	313.27	3.200
93	199.95	158.32	400.00	200.00	246.66	435.01	280.61	3.200
94	194.68	157.00	400.53	200.00	236.38	471.60	317.35	3.200
95	199.95	158.32	401.05	200.00	248.39	430.57	276.53	3.200
96	201.00	158.67	401.05	200.00	250.81	422.37	268.37	3.201
97	193.11	157.00	400.53	200.00	235.21	475.66	321.43	3.201
98	196.79	157.26	400.00	200.00	238.46	463.63	309.18	3.201
99	198.37	157.79	400.00	200.00	244.80	438.67	284.69	3.201

Critical Failure Surface (circle 1)

Intersects:	XL:	198.89	YL:	157.96	XR:	400.00	YR:	200.00	
	Centre:	XC:	246.02	YC:	434.59		Radius:	R:	280.61
Generated failure surface: (20 points)									
198.89	157.96		209.84	156.32		220.85	155.11	231.89	154.34
242.95	154.00								
254.02	154.09		265.08	154.63		276.11	155.60	287.09	157.00
298.00	158.84								
308.84	161.10		319.58	163.79		330.20	166.90	340.69	170.43
351.04	174.37								
361.22	178.72		371.22	183.46		381.03	188.59	390.63	194.11
400.00	200.00								

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	198.89	9.99	-8.5	6.43	6.50	2	0.00	35.0	1308.25	16027.30
2576.16	1.05									
2	205.32	18.98	-8.5	4.52	4.57	3	100.00	18.0	2502.06	11504.37
2818.10	1.03									
3	209.84	35.83	-6.3	5.50	5.53	3	100.00	18.0	4747.41	14154.06
3022.53	1.02									
4	215.34	49.25	-6.3	5.50	5.53	3	100.00	18.0	6538.65	14363.08
3235.65	1.02									
5	220.85	62.31	-4.0	5.52	5.53	3	100.00	18.0	8277.27	14534.56
3428.97	1.01									
6	226.37	74.61	-4.0	5.52	5.53	3	100.00	18.0	9910.27	14668.46
3611.03	1.01									
7	231.89	85.52	-1.8	5.47	5.48	3	100.00	18.0	11353.01	14607.72
3771.19	1.00									
8	237.36	96.42	-1.8	5.47	5.48	3	100.00	18.0	12790.79	14665.04
3920.46	1.00									
9	242.84	109.21	0.5	5.59	5.59	3	100.00	18.0	14472.79	15001.84
4049.73	1.00									
10	248.43	119.36	0.5	5.59	5.59	3	100.00	18.0	15800.16	14984.76
4170.44	1.00									
11	254.02	127.35	2.8	5.53	5.53	3	100.00	18.0	16835.93	14772.83
4267.46	1.00									
12	259.55	136.06	2.8	5.53	5.53	3	100.00	18.0	17962.54	14680.68
4355.71	1.00									
13	265.08	143.77	5.0	5.51	5.53	3	100.00	18.0	18951.42	14550.86
4419.95	0.99									
14	270.59	151.23	5.0	5.51	5.53	3	100.00	18.0	19902.03	14383.43
4476.89	0.99									
15	276.11	157.29	7.3	5.49	5.53	3	100.00	18.0	20662.64	14168.74
4509.12	1.00									
16	281.59	163.48	7.3	5.49	5.53	3	100.00	18.0	21434.47	13926.67

4534.77	1.00										
17	287.08	121.53	9.5	3.96	4.02	2	0.00	35.0	15920.13	9939.97	
4504.60	0.98										
18	291.04	124.12	9.5	3.96	4.02	2	0.00	35.0	16259.47	9773.22	
4506.27	0.98										
19	295.00	95.87	9.5	3.00	3.05	2	0.00	35.0	12559.12	7301.69	
4507.77	0.98										
20	298.00	176.09	11.8	5.42	5.53	2	0.00	35.0	23067.53	12985.33	
4476.70	0.98										
21	303.42	179.74	11.8	5.42	5.53	2	0.00	35.0	23545.42	12594.14	
4450.19	0.98										
22	308.84	120.51	14.1	3.58	3.69	2	0.00	35.0	15786.75	8164.54	
4399.37	0.98										
23	312.42	121.57	14.1	3.58	3.69	2	0.00	35.0	15925.75	7957.93	
4362.65	0.98										
24	316.00	122.54	14.1	3.58	3.69	2	0.00	35.0	16052.36	7745.47	
4361.19	0.98										
25	319.58	187.13	16.3	5.42	5.65	2	0.00	35.0	24514.12	11428.52	
4368.16	0.98										
26	325.00	176.09	16.3	5.20	5.42	2	0.00	35.0	23068.13	10435.37	
4282.01	0.98										
27	330.20	169.00	18.6	5.25	5.53	2	0.00	35.0	22139.23	10089.91	
4053.37	0.98										
28	335.45	159.75	18.6	5.25	5.53	2	0.00	35.0	20926.60	9480.52	
3830.66	0.98										
29	340.69	112.51	20.8	3.90	4.18	2	0.00	35.0	14738.72	6730.53	
3607.13	0.99										
30	344.60	106.71	20.8	3.90	4.18	2	0.00	35.0	13978.66	6343.13	
3420.36	0.99										
31	348.50	66.29	20.8	2.54	2.72	5	0.00	45.0	7291.38	2554.84	
2663.99	0.95										
32	351.04	105.09	23.1	4.25	4.62	2	0.00	35.0	13766.62	784.71	
2972.72	0.99										
33	355.29	97.38	23.1	4.25	4.62	2	0.00	35.0	12756.47	261.57	
2745.87	0.99										
34	359.54	36.35	23.1	1.68	1.83	2	0.00	35.0	4762.01	0.00	
2589.57	0.99										
35	361.22	100.51	25.4	5.00	5.53	2	0.00	35.0	13167.13	0.00	
2381.87	1.00										
36	366.22	88.65	25.4	5.00	5.53	2	0.00	35.0	11613.42	0.00	
2100.82	1.00										
37	371.22	74.82	27.6	4.90	5.53	2	0.00	35.0	9801.10	0.00	
1790.47	1.01										
38	376.13	62.23	27.6	4.90	5.53	2	0.00	35.0	8152.25	0.00	
1489.25	1.01										
39	381.03	26.20	29.9	2.45	2.82	2	0.00	35.0	3432.17	0.00	
1243.38	1.02										
40	383.48	32.08	29.9	3.57	4.12	1	150.00	22.0	4201.93	0.00	
1069.27	1.07										
41	387.05	24.73	29.9	3.57	4.12	1	150.00	22.0	3239.66	0.00	
818.57	1.07										
42	390.63	20.70	32.1	4.69	5.53	1	150.00	22.0	2712.06	0.00	
507.91	1.09										
43	395.31	6.90	32.1	4.69	5.53	1	150.00	22.0	904.03	0.00	
150.85	1.09										

X-S Area: 4255.71

Path Length: 210.33

X-S Weight: 557731.94

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Rapid Drawdown.gmf

Processed: 04 Dec 2020 12:40:38

DATA: Analysis 1 - Case 4-1 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    190.00      348.50    190.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    157.00      348.50    157.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    154.00      348.50    154.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    190.00      450.00    190.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    157.00      450.00    157.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    154.00      450.00    154.00

```

Slope Surface (4 points)

```

-----
100.00    157.00    196.00    157.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    157.00    196.00    157.00    316.00    197.00    348.50    197.00
351.50    178.00
450.00    178.00

```

Failure Surface

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

```

Intersects: XL: 196.00    YL: 157.00    XR: 405.00    YR: 200.00
Centre: XC: 254.94    YC: 399.95    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 4-1 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.041

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.73

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	198.89	157.96	400.00	200.00	246.02	434.59	280.61	1.725	
Critical Surface									
2	194.68	157.00	400.00	200.00	237.72	463.17	309.18	1.728	
3	199.95	158.32	400.00	200.00	248.45	426.41	272.45	1.731	
4	199.42	158.14	400.00	200.00	247.24	430.51	276.53	1.731	
5	195.21	157.00	400.00	200.00	237.82	463.23	309.18	1.731	
6	193.63	157.00	400.00	200.00	236.64	467.30	313.27	1.731	
7	192.05	157.00	400.00	200.00	235.47	471.36	317.35	1.732	
8	196.26	157.09	400.00	200.00	239.02	459.18	305.10	1.733	
9	196.79	157.26	400.00	200.00	240.24	455.13	301.02	1.734	
10	194.16	157.00	400.00	200.00	236.74	467.36	313.27	1.735	
11	195.74	157.00	400.00	200.00	237.92	463.29	309.18	1.735	
12	192.58	157.00	400.00	200.00	235.56	471.42	317.35	1.735	
13	191.00	157.00	400.00	200.00	234.40	475.49	321.43	1.735	
14	197.32	157.44	400.00	200.00	241.47	451.08	296.94	1.735	
15	198.37	157.79	400.00	200.00	243.91	442.95	288.78	1.735	
16	195.21	157.00	400.53	200.00	238.25	463.17	309.18	1.736	
17	197.32	157.44	400.53	200.00	241.89	451.01	296.94	1.736	
18	197.84	157.61	400.00	200.00	242.69	447.02	292.86	1.737	
19	196.26	157.09	400.53	200.00	239.45	459.12	305.10	1.737	
20	198.89	157.96	400.00	200.00	245.12	438.88	284.69	1.738	
21	194.68	157.00	400.00	200.00	236.83	467.42	313.27	1.738	
22	193.11	157.00	400.00	200.00	235.66	471.48	317.35	1.738	
23	196.79	157.26	400.53	200.00	240.67	455.07	301.02	1.738	
24	191.53	157.00	400.00	200.00	234.49	475.54	321.43	1.738	
25	197.84	157.61	400.53	200.00	243.11	446.95	292.86	1.739	
26	194.16	157.00	400.53	200.00	237.17	467.30	313.27	1.739	
27	192.58	157.00	400.53	200.00	235.99	471.36	317.35	1.739	
28	195.74	157.00	400.53	200.00	238.35	463.23	309.18	1.739	
29	191.00	157.00	400.53	200.00	234.83	475.43	321.43	1.739	
30	199.42	158.14	400.00	200.00	246.34	434.80	280.61	1.740	
31	195.74	157.00	401.05	200.00	238.77	463.17	309.18	1.740	
32	195.21	157.00	400.00	200.00	236.93	467.48	313.27	1.741	
33	193.63	157.00	400.00	200.00	235.76	471.54	317.35	1.741	
34	198.37	157.79	400.53	200.00	244.33	442.88	288.78	1.741	
35	192.05	157.00	400.00	200.00	234.59	475.60	321.43	1.741	
36	199.95	158.32	400.00	200.00	247.56	430.72	276.53	1.742	
37	197.32	157.44	401.05	200.00	242.31	450.95	296.94	1.742	
38	194.68	157.00	400.53	200.00	237.26	467.36	313.27	1.742	
39	193.11	157.00	400.53	200.00	236.09	471.42	317.35	1.742	
40	191.53	157.00	400.53	200.00	234.92	475.49	321.43	1.742	
41	196.26	157.09	400.00	200.00	238.13	463.42	309.18	1.742	
42	198.89	157.96	400.53	200.00	245.54	438.81	284.69	1.743	
43	196.79	157.26	400.00	200.00	239.35	459.38	305.10	1.744	
44	200.47	158.49	400.00	200.00	248.77	426.62	272.45	1.744	
45	194.16	157.00	400.00	200.00	235.85	471.60	317.35	1.744	
46	195.74	157.00	400.00	200.00	237.02	467.53	313.27	1.744	
47	192.58	157.00	400.00	200.00	234.69	475.66	321.43	1.744	
48	197.84	157.61	401.05	200.00	243.53	446.89	292.86	1.744	
49	191.00	157.00	400.00	200.00	233.53	479.72	325.51	1.744	
50	199.42	158.14	400.53	200.00	246.76	434.73	280.61	1.745	
51	195.21	157.00	400.53	200.00	237.36	467.42	313.27	1.745	
52	193.63	157.00	400.53	200.00	236.19	471.48	317.35	1.745	
53	192.05	157.00	400.53	200.00	235.02	475.54	321.43	1.745	
54	197.32	157.44	400.00	200.00	240.57	455.33	301.02	1.746	
55	199.95	158.32	400.53	200.00	247.97	430.64	276.53	1.746	
56	198.37	157.79	401.05	200.00	244.75	442.82	288.78	1.746	
57	198.37	157.79	400.00	200.00	243.01	447.22	292.86	1.746	
58	193.11	157.00	401.05	200.00	236.52	471.36	317.35	1.746	
59	194.68	157.00	401.05	200.00	237.69	467.30	313.27	1.746	
60	191.53	157.00	401.05	200.00	235.35	475.43	321.43	1.747	
61	197.32	157.44	400.53	200.00	241.00	455.27	301.02	1.747	
62	194.68	157.00	400.00	200.00	235.95	471.65	317.35	1.747	
63	193.11	157.00	400.00	200.00	234.78	475.72	321.43	1.747	
64	196.26	157.09	400.53	200.00	238.56	463.36	309.18	1.747	
65	191.53	157.00	400.00	200.00	233.62	479.78	325.51	1.747	
66	198.89	157.96	401.05	200.00	245.96	438.74	284.69	1.747	
67	197.84	157.61	400.00	200.00	241.79	451.28	296.94	1.748	
68	196.79	157.26	400.53	200.00	239.78	459.32	305.10	1.748	

69	196.26	157.09	401.05	200.00	238.99	463.31	309.18	1.748
70	194.16	157.00	400.53	200.00	236.28	471.54	317.35	1.748
71	195.74	157.00	400.53	200.00	237.46	467.48	313.27	1.748
72	192.58	157.00	400.53	200.00	235.12	475.60	321.43	1.748
73	199.42	158.14	401.05	200.00	247.18	434.66	280.61	1.749
74	191.00	157.00	400.53	200.00	233.96	479.66	325.51	1.749
75	201.00	158.67	400.00	200.00	249.99	422.53	268.37	1.749
76	198.89	157.96	400.00	200.00	244.23	443.16	288.78	1.749
77	197.84	157.61	400.53	200.00	242.22	451.22	296.94	1.749
78	195.21	157.00	400.00	200.00	236.04	471.71	317.35	1.749
79	193.63	157.00	400.00	200.00	234.87	475.77	321.43	1.750
80	193.63	157.00	401.05	200.00	236.62	471.42	317.35	1.750
81	195.21	157.00	401.05	200.00	237.79	467.36	313.27	1.750
82	192.05	157.00	401.05	200.00	235.45	475.49	321.43	1.750
83	196.79	157.26	401.05	200.00	240.21	459.26	305.10	1.750
84	192.05	157.00	400.00	200.00	233.72	479.83	325.51	1.750
85	201.00	158.67	400.53	200.00	250.40	422.45	268.37	1.750
86	200.47	158.49	400.53	200.00	249.19	426.55	272.45	1.751
87	195.21	157.00	401.58	200.00	238.22	467.30	313.27	1.751
88	196.26	157.09	400.00	200.00	237.24	467.66	313.27	1.751
89	194.68	157.00	400.53	200.00	236.38	471.60	317.35	1.751
90	193.11	157.00	400.53	200.00	235.21	475.66	321.43	1.751
91	191.53	157.00	400.53	200.00	234.05	479.72	325.51	1.752
92	199.42	158.14	400.00	200.00	245.45	439.09	284.69	1.752
93	198.37	157.79	400.53	200.00	243.43	447.16	292.86	1.752
94	195.74	157.00	400.00	200.00	236.13	471.77	317.35	1.752
95	197.32	157.44	401.05	200.00	241.42	455.21	301.02	1.752
96	194.16	157.00	400.00	200.00	234.97	475.83	321.43	1.752
97	192.58	157.00	400.00	200.00	233.81	479.89	325.51	1.753
98	200.47	158.49	401.05	200.00	249.60	426.47	272.45	1.753
99	196.79	157.26	400.00	200.00	238.46	463.63	309.18	1.753

Critical Failure Surface (circle 1)

Intersects:	XL:	198.89	YL:	157.96	XR:	400.00	YR:	200.00	
	Centre:	XC:	246.02	YC:	434.59		Radius:	R:	280.61
Generated failure surface: (20 points)									
198.89	157.96		209.84	156.32		220.85	155.11	231.89	154.34
242.95	154.00								
254.02	154.09		265.08	154.63		276.11	155.60	287.09	157.00
298.00	158.84								
308.84	161.10		319.58	163.79		330.20	166.90	340.69	170.43
351.04	174.37								
361.22	178.72		371.22	183.46		381.03	188.59	390.63	194.11
400.00	200.00								

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	198.89	9.99	-8.5	6.43	6.50	2	0.00	35.0	1308.25	630.15
210.45	1.08									
2	205.32	18.98	-8.5	4.52	4.57	3	100.00	18.0	2502.06	1197.79
571.02	1.04									
3	209.84	35.83	-6.3	5.50	5.53	3	100.00	18.0	4747.41	2249.14
879.06	1.03									
4	215.34	49.25	-6.3	5.50	5.53	3	100.00	18.0	6538.65	3091.56
1208.30	1.03									
5	220.85	62.31	-4.0	5.52	5.53	3	100.00	18.0	8277.27	3897.56
1513.92	1.02									
6	226.37	74.61	-4.0	5.52	5.53	3	100.00	18.0	9910.27	4667.11
1811.78	1.02									
7	231.89	85.52	-1.8	5.47	5.48	3	100.00	18.0	11353.01	5338.70
2082.30	1.01									
8	237.36	96.42	-1.8	5.47	5.48	3	100.00	18.0	12790.79	6019.51
2345.78	1.01									
9	242.84	109.21	0.5	5.59	5.59	3	100.00	18.0	14472.79	6814.73
2584.94	1.00									
10	248.43	119.36	0.5	5.59	5.59	3	100.00	18.0	15800.16	7448.38
2821.78	1.00									
11	254.02	127.35	2.8	5.53	5.53	3	100.00	18.0	16835.93	7955.80
3028.04	0.99									
12	259.55	136.06	2.8	5.53	5.53	3	100.00	18.0	17962.54	8500.10
3230.86	0.99									
13	265.08	143.77	5.0	5.51	5.53	3	100.00	18.0	18951.42	9005.91
3402.67	0.99									
14	270.59	151.23	5.0	5.51	5.53	3	100.00	18.0	19902.03	9473.25
3573.65	0.99									
15	276.11	157.29	7.3	5.49	5.53	3	100.00	18.0	20662.64	9894.74
3712.40	0.98									
16	281.59	163.48	7.3	5.49	5.53	3	100.00	18.0	21434.47	10283.86

3851.43	0.98									
17	287.08	121.53	9.5	3.96	4.02	2	0.00	35.0	15920.13	7689.71
3885.59	0.95									
18	291.04	124.12	9.5	3.96	4.02	2	0.00	35.0	16259.47	7853.72
3968.35	0.95									
19	295.00	95.87	9.5	3.00	3.05	2	0.00	35.0	12559.12	6066.35
4041.17	0.95									
20	298.00	176.09	11.8	5.42	5.53	2	0.00	35.0	23067.53	11225.35
4083.32	0.94									
21	303.42	179.74	11.8	5.42	5.53	2	0.00	35.0	23545.42	11457.91
4167.93	0.94									
22	308.84	120.51	14.1	3.58	3.69	2	0.00	35.0	15786.75	7752.25
4196.29	0.94									
23	312.42	121.57	14.1	3.58	3.69	2	0.00	35.0	15925.75	7820.50
4233.24	0.94									
24	316.00	122.54	14.1	3.58	3.69	2	0.00	35.0	16052.36	7745.47
4266.73	0.94									
25	319.58	187.13	16.3	5.42	5.65	2	0.00	35.0	24514.12	11428.52
4255.36	0.93									
26	325.00	176.09	16.3	5.20	5.42	2	0.00	35.0	23068.13	10435.37
4168.68	0.93									
27	330.20	169.00	18.6	5.25	5.53	2	0.00	35.0	22139.23	10089.91
3932.14	0.93									
28	335.45	159.75	18.6	5.25	5.53	2	0.00	35.0	20926.60	9480.52
3715.55	0.93									
29	340.69	112.51	20.8	3.90	4.18	2	0.00	35.0	14738.72	6730.53
3486.21	0.93									
30	344.60	106.71	20.8	3.90	4.18	2	0.00	35.0	13978.66	6343.13
3305.14	0.93									
31	348.50	66.29	20.8	2.54	2.72	5	0.00	45.0	7291.38	2554.84
2522.94	0.88									
32	351.04	105.09	23.1	4.25	4.62	2	0.00	35.0	13766.62	784.71
2785.45	0.93									
33	355.29	97.38	23.1	4.25	4.62	2	0.00	35.0	12756.47	261.57
2566.20	0.93									
34	359.54	36.35	23.1	1.68	1.83	2	0.00	35.0	4762.01	0.00
2416.56	0.93									
35	361.22	100.51	25.4	5.00	5.53	2	0.00	35.0	13167.13	0.00
2207.89	0.93									
36	366.22	88.65	25.4	5.00	5.53	2	0.00	35.0	11613.42	0.00
1947.37	0.93									
37	371.22	74.82	27.6	4.90	5.53	2	0.00	35.0	9801.10	0.00
1648.48	0.93									
38	376.13	62.23	27.6	4.90	5.53	2	0.00	35.0	8152.25	0.00
1371.15	0.93									
39	381.03	26.20	29.9	2.45	2.82	2	0.00	35.0	3432.17	0.00
1136.93	0.94									
40	383.48	32.08	29.9	3.57	4.12	1	150.00	22.0	4201.93	0.00
991.92	1.02									
41	387.05	24.73	29.9	3.57	4.12	1	150.00	22.0	3239.66	0.00
754.69	1.02									
42	390.63	20.70	32.1	4.69	5.53	1	150.00	22.0	2712.06	0.00
456.85	1.03									
43	395.31	6.90	32.1	4.69	5.53	1	150.00	22.0	904.03	0.00
120.53	1.03									

X-S Area: 4255.71

Path Length: 210.33

X-S Weight: 557731.94

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 4-2 Full Reservoir.gmf

Processed: 02 Dec 2020 14:01:24

DATA: Analysis 1 - Case 4-2 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    188.00      348.50    188.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    146.00      348.50    146.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    143.00      348.50    143.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    188.00      450.00    188.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    146.00      450.00    146.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    143.00      450.00    143.00

```

Slope Surface (8 points)

```

-----
100.00    146.00    163.00    146.00    325.00    200.00    410.00    200.00
415.00    195.00
420.00    195.00    425.00    200.00    450.00    200.00

```

Phreatic Surface (5 points)

```

-----
100.00    197.00    316.00    197.00    348.50    197.00    351.50    170.00
450.00    170.00

```

Failure Surface

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

```

Intersects: XL: 163.00  YL: 146.00  XR: 415.00  YR: 195.00
Centre: XC: 248.05  YC: 381.09  Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 4-2 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 5.365

Analysis Summary

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

Critical (minimum) Factor of Safety: 3.11

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	166.42	147.14	410.00	200.00	219.78	488.92	345.92	3.112	
Critical Surface									
2	166.95	147.32	410.00	200.00	221.02	484.85	341.84	3.116	
3	167.47	147.49	410.00	200.00	222.26	480.77	337.76	3.121	
4	166.42	147.14	410.00	200.00	218.85	493.19	350.00	3.124	
5	168.00	147.67	410.00	200.00	223.51	476.69	333.67	3.126	
6	166.95	147.32	410.00	200.00	220.09	489.13	345.92	3.129	
7	167.47	147.49	410.00	200.00	221.34	485.06	341.84	3.134	
8	168.00	147.67	410.00	200.00	222.58	480.98	337.76	3.140	
9	165.89	146.96	410.00	200.00	218.53	492.98	350.00	3.140	
10	166.95	147.32	410.00	200.00	219.17	493.40	350.00	3.141	
11	166.42	147.14	410.53	199.47	219.93	493.03	350.00	3.144	
12	167.47	147.49	410.00	200.00	220.41	489.34	345.92	3.147	
13	166.95	147.32	410.53	199.47	221.16	488.96	345.92	3.149	
14	168.00	147.67	410.00	200.00	221.65	485.27	341.84	3.153	
15	167.47	147.49	410.53	199.47	222.40	484.89	341.84	3.154	
16	168.00	147.67	410.53	199.47	223.63	480.81	337.76	3.158	
17	167.47	147.49	410.00	200.00	219.48	493.61	350.00	3.159	
18	166.95	147.32	410.53	199.47	220.25	493.23	350.00	3.161	
19	168.00	147.67	410.00	200.00	220.73	489.54	345.92	3.167	
20	167.47	147.49	410.53	199.47	221.48	489.17	345.92	3.168	
21	168.00	147.67	410.53	199.47	222.72	485.10	341.84	3.173	
22	167.47	147.49	410.53	199.47	220.57	493.44	350.00	3.180	
23	168.00	147.67	410.00	200.00	219.80	493.81	350.00	3.182	
24	166.95	147.32	411.05	198.95	221.33	493.07	350.00	3.184	
25	168.00	147.67	410.53	199.47	221.80	489.38	345.92	3.186	
26	167.47	147.49	411.05	198.95	222.56	489.00	345.92	3.187	
27	168.00	147.67	411.05	198.95	223.78	484.92	341.84	3.190	
28	168.00	147.67	410.53	199.47	220.89	493.65	350.00	3.201	
29	167.47	147.49	411.05	198.95	221.65	493.27	350.00	3.201	
30	168.00	147.67	411.05	198.95	222.88	489.20	345.92	3.205	
31	168.00	147.67	411.05	198.95	221.97	493.48	350.00	3.219	
32	167.47	147.49	411.58	198.42	222.73	493.10	350.00	3.219	
33	168.00	147.67	411.58	198.42	223.95	489.03	345.92	3.223	
34	168.00	147.67	411.58	198.42	223.06	493.31	350.00	3.238	
35	168.00	147.67	412.11	197.89	224.14	493.14	350.00	3.257	
36	168.00	147.67	412.63	197.37	225.21	492.96	350.00	3.344	
37	168.00	147.67	412.11	197.89	225.02	488.85	345.92	3.382	
38	167.47	147.49	412.11	197.89	223.81	492.93	350.00	3.402	
39	168.00	147.67	411.58	198.42	224.84	484.74	341.84	3.428	
40	167.47	147.49	411.58	198.42	223.62	488.82	345.92	3.429	
41	166.95	147.32	411.58	198.42	222.41	492.89	350.00	3.444	
42	167.47	147.49	411.05	198.95	223.46	484.71	341.84	3.465	
43	166.95	147.32	411.05	198.95	222.23	488.79	345.92	3.468	
44	168.00	147.67	411.05	198.95	224.69	480.63	337.76	3.484	
45	166.42	147.14	411.05	198.95	221.01	492.86	350.00	3.485	
46	166.95	147.32	410.53	199.47	222.08	484.68	341.84	3.497	
47	166.42	147.14	410.53	199.47	220.85	488.75	345.92	3.503	
48	167.47	147.49	410.53	199.47	223.32	480.60	337.76	3.510	
49	168.00	147.67	410.00	200.00	224.44	472.39	329.59	3.528	
50	165.89	146.96	410.53	199.47	219.61	492.82	350.00	3.528	
51	168.00	147.67	410.53	199.47	224.55	476.51	333.67	3.530	
52	166.42	147.14	410.00	200.00	220.70	484.64	341.84	3.532	
53	166.95	147.32	410.00	200.00	221.95	480.56	337.76	3.534	
54	167.47	147.49	410.00	200.00	223.19	476.48	333.67	3.537	
55	165.89	146.96	410.00	200.00	219.46	488.71	345.92	3.550	
56	165.37	146.79	410.00	200.00	218.21	492.78	350.00	3.608	
57	168.00	147.67	411.58	198.42	225.74	480.45	337.76	3.732	
58	168.00	147.67	412.11	197.89	225.90	484.56	341.84	3.734	
59	168.00	147.67	411.05	198.95	225.59	476.33	333.67	3.737	
60	167.47	147.49	411.58	198.42	224.52	484.53	341.84	3.739	
61	168.00	147.67	412.63	197.37	226.08	488.67	345.92	3.741	
62	167.47	147.49	411.05	198.95	224.37	480.42	337.76	3.741	
63	167.47	147.49	412.11	197.89	224.69	488.64	345.92	3.742	
64	168.00	147.67	410.53	199.47	225.47	472.21	329.59	3.747	
65	167.47	147.49	410.53	199.47	224.24	476.30	333.67	3.748	
66	166.42	147.14	410.00	200.00	221.64	480.35	337.76	3.751	
67	167.47	147.49	412.63	197.37	224.88	492.75	350.00	3.752	

68	165.89	146.96	410.00	200.00	220.39	484.43	341.84	3.752
69	168.00	147.67	413.16	196.84	226.29	492.78	350.00	3.753
70	166.95	147.32	411.58	198.42	223.30	488.61	345.92	3.754
71	166.95	147.32	411.05	198.95	223.14	484.50	341.84	3.754
72	166.95	147.32	410.00	200.00	222.88	476.27	333.67	3.755
73	166.95	147.32	412.11	197.89	223.48	492.72	350.00	3.759
74	166.42	147.14	410.53	199.47	221.76	484.47	341.84	3.761
75	168.00	147.67	410.00	200.00	225.37	468.08	325.51	3.763
76	165.89	146.96	410.53	199.47	220.53	488.54	345.92	3.764
77	166.95	147.32	410.53	199.47	223.00	480.39	337.76	3.767
78	167.47	147.49	410.00	200.00	224.12	472.18	329.59	3.768
79	165.37	146.79	410.00	200.00	219.14	488.50	345.92	3.771
80	165.37	146.79	410.53	199.47	219.29	492.61	350.00	3.772
81	166.42	147.14	411.05	198.95	221.91	488.58	345.92	3.777
82	166.42	147.14	411.58	198.42	222.08	492.69	350.00	3.779
83	165.89	146.96	411.05	198.95	220.69	492.65	350.00	3.781
84	164.84	146.61	410.00	200.00	217.90	492.57	350.00	3.783
85	165.89	146.96	410.00	200.00	221.32	480.14	337.76	3.878
86	165.37	146.79	410.00	200.00	220.08	484.22	341.84	3.879
87	166.42	147.14	410.00	200.00	222.57	476.06	333.67	3.881
88	165.89	146.96	410.53	199.47	221.45	484.26	341.84	3.888
89	166.42	147.14	410.53	199.47	222.68	480.18	337.76	3.890
90	166.95	147.32	410.00	200.00	223.81	471.97	329.59	3.891
91	165.37	146.79	410.53	199.47	220.21	488.33	345.92	3.892
92	166.95	147.32	410.53	199.47	223.92	476.09	333.67	3.897
93	164.84	146.61	410.00	200.00	218.83	488.29	345.92	3.900
94	164.84	146.61	410.53	199.47	218.97	492.40	350.00	3.900
95	166.42	147.14	411.05	198.95	222.82	484.29	341.84	3.904
96	165.89	146.96	411.05	198.95	221.59	488.37	345.92	3.904
97	166.95	147.32	411.05	198.95	224.05	480.21	337.76	3.906
98	167.47	147.49	410.00	200.00	225.06	467.87	325.51	3.906
99	167.47	147.49	410.53	199.47	225.16	472.00	329.59	3.908

Intersects:	XL:	166.42	YL:	147.14	XR:	410.00	YR:	200.00	
Centre:	XC:	219.78	YC:	488.92			Radius:	R:	345.92
Generated failure surface: (20 points)									
	166.42	147.14	179.72	145.33		193.07	144.03	206.47	143.26
219.89	143.00								
	233.30	143.27	246.70	144.05		260.06	145.35	273.35	147.17
286.57	149.51								
	299.68	152.36	312.67	155.71		325.53	159.56	338.22	163.91
350.74	168.75								
	363.06	174.07	375.16	179.87		387.03	186.12	398.65	192.84
410.00	200.00								

Slice Normal	X-S	Base							PoreWater	
Test X-Left Factor	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	
Stress 1	166.42	4.11	-7.8	4.18	4.22	2	0.00	35.0	538.34	13211.00
3198.55	1.04									
2	170.60	12.33	-7.8	4.18	4.22	2	0.00	35.0	1615.00	13361.21
3373.17	1.04									
3	174.79	25.08	-7.8	4.93	4.98	3	100.00	18.0	3301.49	15937.23
3565.21	1.02									
4	179.72	51.30	-5.5	6.68	6.71	3	100.00	18.0	6786.52	21769.78
3790.06	1.01									
5	186.40	70.49	-5.5	6.68	6.71	3	100.00	18.0	9343.89	22040.96
4036.16	1.01									
6	193.07	89.10	-3.3	6.70	6.71	3	100.00	18.0	11817.28	22257.47
4258.95	1.01									
7	199.77	106.66	-3.3	6.70	6.71	3	100.00	18.0	14143.05	22419.94
4467.96	1.01									
8	206.47	123.54	-1.1	6.71	6.71	3	100.00	18.0	16371.86	22527.96
4652.14	1.00									
9	213.18	139.40	-1.1	6.71	6.71	3	100.00	18.0	18458.04	22581.55
4823.91	1.00									
10	219.89	154.38	1.1	6.71	6.71	3	100.00	18.0	20421.09	22580.93
4969.54	1.00									
11	226.60	168.50	1.1	6.71	6.71	3	100.00	18.0	22261.04	22525.53
5103.99	1.00									
12	233.30	181.45	3.4	6.70	6.71	3	100.00	18.0	23939.84	22415.43
5211.19	1.00									
13	240.00	193.78	3.4	6.70	6.71	3	100.00	18.0	25528.32	22251.13
5308.27	1.00									
14	246.70	204.59	5.6	6.68	6.71	3	100.00	18.0	26909.62	22032.45
5377.18	0.99									
15	253.38	215.10	5.6	6.68	6.71	3	100.00	18.0	28243.10	21759.52
5436.94	0.99									

16	260.06	157.81	7.8	4.72	4.76	3	100.00	18.0	20688.77	15245.23
5464.47	1.00									
17	264.77	147.32	7.8	4.29	4.33	2	0.00	35.0	19299.49	13698.95
5449.73	0.98									
18	269.06	150.94	7.8	4.29	4.33	2	0.00	35.0	19772.83	13540.23
5469.13	0.98									
19	273.35	238.70	10.0	6.61	6.71	2	0.00	35.0	31269.13	20616.29
5456.15	0.98									
20	279.96	245.53	10.0	6.61	6.71	2	0.00	35.0	32165.02	20127.56
5451.57	0.98									
21	286.57	92.04	12.2	2.43	2.49	2	0.00	35.0	12057.88	7338.94
5420.56	0.98									
22	289.00	204.38	12.2	5.34	5.46	2	0.00	35.0	26773.65	15815.45
5397.50	0.98									
23	294.34	207.70	12.2	5.34	5.46	2	0.00	35.0	27208.17	15420.28
5365.81	0.98									
24	299.68	256.29	14.5	6.50	6.71	2	0.00	35.0	33574.41	18340.63
5291.19	0.98									
25	306.18	259.47	14.5	6.50	6.71	2	0.00	35.0	33990.96	17638.84
5218.32	0.98									
26	312.67	133.84	16.7	3.33	3.47	2	0.00	35.0	17532.50	8838.74
5131.40	0.98									
27	316.00	181.66	16.7	4.50	4.70	2	0.00	35.0	23798.01	11614.52
5110.46	0.98									
28	320.50	182.34	16.7	4.50	4.70	2	0.00	35.0	23886.92	11219.01
5123.64	0.98									
29	325.00	261.06	18.7	6.61	6.98	2	0.00	35.0	34198.55	15894.72
4967.30	0.98									
30	331.61	246.08	18.9	6.61	6.99	2	0.00	35.0	32236.82	14923.57
4679.76	0.98									
31	338.22	180.34	21.1	5.14	5.51	2	0.00	35.0	23624.33	11033.37
4389.79	0.99									
32	343.36	170.13	21.1	5.14	5.51	2	0.00	35.0	22287.28	10350.56
4140.47	0.99									
33	348.50	70.95	21.1	2.24	2.40	5	0.00	45.0	7804.19	2787.31
3228.25	0.95									
34	350.74	88.61	23.4	2.89	3.15	2	0.00	35.0	11608.39	122.89
3659.96	0.99									
35	353.63	136.59	23.4	4.71	5.13	2	0.00	35.0	17893.91	0.00
3460.39	0.99									
36	358.35	127.00	23.4	4.71	5.13	2	0.00	35.0	16637.22	0.00
3217.37	0.99									
37	363.06	148.15	25.6	6.05	6.71	2	0.00	35.0	19408.21	0.00
2895.09	1.00									
38	369.11	130.62	25.6	6.05	6.71	2	0.00	35.0	17111.37	0.00
2552.47	1.00									
39	375.16	110.21	27.8	5.93	6.71	2	0.00	35.0	14437.86	0.00
2174.63	1.01									
40	381.10	91.64	27.8	5.93	6.71	2	0.00	35.0	12004.69	0.00
1808.14	1.01									
41	387.03	41.98	30.0	3.25	3.75	2	0.00	35.0	5499.99	0.00
1499.79	1.02									
42	390.28	45.17	30.0	4.19	4.84	1	150.00	22.0	5917.84	0.00
1288.92	1.07									
43	394.46	35.04	30.0	4.19	4.84	1	150.00	22.0	4590.72	0.00
994.05	1.07									
44	398.65	30.47	32.2	5.67	6.71	1	150.00	22.0	3992.05	0.00
622.13	1.09									
45	404.33	10.16	32.2	5.67	6.71	1	150.00	22.0	1330.68	0.00
188.64	1.09									

X-S Area:

6122.06

Path Length:

254.97

X-S Weight:

802280.44

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 4-2 Rapid Drawdown.gmf

Processed: 02 Dec 2020 14:02:16

DATA: Analysis 1 - Case 4-2 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    188.00      348.50    188.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    146.00      348.50    146.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    143.00      348.50    143.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    188.00      450.00    188.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    146.00      450.00    146.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    143.00      450.00    143.00

```

Slope Surface (8 points)

```

-----
100.00    146.00    163.00    146.00    325.00    200.00    410.00    200.00
415.00    195.00
420.00    195.00    425.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    146.00    163.00    146.00    316.00    197.00    348.50    197.00
351.50    170.00
450.00    170.00

```

Failure Surface

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

```

Intersects: XL: 163.00    YL: 146.00    XR: 415.00    YR: 195.00
Centre: XC: 248.05    YC: 381.09    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 4-2 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.925

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.66

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	166.42	147.14	410.00	200.00	219.78	488.92	345.92	1.664	
Critical Surface									
2	166.95	147.32	410.00	200.00	221.02	484.85	341.84	1.667	
3	167.47	147.49	410.00	200.00	222.26	480.77	337.76	1.669	
4	168.00	147.67	410.00	200.00	223.51	476.69	333.67	1.672	
5	166.42	147.14	410.00	200.00	218.85	493.19	350.00	1.672	
6	166.95	147.32	410.00	200.00	220.09	489.13	345.92	1.675	
7	167.47	147.49	410.00	200.00	221.34	485.06	341.84	1.677	
8	168.00	147.67	410.00	200.00	222.58	480.98	337.76	1.680	
9	165.89	146.96	410.00	200.00	218.53	492.98	350.00	1.682	
10	166.95	147.32	410.00	200.00	219.17	493.40	350.00	1.682	
11	166.42	147.14	410.53	199.47	219.93	493.03	350.00	1.682	
12	167.47	147.49	410.00	200.00	220.41	489.34	345.92	1.685	
13	166.95	147.32	410.53	199.47	221.16	488.96	345.92	1.685	
14	167.47	147.49	410.53	199.47	222.40	484.89	341.84	1.688	
15	168.00	147.67	410.00	200.00	221.65	485.27	341.84	1.688	
16	168.00	147.67	410.53	199.47	223.63	480.81	337.76	1.690	
17	167.47	147.49	410.00	200.00	219.48	493.61	350.00	1.693	
18	166.95	147.32	410.53	199.47	220.25	493.23	350.00	1.693	
19	167.47	147.49	410.53	199.47	221.48	489.17	345.92	1.696	
20	168.00	147.67	410.00	200.00	220.73	489.54	345.92	1.697	
21	168.00	147.67	410.53	199.47	222.72	485.10	341.84	1.699	
22	167.47	147.49	410.53	199.47	220.57	493.44	350.00	1.704	
23	166.95	147.32	411.05	198.95	221.33	493.07	350.00	1.704	
24	168.00	147.67	410.00	200.00	219.80	493.81	350.00	1.706	
25	167.47	147.49	411.05	198.95	222.56	489.00	345.92	1.706	
26	168.00	147.67	410.53	199.47	221.80	489.38	345.92	1.707	
27	168.00	147.67	411.05	198.95	223.78	484.92	341.84	1.708	
28	167.47	147.49	411.05	198.95	221.65	493.27	350.00	1.715	
29	168.00	147.67	410.53	199.47	220.89	493.65	350.00	1.716	
30	168.00	147.67	411.05	198.95	222.88	489.20	345.92	1.717	
31	167.47	147.49	411.58	198.42	222.73	493.10	350.00	1.725	
32	168.00	147.67	411.05	198.95	221.97	493.48	350.00	1.726	
33	168.00	147.67	411.58	198.42	223.95	489.03	345.92	1.727	
34	168.00	147.67	411.58	198.42	223.06	493.31	350.00	1.736	
35	168.00	147.67	412.11	197.89	224.14	493.14	350.00	1.745	
36	168.00	147.67	412.63	197.37	225.21	492.96	350.00	1.794	
37	168.00	147.67	412.11	197.89	225.02	488.85	345.92	1.818	
38	167.47	147.49	412.11	197.89	223.81	492.93	350.00	1.830	
39	168.00	147.67	411.58	198.42	224.84	484.74	341.84	1.847	
40	167.47	147.49	411.58	198.42	223.62	488.82	345.92	1.847	
41	166.95	147.32	411.58	198.42	222.41	492.89	350.00	1.856	
42	167.47	147.49	411.05	198.95	223.46	484.71	341.84	1.869	
43	166.95	147.32	411.05	198.95	222.23	488.79	345.92	1.870	
44	168.00	147.67	411.05	198.95	224.69	480.63	337.76	1.880	
45	166.42	147.14	411.05	198.95	221.01	492.86	350.00	1.880	
46	166.95	147.32	410.53	199.47	222.08	484.68	341.84	1.888	
47	166.42	147.14	410.53	199.47	220.85	488.75	345.92	1.892	
48	167.47	147.49	410.53	199.47	223.32	480.60	337.76	1.896	
49	168.00	147.67	410.00	200.00	224.44	472.39	329.59	1.906	
50	168.00	147.67	410.53	199.47	224.55	476.51	333.67	1.907	
51	165.89	146.96	410.53	199.47	219.61	492.82	350.00	1.907	
52	166.42	147.14	410.00	200.00	220.70	484.64	341.84	1.909	
53	166.95	147.32	410.00	200.00	221.95	480.56	337.76	1.911	
54	167.47	147.49	410.00	200.00	223.19	476.48	333.67	1.912	
55	165.89	146.96	410.00	200.00	219.46	488.71	345.92	1.920	
56	165.37	146.79	410.00	200.00	218.21	492.78	350.00	1.951	
57	168.00	147.67	412.11	197.89	225.90	484.56	341.84	2.023	
58	168.00	147.67	411.58	198.42	225.74	480.45	337.76	2.023	
59	168.00	147.67	412.63	197.37	226.08	488.67	345.92	2.025	
60	167.47	147.49	411.58	198.42	224.52	484.53	341.84	2.027	
61	168.00	147.67	411.05	198.95	225.59	476.33	333.67	2.027	
62	167.47	147.49	412.11	197.89	224.69	488.64	345.92	2.028	
63	167.47	147.49	411.05	198.95	224.37	480.42	337.76	2.029	
64	168.00	147.67	413.16	196.84	226.29	492.78	350.00	2.030	
65	167.47	147.49	412.63	197.37	224.88	492.75	350.00	2.031	
66	168.00	147.67	410.53	199.47	225.47	472.21	329.59	2.033	

67	167.47	147.49	410.53	199.47	224.24	476.30	333.67	2.034
68	166.95	147.32	411.58	198.42	223.30	488.61	345.92	2.035
69	166.95	147.32	411.05	198.95	223.14	484.50	341.84	2.036
70	166.42	147.14	410.00	200.00	221.64	480.35	337.76	2.036
71	166.95	147.32	412.11	197.89	223.48	492.72	350.00	2.037
72	165.89	146.96	410.00	200.00	220.39	484.43	341.84	2.037
73	166.95	147.32	410.00	200.00	222.88	476.27	333.67	2.038
74	166.42	147.14	410.53	199.47	221.76	484.47	341.84	2.042
75	168.00	147.67	410.00	200.00	225.37	468.08	325.51	2.042
76	165.89	146.96	410.53	199.47	220.53	488.54	345.92	2.044
77	166.95	147.32	410.53	199.47	223.00	480.39	337.76	2.045
78	167.47	147.49	410.00	200.00	224.12	472.18	329.59	2.045
79	165.37	146.79	410.00	200.00	219.14	488.50	345.92	2.045
80	165.37	146.79	410.53	199.47	219.29	492.61	350.00	2.049
81	166.42	147.14	411.05	198.95	221.91	488.58	345.92	2.049
82	166.42	147.14	411.58	198.42	222.08	492.69	350.00	2.050
83	164.84	146.61	410.00	200.00	217.90	492.57	350.00	2.052
84	165.89	146.96	411.05	198.95	220.69	492.65	350.00	2.053
85	165.89	146.96	410.00	200.00	221.32	480.14	337.76	2.109
86	165.37	146.79	410.00	200.00	220.08	484.22	341.84	2.111
87	166.42	147.14	410.00	200.00	222.57	476.06	333.67	2.111
88	165.89	146.96	410.53	199.47	221.45	484.26	341.84	2.115
89	166.42	147.14	410.53	199.47	222.68	480.18	337.76	2.116
90	166.95	147.32	410.00	200.00	223.81	471.97	329.59	2.116
91	165.37	146.79	410.53	199.47	220.21	488.33	345.92	2.117
92	164.84	146.61	410.00	200.00	218.83	488.29	345.92	2.119
93	166.95	147.32	410.53	199.47	223.92	476.09	333.67	2.120
94	166.42	147.14	411.05	198.95	222.82	484.29	341.84	2.122
95	164.84	146.61	410.53	199.47	218.97	492.40	350.00	2.123
96	165.89	146.96	411.05	198.95	221.59	488.37	345.92	2.123
97	166.95	147.32	411.05	198.95	224.05	480.21	337.76	2.124
98	167.47	147.49	410.00	200.00	225.06	467.87	325.51	2.125
99	167.47	147.49	410.53	199.47	225.16	472.00	329.59	2.126

Critical Failure Surface (circle 1)

Intersects:	XL:	166.42	YL:	147.14	XR:	410.00	YR:	200.00	
Centre:	XC:	219.78	YC:	488.92			Radius:	R:	345.92
Generated failure surface: (20 points)									
166.42	147.14	179.72	145.33	193.07	144.03	206.47	143.26		
219.89	143.00								
233.30	143.27	246.70	144.05	260.06	145.35	273.35	147.17		
286.57	149.51								
299.68	152.36	312.67	155.71	325.53	159.56	338.22	163.91		
350.74	168.75								
363.06	174.07	375.16	179.87	387.03	186.12	398.65	192.84		
410.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	166.42	4.11	-7.8	4.18	4.22	2	0.00	35.0	538.34	258.80
132.78	1.07									
2	170.60	12.33	-7.8	4.18	4.22	2	0.00	35.0	1615.00	776.39
398.35	1.07									
3	174.79	25.08	-7.8	4.93	4.98	3	100.00	18.0	3301.49	1579.20
687.78	1.04									
4	179.72	51.30	-5.5	6.68	6.71	3	100.00	18.0	6786.52	3216.00
1032.49	1.02									
5	186.40	70.49	-5.5	6.68	6.71	3	100.00	18.0	9343.89	4419.19
1419.35	1.02									
6	193.07	89.10	-3.3	6.70	6.71	3	100.00	18.0	11817.28	5569.36
1778.41	1.01									
7	199.77	106.66	-3.3	6.70	6.71	3	100.00	18.0	14143.05	6666.66
2127.72	1.01									
8	206.47	123.54	-1.1	6.71	6.71	3	100.00	18.0	16371.86	7710.21
2446.48	1.00									
9	213.18	139.40	-1.1	6.71	6.71	3	100.00	18.0	18458.04	8700.02
2758.08	1.00									
10	219.89	154.38	1.1	6.71	6.71	3	100.00	18.0	20421.09	9635.45
3036.76	1.00									
11	226.60	168.50	1.1	6.71	6.71	3	100.00	18.0	22261.04	10516.28
3310.49	1.00									
12	233.30	181.45	3.4	6.70	6.71	3	100.00	18.0	23939.84	11341.83
3549.32	0.99									
13	240.00	193.78	3.4	6.70	6.71	3	100.00	18.0	25528.32	12112.32
3785.09	0.99									
14	246.70	204.59	5.6	6.68	6.71	3	100.00	18.0	26909.62	12827.05
3984.32	0.99									
15	253.38	215.10	5.6	6.68	6.71	3	100.00	18.0	28243.10	13486.08

4182.10	0.99										
16	260.06	157.81	7.8	4.72	4.76	3	100.00	18.0	20688.77	9939.47	
4318.77	0.98										
17	264.77	147.32	7.8	4.29	4.33	2	0.00	35.0	19299.49	9278.86	
4370.89	0.95										
18	269.06	150.94	7.8	4.29	4.33	2	0.00	35.0	19772.83	9506.43	
4478.09	0.95										
19	273.35	238.70	10.0	6.61	6.71	2	0.00	35.0	31269.13	15125.37	
4561.06	0.95										
20	279.96	245.53	10.0	6.61	6.71	2	0.00	35.0	32165.02	15558.73	
4691.72	0.95										
21	286.57	92.04	12.2	2.43	2.49	2	0.00	35.0	12057.88	5877.30	
4737.38	0.94										
22	289.00	204.38	12.2	5.34	5.46	2	0.00	35.0	26773.65	13050.11	
4794.02	0.94										
23	294.34	207.70	12.2	5.34	5.46	2	0.00	35.0	27208.17	13261.91	
4871.83	0.94										
24	299.68	256.29	14.5	6.50	6.71	2	0.00	35.0	33574.41	16516.40	
4902.81	0.93										
25	306.18	259.47	14.5	6.50	6.71	2	0.00	35.0	33990.96	16721.30	
4963.64	0.93										
26	312.67	133.84	16.7	3.33	3.47	2	0.00	35.0	17532.50	8718.63	
4962.07	0.93										
27	316.00	181.66	16.7	4.50	4.70	2	0.00	35.0	23798.01	11614.52	
4973.00	0.93										
28	320.50	182.34	16.7	4.50	4.70	2	0.00	35.0	23886.92	11219.01	
4981.12	0.93										
29	325.00	261.06	18.7	6.61	6.98	2	0.00	35.0	34198.55	15894.72	
4811.00	0.92										
30	331.61	246.08	18.9	6.61	6.99	2	0.00	35.0	32236.82	14923.57	
4530.65	0.92										
31	338.22	180.34	21.1	5.14	5.51	2	0.00	35.0	23624.33	11033.37	
4234.47	0.92										
32	343.36	170.13	21.1	5.14	5.51	2	0.00	35.0	22287.28	10350.56	
3993.30	0.92										
33	348.50	70.95	21.1	2.24	2.40	5	0.00	45.0	7804.19	2787.31	
3047.00	0.87										
34	350.74	88.61	23.4	2.89	3.15	2	0.00	35.0	11608.39	122.89	
3400.98	0.92										
35	353.63	136.59	23.4	4.71	5.13	2	0.00	35.0	17893.91	0.00	
3212.90	0.92										
36	358.35	127.00	23.4	4.71	5.13	2	0.00	35.0	16637.22	0.00	
2987.26	0.92										
37	363.06	148.15	25.6	6.05	6.71	2	0.00	35.0	19408.21	0.00	
2669.34	0.92										
38	369.11	130.62	25.6	6.05	6.71	2	0.00	35.0	17111.37	0.00	
2353.44	0.92										
39	375.16	110.21	27.8	5.93	6.71	2	0.00	35.0	14437.86	0.00	
1990.97	0.93										
40	381.10	91.64	27.8	5.93	6.71	2	0.00	35.0	12004.69	0.00	
1655.42	0.93										
41	387.03	41.98	30.0	3.25	3.75	2	0.00	35.0	5499.99	0.00	
1363.33	0.93										
42	390.28	45.17	30.0	4.19	4.84	1	150.00	22.0	5917.84	0.00	
1193.90	1.01										
43	394.46	35.04	30.0	4.19	4.84	1	150.00	22.0	4590.72	0.00	
915.91	1.01										
44	398.65	30.47	32.2	5.67	6.71	1	150.00	22.0	3992.05	0.00	
560.76	1.03										
45	404.33	10.16	32.2	5.67	6.71	1	150.00	22.0	1330.68	0.00	
154.04	1.03										

X-S Area:

6122.06

Path Length:

254.97

X-S Weight:

802280.44

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Full Reservoir.gmf

Processed: 04 Dec 2020 12:52:22

DATA: Analysis 1 - Case 5-1 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    174.00      348.50    174.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    161.00      348.50    161.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    158.00      348.50    158.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    174.00      450.00    174.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    161.00      450.00    161.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    158.00      450.00    158.00

```

Slope Surface (4 points)

```

-----
100.00    161.00    208.00    161.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00    208.00    197.00    316.00    197.00    348.50    197.00
351.50    185.00
450.00    185.00

```

Failure Surface

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

```

Intersects: XL: 208.00  YL: 161.00  XR: 385.00  YR: 200.00
Centre: XC: 246.36  YC: 408.04  Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 5-1 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.634

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.55

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	206.68	161.00	380.00	200.00	244.44	397.80	239.80	2.545	
Critical Surface									
2	205.11	161.00	380.00	200.00	243.19	401.89	243.88	2.547	
3	209.84	161.61	380.00	200.00	249.64	381.51	223.47	2.547	
4	208.79	161.26	380.00	200.00	247.09	389.71	231.63	2.547	
5	210.37	161.79	380.00	200.00	250.92	377.40	219.39	2.547	
6	209.32	161.44	380.00	200.00	248.37	385.61	227.55	2.548	
7	203.53	161.00	380.00	200.00	241.94	405.97	247.96	2.549	
8	208.26	161.09	380.00	200.00	245.81	393.79	235.71	2.550	
9	207.21	161.00	380.00	200.00	244.54	397.87	239.80	2.550	
10	205.63	161.00	380.00	200.00	243.28	401.95	243.88	2.551	
11	204.05	161.00	380.00	200.00	242.04	406.03	247.96	2.553	
12	208.79	161.26	380.53	200.00	247.52	389.64	231.63	2.554	
13	210.89	161.96	380.00	200.00	252.20	373.27	215.31	2.555	
14	207.74	161.00	380.00	200.00	244.64	397.94	239.80	2.555	
15	206.68	161.00	380.00	200.00	243.48	402.09	243.88	2.555	
16	208.26	161.09	380.53	200.00	246.24	393.72	235.71	2.555	
17	207.21	161.00	380.53	200.00	244.97	397.80	239.80	2.556	
18	206.16	161.00	380.00	200.00	243.38	402.02	243.88	2.556	
19	205.63	161.00	380.53	200.00	243.71	401.89	243.88	2.557	
20	204.58	161.00	380.00	200.00	242.13	406.10	247.96	2.558	
21	204.05	161.00	380.53	200.00	242.46	405.97	247.96	2.559	
22	203.00	161.00	380.00	200.00	240.89	410.18	252.04	2.559	
23	207.74	161.00	380.53	200.00	245.07	397.87	239.80	2.560	
24	208.26	161.09	380.00	200.00	244.84	398.08	239.80	2.561	
25	209.32	161.44	380.53	200.00	248.79	385.54	227.55	2.561	
26	210.37	161.79	380.00	200.00	249.95	381.73	223.47	2.561	
27	207.21	161.00	380.00	200.00	243.58	402.15	243.88	2.561	
28	206.16	161.00	380.53	200.00	243.81	401.95	243.88	2.562	
29	209.84	161.61	380.00	200.00	248.67	385.83	227.55	2.562	
30	205.11	161.00	380.00	200.00	242.23	406.16	247.96	2.562	
31	205.63	161.00	380.00	200.00	242.33	406.23	247.96	2.562	
32	209.32	161.44	380.00	200.00	247.39	389.92	231.63	2.563	
33	213.00	162.67	380.00	200.00	256.32	361.05	203.06	2.563	
34	208.79	161.26	380.00	200.00	246.12	394.00	235.71	2.563	
35	204.58	161.00	380.53	200.00	242.56	406.03	247.96	2.563	
36	204.05	161.00	380.00	200.00	241.09	410.30	252.04	2.564	
37	203.53	161.00	380.00	200.00	240.99	410.24	252.04	2.564	
38	212.47	162.49	380.00	200.00	255.05	365.21	207.14	2.564	
39	203.00	161.00	380.53	200.00	241.32	410.11	252.04	2.565	
40	207.21	161.00	380.53	200.00	244.01	402.09	243.88	2.565	
41	206.68	161.00	380.53	200.00	243.91	402.02	243.88	2.566	
42	211.95	162.32	380.00	200.00	253.77	369.36	211.22	2.566	
43	206.16	161.00	381.05	200.00	244.24	401.89	243.88	2.567	
44	207.74	161.00	380.00	200.00	243.67	402.22	243.88	2.567	
45	205.11	161.00	380.53	200.00	242.66	406.10	247.96	2.567	
46	206.16	161.00	380.00	200.00	242.42	406.29	247.96	2.568	
47	211.42	162.14	380.00	200.00	252.50	373.49	215.31	2.568	
48	211.42	162.14	380.53	200.00	252.91	373.41	215.31	2.568	
49	212.47	162.49	380.53	200.00	255.46	365.12	207.14	2.568	
50	204.58	161.00	381.05	200.00	242.99	405.97	247.96	2.568	
51	211.95	162.32	380.53	200.00	254.19	369.27	211.22	2.569	
52	208.79	161.26	380.53	200.00	246.55	393.93	235.71	2.569	
53	204.58	161.00	380.00	200.00	241.18	410.37	252.04	2.569	
54	203.53	161.00	380.53	200.00	241.42	410.18	252.04	2.569	
55	210.89	161.96	380.53	200.00	251.64	377.54	219.39	2.570	
56	203.00	161.00	381.05	200.00	241.75	410.04	252.04	2.570	
57	203.00	161.00	380.00	200.00	239.95	414.44	256.12	2.571	
58	208.26	161.09	380.53	200.00	245.27	398.01	239.80	2.571	
59	207.74	161.00	380.53	200.00	244.10	402.15	243.88	2.571	
60	206.68	161.00	381.05	200.00	244.34	401.95	243.88	2.572	
61	205.63	161.00	380.53	200.00	242.76	406.16	247.96	2.572	
62	206.16	161.00	380.53	200.00	242.85	406.23	247.96	2.572	
63	205.11	161.00	381.05	200.00	243.09	406.03	247.96	2.573	
64	210.37	161.79	381.05	200.00	250.79	381.57	223.47	2.573	
65	210.89	161.96	380.00	200.00	251.22	377.61	219.39	2.573	
66	204.58	161.00	380.53	200.00	241.61	410.30	252.04	2.573	
67	206.68	161.00	380.00	200.00	242.52	406.36	247.96	2.574	
68	204.05	161.00	380.53	200.00	241.52	410.24	252.04	2.574	

69	209.84	161.61	380.53	200.00	249.09	385.75	227.55	2.574
70	207.74	161.00	381.05	200.00	245.50	397.80	239.80	2.574
71	210.89	161.96	381.05	200.00	252.06	377.46	219.39	2.574
72	209.32	161.44	380.00	200.00	246.42	394.21	235.71	2.574
73	211.95	162.32	381.05	200.00	254.60	369.19	211.22	2.574
74	211.42	162.14	381.05	200.00	253.33	373.33	215.31	2.574
75	210.37	161.79	380.53	200.00	250.37	381.65	223.47	2.574
76	205.11	161.00	380.00	200.00	241.28	410.43	252.04	2.575
77	203.53	161.00	381.05	200.00	241.85	410.11	252.04	2.575
78	203.00	161.00	380.53	200.00	240.38	414.38	256.12	2.575
79	207.74	161.00	381.05	200.00	244.53	402.09	243.88	2.576
80	209.84	161.61	381.05	200.00	249.51	385.68	227.55	2.576
81	208.79	161.26	380.00	200.00	245.15	398.29	239.80	2.576
82	203.53	161.00	380.00	200.00	240.05	414.51	256.12	2.576
83	207.21	161.00	381.05	200.00	244.44	402.02	243.88	2.576
84	209.32	161.44	381.05	200.00	248.24	389.78	231.63	2.576
85	209.32	161.44	380.53	200.00	247.82	389.85	231.63	2.577
86	205.63	161.00	381.05	200.00	243.19	406.10	247.96	2.577
87	207.21	161.00	380.00	200.00	242.61	406.42	247.96	2.578
88	206.68	161.00	380.53	200.00	242.95	406.29	247.96	2.578
89	209.84	161.61	380.00	200.00	247.70	390.13	231.63	2.578
90	205.11	161.00	381.58	200.00	243.51	405.97	247.96	2.578
91	210.37	161.79	380.00	200.00	248.97	386.04	227.55	2.578
92	210.89	161.96	380.00	200.00	250.25	381.94	223.47	2.578
93	208.26	161.09	380.00	200.00	243.87	402.35	243.88	2.579
94	213.00	162.67	380.00	200.00	255.34	365.44	207.14	2.579
95	209.84	161.61	381.58	200.00	249.93	385.61	227.55	2.579
96	205.63	161.00	380.00	200.00	241.37	410.49	252.04	2.579
97	204.05	161.00	381.05	200.00	241.95	410.18	252.04	2.579
98	205.11	161.00	380.53	200.00	241.71	410.37	252.04	2.579
99	208.79	161.26	381.58	200.00	247.40	393.79	235.71	2.579

Critical Failure Surface (circle 1)

Intersects:	XL:	206.68	YL:	161.00	XR:	380.00	YR:	200.00	
Centre:	XC:	244.44	YC:	397.80			Radius:	R:	239.80
Generated failure surface: (20 points)									
206.68	161.00		216.17	159.68		225.70	158.74	235.26	158.18
244.84	158.01								
254.41	158.22		263.97	158.81		273.50	159.78	282.98	161.13
292.40	162.85								
301.75	164.96		311.00	167.43		320.15	170.27	329.17	173.48
338.06	177.04								
346.80	180.95		355.38	185.21		363.78	189.81	371.99	194.74
380.00	200.00								

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	206.68	0.12	-7.9	1.32	1.33	3	100.00	18.0	16.97	2991.82
2264.99	1.03									
2	208.00	4.69	-7.9	4.09	4.12	3	100.00	18.0	633.35	9385.63
2366.01	1.03									
3	212.09	12.57	-7.9	4.09	4.12	3	100.00	18.0	1689.32	9531.82
2542.01	1.03									
4	216.17	24.17	-5.6	4.77	4.79	3	100.00	18.0	3240.24	11221.82
2715.34	1.02									
5	220.94	33.98	-5.6	4.77	4.79	3	100.00	18.0	4547.52	11362.13
2892.38	1.02									
6	225.70	43.48	-3.3	4.78	4.79	3	100.00	18.0	5810.38	11473.82
3051.06	1.01									
7	230.48	52.43	-3.3	4.78	4.79	3	100.00	18.0	6996.30	11557.11
3200.68	1.01									
8	235.26	61.02	-1.0	4.79	4.79	3	100.00	18.0	8131.16	11612.07
3330.61	1.00									
9	240.05	69.09	-1.0	4.79	4.79	3	100.00	18.0	9191.44	11638.29
3452.74	1.00									
10	244.84	33.73	1.2	2.16	2.16	3	100.00	18.0	4482.15	5255.45
3528.09	1.00									
11	247.00	61.25	1.2	3.71	3.71	3	100.00	18.0	8131.74	9001.98
3586.06	1.00									
12	250.71	65.54	1.2	3.71	3.71	3	100.00	18.0	8689.98	8983.43
3659.31	1.00									
13	254.41	90.36	3.5	4.78	4.79	3	100.00	18.0	11963.26	11545.50
3721.45	0.99									
14	259.19	96.57	3.5	4.78	4.79	3	100.00	18.0	12762.30	11457.45
3788.54	0.99									
15	263.97	101.97	5.8	4.76	4.79	3	100.00	18.0	13451.44	11340.89
3833.03	0.99									
16	268.74	107.23	5.8	4.76	4.79	3	100.00	18.0	14116.65	11195.96

3872.64	0.99										
17	273.50	100.89	8.1	4.30	4.34	3	100.00	18.0	13256.64	10003.68	
3888.45	0.99										
18	277.80	104.42	8.1	4.30	4.34	3	100.00	18.0	13692.51	9837.73	
3899.54	0.99										
19	282.10	21.90	8.1	0.88	0.89	2	0.00	35.0	2869.16	2001.66	
3878.60	0.97										
20	282.98	118.80	10.4	4.71	4.79	2	0.00	35.0	15562.87	10590.83	
3858.71	0.97										
21	287.69	122.13	10.4	4.71	4.79	2	0.00	35.0	15998.70	10332.74	
3850.92	0.97										
22	292.40	123.97	12.7	4.67	4.79	2	0.00	35.0	16239.66	10046.55	
3812.07	0.97										
23	297.08	126.33	12.7	4.67	4.79	2	0.00	35.0	16549.36	9732.40	
3779.16	0.97										
24	301.75	126.97	15.0	4.63	4.79	2	0.00	35.0	16633.20	9390.48	
3714.71	0.96										
25	306.37	128.38	15.0	4.63	4.79	2	0.00	35.0	16818.20	9020.90	
3657.02	0.96										
26	311.00	139.77	17.3	5.00	5.23	2	0.00	35.0	18310.21	9405.19	
3563.73	0.96										
27	316.00	116.39	17.3	4.15	4.34	2	0.00	35.0	15246.88	7417.75	
3521.36	0.96										
28	320.15	136.16	19.5	4.85	5.15	2	0.00	35.0	17836.48	8311.67	
3492.15	0.97										
29	325.00	113.77	19.5	4.17	4.43	2	0.00	35.0	14903.71	6704.43	
3388.56	0.97										
30	329.17	34.32	21.8	1.31	1.41	2	0.00	35.0	4496.07	2043.62	
3242.85	0.97										
31	330.48	95.70	21.8	3.79	4.08	1	150.00	22.0	12537.35	5668.91	
3169.54	1.01										
32	334.27	89.94	21.8	3.79	4.08	1	150.00	22.0	11782.75	5281.67	
2976.74	1.01										
33	338.06	96.08	24.1	4.37	4.79	1	150.00	22.0	12585.88	5672.38	
2742.58	1.02										
34	342.43	87.52	24.1	4.37	4.79	1	150.00	22.0	11465.35	5087.54	
2495.09	1.02										
35	346.80	31.58	26.4	1.70	1.89	1	150.00	22.0	4137.53	1846.13	
2305.77	1.03										
36	348.50	52.38	26.4	3.00	3.35	5	0.00	45.0	5761.62	1768.19	
1693.15	0.93										
37	351.50	54.73	26.4	3.45	3.85	1	150.00	22.0	7170.18	206.15	
1902.27	1.03										
38	354.95	60.99	28.5	4.42	5.02	1	150.00	22.0	7989.99	0.00	
1636.59	1.05										
39	359.37	50.32	28.7	4.42	5.03	1	150.00	22.0	6591.52	0.00	
1343.76	1.05										
40	363.78	36.76	31.0	4.11	4.79	1	150.00	22.0	4815.21	0.00	
1038.54	1.06										
41	367.89	26.63	31.0	4.11	4.79	1	150.00	22.0	3489.16	0.00	
743.65	1.06										
42	371.99	15.78	33.3	4.00	4.79	1	150.00	22.0	2067.06	0.00	
432.58	1.08										
43	376.00	5.26	33.3	4.00	4.79	1	150.00	22.0	689.03	0.00	
120.84	1.08										

X-S Area: 3076.08

Path Length: 181.97

X-S Weight: 403350.50

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Rapid Drawdown.gmf

Processed: 04 Dec 2020 12:51:06

DATA: Analysis 1 - Case 5-1 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    174.00      348.50    174.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    161.00      348.50    161.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    158.00      348.50    158.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    174.00      450.00    174.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    161.00      450.00    161.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    158.00      450.00    158.00

```

Slope Surface (4 points)

```

-----
100.00    161.00    208.00    161.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    161.00    208.00    161.00    316.00    197.00    348.50    197.00
351.50    185.00
450.00    185.00

```

Failure Surface

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

```

Intersects: XL: 208.00  YL: 161.00  XR: 385.00  YR: 200.00
Centre: XC: 246.36  YC: 408.04  Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 5-1 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.451

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.39

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	206.68	161.00	380.00	200.00	244.44	397.80	239.80	1.393	
Critical Surface									
2	205.11	161.00	380.00	200.00	243.19	401.89	243.88	1.394	
3	208.79	161.26	380.00	200.00	247.09	389.71	231.63	1.395	
4	209.84	161.61	380.00	200.00	249.64	381.51	223.47	1.395	
5	203.53	161.00	380.00	200.00	241.94	405.97	247.96	1.395	
6	210.37	161.79	380.00	200.00	250.92	377.40	219.39	1.395	
7	209.32	161.44	380.00	200.00	248.37	385.61	227.55	1.395	
8	207.21	161.00	380.00	200.00	244.54	397.87	239.80	1.396	
9	208.26	161.09	380.00	200.00	245.81	393.79	235.71	1.396	
10	205.63	161.00	380.00	200.00	243.28	401.95	243.88	1.397	
11	204.05	161.00	380.00	200.00	242.04	406.03	247.96	1.398	
12	210.89	161.96	380.00	200.00	252.20	373.27	215.31	1.398	
13	207.74	161.00	380.00	200.00	244.64	397.94	239.80	1.399	
14	208.79	161.26	380.53	200.00	247.52	389.64	231.63	1.399	
15	207.21	161.00	380.53	200.00	244.97	397.80	239.80	1.399	
16	208.26	161.09	380.53	200.00	246.24	393.72	235.71	1.399	
17	206.16	161.00	380.00	200.00	243.38	402.02	243.88	1.399	
18	206.68	161.00	380.00	200.00	243.48	402.09	243.88	1.400	
19	205.63	161.00	380.53	200.00	243.71	401.89	243.88	1.400	
20	204.58	161.00	380.00	200.00	242.13	406.10	247.96	1.400	
21	204.05	161.00	380.53	200.00	242.46	405.97	247.96	1.401	
22	209.32	161.44	380.53	200.00	248.79	385.54	227.55	1.401	
23	203.00	161.00	380.00	200.00	240.89	410.18	252.04	1.401	
24	207.74	161.00	380.53	200.00	245.07	397.87	239.80	1.402	
25	206.16	161.00	380.53	200.00	243.81	401.95	243.88	1.403	
26	208.26	161.09	380.00	200.00	244.84	398.08	239.80	1.403	
27	205.11	161.00	380.00	200.00	242.23	406.16	247.96	1.403	
28	207.21	161.00	380.00	200.00	243.58	402.15	243.88	1.403	
29	205.63	161.00	380.00	200.00	242.33	406.23	247.96	1.404	
30	210.37	161.79	380.00	200.00	249.95	381.73	223.47	1.404	
31	204.58	161.00	380.53	200.00	242.56	406.03	247.96	1.404	
32	209.84	161.61	380.00	200.00	248.67	385.83	227.55	1.404	
33	203.53	161.00	380.00	200.00	240.99	410.24	252.04	1.404	
34	209.32	161.44	380.00	200.00	247.39	389.92	231.63	1.404	
35	208.79	161.26	380.00	200.00	246.12	394.00	235.71	1.404	
36	204.05	161.00	380.00	200.00	241.09	410.30	252.04	1.405	
37	203.00	161.00	380.53	200.00	241.32	410.11	252.04	1.405	
38	213.00	162.67	380.00	200.00	256.32	361.05	203.06	1.406	
39	206.68	161.00	380.53	200.00	243.91	402.02	243.88	1.406	
40	207.21	161.00	380.53	200.00	244.01	402.09	243.88	1.406	
41	212.47	162.49	380.00	200.00	255.05	365.21	207.14	1.406	
42	206.16	161.00	381.05	200.00	244.24	401.89	243.88	1.406	
43	205.11	161.00	380.53	200.00	242.66	406.10	247.96	1.407	
44	211.95	162.32	380.00	200.00	253.77	369.36	211.22	1.407	
45	207.74	161.00	380.00	200.00	243.67	402.22	243.88	1.407	
46	211.42	162.14	380.00	200.00	252.50	373.49	215.31	1.407	
47	204.58	161.00	381.05	200.00	242.99	405.97	247.96	1.407	
48	206.16	161.00	380.00	200.00	242.42	406.29	247.96	1.407	
49	203.53	161.00	380.53	200.00	241.42	410.18	252.04	1.408	
50	204.58	161.00	380.00	200.00	241.18	410.37	252.04	1.408	
51	208.79	161.26	380.53	200.00	246.55	393.93	235.71	1.408	
52	203.00	161.00	381.05	200.00	241.75	410.04	252.04	1.408	
53	207.74	161.00	381.05	200.00	245.50	397.80	239.80	1.408	
54	211.42	162.14	380.53	200.00	252.91	373.41	215.31	1.409	
55	203.00	161.00	380.00	200.00	239.95	414.44	256.12	1.409	
56	210.89	161.96	380.53	200.00	251.64	377.54	219.39	1.409	
57	208.26	161.09	380.53	200.00	245.27	398.01	239.80	1.409	
58	210.89	161.96	380.00	200.00	251.22	377.61	219.39	1.409	
59	211.95	162.32	380.53	200.00	254.19	369.27	211.22	1.409	
60	206.68	161.00	381.05	200.00	244.34	401.95	243.88	1.409	
61	212.47	162.49	380.53	200.00	255.46	365.12	207.14	1.409	
62	205.63	161.00	380.53	200.00	242.76	406.16	247.96	1.409	
63	209.84	161.61	380.53	200.00	249.09	385.75	227.55	1.410	
64	207.74	161.00	380.53	200.00	244.10	402.15	243.88	1.410	
65	205.11	161.00	381.05	200.00	243.09	406.03	247.96	1.410	
66	206.16	161.00	380.53	200.00	242.85	406.23	247.96	1.410	
67	204.05	161.00	380.53	200.00	241.52	410.24	252.04	1.410	
68	209.32	161.44	380.53	200.00	247.82	389.85	231.63	1.410	

69	210.37	161.79	380.53	200.00	250.37	381.65	223.47	1.411
70	206.68	161.00	380.00	200.00	242.52	406.36	247.96	1.411
71	204.58	161.00	380.53	200.00	241.61	410.30	252.04	1.411
72	203.53	161.00	381.05	200.00	241.85	410.11	252.04	1.411
73	205.11	161.00	380.00	200.00	241.28	410.43	252.04	1.411
74	210.37	161.79	381.05	200.00	250.79	381.57	223.47	1.411
75	203.00	161.00	380.53	200.00	240.38	414.38	256.12	1.412
76	209.32	161.44	380.00	200.00	246.42	394.21	235.71	1.412
77	210.89	161.96	381.05	200.00	252.06	377.46	219.39	1.412
78	209.32	161.44	381.05	200.00	248.24	389.78	231.63	1.412
79	203.53	161.00	380.00	200.00	240.05	414.51	256.12	1.412
80	207.21	161.00	381.05	200.00	244.44	402.02	243.88	1.412
81	209.84	161.61	381.05	200.00	249.51	385.68	227.55	1.412
82	207.74	161.00	381.05	200.00	244.53	402.09	243.88	1.412
83	211.42	162.14	381.05	200.00	253.33	373.33	215.31	1.412
84	208.79	161.26	380.00	200.00	245.15	398.29	239.80	1.413
85	211.95	162.32	381.05	200.00	254.60	369.19	211.22	1.413
86	205.63	161.00	381.05	200.00	243.19	406.10	247.96	1.413
87	208.79	161.26	381.05	200.00	246.97	393.86	235.71	1.413
88	205.11	161.00	381.58	200.00	243.51	405.97	247.96	1.413
89	207.21	161.00	380.00	200.00	242.61	406.42	247.96	1.413
90	206.68	161.00	380.53	200.00	242.95	406.29	247.96	1.414
91	204.05	161.00	381.05	200.00	241.95	410.18	252.04	1.414
92	205.63	161.00	380.00	200.00	241.37	410.49	252.04	1.414
93	208.26	161.09	380.00	200.00	243.87	402.35	243.88	1.414
94	205.11	161.00	380.53	200.00	241.71	410.37	252.04	1.414
95	203.53	161.00	381.58	200.00	242.27	410.04	252.04	1.414
96	209.84	161.61	380.00	200.00	247.70	390.13	231.63	1.414
97	208.79	161.26	381.58	200.00	247.40	393.79	235.71	1.414
98	210.37	161.79	380.00	200.00	248.97	386.04	227.55	1.415
99	206.68	161.00	381.58	200.00	244.76	401.89	243.88	1.415

Critical Failure Surface (circle 1)

Intersects:	XL:	206.68	YL:	161.00	XR:	380.00	YR:	200.00	
Centre:	XC:	244.44	YC:	397.80			Radius:	R:	239.80
Generated failure surface: (20 points)									
206.68	161.00		216.17	159.68		225.70	158.74	235.26	158.18
244.84	158.01								
254.41	158.22		263.97	158.81		273.50	159.78	282.98	161.13
292.40	162.85								
301.75	164.96		311.00	167.43		320.15	170.27	329.17	173.48
338.06	177.04								
346.80	180.95		355.38	185.21		363.78	189.81	371.99	194.74
380.00	200.00								

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	206.68	0.12	-7.9	1.32	1.33	3	100.00	18.0	16.97	7.58
23.46	1.04									
2	208.00	4.69	-7.9	4.09	4.12	3	100.00	18.0	633.35	295.42
168.14	1.04									
3	212.09	12.57	-7.9	4.09	4.12	3	100.00	18.0	1689.32	792.09
431.25	1.04									
4	216.17	24.17	-5.6	4.77	4.79	3	100.00	18.0	3240.24	1515.47
695.69	1.03									
5	220.94	33.98	-5.6	4.77	4.79	3	100.00	18.0	4547.52	2130.48
973.44	1.03									
6	225.70	43.48	-3.3	4.78	4.79	3	100.00	18.0	5810.38	2717.71
1228.59	1.02									
7	230.48	52.43	-3.3	4.78	4.79	3	100.00	18.0	6996.30	3277.21
1478.47	1.02									
8	235.26	61.02	-1.0	4.79	4.79	3	100.00	18.0	8131.16	3808.58
1703.44	1.00									
9	240.05	69.09	-1.0	4.79	4.79	3	100.00	18.0	9191.44	4311.72
1925.38	1.00									
10	244.84	33.73	1.2	2.16	2.16	3	100.00	18.0	4482.15	2104.96
2067.22	1.00									
11	247.00	61.25	1.2	3.71	3.71	3	100.00	18.0	8131.74	3823.05
2186.09	1.00									
12	250.71	65.54	1.2	3.71	3.71	3	100.00	18.0	8689.98	4090.43
2336.27	1.00									
13	254.41	90.36	3.5	4.78	4.79	3	100.00	18.0	11963.26	5649.20
2479.80	0.99									
14	259.19	96.57	3.5	4.78	4.79	3	100.00	18.0	12762.30	6037.25
2645.75	0.99									
15	263.97	101.97	5.8	4.76	4.79	3	100.00	18.0	13451.44	6396.02
2781.81	0.98									
16	268.74	107.23	5.8	4.76	4.79	3	100.00	18.0	14116.65	6725.60

2919.78	0.98									
17	273.50	100.89	8.1	4.30	4.34	3	100.00	18.0	13256.64	6359.32
3021.66	0.98									
18	277.80	104.42	8.1	4.30	4.34	3	100.00	18.0	13692.51	6581.70
3121.45	0.98									
19	282.10	21.90	8.1	0.88	0.89	2	0.00	35.0	2869.16	1380.47
3133.19	0.94									
20	282.98	118.80	10.4	4.71	4.79	2	0.00	35.0	15562.87	7536.81
3158.01	0.93									
21	287.69	122.13	10.4	4.71	4.79	2	0.00	35.0	15998.70	7747.87
3246.43	0.93									
22	292.40	123.97	12.7	4.67	4.79	2	0.00	35.0	16239.66	7928.96
3291.00	0.92									
23	297.08	126.33	12.7	4.67	4.79	2	0.00	35.0	16549.36	8080.17
3353.76	0.92									
24	301.75	126.97	15.0	4.63	4.79	2	0.00	35.0	16633.20	8201.34
3372.31	0.91									
25	306.37	128.38	15.0	4.63	4.79	2	0.00	35.0	16818.20	8292.56
3409.79	0.91									
26	311.00	139.77	17.3	5.00	5.23	2	0.00	35.0	18310.21	9133.03
3403.67	0.91									
27	316.00	116.39	17.3	4.15	4.34	2	0.00	35.0	15246.88	7417.75
3410.46	0.91									
28	320.15	136.16	19.5	4.85	5.15	2	0.00	35.0	17836.48	8311.67
3363.37	0.90									
29	325.00	113.77	19.5	4.17	4.43	2	0.00	35.0	14903.71	6704.43
3260.03	0.90									
30	329.17	34.32	21.8	1.31	1.41	2	0.00	35.0	4496.07	2043.62
3106.87	0.90									
31	330.48	95.70	21.8	3.79	4.08	1	150.00	22.0	12537.35	5668.91
3068.04	0.97									
32	334.27	89.94	21.8	3.79	4.08	1	150.00	22.0	11782.75	5281.67
2879.86	0.97									
33	338.06	96.08	24.1	4.37	4.79	1	150.00	22.0	12585.88	5672.38
2642.15	0.97									
34	342.43	87.52	24.1	4.37	4.79	1	150.00	22.0	11465.35	5087.54
2401.19	0.97									
35	346.80	31.58	26.4	1.70	1.89	1	150.00	22.0	4137.53	1846.13
2208.73	0.98									
36	348.50	52.38	26.4	3.00	3.35	5	0.00	45.0	5761.62	1768.19
1554.47	0.82									
37	351.50	54.73	26.4	3.45	3.85	1	150.00	22.0	7170.18	206.15
1775.69	0.98									
38	354.95	60.99	28.5	4.42	5.02	1	150.00	22.0	7989.99	0.00
1512.98	0.98									
39	359.37	50.32	28.7	4.42	5.03	1	150.00	22.0	6591.52	0.00
1237.34	0.98									
40	363.78	36.76	31.0	4.11	4.79	1	150.00	22.0	4815.21	0.00
943.83	0.99									
41	367.89	26.63	31.0	4.11	4.79	1	150.00	22.0	3489.16	0.00
668.75	0.99									
42	371.99	15.78	33.3	4.00	4.79	1	150.00	22.0	2067.06	0.00
374.38	1.00									
43	376.00	5.26	33.3	4.00	4.79	1	150.00	22.0	689.03	0.00
85.21	1.00									

X-S Area: 3076.08

Path Length: 181.97

X-S Weight: 403350.50

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 5-2 Full Reservoir.gmf

Processed: 02 Dec 2020 14:23:57

DATA: Analysis 1 - Case 5-2 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    192.00        348.50    192.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    183.00        348.50    183.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    180.00        348.50    180.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    192.00        450.00    192.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    183.00        450.00    183.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    180.00        450.00    180.00

```

Slope Surface (8 points)

```

-----
100.00    183.00        274.00    183.00        325.00    200.00        400.00    200.00
405.00    195.00
410.00    195.00        415.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00        274.00    197.00        316.00    197.00        348.50    197.00
351.50    197.00
450.00    197.00

```

Failure Surface

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

```

Intersects: XL: 274.00    YL: 183.00    XR: 405.00    YR: 195.00
Centre: XC: 317.50    YC: 429.19    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 5-2 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 10.645

Analysis Summary

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

Critical (minimum) Factor of Safety: 4.13

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	271.11	183.00	400.00	200.00	307.60	403.47	223.47	4.127	
Critical Surface									
2	270.05	183.00	400.00	200.00	306.76	407.57	227.55	4.128	
3	269.00	183.00	400.00	200.00	305.93	411.67	231.63	4.130	
4	271.63	183.00	400.00	200.00	307.74	403.53	223.47	4.142	
5	272.68	183.00	400.00	200.00	308.58	399.43	219.39	4.142	
6	270.58	183.00	400.00	200.00	306.90	407.63	227.55	4.142	
7	269.53	183.00	400.00	200.00	306.07	411.73	231.63	4.144	
8	274.26	183.09	400.00	200.00	310.27	391.22	211.22	4.146	
9	273.74	183.00	400.00	200.00	309.43	395.33	215.31	4.149	
10	272.16	183.00	400.00	200.00	307.88	403.60	223.47	4.156	
11	271.11	183.00	400.00	200.00	307.04	407.70	227.55	4.157	
12	270.05	183.00	400.00	200.00	306.21	411.79	231.63	4.158	
13	269.00	183.00	400.00	200.00	305.38	415.89	235.71	4.161	
14	274.79	183.26	400.00	200.00	311.26	387.17	207.14	4.163	
15	273.21	183.00	400.00	200.00	308.72	399.50	219.39	4.168	
16	271.63	183.00	400.00	200.00	307.18	407.76	227.55	4.171	
17	272.68	183.00	400.00	200.00	308.01	403.66	223.47	4.171	
18	270.58	183.00	400.00	200.00	306.34	411.85	231.63	4.172	
19	269.53	183.00	400.00	200.00	305.52	415.95	235.71	4.174	
20	274.26	183.09	400.00	200.00	309.70	395.46	215.31	4.176	
21	273.74	183.00	400.00	200.00	308.86	399.56	219.39	4.179	
22	271.63	183.00	400.53	199.47	308.43	407.56	227.55	4.181	
23	270.58	183.00	400.53	199.47	307.61	411.65	231.63	4.181	
24	275.32	183.44	400.00	200.00	312.24	383.12	203.06	4.182	
25	269.53	183.00	400.53	199.47	306.79	415.75	235.71	4.183	
26	272.16	183.00	400.00	200.00	307.31	407.82	227.55	4.186	
27	273.21	183.00	400.00	200.00	308.15	403.72	223.47	4.186	
28	271.11	183.00	400.00	200.00	306.48	411.92	231.63	4.186	
29	270.05	183.00	400.00	200.00	305.66	416.01	235.71	4.188	
30	269.00	183.00	400.00	200.00	304.83	420.10	239.80	4.191	
31	272.68	183.00	400.53	199.47	309.26	403.46	223.47	4.192	
32	274.79	183.26	400.00	200.00	310.69	391.41	211.22	4.194	
33	271.11	183.00	400.53	199.47	307.75	411.72	231.63	4.197	
34	272.16	183.00	400.53	199.47	308.57	407.62	227.55	4.197	
35	270.05	183.00	400.53	199.47	306.93	415.81	235.71	4.198	
36	269.00	183.00	400.53	199.47	306.12	419.91	239.80	4.199	
37	272.68	183.00	400.00	200.00	307.45	407.88	227.55	4.200	
38	271.63	183.00	400.00	200.00	306.62	411.98	231.63	4.200	
39	270.58	183.00	400.00	200.00	305.79	416.07	235.71	4.202	
40	275.84	183.61	400.00	200.00	313.21	379.05	198.98	4.203	
41	273.21	183.00	400.53	199.47	309.40	403.52	223.47	4.204	
42	269.53	183.00	400.00	200.00	304.97	420.16	239.80	4.204	
43	274.79	183.26	400.53	199.47	311.89	391.20	211.22	4.205	
44	274.26	183.09	400.00	200.00	309.14	399.69	219.39	4.205	
45	273.74	183.00	400.00	200.00	308.29	403.78	223.47	4.208	
46	271.63	183.00	400.53	199.47	307.89	411.78	231.63	4.212	
47	270.58	183.00	400.53	199.47	307.08	415.87	235.71	4.212	
48	269.53	183.00	400.53	199.47	306.26	419.97	239.80	4.214	
49	275.32	183.44	400.00	200.00	311.67	387.37	207.14	4.214	
50	272.16	183.00	400.00	200.00	306.75	412.03	231.63	4.214	
51	273.21	183.00	400.00	200.00	307.58	407.94	227.55	4.214	
52	271.11	183.00	400.00	200.00	305.93	416.13	235.71	4.215	
53	273.74	183.00	400.53	199.47	309.54	403.58	223.47	4.216	
54	274.26	183.09	400.53	199.47	310.38	399.48	219.39	4.217	
55	274.79	183.26	400.00	200.00	310.12	395.65	215.31	4.223	
56	272.68	183.00	400.53	199.47	308.71	407.68	227.55	4.223	
57	276.37	183.79	400.00	200.00	314.18	374.98	194.90	4.224	
58	271.11	183.00	400.53	199.47	307.21	415.93	235.71	4.227	
59	275.32	183.44	400.53	199.47	312.86	387.15	207.14	4.227	
60	272.16	183.00	400.53	199.47	308.03	411.84	231.63	4.227	
61	270.05	183.00	400.53	199.47	306.40	420.02	239.80	4.228	
62	269.00	183.00	400.53	199.47	305.60	424.12	243.88	4.230	
63	270.05	183.00	400.00	200.00	305.10	420.22	239.80	4.230	
64	271.63	183.00	400.00	200.00	306.06	416.19	235.71	4.231	
65	270.58	183.00	400.00	200.00	305.24	420.28	239.80	4.231	
66	269.00	183.00	400.00	200.00	304.29	424.31	243.88	4.231	

67	272.68	183.00	400.00	200.00	306.89	412.09	231.63	4.232
68	269.53	183.00	400.00	200.00	304.42	424.37	243.88	4.234
69	273.21	183.00	400.53	199.47	308.85	407.74	227.55	4.234
70	274.26	183.09	400.00	200.00	308.57	403.91	223.47	4.234
71	275.84	183.61	400.00	200.00	312.65	383.31	203.06	4.235
72	274.79	183.26	400.53	199.47	311.35	395.44	215.31	4.236
73	271.63	183.00	400.53	199.47	307.35	415.99	235.71	4.241
74	272.68	183.00	400.53	199.47	308.17	411.90	231.63	4.242
75	270.58	183.00	400.53	199.47	306.54	420.08	239.80	4.242
76	273.74	183.00	400.00	200.00	307.72	408.00	227.55	4.243
77	269.53	183.00	400.53	199.47	305.73	424.17	243.88	4.243
78	275.32	183.44	400.00	200.00	311.11	391.61	211.22	4.244
79	273.21	183.00	400.00	200.00	307.02	412.15	231.63	4.244
80	273.74	183.00	400.53	199.47	308.99	407.80	227.55	4.245
81	272.16	183.00	400.00	200.00	306.19	416.24	235.71	4.245
82	270.05	183.00	401.05	198.95	307.69	419.82	239.80	4.246
83	271.11	183.00	401.05	198.95	308.50	415.73	235.71	4.246
84	274.26	183.09	400.53	199.47	309.83	403.71	223.47	4.246
85	269.00	183.00	401.05	198.95	306.90	423.92	243.88	4.247
86	271.11	183.00	400.00	200.00	305.37	420.34	239.80	4.247
87	270.05	183.00	400.00	200.00	304.55	424.42	243.88	4.250
88	273.21	183.00	401.05	198.95	310.12	407.54	227.55	4.250
89	275.84	183.61	400.53	199.47	313.82	383.09	203.06	4.251
90	274.79	183.26	400.00	200.00	309.56	399.88	219.39	4.252
91	276.89	183.96	400.00	200.00	315.14	370.91	190.82	4.253
92	269.00	183.00	400.00	200.00	303.74	428.51	247.96	4.254
93	272.16	183.00	400.53	199.47	307.49	416.05	235.71	4.255
94	271.11	183.00	400.53	199.47	306.68	420.14	239.80	4.256
95	270.05	183.00	400.53	199.47	305.87	424.23	243.88	4.257
96	275.32	183.44	400.53	199.47	312.32	391.40	211.22	4.257
97	272.16	183.00	401.05	198.95	309.30	411.63	231.63	4.257
98	276.37	183.79	400.00	200.00	313.62	379.25	198.98	4.258
99	269.00	183.00	400.53	199.47	305.07	428.32	247.96	4.260

Critical Failure Surface (circle 1)

Intersects:	XL:	271.11	YL:	183.00	XR:	400.00	YR:	200.00	
	Centre:	XC:	307.60	YC:	403.47		Radius:	R:	223.47
Generated failure surface: (20 points)									
271.11	183.00	277.97	181.97	284.87	181.16	291.78	180.56		
298.72	180.18								
305.66	180.01	312.60	180.06	319.54	180.32	326.46	180.80		
333.37	181.49								
340.25	182.40	347.11	183.52	353.92	184.85	360.69	186.40		
367.41	188.15								
374.07	190.12	380.66	192.28	387.19	194.65	393.63	197.23		
400.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	271.11	0.63	-8.5	2.89	2.93	3	100.00	18.0	88.37	2596.50
908.00	1.02									
2	274.00	5.53	-8.5	3.97	4.02	3	100.00	18.0	753.26	3691.22
1026.84	1.02									
3	277.97	10.79	-6.7	3.45	3.47	3	100.00	18.0	1455.54	3299.17
1182.35	1.02									
4	281.42	16.15	-6.7	3.45	3.47	3	100.00	18.0	2172.24	3387.30
1319.56	1.02									
5	284.87	21.40	-4.9	3.46	3.47	3	100.00	18.0	2872.75	3463.72
1447.41	1.01									
6	288.33	26.43	-4.9	3.46	3.47	3	100.00	18.0	3541.01	3528.55
1569.41	1.01									
7	291.78	31.34	-3.2	3.47	3.47	3	100.00	18.0	4192.86	3581.74
1681.51	1.01									
8	295.25	36.01	-3.2	3.47	3.47	3	100.00	18.0	4811.19	3623.29
1788.23	1.01									
9	298.72	26.20	-1.4	2.28	2.28	3	100.00	18.0	3497.30	2402.53
1868.96	1.00									
10	301.00	28.62	-1.4	2.33	2.33	3	100.00	18.0	3817.48	2456.93
1929.68	1.00									
11	303.33	30.56	-1.4	2.33	2.33	3	100.00	18.0	4072.69	2465.12
1990.98	1.00									
12	305.66	48.98	0.4	3.47	3.47	3	100.00	18.0	6519.79	3677.96
2056.51	1.00									
13	309.13	52.91	0.4	3.47	3.47	3	100.00	18.0	7034.34	3672.80
2132.50	1.00									
14	312.60	55.47	2.2	3.40	3.40	3	100.00	18.0	7365.05	3584.46
2196.70	1.00									
15	316.00	61.32	2.2	3.54	3.54	3	100.00	18.0	8130.00	3698.88

2293.94	1.00										
16	319.54	49.77	4.0	2.73	2.74	3	100.00	18.0	6590.31	2833.75	
2403.55	1.00										
17	322.27	51.74	4.0	2.73	2.74	3	100.00	18.0	6843.35	2801.47	
2495.65	1.00										
18	325.00	28.17	4.0	1.46	1.47	3	100.00	18.0	3723.16	1487.41	
2534.59	1.00										
19	326.46	65.72	5.7	3.45	3.47	3	100.00	18.0	8679.80	3471.91	
2498.68	1.00										
20	329.92	64.53	5.7	3.45	3.47	3	100.00	18.0	8510.92	3396.79	
2450.00	1.00										
21	333.37	62.92	7.5	3.44	3.47	3	100.00	18.0	8286.11	3310.12	
2389.51	1.00										
22	336.81	61.35	7.5	3.44	3.47	3	100.00	18.0	8065.83	3211.79	
2325.87	1.00										
23	340.25	63.44	9.3	3.67	3.72	3	100.00	18.0	8321.95	3315.83	
2247.88	1.00										
24	343.92	53.31	9.3	3.18	3.23	2	0.00	35.0	6983.08	2766.47	
2156.79	0.99										
25	347.11	22.78	11.1	1.39	1.42	2	0.00	35.0	2984.20	1182.56	
2098.82	0.99										
26	348.50	47.74	11.1	3.00	3.06	5	0.00	45.0	5251.13	2463.08	
1707.60	0.97										
27	351.50	37.22	11.1	2.42	2.47	2	0.00	35.0	4875.56	1904.93	
1975.13	0.99										
28	353.92	49.95	12.9	3.38	3.47	2	0.00	35.0	6543.61	2547.23	
1888.75	0.99										
29	357.30	47.34	12.9	3.38	3.47	2	0.00	35.0	6201.17	2379.92	
1789.56	0.99										
30	360.69	44.21	14.6	3.36	3.47	2	0.00	35.0	5791.52	2201.35	
1678.02	0.99										
31	364.05	41.26	14.6	3.36	3.47	2	0.00	35.0	5405.62	2011.37	
1565.68	0.99										
32	367.41	37.82	16.4	3.33	3.47	2	0.00	35.0	4953.82	1810.10	
1441.68	0.99										
33	370.74	34.55	16.4	3.33	3.47	2	0.00	35.0	4525.92	1597.61	
1316.38	0.99										
34	374.07	26.99	18.2	2.87	3.02	2	0.00	35.0	3536.21	1208.02	
1189.19	1.00										
35	376.93	24.29	18.2	2.87	3.02	2	0.00	35.0	3182.14	1030.49	
1069.15	1.00										
36	379.80	6.76	18.2	0.86	0.91	1	150.00	22.0	885.99	274.65	
995.26	1.02										
37	380.66	23.24	20.0	3.26	3.47	1	150.00	22.0	3044.89	893.37	
897.29	1.03										
38	383.92	19.37	20.0	3.26	3.47	1	150.00	22.0	2538.07	636.50	
744.74	1.03										
39	387.19	13.99	21.8	2.94	3.16	1	150.00	22.0	1832.13	347.31	
590.17	1.04										
40	390.13	10.54	21.8	2.94	3.16	1	150.00	22.0	1380.67	115.77	
439.56	1.04										
41	393.06	1.65	21.8	0.57	0.61	1	150.00	22.0	215.80	0.00	
349.91	1.04										
42	393.63	6.62	23.5	3.18	3.47	1	150.00	22.0	866.84	0.00	
246.05	1.05										
43	396.82	2.21	23.5	3.18	3.47	1	150.00	22.0	288.94	0.00	
71.89	1.05										

X-S Area:	----- 1451.81	Path Length:	----- 131.91	X-S Weight:	----- 190632.58

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 5-2 Rapid Drawdown.gmf

Processed: 02 Dec 2020 14:23:06

DATA: Analysis 1 - Case 5-2 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    192.00        348.50    192.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    183.00        348.50    183.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    180.00        348.50    180.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    192.00        450.00    192.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    183.00        450.00    183.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    180.00        450.00    180.00

```

Slope Surface (8 points)

```

-----
100.00    183.00        274.00    183.00        325.00    200.00        400.00    200.00
405.00    195.00
410.00    195.00        415.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    183.00        274.00    183.00        316.00    197.00        348.50    197.00
351.50    197.00
450.00    197.00

```

Failure Surface

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

```

Intersects: XL: 274.00    YL: 183.00    XR: 405.00    YR: 195.00
Centre: XC: 317.50    YC: 429.19    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 5-2 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 6.754

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.69

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	269.00	183.00	400.00	200.00	305.93	411.67	231.63	2.686	
Critical Surface									
2	270.05	183.00	400.00	200.00	306.76	407.57	227.55	2.687	
3	271.11	183.00	400.00	200.00	307.60	403.47	223.47	2.689	
4	269.53	183.00	400.00	200.00	306.07	411.73	231.63	2.697	
5	270.58	183.00	400.00	200.00	306.90	407.63	227.55	2.699	
6	271.63	183.00	400.00	200.00	307.74	403.53	223.47	2.701	
7	272.68	183.00	400.00	200.00	308.58	399.43	219.39	2.704	
8	269.00	183.00	400.00	200.00	305.38	415.89	235.71	2.707	
9	270.05	183.00	400.00	200.00	306.21	411.79	231.63	2.708	
10	271.11	183.00	400.00	200.00	307.04	407.70	227.55	2.710	
11	273.74	183.00	400.00	200.00	309.43	395.33	215.31	2.711	
12	272.16	183.00	400.00	200.00	307.88	403.60	223.47	2.713	
13	274.26	183.09	400.00	200.00	310.27	391.22	211.22	2.714	
14	269.53	183.00	400.00	200.00	305.52	415.95	235.71	2.718	
15	270.58	183.00	400.00	200.00	306.34	411.85	231.63	2.719	
16	273.21	183.00	400.00	200.00	308.72	399.50	219.39	2.721	
17	271.63	183.00	400.00	200.00	307.18	407.76	227.55	2.721	
18	269.53	183.00	400.53	199.47	306.79	415.75	235.71	2.723	
19	272.68	183.00	400.00	200.00	308.01	403.66	223.47	2.724	
20	270.58	183.00	400.53	199.47	307.61	411.65	231.63	2.725	
21	271.63	183.00	400.53	199.47	308.43	407.56	227.55	2.728	
22	269.00	183.00	400.00	200.00	304.83	420.10	239.80	2.728	
23	270.05	183.00	400.00	200.00	305.66	416.01	235.71	2.729	
24	271.11	183.00	400.00	200.00	306.48	411.92	231.63	2.730	
25	273.74	183.00	400.00	200.00	308.86	399.56	219.39	2.731	
26	274.79	183.26	400.00	200.00	311.26	387.17	207.14	2.731	
27	272.16	183.00	400.00	200.00	307.31	407.82	227.55	2.733	
28	269.00	183.00	400.53	199.47	306.12	419.91	239.80	2.733	
29	274.26	183.09	400.00	200.00	309.70	395.46	215.31	2.734	
30	270.05	183.00	400.53	199.47	306.93	415.81	235.71	2.735	
31	272.68	183.00	400.53	199.47	309.26	403.46	223.47	2.736	
32	273.21	183.00	400.00	200.00	308.15	403.72	223.47	2.736	
33	271.11	183.00	400.53	199.47	307.75	411.72	231.63	2.737	
34	269.53	183.00	400.00	200.00	304.97	420.16	239.80	2.739	
35	270.58	183.00	400.00	200.00	305.79	416.07	235.71	2.740	
36	272.16	183.00	400.53	199.47	308.57	407.62	227.55	2.740	
37	271.63	183.00	400.00	200.00	306.62	411.98	231.63	2.741	
38	272.68	183.00	400.00	200.00	307.45	407.88	227.55	2.744	
39	269.53	183.00	400.53	199.47	306.26	419.97	239.80	2.744	
40	270.58	183.00	400.53	199.47	307.08	415.87	235.71	2.746	
41	273.21	183.00	400.53	199.47	309.40	403.52	223.47	2.747	
42	271.63	183.00	400.53	199.47	307.89	411.78	231.63	2.749	
43	275.32	183.44	400.00	200.00	312.24	383.12	203.06	2.750	
44	271.11	183.00	400.00	200.00	305.93	416.13	235.71	2.750	
45	273.74	183.00	400.00	200.00	308.29	403.78	223.47	2.751	
46	274.79	183.26	400.00	200.00	310.69	391.41	211.22	2.752	
47	272.16	183.00	400.00	200.00	306.75	412.03	231.63	2.753	
48	269.00	183.00	400.53	199.47	305.60	424.12	243.88	2.754	
49	274.26	183.09	400.00	200.00	309.14	399.69	219.39	2.754	
50	270.05	183.00	400.53	199.47	306.40	420.02	239.80	2.755	
51	269.00	183.00	400.00	200.00	304.29	424.31	243.88	2.756	
52	273.21	183.00	400.00	200.00	307.58	407.94	227.55	2.756	
53	270.05	183.00	400.00	200.00	305.10	420.22	239.80	2.757	
54	272.68	183.00	400.53	199.47	308.71	407.68	227.55	2.757	
55	271.11	183.00	400.53	199.47	307.21	415.93	235.71	2.757	
56	273.74	183.00	400.53	199.47	309.54	403.58	223.47	2.758	
57	269.53	183.00	400.00	200.00	304.42	424.37	243.88	2.759	
58	274.79	183.26	400.53	199.47	311.89	391.20	211.22	2.760	
59	270.58	183.00	400.00	200.00	305.24	420.28	239.80	2.760	
60	272.16	183.00	400.53	199.47	308.03	411.84	231.63	2.760	
61	269.00	183.00	401.05	198.95	306.90	423.92	243.88	2.762	
62	271.63	183.00	400.00	200.00	306.06	416.19	235.71	2.762	
63	274.26	183.09	400.53	199.47	310.38	399.48	219.39	2.762	
64	270.05	183.00	401.05	198.95	307.69	419.82	239.80	2.764	
65	269.53	183.00	400.53	199.47	305.73	424.17	243.88	2.765	
66	272.68	183.00	400.00	200.00	306.89	412.09	231.63	2.766	

67	270.58	183.00	400.53	199.47	306.54	420.08	239.80	2.766
68	271.11	183.00	401.05	198.95	308.50	415.73	235.71	2.767
69	273.21	183.00	400.53	199.47	308.85	407.74	227.55	2.767
70	271.63	183.00	400.53	199.47	307.35	415.99	235.71	2.769
71	275.84	183.61	400.00	200.00	313.21	379.05	198.98	2.770
72	270.05	183.00	400.00	200.00	304.55	424.42	243.88	2.771
73	269.00	183.00	400.00	200.00	303.74	428.51	247.96	2.772
74	275.32	183.44	400.00	200.00	311.67	387.37	207.14	2.772
75	271.11	183.00	400.00	200.00	305.37	420.34	239.80	2.772
76	272.68	183.00	400.53	199.47	308.17	411.90	231.63	2.772
77	274.79	183.26	400.00	200.00	310.12	395.65	215.31	2.772
78	269.53	183.00	401.05	198.95	307.04	423.98	243.88	2.773
79	272.16	183.00	400.00	200.00	306.19	416.24	235.71	2.774
80	274.26	183.09	400.00	200.00	308.57	403.91	223.47	2.774
81	273.74	183.00	400.00	200.00	307.72	408.00	227.55	2.775
82	269.00	183.00	400.53	199.47	305.07	428.32	247.96	2.775
83	272.16	183.00	401.05	198.95	309.30	411.63	231.63	2.775
84	270.05	183.00	400.53	199.47	305.87	424.23	243.88	2.776
85	270.58	183.00	401.05	198.95	307.84	419.88	239.80	2.776
86	273.21	183.00	401.05	198.95	310.12	407.54	227.55	2.776
87	273.21	183.00	400.00	200.00	307.02	412.15	231.63	2.776
88	273.74	183.00	400.53	199.47	308.99	407.80	227.55	2.777
89	271.11	183.00	400.53	199.47	306.68	420.14	239.80	2.777
90	271.63	183.00	401.05	198.95	308.64	415.79	235.71	2.779
91	272.16	183.00	400.53	199.47	307.49	416.05	235.71	2.780
92	275.32	183.44	400.53	199.47	312.86	387.15	207.14	2.780
93	274.79	183.26	400.53	199.47	311.35	395.44	215.31	2.781
94	274.26	183.09	400.53	199.47	309.83	403.71	223.47	2.782
95	269.00	183.00	401.05	198.95	306.39	428.12	247.96	2.783
96	269.53	183.00	400.00	200.00	303.87	428.57	247.96	2.783
97	270.58	183.00	400.00	200.00	304.69	424.48	243.88	2.783
98	271.63	183.00	400.00	200.00	305.50	420.39	239.80	2.784
99	270.05	183.00	401.05	198.95	307.18	424.03	243.88	2.785

Critical Failure Surface (circle 1)

Intersects:	XL:	269.00	YL:	183.00	XR:	400.00	YR:	200.00	
	Centre:	XC:	305.93	YC:	411.67		Radius:	R:	231.63
Generated failure surface: (20 points)									
269.00	183.00	275.98	181.98	282.98	181.18	290.01	180.59		
297.05	180.21								
304.09	180.04	311.14	180.10	318.19	180.36	325.22	180.84		
332.24	181.54								
339.23	182.44	346.19	183.56	353.11	184.89	359.99	186.44		
366.82	188.19								
373.60	190.14	380.31	192.30	386.95	194.67	393.51	197.24		
400.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	269.00	0.46	-8.3	2.50	2.53	3	100.00	18.0	64.29	28.75
31.50	1.03									
2	271.50	1.37	-8.3	2.50	2.53	3	100.00	18.0	192.88	86.26
83.45	1.03									
3	274.00	2.38	-8.3	1.98	2.00	3	100.00	18.0	328.76	149.95
173.52	1.03									
4	275.98	8.62	-6.6	3.50	3.53	3	100.00	18.0	1172.00	541.47
341.56	1.02									
5	279.48	14.12	-6.6	3.50	3.53	3	100.00	18.0	1906.29	886.78
552.82	1.02									
6	282.98	19.49	-4.8	3.51	3.53	3	100.00	18.0	2623.02	1220.77
754.03	1.01									
7	286.49	24.65	-4.8	3.51	3.53	3	100.00	18.0	3308.31	1543.39
950.19	1.01									
8	290.01	29.68	-3.1	3.52	3.53	3	100.00	18.0	3976.01	1854.51
1135.49	1.01									
9	293.53	34.47	-3.1	3.52	3.53	3	100.00	18.0	4610.76	2154.13
1316.44	1.01									
10	297.05	44.21	-1.3	3.95	3.96	3	100.00	18.0	5903.21	2759.19
1495.91	1.00									
11	301.00	38.47	-1.3	3.09	3.09	3	100.00	18.0	5130.21	2401.32
1661.54	1.00									
12	304.09	47.80	0.4	3.52	3.53	3	100.00	18.0	6365.84	2982.95
1804.83	1.00									
13	307.62	51.85	0.4	3.52	3.53	3	100.00	18.0	6895.62	3235.74
1955.05	1.00									
14	311.14	37.99	2.2	2.43	2.43	3	100.00	18.0	5045.51	2371.99
2071.53	1.00									
15	313.57	39.73	2.2	2.43	2.43	3	100.00	18.0	5271.64	2480.84

2164.42	1.00										
16	316.00	37.31	2.2	2.19	2.19	3	100.00	18.0	4945.82	2279.73	
2252.62	1.00										
17	318.19	60.68	3.9	3.41	3.41	3	100.00	18.0	8035.41	3519.15	
2346.08	0.99										
18	321.59	63.76	3.9	3.41	3.41	3	100.00	18.0	8430.19	3469.62	
2460.94	0.99										
19	325.00	68.77	5.5	3.62	3.64	3	100.00	18.0	9081.04	3630.59	
2487.99	0.99										
20	328.62	67.47	5.7	3.62	3.64	3	100.00	18.0	8898.32	3549.99	
2437.43	0.99										
21	332.24	63.75	7.4	3.50	3.53	3	100.00	18.0	8394.48	3351.48	
2374.20	0.99										
22	335.73	62.16	7.4	3.50	3.53	3	100.00	18.0	8170.88	3251.69	
2310.79	0.99										
23	339.23	59.75	9.1	3.46	3.50	3	100.00	18.0	7836.58	3120.53	
2234.09	0.99										
24	342.69	58.56	9.1	3.50	3.55	2	0.00	35.0	7671.22	3036.92	
2136.41	0.97										
25	346.19	37.45	10.9	2.31	2.35	2	0.00	35.0	4905.40	1939.17	
2062.10	0.97										
26	348.50	47.11	10.9	3.00	3.05	5	0.00	45.0	5182.40	2421.79	
1665.04	0.95										
27	351.50	24.63	10.9	1.61	1.64	2	0.00	35.0	3226.61	1257.42	
1940.27	0.97										
28	353.11	50.64	12.6	3.44	3.53	2	0.00	35.0	6633.28	2578.07	
1862.33	0.97										
29	356.55	47.98	12.6	3.44	3.53	2	0.00	35.0	6286.01	2408.56	
1764.31	0.97										
30	359.99	44.83	14.4	3.41	3.53	2	0.00	35.0	5872.16	2227.58	
1651.57	0.97										
31	363.41	41.84	14.4	3.41	3.53	2	0.00	35.0	5480.82	2035.15	
1540.72	0.97										
32	366.82	38.36	16.1	3.39	3.53	2	0.00	35.0	5024.58	1831.37	
1416.15	0.97										
33	370.21	35.04	16.1	3.39	3.53	2	0.00	35.0	4590.49	1616.14	
1292.68	0.97										
34	373.60	27.09	17.9	2.88	3.03	2	0.00	35.0	3548.57	1208.72	
1166.14	0.97										
35	376.48	24.41	17.9	2.88	3.03	2	0.00	35.0	3197.64	1033.09	
1049.37	0.97										
36	379.36	7.40	17.9	0.94	0.99	1	150.00	22.0	969.55	299.73	
977.41	1.00										
37	380.31	23.59	19.6	3.32	3.53	1	150.00	22.0	3090.80	902.93	
877.57	1.01										
38	383.63	19.67	19.6	3.32	3.53	1	150.00	22.0	2576.31	642.79	
726.77	1.01										
39	386.95	14.16	21.3	2.98	3.20	1	150.00	22.0	1855.04	349.30	
572.93	1.01										
40	389.93	10.68	21.3	2.98	3.20	1	150.00	22.0	1399.71	116.43	
424.69	1.01										
41	392.91	1.73	21.3	0.60	0.65	1	150.00	22.0	227.24	0.00	
336.03	1.01										
42	393.51	6.72	23.1	3.24	3.53	1	150.00	22.0	880.84	0.00	
232.90	1.02										
43	396.76	2.24	23.1	3.24	3.52	1	150.00	22.0	293.61	0.00	
62.72	1.02										

X-S Area:	----- 1443.06	Path Length:	----- 133.95	X-S Weight:	----- 189499.38

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Full Reservoir.gmf

Processed: 01 Apr 2021 09:51:58

DATA: Analysis 1 - Case 5-3 Full Reservoir

Material Properties (5 materials)

```

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

```

Water Properties

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

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Material Profiles (9 profiles)

```

-----
Profile: 1 (2 points)   Material beneath: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    190.00        348.50    190.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    164.00        348.50    164.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    161.00        348.50    161.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    190.00        450.00    190.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    164.00        450.00    164.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    161.00        450.00    161.00

```

Slope Surface (4 points)

```

-----
100.00    164.00    217.00    164.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (4 points)

```

-----
100.00    197.00    348.50    197.00    351.50    178.00    450.00    178.00

```

Failure Surface

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

```

Intersects: XL: 217.00    YL: 164.00    XR: 390.00    YR: 200.00
Centre: XC: 255.85    YC: 410.96    Radius: R: 250.00

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Variable Restraints

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Parameter descriptor:      XL      XR      R
Range of variation:      10.00   10.00   200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 5-3 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.272

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.96

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	216.21	164.00	385.00	200.00	253.94	400.81	239.80	2.957	
Critical Surface									
2	217.79	164.26	385.00	200.00	256.40	392.66	231.63	2.958	
3	217.26	164.09	385.00	200.00	255.17	396.73	235.71	2.959	
4	218.32	164.44	385.00	200.00	257.63	388.57	227.55	2.959	
5	218.84	164.61	385.00	200.00	258.87	384.47	223.47	2.962	
6	219.37	164.79	385.00	200.00	260.10	380.36	219.39	2.962	
7	216.74	164.00	385.00	200.00	254.04	400.88	239.80	2.962	
8	215.16	164.00	385.00	200.00	252.82	404.95	243.88	2.963	
9	212.00	164.00	385.00	200.00	250.41	413.10	252.04	2.965	
10	215.68	164.00	385.00	200.00	252.92	405.02	243.88	2.970	
11	213.05	164.00	385.00	200.00	251.51	408.96	247.96	2.972	
12	216.74	164.00	385.53	200.00	254.46	400.81	239.80	2.972	
13	215.16	164.00	385.53	200.00	253.24	404.89	243.88	2.973	
14	216.21	164.00	385.00	200.00	253.03	405.08	243.88	2.973	
15	213.58	164.00	385.53	200.00	252.04	408.96	247.96	2.974	
16	217.26	164.09	385.00	200.00	254.25	401.01	239.80	2.974	
17	212.53	164.00	385.00	200.00	250.51	413.16	252.04	2.974	
18	218.32	164.44	385.00	200.00	256.72	392.87	231.63	2.976	
19	214.63	164.00	385.00	200.00	252.72	404.89	243.88	2.976	
20	217.79	164.26	385.00	200.00	255.48	396.94	235.71	2.977	
21	218.84	164.61	385.00	200.00	257.95	388.78	227.55	2.977	
22	215.68	164.00	385.53	200.00	253.35	404.95	243.88	2.978	
23	213.58	164.00	385.00	200.00	251.61	409.02	247.96	2.978	
24	214.11	164.00	385.53	200.00	252.14	409.02	247.96	2.978	
25	219.37	164.79	385.00	200.00	259.18	384.68	223.47	2.979	
26	216.74	164.00	385.00	200.00	253.13	405.15	243.88	2.979	
27	212.00	164.00	385.00	200.00	249.52	417.36	256.12	2.982	
28	220.42	165.14	385.00	200.00	261.64	376.46	215.31	2.983	
29	219.89	164.96	385.00	200.00	260.41	380.58	219.39	2.983	
30	217.79	164.26	385.53	200.00	255.91	396.88	235.71	2.984	
31	220.95	165.32	385.00	200.00	262.87	372.34	211.22	2.985	
32	216.21	164.00	385.53	200.00	253.45	405.02	243.88	2.985	
33	221.47	165.49	385.00	200.00	264.10	368.20	207.14	2.986	
34	215.68	164.00	385.00	200.00	252.02	409.28	247.96	2.986	
35	218.32	164.44	385.53	200.00	257.14	392.79	231.63	2.986	
36	222.00	165.67	385.00	200.00	265.33	364.05	203.06	2.986	
37	214.63	164.00	385.53	200.00	252.24	409.09	247.96	2.987	
38	213.05	164.00	385.00	200.00	250.62	413.23	252.04	2.987	
39	214.11	164.00	385.00	200.00	251.71	409.09	247.96	2.988	
40	212.53	164.00	385.00	200.00	249.62	417.42	256.12	2.988	
41	218.84	164.61	385.53	200.00	258.37	388.71	227.55	2.988	
42	215.68	164.00	386.05	200.00	253.77	404.89	243.88	2.988	
43	216.74	164.00	385.53	200.00	253.55	405.08	243.88	2.988	
44	215.16	164.00	385.53	200.00	252.34	409.16	247.96	2.988	
45	214.11	164.00	386.05	200.00	252.56	408.96	247.96	2.989	
46	213.58	164.00	385.53	200.00	251.14	413.23	252.04	2.989	
47	217.26	164.09	385.53	200.00	254.67	400.95	239.80	2.989	
48	219.37	164.79	385.53	200.00	259.60	384.61	223.47	2.990	
49	214.63	164.00	385.00	200.00	251.82	409.16	247.96	2.991	
50	219.89	164.96	385.53	200.00	260.82	380.50	219.39	2.991	
51	216.21	164.00	385.00	200.00	252.12	409.35	247.96	2.992	
52	217.26	164.09	385.00	200.00	253.34	405.28	243.88	2.992	
53	217.79	164.26	385.00	200.00	254.57	401.22	239.80	2.993	
54	216.21	164.00	386.05	200.00	253.87	404.95	243.88	2.993	
55	220.42	165.14	385.53	200.00	262.05	376.38	215.31	2.993	
56	214.63	164.00	386.05	200.00	252.66	409.02	247.96	2.993	
57	218.32	164.44	385.00	200.00	255.80	397.15	235.71	2.994	
58	213.05	164.00	386.05	200.00	251.46	413.10	252.04	2.994	
59	213.58	164.00	385.00	200.00	250.72	413.29	252.04	2.994	
60	218.84	164.61	385.00	200.00	257.03	393.08	231.63	2.994	
61	220.95	165.32	385.53	200.00	263.28	372.25	211.22	2.994	
62	215.68	164.00	385.53	200.00	252.44	409.22	247.96	2.995	
63	217.26	164.09	386.05	200.00	255.10	400.88	239.80	2.995	
64	217.79	164.26	386.05	200.00	256.33	396.81	235.71	2.995	
65	214.11	164.00	385.53	200.00	251.24	413.29	252.04	2.995	
66	218.32	164.44	386.05	200.00	257.56	392.72	231.63	2.996	
67	212.53	164.00	385.53	200.00	250.94	413.10	252.04	2.997	
68	216.74	164.00	385.00	200.00	252.21	409.41	247.96	2.997	
69	219.37	164.79	385.00	200.00	258.27	388.99	227.55	2.998	
70	218.84	164.61	386.05	200.00	258.78	388.63	227.55	2.998	

71	219.89	164.96	385.00	200.00	259.50	384.90	223.47	2.999
72	215.16	164.00	385.00	200.00	251.92	409.22	247.96	2.999
73	219.37	164.79	386.05	200.00	260.01	384.53	223.47	3.000
74	216.74	164.00	386.05	200.00	253.98	405.02	243.88	3.000
75	212.00	164.00	385.00	200.00	248.64	421.61	260.20	3.000
76	216.21	164.00	385.53	200.00	252.54	409.28	247.96	3.001
77	220.42	165.14	385.00	200.00	260.72	380.79	219.39	3.001
78	214.63	164.00	385.53	200.00	251.34	413.35	252.04	3.001
79	217.79	164.26	385.53	200.00	254.99	401.16	239.80	3.002
80	219.89	164.96	386.05	200.00	261.24	380.42	219.39	3.002
81	215.16	164.00	386.05	200.00	252.77	409.09	247.96	3.002
82	214.11	164.00	385.00	200.00	250.82	413.35	252.04	3.002
83	218.32	164.44	385.53	200.00	256.22	397.08	235.71	3.002
84	217.26	164.09	385.53	200.00	253.76	405.22	243.88	3.002
85	220.42	165.14	386.05	200.00	262.46	376.30	215.31	3.003
86	216.21	164.00	386.58	200.00	254.30	404.89	243.88	3.003
87	215.68	164.00	386.05	200.00	252.87	409.16	247.96	3.003
88	214.63	164.00	386.58	200.00	253.09	408.96	247.96	3.004
89	213.58	164.00	386.05	200.00	251.57	413.16	252.04	3.004
90	214.11	164.00	386.05	200.00	251.67	413.23	252.04	3.004
91	212.53	164.00	386.05	200.00	250.47	417.30	256.12	3.005
92	212.00	164.00	385.53	200.00	249.95	417.30	256.12	3.005
93	217.26	164.09	386.58	200.00	255.52	400.81	239.80	3.005
94	217.79	164.26	386.58	200.00	256.75	396.74	235.71	3.005
95	213.05	164.00	385.00	200.00	249.72	417.48	256.12	3.005
96	212.53	164.00	385.00	200.00	248.74	421.67	260.20	3.006
97	221.47	165.49	385.00	200.00	263.18	372.56	211.22	3.006
98	212.00	164.00	386.05	200.00	250.37	417.23	256.12	3.006
99	218.84	164.61	385.53	200.00	257.45	393.01	231.63	3.006

Critical Failure Surface (circle 1)

Intersects:	XL:	216.21	YL:	164.00	XR:	385.00	YR:	200.00
	Centre:	XC:	253.94	YC:	400.81	Radius:	R:	239.80
Generated failure surface: (20 points)								
216.21	164.00		225.41	162.72		234.66	161.79	243.93
253.22	161.01							161.22
262.51	161.17		271.79	161.68		281.04	162.55	290.25
299.40	165.36							163.78
308.49	167.30		317.50	169.59		326.41	172.23	335.21
343.88	178.52							175.21
352.43	182.17		360.82	186.15		369.06	190.46	377.12
385.00	200.00							195.07

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

Slice	Test	X-S	Base						PoreWater	
Normal	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	216.21	0.04	-7.9	0.79	0.80	3	100.00	18.0	6.13	1644.17
2071.82	1.03									
2	217.00	4.65	-7.9	4.21	4.25	3	100.00	18.0	625.65	8852.62
2170.22	1.03									
3	221.21	13.01	-7.9	4.21	4.25	3	100.00	18.0	1746.30	9008.11
2351.37	1.03									
4	225.41	23.53	-5.7	4.62	4.65	3	100.00	18.0	3152.29	10005.61
2525.56	1.02									
5	230.04	32.79	-5.7	4.62	4.65	3	100.00	18.0	4387.21	10139.90
2698.15	1.02									
6	234.66	41.78	-3.5	4.64	4.65	3	100.00	18.0	5582.54	10248.14
2854.03	1.01									
7	239.29	50.26	-3.5	4.64	4.65	3	100.00	18.0	6706.92	10330.36
3000.94	1.01									
8	243.93	58.43	-1.3	4.64	4.65	3	100.00	18.0	7785.90	10386.56
3130.04	1.00									
9	248.58	66.10	-1.3	4.64	4.65	3	100.00	18.0	8795.88	10416.67
3251.17	1.00									
10	253.22	73.37	0.9	4.65	4.65	3	100.00	18.0	9748.21	10420.81
3353.55	1.00									
11	257.87	80.21	0.9	4.65	4.65	3	100.00	18.0	10640.58	10398.78
3448.85	1.00									
12	262.51	86.50	3.2	4.64	4.65	3	100.00	18.0	11457.30	10350.50
3524.58	1.00									
13	267.15	92.49	3.2	4.64	4.65	3	100.00	18.0	12229.32	10276.21
3594.04	1.00									
14	271.79	97.76	5.4	4.63	4.65	3	100.00	18.0	12904.07	10176.05
3643.23	0.99									
15	276.41	102.88	5.4	4.63	4.65	3	100.00	18.0	13554.09	10049.72
3686.85	0.99									
16	281.04	107.09	7.6	4.60	4.65	3	100.00	18.0	14081.67	9897.59
3709.65	0.99									
17	285.64	111.33	7.6	4.60	4.65	3	100.00	18.0	14608.69	9719.49

3727.49	0.99									
18	290.25	31.60	9.8	1.28	1.30	3	100.00	18.0	4140.52	2677.97
3726.89	1.00									
19	291.53	87.28	9.8	3.47	3.53	2	0.00	35.0	11433.87	7195.01
3695.84	0.97									
20	295.00	113.40	9.8	4.40	4.47	2	0.00	35.0	14854.95	8928.54
3694.89	0.97									
21	299.40	119.84	12.0	4.54	4.65	2	0.00	35.0	15699.40	9030.59
3666.35	0.97									
22	303.95	122.32	12.0	4.54	4.65	2	0.00	35.0	16024.04	8749.67
3641.50	0.97									
23	308.49	102.67	14.3	3.75	3.87	2	0.00	35.0	13449.81	7064.16
3592.71	0.97									
24	312.25	103.79	14.3	3.75	3.87	2	0.00	35.0	13596.05	6833.46
3552.40	0.97									
25	316.00	41.65	14.3	1.50	1.54	2	0.00	35.0	5455.74	2657.38
3538.89	0.97									
26	317.50	104.98	16.5	3.75	3.91	2	0.00	35.0	13752.84	6557.21
3534.95	0.97									
27	321.25	105.51	16.5	3.75	3.91	2	0.00	35.0	13821.89	6286.11
3547.64	0.97									
28	325.00	39.32	16.5	1.41	1.47	2	0.00	35.0	5150.51	2284.18
3527.69	0.97									
29	326.41	118.94	18.7	4.40	4.65	2	0.00	35.0	15580.99	6965.77
3389.34	0.98									
30	330.81	112.39	18.7	4.40	4.65	2	0.00	35.0	14722.48	6534.03
3201.80	0.98									
31	335.21	104.00	20.9	4.34	4.65	2	0.00	35.0	13623.42	6077.65
2987.48	0.98									
32	339.55	96.80	20.9	4.34	4.65	2	0.00	35.0	12680.53	5596.81
2779.62	0.98									
33	343.88	94.57	23.1	4.62	5.02	2	0.00	35.0	12388.94	5478.07
2537.94	0.99									
34	348.50	46.34	23.1	2.44	2.65	5	0.00	45.0	5097.74	1367.13
1889.49	0.95									
35	350.94	26.98	23.1	1.49	1.62	2	0.00	35.0	3534.76	0.00
2158.39	0.99									
36	352.43	70.66	25.4	4.20	4.65	2	0.00	35.0	9255.96	0.00
1982.36	0.99									
37	356.63	62.30	25.4	4.20	4.65	2	0.00	35.0	8161.66	0.00
1747.99	0.99									
38	360.82	47.43	27.6	3.68	4.15	2	0.00	35.0	6213.92	0.00
1502.09	1.00									
39	364.51	40.35	27.6	3.68	4.15	2	0.00	35.0	5286.48	0.00
1277.90	1.00									
40	368.19	8.53	27.6	0.87	0.98	1	150.00	22.0	1116.89	0.00
1170.14	1.05									
41	369.06	33.82	29.8	4.03	4.65	1	150.00	22.0	4430.64	0.00
992.36	1.07									
42	373.09	24.51	29.8	4.03	4.65	1	150.00	22.0	3211.37	0.00
711.85	1.07									
43	377.12	14.55	32.0	3.94	4.65	1	150.00	22.0	1906.48	0.00
416.70	1.09									
44	381.06	4.85	32.0	3.94	4.65	1	150.00	22.0	635.49	0.00
119.42	1.09									

X-S Area:	2921.62	Path Length:	176.54	X-S Weight:	383240.12

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Rapid Drawdown.gmf

Processed: 01 Apr 2021 09:48:57

DATA: Analysis 1 - Case 5-3 Rapid Drawdown

Material Properties (5 materials)

```

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

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-----
Profile: 1 (2 points)  Material beneath: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    190.00      348.50    190.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    164.00      348.50    164.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    161.00      348.50    161.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    190.00      450.00    190.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    164.00      450.00    164.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    161.00      450.00    161.00

```

Slope Surface (4 points)

```

-----
100.00    164.00    217.00    164.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    164.00    217.00    164.00    316.00    197.00    348.50    197.00
351.50    178.00
450.00    178.00

```

Failure Surface

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

```

Intersects: XL:    217.00    YL:    164.00    XR:    390.00    YR:    200.00
Centre: XC:    255.85    YC:    410.96    Radius: R:    250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 5-3 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.830

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.64

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	216.21	164.00	385.00	200.00	253.94	400.81	239.80	1.639	
Critical Surface									
2	217.26	164.09	385.00	200.00	255.17	396.73	235.71	1.641	
3	217.79	164.26	385.00	200.00	256.40	392.66	231.63	1.641	
4	218.32	164.44	385.00	200.00	257.63	388.57	227.55	1.642	
5	216.74	164.00	385.00	200.00	254.04	400.88	239.80	1.643	
6	215.16	164.00	385.00	200.00	252.82	404.95	243.88	1.643	
7	218.84	164.61	385.00	200.00	258.87	384.47	223.47	1.643	
8	219.37	164.79	385.00	200.00	260.10	380.36	219.39	1.644	
9	212.00	164.00	385.00	200.00	250.41	413.10	252.04	1.644	
10	213.05	164.00	385.00	200.00	251.51	408.96	247.96	1.645	
11	214.63	164.00	385.00	200.00	252.72	404.89	243.88	1.646	
12	215.68	164.00	385.00	200.00	252.92	405.02	243.88	1.647	
13	213.58	164.00	385.00	200.00	251.61	409.02	247.96	1.649	
14	216.74	164.00	385.53	200.00	254.46	400.81	239.80	1.649	
15	215.16	164.00	385.53	200.00	253.24	404.89	243.88	1.649	
16	213.58	164.00	385.53	200.00	252.04	408.96	247.96	1.649	
17	216.21	164.00	385.00	200.00	253.03	405.08	243.88	1.649	
18	212.53	164.00	385.00	200.00	250.51	413.16	252.04	1.649	
19	217.26	164.09	385.00	200.00	254.25	401.01	239.80	1.650	
20	218.32	164.44	385.00	200.00	256.72	392.87	231.63	1.652	
21	215.68	164.00	385.53	200.00	253.35	404.95	243.88	1.652	
22	214.11	164.00	385.53	200.00	252.14	409.02	247.96	1.652	
23	217.79	164.26	385.00	200.00	255.48	396.94	235.71	1.653	
24	218.84	164.61	385.00	200.00	257.95	388.78	227.55	1.653	
25	216.74	164.00	385.00	200.00	253.13	405.15	243.88	1.653	
26	214.11	164.00	385.00	200.00	251.71	409.09	247.96	1.654	
27	212.00	164.00	385.00	200.00	249.52	417.36	256.12	1.654	
28	213.05	164.00	385.00	200.00	250.62	413.23	252.04	1.655	
29	219.37	164.79	385.00	200.00	259.18	384.68	223.47	1.655	
30	214.63	164.00	385.00	200.00	251.82	409.16	247.96	1.656	
31	216.21	164.00	385.53	200.00	253.45	405.02	243.88	1.657	
32	217.79	164.26	385.53	200.00	255.91	396.88	235.71	1.657	
33	214.63	164.00	385.53	200.00	252.24	409.09	247.96	1.657	
34	215.68	164.00	385.00	200.00	252.02	409.28	247.96	1.657	
35	219.89	164.96	385.00	200.00	260.41	380.58	219.39	1.657	
36	220.42	165.14	385.00	200.00	261.64	376.46	215.31	1.658	
37	215.68	164.00	386.05	200.00	253.77	404.89	243.88	1.658	
38	218.32	164.44	385.53	200.00	257.14	392.79	231.63	1.658	
39	212.53	164.00	385.00	200.00	249.62	417.42	256.12	1.658	
40	214.11	164.00	386.05	200.00	252.56	408.96	247.96	1.658	
41	215.16	164.00	385.53	200.00	252.34	409.16	247.96	1.659	
42	216.74	164.00	385.53	200.00	253.55	405.08	243.88	1.659	
43	213.58	164.00	385.53	200.00	251.14	413.23	252.04	1.659	
44	220.95	165.32	385.00	200.00	262.87	372.34	211.22	1.659	
45	213.58	164.00	385.00	200.00	250.72	413.29	252.04	1.659	
46	217.26	164.09	385.53	200.00	254.67	400.95	239.80	1.659	
47	212.53	164.00	385.53	200.00	250.94	413.10	252.04	1.659	
48	218.84	164.61	385.53	200.00	258.37	388.71	227.55	1.659	
49	221.47	165.49	385.00	200.00	264.10	368.20	207.14	1.660	
50	222.00	165.67	385.00	200.00	265.33	364.05	203.06	1.660	
51	215.16	164.00	385.00	200.00	251.92	409.22	247.96	1.661	
52	219.37	164.79	385.53	200.00	259.60	384.61	223.47	1.661	
53	216.21	164.00	385.00	200.00	252.12	409.35	247.96	1.661	
54	216.21	164.00	386.05	200.00	253.87	404.95	243.88	1.661	
55	214.63	164.00	386.05	200.00	252.66	409.02	247.96	1.661	
56	217.26	164.09	385.00	200.00	253.34	405.28	243.88	1.662	
57	213.05	164.00	386.05	200.00	251.46	413.10	252.04	1.662	
58	219.89	164.96	385.53	200.00	260.82	380.50	219.39	1.662	
59	217.79	164.26	385.00	200.00	254.57	401.22	239.80	1.662	
60	217.26	164.09	386.05	200.00	255.10	400.88	239.80	1.663	
61	215.68	164.00	385.53	200.00	252.44	409.22	247.96	1.663	
62	214.11	164.00	385.53	200.00	251.24	413.29	252.04	1.663	
63	217.79	164.26	386.05	200.00	256.33	396.81	235.71	1.663	
64	218.32	164.44	385.00	200.00	255.80	397.15	235.71	1.663	
65	214.11	164.00	385.00	200.00	250.82	413.35	252.04	1.664	
66	220.42	165.14	385.53	200.00	262.05	376.38	215.31	1.664	
67	218.84	164.61	385.00	200.00	257.03	393.08	231.63	1.664	
68	218.32	164.44	386.05	200.00	257.56	392.72	231.63	1.664	

69	220.95	165.32	385.53	200.00	263.28	372.25	211.22	1.665
70	216.74	164.00	385.00	200.00	252.21	409.41	247.96	1.665
71	212.00	164.00	385.53	200.00	249.95	417.30	256.12	1.665
72	213.05	164.00	385.53	200.00	251.04	413.16	252.04	1.665
73	218.84	164.61	386.05	200.00	258.78	388.63	227.55	1.666
74	216.74	164.00	386.05	200.00	253.98	405.02	243.88	1.666
75	212.00	164.00	385.00	200.00	248.64	421.61	260.20	1.666
76	213.05	164.00	385.00	200.00	249.72	417.48	256.12	1.666
77	215.16	164.00	386.05	200.00	252.77	409.09	247.96	1.667
78	219.37	164.79	385.00	200.00	258.27	388.99	227.55	1.667
79	216.21	164.00	385.53	200.00	252.54	409.28	247.96	1.667
80	214.63	164.00	385.53	200.00	251.34	413.35	252.04	1.667
81	219.37	164.79	386.05	200.00	260.01	384.53	223.47	1.667
82	214.63	164.00	386.58	200.00	253.09	408.96	247.96	1.667
83	216.21	164.00	386.58	200.00	254.30	404.89	243.88	1.667
84	219.89	164.96	385.00	200.00	259.50	384.90	223.47	1.667
85	213.58	164.00	386.05	200.00	251.57	413.16	252.04	1.667
86	217.79	164.26	385.53	200.00	254.99	401.16	239.80	1.668
87	214.63	164.00	385.00	200.00	250.92	413.42	252.04	1.668
88	215.68	164.00	386.05	200.00	252.87	409.16	247.96	1.668
89	217.26	164.09	385.53	200.00	253.76	405.22	243.88	1.668
90	214.11	164.00	386.05	200.00	251.67	413.23	252.04	1.668
91	212.53	164.00	386.05	200.00	250.47	417.30	256.12	1.668
92	219.89	164.96	386.05	200.00	261.24	380.42	219.39	1.668
93	218.32	164.44	385.53	200.00	256.22	397.08	235.71	1.669
94	212.00	164.00	386.05	200.00	250.37	417.23	256.12	1.669
95	217.26	164.09	386.58	200.00	255.52	400.81	239.80	1.669
96	217.79	164.26	386.58	200.00	256.75	396.74	235.71	1.669
97	220.42	165.14	385.00	200.00	260.72	380.79	219.39	1.669
98	212.53	164.00	385.00	200.00	248.74	421.67	260.20	1.670
99	220.42	165.14	386.05	200.00	262.46	376.30	215.31	1.670

Critical Failure Surface (circle 1)

Intersects:	XL:	216.21	YL:	164.00	XR:	385.00	YR:	200.00	
Centre:	XC:	253.94	YC:	400.81			Radius:	R:	239.80
Generated failure surface: (20 points)									
216.21	164.00		225.41	162.72		234.66	161.79	243.93	161.22
253.22	161.01								
262.51	161.17		271.79	161.68		281.04	162.55	290.25	163.78
299.40	165.36								
308.49	167.30		317.50	169.59		326.41	172.23	335.21	175.21
343.88	178.52								
352.43	182.17		360.82	186.15		369.06	190.46	377.12	195.07
385.00	200.00								

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	216.21	0.04	-7.9	0.79	0.80	3	100.00	18.0	6.13	2.74
16.64	1.04									
2	217.00	4.65	-7.9	4.21	4.25	3	100.00	18.0	625.65	292.74
159.76	1.04									
3	221.21	13.01	-7.9	4.21	4.25	3	100.00	18.0	1746.30	819.85
430.22	1.04									
4	225.41	23.53	-5.7	4.62	4.65	3	100.00	18.0	3152.29	1475.53
695.56	1.03									
5	230.04	32.79	-5.7	4.62	4.65	3	100.00	18.0	4387.21	2056.47
965.59	1.03									
6	234.66	41.78	-3.5	4.64	4.65	3	100.00	18.0	5582.54	2612.09
1215.57	1.01									
7	239.29	50.26	-3.5	4.64	4.65	3	100.00	18.0	6706.92	3142.40
1459.63	1.01									
8	243.93	58.43	-1.3	4.64	4.65	3	100.00	18.0	7785.90	3647.02
1681.71	1.00									
9	248.58	66.10	-1.3	4.64	4.65	3	100.00	18.0	8795.88	4125.93
1899.67	1.00									
10	253.22	73.37	0.9	4.65	4.65	3	100.00	18.0	9748.21	4578.83
2094.00	1.00									
11	257.87	80.21	0.9	4.65	4.65	3	100.00	18.0	10640.58	5005.64
2285.78	1.00									
12	262.51	86.50	3.2	4.64	4.65	3	100.00	18.0	11457.30	5405.97
2452.52	0.99									
13	267.15	92.49	3.2	4.64	4.65	3	100.00	18.0	12229.32	5779.94
2618.04	0.99									
14	271.79	97.76	5.4	4.63	4.65	3	100.00	18.0	12904.07	6127.33
2757.35	0.99									
15	276.41	102.88	5.4	4.63	4.65	3	100.00	18.0	13554.09	6447.96
2896.60	0.99									
16	281.04	107.09	7.6	4.60	4.65	3	100.00	18.0	14081.67	6741.75

3008.68	0.98									
17	285.64	111.33	7.6	4.60	4.65	3	100.00	18.0	14608.69	7008.62
3121.66	0.98									
18	290.25	31.60	9.8	1.28	1.30	3	100.00	18.0	4140.52	2000.92
3175.44	0.98									
19	291.53	87.28	9.8	3.47	3.53	2	0.00	35.0	11433.87	5527.34
3172.12	0.95									
20	295.00	113.40	9.8	4.40	4.47	2	0.00	35.0	14854.95	7181.16
3251.83	0.95									
21	299.40	119.84	12.0	4.54	4.65	2	0.00	35.0	15699.40	7646.39
3304.31	0.94									
22	303.95	122.32	12.0	4.54	4.65	2	0.00	35.0	16024.04	7804.50
3372.64	0.94									
23	308.49	102.67	14.3	3.75	3.87	2	0.00	35.0	13449.81	6610.30
3398.36	0.93									
24	312.25	103.79	14.3	3.75	3.87	2	0.00	35.0	13596.05	6682.18
3435.30	0.93									
25	316.00	41.65	14.3	1.50	1.54	2	0.00	35.0	5455.74	2657.38
3459.62	0.93									
26	317.50	104.98	16.5	3.75	3.91	2	0.00	35.0	13752.84	6557.21
3442.01	0.93									
27	321.25	105.51	16.5	3.75	3.91	2	0.00	35.0	13821.89	6286.11
3450.60	0.93									
28	325.00	39.32	16.5	1.41	1.47	2	0.00	35.0	5150.51	2284.18
3429.27	0.93									
29	326.41	118.94	18.7	4.40	4.65	2	0.00	35.0	15580.99	6965.77
3282.96	0.92									
30	330.81	112.39	18.7	4.40	4.65	2	0.00	35.0	14722.48	6534.03
3100.75	0.92									
31	335.21	104.00	20.9	4.34	4.65	2	0.00	35.0	13623.42	6077.65
2882.45	0.92									
32	339.55	96.80	20.9	4.34	4.65	2	0.00	35.0	12680.53	5596.81
2681.12	0.92									
33	343.88	94.57	23.1	4.62	5.02	2	0.00	35.0	12388.94	5478.07
2438.44	0.92									
34	348.50	46.34	23.1	2.44	2.65	5	0.00	45.0	5097.74	1367.13
1762.82	0.86									
35	350.94	26.98	23.1	1.49	1.62	2	0.00	35.0	3534.76	0.00
2009.92	0.92									
36	352.43	70.66	25.4	4.20	4.65	2	0.00	35.0	9255.96	0.00
1833.62	0.92									
37	356.63	62.30	25.4	4.20	4.65	2	0.00	35.0	8161.66	0.00
1616.84	0.92									
38	360.82	47.43	27.6	3.68	4.15	2	0.00	35.0	6213.92	0.00
1379.99	0.92									
39	364.51	40.35	27.6	3.68	4.15	2	0.00	35.0	5286.48	0.00
1174.03	0.92									
40	368.19	8.53	27.6	0.87	0.98	1	150.00	22.0	1116.89	0.00
1091.80	1.00									
41	369.06	33.82	29.8	4.03	4.65	1	150.00	22.0	4430.64	0.00
917.20	1.01									
42	373.09	24.51	29.8	4.03	4.65	1	150.00	22.0	3211.37	0.00
652.15	1.01									
43	377.12	14.55	32.0	3.94	4.65	1	150.00	22.0	1906.48	0.00
369.81	1.02									
44	381.06	4.85	32.0	3.94	4.65	1	150.00	22.0	635.49	0.00
90.22	1.02									

X-S Area:	----- 2921.62	Path Length:	----- 176.54	X-S Weight:	----- 383240.12

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 6-1 Full Reservoir.gmf

Processed: 02 Dec 2020 14:32:07

DATA: Analysis 1 - Case 6-1 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    196.00        348.50    196.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    159.00        348.50    159.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    156.00        348.50    156.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    196.00        450.00    196.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    159.00        450.00    159.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    156.00        450.00    156.00

```

Slope Surface (4 points)

```

-----
100.00    159.00        202.00    159.00        325.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00        202.00    197.00        316.00    197.00        348.50    197.00
351.50    181.00
450.00    181.00

```

Failure Surface

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

```

Intersects: XL:    202.00    YL:    159.00    XR:    380.00    YR:    200.00
Centre: XC:    238.76    YC:    406.28    Radius: R:    250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 6-1 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.748

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.60

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	203.84	159.61	375.00	200.00	243.26	375.43	219.39	2.600	
Critical Surface									
2	204.37	159.79	375.00	200.00	244.58	371.31	215.31	2.600	
3	203.32	159.44	375.00	200.00	241.95	379.54	223.47	2.604	
4	202.79	159.26	375.00	200.00	240.63	383.64	227.55	2.607	
5	205.95	160.32	375.00	200.00	247.49	363.25	207.14	2.608	
6	203.32	159.44	375.53	200.00	242.37	379.47	223.47	2.610	
7	205.42	160.14	375.00	200.00	246.18	367.40	211.22	2.610	
8	202.79	159.26	375.53	200.00	241.06	383.57	227.55	2.614	
9	204.89	159.96	375.00	200.00	244.87	371.53	215.31	2.614	
10	206.47	160.49	375.00	200.00	248.81	359.09	203.06	2.616	
11	205.95	160.32	375.53	200.00	247.91	363.16	207.14	2.617	
12	204.37	159.79	375.00	200.00	243.55	375.65	219.39	2.617	
13	200.68	159.00	375.00	200.00	237.92	391.75	235.71	2.618	
14	202.26	159.09	375.53	200.00	239.75	387.67	231.63	2.618	
15	203.84	159.61	375.00	200.00	242.24	379.76	223.47	2.620	
16	202.26	159.09	375.00	200.00	239.32	387.74	231.63	2.620	
17	201.21	159.00	375.53	200.00	238.44	391.75	235.71	2.621	
18	203.32	159.44	375.00	200.00	240.93	383.86	227.55	2.623	
19	201.21	159.00	375.00	200.00	238.01	391.82	235.71	2.623	
20	199.11	159.00	375.00	200.00	236.62	395.84	239.80	2.623	
21	201.74	159.00	375.53	200.00	238.54	391.82	235.71	2.625	
22	205.42	160.14	376.05	200.00	247.02	367.23	211.22	2.626	
23	203.84	159.61	375.53	200.00	242.67	379.69	223.47	2.626	
24	197.53	159.00	375.00	200.00	235.34	399.93	243.88	2.626	
25	201.74	159.00	375.00	200.00	238.11	391.89	235.71	2.627	
26	199.63	159.00	375.00	200.00	236.72	395.91	239.80	2.627	
27	205.95	160.32	375.00	200.00	246.47	367.62	211.22	2.629	
28	203.32	159.44	375.53	200.00	241.36	383.79	227.55	2.629	
29	204.89	159.96	375.53	200.00	245.29	371.45	215.31	2.630	
30	204.37	159.79	376.05	200.00	244.40	375.49	219.39	2.630	
31	198.05	159.00	375.00	200.00	235.44	400.00	243.88	2.631	
32	207.00	160.67	375.53	200.00	249.51	359.23	203.06	2.631	
33	200.16	159.00	375.00	200.00	236.82	395.98	239.80	2.632	
34	204.89	159.96	376.05	200.00	245.71	371.37	215.31	2.632	
35	202.79	159.26	375.53	200.00	240.05	387.88	231.63	2.632	
36	201.74	159.00	376.05	200.00	238.97	391.75	235.71	2.632	
37	204.37	159.79	375.53	200.00	243.98	375.57	219.39	2.632	
38	205.42	160.14	375.00	200.00	245.16	371.75	215.31	2.632	
39	199.63	159.00	375.53	200.00	237.15	395.84	239.80	2.632	
40	207.00	160.67	375.00	200.00	249.10	359.32	203.06	2.633	
41	200.68	159.00	375.53	200.00	237.34	395.98	239.80	2.633	
42	202.79	159.26	375.00	200.00	239.62	387.95	231.63	2.633	
43	206.47	160.49	375.00	200.00	247.78	363.47	207.14	2.634	
44	204.89	159.96	375.00	200.00	243.84	375.87	219.39	2.634	
45	198.58	159.00	375.00	200.00	235.53	400.06	243.88	2.635	
46	200.16	159.00	376.05	200.00	237.68	395.84	239.80	2.635	
47	200.68	159.00	375.00	200.00	236.91	396.04	239.80	2.636	
48	204.89	159.96	376.58	200.00	246.13	371.29	215.31	2.636	
49	202.26	159.09	375.53	200.00	238.74	391.96	235.71	2.636	
50	205.42	160.14	375.53	200.00	246.60	367.31	211.22	2.636	
51	206.47	160.49	375.53	200.00	248.20	363.39	207.14	2.636	
52	204.37	159.79	375.00	200.00	242.53	379.98	223.47	2.636	
53	200.16	159.00	375.53	200.00	237.25	395.91	239.80	2.637	
54	198.05	159.00	375.53	200.00	235.87	399.93	243.88	2.637	
55	202.26	159.09	375.00	200.00	238.30	392.03	235.71	2.637	
56	204.37	159.79	376.58	200.00	244.82	375.42	219.39	2.639	
57	207.00	160.67	376.05	200.00	249.92	359.14	203.06	2.639	
58	198.58	159.00	376.05	200.00	236.39	399.93	243.88	2.639	
59	197.00	159.00	375.00	200.00	234.26	404.14	247.96	2.639	
60	201.21	159.00	375.00	200.00	237.00	396.11	239.80	2.640	
61	203.84	159.61	376.58	200.00	243.51	379.53	223.47	2.640	
62	200.68	159.00	376.05	200.00	237.77	395.91	239.80	2.640	
63	206.47	160.49	376.05	200.00	248.61	363.30	207.14	2.640	
64	199.11	159.00	375.00	200.00	235.63	400.13	243.88	2.641	
65	198.58	159.00	375.53	200.00	235.96	400.00	243.88	2.641	
66	205.95	160.32	376.05	200.00	247.31	367.45	211.22	2.642	
67	202.26	159.09	376.05	200.00	239.17	391.90	235.71	2.642	
68	203.32	159.44	376.58	200.00	242.21	383.64	227.55	2.643	

69	204.37	159.79	375.53	200.00	242.96	379.90	223.47	2.643
70	201.74	159.00	375.00	200.00	237.10	396.17	239.80	2.644
71	197.53	159.00	375.00	200.00	234.35	404.21	247.96	2.644
72	199.11	159.00	376.05	200.00	236.49	400.00	243.88	2.644
73	199.63	159.00	375.00	200.00	235.72	400.19	243.88	2.644
74	201.21	159.00	376.05	200.00	237.87	395.98	239.80	2.644
75	203.84	159.61	375.53	200.00	241.65	384.00	227.55	2.645
76	205.42	160.14	376.05	200.00	246.00	371.59	215.31	2.645
77	203.84	159.61	376.05	200.00	243.09	379.61	223.47	2.645
78	199.11	159.00	375.53	200.00	236.06	400.06	243.88	2.646
79	201.21	159.00	375.53	200.00	237.44	396.04	239.80	2.646
80	202.79	159.26	376.58	200.00	240.90	387.74	231.63	2.646
81	203.84	159.61	377.11	200.00	243.94	379.46	223.47	2.646
82	203.84	159.61	375.00	200.00	241.22	384.07	227.55	2.646
83	207.00	160.67	376.58	200.00	250.34	359.05	203.06	2.647
84	197.00	159.00	375.53	200.00	234.69	404.08	247.96	2.647
85	203.32	159.44	375.53	200.00	240.34	388.09	231.63	2.647
86	203.32	159.44	376.05	200.00	241.78	383.71	227.55	2.647
87	205.95	160.32	375.53	200.00	246.89	367.53	211.22	2.647
88	198.05	159.00	375.00	200.00	234.44	404.27	247.96	2.648
89	199.63	159.00	376.05	200.00	236.58	400.06	243.88	2.648
90	202.79	159.26	376.05	200.00	240.48	387.81	231.63	2.648
91	200.16	159.00	375.00	200.00	235.81	400.26	243.88	2.648
92	204.89	159.96	376.05	200.00	244.69	375.71	219.39	2.648
93	206.47	160.49	376.58	200.00	249.03	363.22	207.14	2.648
94	203.32	159.44	375.00	200.00	239.91	388.16	231.63	2.648
95	206.47	160.49	375.00	200.00	246.76	367.84	211.22	2.648
96	202.79	159.26	375.53	200.00	239.03	392.17	235.71	2.649
97	201.74	159.00	376.05	200.00	237.96	396.04	239.80	2.649
98	205.42	160.14	375.53	200.00	245.58	371.67	215.31	2.649
99	203.32	159.44	377.11	200.00	242.63	383.57	227.55	2.650

Critical Failure Surface (circle 1)

Intersects:	XL:	203.84	YL:	159.61	XR:	375.00	YR:	200.00	
	Centre:	XC:	243.26	YC:	375.43		Radius:	R:	219.39
Generated failure surface: (20 points)									
	203.84	159.61		213.24	158.11		222.70	157.01	232.20
	241.72	156.05							156.32
	251.24	156.19		260.75	156.74		270.22	157.71	279.64
	289.00	160.86							159.08
	298.27	163.05		307.43	165.64		316.47	168.62	325.38
	334.13	175.75							171.99
	342.71	179.88		351.10	184.38		359.29	189.24	367.26
	375.00	200.00							194.45

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S		Base						PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	203.84	3.62	-9.1	3.83	3.88	2	0.00	35.0	474.37	9124.03
2419.82	1.06									
2	207.67	18.20	-9.1	5.57	5.64	3	100.00	18.0	2409.11	13539.16
2638.56	1.03									
3	213.24	26.98	-6.6	4.73	4.76	3	100.00	18.0	3589.39	11636.84
2857.52	1.02									
4	217.97	37.03	-6.6	4.73	4.76	3	100.00	18.0	4932.21	11799.93
3045.30	1.02									
5	222.70	46.80	-4.1	4.75	4.76	3	100.00	18.0	6233.92	11932.60
3213.04	1.01									
6	227.45	55.95	-4.1	4.75	4.76	3	100.00	18.0	7448.51	12034.57
3371.25	1.01									
7	232.20	64.76	-1.6	4.76	4.76	3	100.00	18.0	8613.81	12105.72
3507.98	1.00									
8	236.96	72.96	-1.6	4.76	4.76	3	100.00	18.0	9694.69	12146.36
3636.52	1.00									
9	241.72	80.69	0.8	4.76	4.76	3	100.00	18.0	10709.78	12156.44
3742.33	1.00									
10	246.48	87.92	0.8	4.76	4.76	3	100.00	18.0	11652.60	12135.69
3841.16	1.00									
11	251.24	94.49	3.3	4.75	4.76	3	100.00	18.0	12505.38	12084.12
3916.20	0.99									
12	256.00	100.71	3.3	4.75	4.76	3	100.00	18.0	13306.71	12002.00
3985.29	0.99									
13	260.75	106.06	5.8	4.74	4.76	3	100.00	18.0	13988.80	11889.40
4029.75	0.99									
14	265.49	111.25	5.8	4.74	4.76	3	100.00	18.0	14646.37	11746.08
4069.16	0.99									
15	270.22	108.38	8.3	4.43	4.48	3	100.00	18.0	14240.99	10893.68
4082.97	0.99									
16	274.65	112.06	8.3	4.43	4.48	3	100.00	18.0	14694.73	10712.86

4092.22	0.99									
17	279.09	129.22	10.5	4.96	5.04	2	0.00	35.0	16927.43	11810.81
4046.86	0.97									
18	284.04	132.72	10.8	4.96	5.04	2	0.00	35.0	17386.63	11524.21
4031.91	0.97									
19	289.00	126.79	13.3	4.63	4.76	2	0.00	35.0	16609.82	10573.69
3985.61	0.97									
20	293.63	128.88	13.3	4.63	4.76	2	0.00	35.0	16883.75	10248.84
3946.48	0.97									
21	298.27	129.01	15.8	4.58	4.76	2	0.00	35.0	16900.81	9894.37
3873.05	0.97									
22	302.85	130.08	15.8	4.58	4.76	2	0.00	35.0	17041.10	9510.00
3807.24	0.97									
23	307.43	158.79	18.3	5.57	5.86	2	0.00	35.0	20802.01	11139.08
3696.33	0.97									
24	313.00	85.59	18.3	3.00	3.16	2	0.00	35.0	11212.78	5722.51
3609.14	0.97									
25	316.00	128.06	20.5	4.50	4.80	2	0.00	35.0	16775.92	8305.27
3545.29	0.97									
26	320.50	127.14	20.7	4.50	4.81	2	0.00	35.0	16655.78	7807.81
3508.93	0.97									
27	325.00	124.15	23.0	4.57	4.96	2	0.00	35.0	16263.60	7488.63
3351.35	0.97									
28	329.57	115.20	23.2	4.57	4.97	2	0.00	35.0	15091.76	6892.60
3106.74	0.98									
29	334.13	99.61	25.7	4.29	4.76	2	0.00	35.0	13049.00	6007.48
2837.47	0.98									
30	338.42	90.75	25.7	4.29	4.76	2	0.00	35.0	11888.23	5393.79
2583.13	0.98									
31	342.71	55.99	28.2	2.89	3.28	2	0.00	35.0	7335.28	3349.81
2343.18	0.99									
32	345.61	51.50	28.2	2.89	3.28	2	0.00	35.0	6746.76	3031.73
2153.31	0.99									
33	348.50	39.11	28.2	2.39	2.71	5	0.00	45.0	4302.40	1185.17
1568.28	0.94									
34	350.89	60.94	30.6	4.20	4.88	2	0.00	35.0	7983.52	0.00
1639.15	1.00									
35	355.09	50.46	30.7	4.20	4.89	2	0.00	35.0	6610.74	0.00
1356.37	1.00									
36	359.29	37.70	33.2	3.99	4.76	2	0.00	35.0	4938.42	0.00
1053.66	1.02									
37	363.28	27.32	33.2	3.99	4.76	2	0.00	35.0	3578.28	0.00
763.46	1.02									
38	367.26	10.33	35.7	2.16	2.66	2	0.00	35.0	1352.71	0.00
524.30	1.03									
39	369.43	11.15	35.7	5.57	6.86	1	150.00	22.0	1460.58	0.00
198.47	1.11									

X-S Area:

3178.38

Path Length:

180.93

X-S Weight:

416938.66

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 6-1 Rapid Drawdown.gmf

Processed: 02 Dec 2020 14:31:16

DATA: Analysis 1 - Case 6-1 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    196.00        348.50    196.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    159.00        348.50    159.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    156.00        348.50    156.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    196.00        450.00    196.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    159.00        450.00    159.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    156.00        450.00    156.00

```

Slope Surface (4 points)

```

-----
100.00    159.00    202.00    159.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    159.00    202.00    159.00    316.00    197.00    348.50    197.00
351.50    181.00
450.00    181.00

```

Failure Surface

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

```

Intersects: XL:    202.00    YL:    159.00    XR:    380.00    YR:    200.00
Centre: XC:    238.76    YC:    406.28    Radius: R:    250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 6-1 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.482

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.39

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	203.84	159.61	375.00	200.00	243.26	375.43	219.39	1.393	
Critical Surface									
2	204.37	159.79	375.00	200.00	244.58	371.31	215.31	1.394	
3	203.32	159.44	375.00	200.00	241.95	379.54	223.47	1.395	
4	202.79	159.26	375.00	200.00	240.63	383.64	227.55	1.397	
5	203.32	159.44	375.53	200.00	242.37	379.47	223.47	1.399	
6	205.95	160.32	375.00	200.00	247.49	363.25	207.14	1.399	
7	205.42	160.14	375.00	200.00	246.18	367.40	211.22	1.400	
8	202.79	159.26	375.53	200.00	241.06	383.57	227.55	1.401	
9	206.47	160.49	375.00	200.00	248.81	359.09	203.06	1.401	
10	200.68	159.00	375.00	200.00	237.92	391.75	235.71	1.401	
11	204.89	159.96	375.00	200.00	244.87	371.53	215.31	1.402	
12	202.26	159.09	375.00	200.00	239.32	387.74	231.63	1.403	
13	205.95	160.32	375.53	200.00	247.91	363.16	207.14	1.404	
14	204.37	159.79	375.00	200.00	243.55	375.65	219.39	1.404	
15	202.26	159.09	375.53	200.00	239.75	387.67	231.63	1.404	
16	199.11	159.00	375.00	200.00	236.62	395.84	239.80	1.404	
17	201.21	159.00	375.00	200.00	238.01	391.82	235.71	1.404	
18	201.21	159.00	375.53	200.00	238.44	391.75	235.71	1.405	
19	203.84	159.61	375.00	200.00	242.24	379.76	223.47	1.406	
20	197.53	159.00	375.00	200.00	235.34	399.93	243.88	1.406	
21	199.63	159.00	375.00	200.00	236.72	395.91	239.80	1.407	
22	201.74	159.00	375.00	200.00	238.11	391.89	235.71	1.407	
23	203.32	159.44	375.00	200.00	240.93	383.86	227.55	1.407	
24	201.74	159.00	375.53	200.00	238.54	391.82	235.71	1.408	
25	198.05	159.00	375.00	200.00	235.44	400.00	243.88	1.409	
26	204.89	159.96	375.53	200.00	245.29	371.45	215.31	1.409	
27	205.42	160.14	376.05	200.00	247.02	367.23	211.22	1.409	
28	203.84	159.61	375.53	200.00	242.67	379.69	223.47	1.409	
29	200.16	159.00	375.00	200.00	236.82	395.98	239.80	1.409	
30	199.63	159.00	375.53	200.00	237.15	395.84	239.80	1.410	
31	204.37	159.79	375.53	200.00	243.98	375.57	219.39	1.411	
32	203.32	159.44	375.53	200.00	241.36	383.79	227.55	1.411	
33	202.79	159.26	375.00	200.00	239.62	387.95	231.63	1.411	
34	198.58	159.00	375.00	200.00	235.53	400.06	243.88	1.411	
35	204.37	159.79	376.05	200.00	244.40	375.49	219.39	1.412	
36	207.00	160.67	375.00	200.00	249.10	359.32	203.06	1.412	
37	205.95	160.32	375.00	200.00	246.47	367.62	211.22	1.412	
38	200.68	159.00	375.00	200.00	236.91	396.04	239.80	1.412	
39	201.74	159.00	376.05	200.00	238.97	391.75	235.71	1.412	
40	205.42	160.14	375.53	200.00	246.60	367.31	211.22	1.412	
41	204.89	159.96	376.05	200.00	245.71	371.37	215.31	1.412	
42	202.79	159.26	375.53	200.00	240.05	387.88	231.63	1.412	
43	206.47	160.49	375.00	200.00	247.78	363.47	207.14	1.413	
44	198.05	159.00	375.53	200.00	235.87	399.93	243.88	1.413	
45	200.68	159.00	375.53	200.00	237.34	395.98	239.80	1.413	
46	200.16	159.00	375.53	200.00	237.25	395.91	239.80	1.413	
47	207.00	160.67	375.53	200.00	249.51	359.23	203.06	1.413	
48	202.26	159.09	375.00	200.00	238.30	392.03	235.71	1.413	
49	205.42	160.14	375.00	200.00	245.16	371.75	215.31	1.414	
50	197.00	159.00	375.00	200.00	234.26	404.14	247.96	1.414	
51	200.16	159.00	376.05	200.00	237.68	395.84	239.80	1.414	
52	201.21	159.00	375.00	200.00	237.00	396.11	239.80	1.415	
53	202.26	159.09	375.53	200.00	238.74	391.96	235.71	1.415	
54	204.89	159.96	375.00	200.00	243.84	375.87	219.39	1.415	
55	199.11	159.00	375.00	200.00	235.63	400.13	243.88	1.415	
56	204.89	159.96	376.58	200.00	246.13	371.29	215.31	1.415	
57	198.58	159.00	375.53	200.00	235.96	400.00	243.88	1.415	
58	204.37	159.79	375.00	200.00	242.53	379.98	223.47	1.416	
59	206.47	160.49	375.53	200.00	248.20	363.39	207.14	1.416	
60	198.58	159.00	376.05	200.00	236.39	399.93	243.88	1.416	
61	197.53	159.00	375.00	200.00	234.35	404.21	247.96	1.417	
62	204.37	159.79	376.58	200.00	244.82	375.42	219.39	1.417	
63	200.68	159.00	376.05	200.00	237.77	395.91	239.80	1.417	
64	201.74	159.00	375.00	200.00	237.10	396.17	239.80	1.417	
65	199.63	159.00	375.00	200.00	235.72	400.19	243.88	1.417	
66	203.84	159.61	376.58	200.00	243.51	379.53	223.47	1.417	
67	203.84	159.61	376.05	200.00	243.09	379.61	223.47	1.418	
68	207.00	160.67	376.05	200.00	249.92	359.14	203.06	1.418	

69	199.11	159.00	375.53	200.00	236.06	400.06	243.88	1.418
70	197.00	159.00	375.53	200.00	234.69	404.08	247.96	1.418
71	206.47	160.49	376.05	200.00	248.61	363.30	207.14	1.419
72	201.21	159.00	375.53	200.00	237.44	396.04	239.80	1.419
73	203.32	159.44	376.05	200.00	241.78	383.71	227.55	1.419
74	202.26	159.09	376.05	200.00	239.17	391.90	235.71	1.419
75	198.05	159.00	375.00	200.00	234.44	404.27	247.96	1.419
76	199.11	159.00	376.05	200.00	236.49	400.00	243.88	1.419
77	203.32	159.44	376.58	200.00	242.21	383.64	227.55	1.419
78	205.95	160.32	376.05	200.00	247.31	367.45	211.22	1.419
79	200.16	159.00	375.00	200.00	235.81	400.26	243.88	1.420
80	205.95	160.32	375.53	200.00	246.89	367.53	211.22	1.420
81	203.84	159.61	375.00	200.00	241.22	384.07	227.55	1.420
82	202.79	159.26	376.05	200.00	240.48	387.81	231.63	1.420
83	201.21	159.00	376.05	200.00	237.87	395.98	239.80	1.420
84	204.37	159.79	375.53	200.00	242.96	379.90	223.47	1.420
85	203.32	159.44	375.00	200.00	239.91	388.16	231.63	1.421
86	199.63	159.00	375.53	200.00	236.15	400.13	243.88	1.421
87	202.79	159.26	376.58	200.00	240.90	387.74	231.63	1.421
88	197.53	159.00	375.53	200.00	234.78	404.14	247.96	1.421
89	203.84	159.61	375.53	200.00	241.65	384.00	227.55	1.421
90	205.42	160.14	375.53	200.00	245.58	371.67	215.31	1.421
91	203.84	159.61	377.11	200.00	243.94	379.46	223.47	1.421
92	205.42	160.14	376.05	200.00	246.00	371.59	215.31	1.421
93	201.74	159.00	375.53	200.00	237.53	396.11	239.80	1.421
94	202.79	159.26	375.00	200.00	238.60	392.24	235.71	1.421
95	198.58	159.00	375.00	200.00	234.54	404.34	247.96	1.422
96	197.00	159.00	376.05	200.00	235.12	404.01	247.96	1.422
97	199.63	159.00	376.05	200.00	236.58	400.06	243.88	1.422
98	203.32	159.44	375.53	200.00	240.34	388.09	231.63	1.422
99	200.68	159.00	375.00	200.00	235.90	400.32	243.88	1.422

Critical Failure Surface (circle 1)

Intersects:	XL:	203.84	YL:	159.61	XR:	375.00	YR:	200.00	
	Centre:	XC:	243.26	YC:	375.43		Radius:	R:	219.39
Generated failure surface: (20 points)									
203.84	159.61	213.24	158.11	222.70	157.01	232.20	156.32		
241.72	156.05								
251.24	156.19	260.75	156.74	270.22	157.71	279.64	159.08		
289.00	160.86								
298.27	163.05	307.43	165.64	316.47	168.62	325.38	171.99		
334.13	175.75								
342.71	179.88	351.10	184.38	359.29	189.24	367.26	194.45		
375.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S		Base						PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	203.84	3.62	-9.1	3.83	3.88	2	0.00	35.0	474.37	228.84
129.53	1.10									
2	207.67	18.20	-9.1	5.57	5.64	3	100.00	18.0	2409.11	1150.19
453.16	1.05									
3	213.24	26.98	-6.6	4.73	4.76	3	100.00	18.0	3589.39	1694.75
778.71	1.03									
4	217.97	37.03	-6.6	4.73	4.76	3	100.00	18.0	4932.21	2326.23
1066.84	1.03									
5	222.70	46.80	-4.1	4.75	4.76	3	100.00	18.0	6233.92	2928.13
1329.94	1.02									
6	227.45	55.95	-4.1	4.75	4.76	3	100.00	18.0	7448.51	3500.41
1588.02	1.02									
7	232.20	64.76	-1.6	4.76	4.76	3	100.00	18.0	8613.81	4042.49
1818.45	1.01									
8	236.96	72.96	-1.6	4.76	4.76	3	100.00	18.0	9694.69	4554.45
2046.37	1.01									
9	241.72	80.69	0.8	4.76	4.76	3	100.00	18.0	10709.78	5035.86
2244.46	1.00									
10	246.48	87.92	0.8	4.76	4.76	3	100.00	18.0	11652.60	5486.59
2442.14	1.00									
11	251.24	94.49	3.3	4.75	4.76	3	100.00	18.0	12505.38	5906.20
2608.20	0.99									
12	256.00	100.71	3.3	4.75	4.76	3	100.00	18.0	13306.71	6294.81
2775.62	0.99									
13	260.75	106.06	5.8	4.74	4.76	3	100.00	18.0	13988.80	6652.08
2909.97	0.98									
14	265.49	111.25	5.8	4.74	4.76	3	100.00	18.0	14646.37	6977.87
3047.15	0.98									
15	270.22	108.38	8.3	4.43	4.48	3	100.00	18.0	14240.99	6834.63
3146.97	0.98									
16	274.65	112.06	8.3	4.43	4.48	3	100.00	18.0	14694.73	7066.86

3247.66	0.98									
17	279.09	129.22	10.5	4.96	5.04	2	0.00	35.0	16927.43	8200.77
3263.18	0.93									
18	284.04	132.72	10.8	4.96	5.04	2	0.00	35.0	17386.63	8430.91
3347.86	0.93									
19	289.00	126.79	13.3	4.63	4.76	2	0.00	35.0	16609.82	8129.12
3385.35	0.92									
20	293.63	128.88	13.3	4.63	4.76	2	0.00	35.0	16883.75	8263.20
3441.18	0.92									
21	298.27	129.01	15.8	4.58	4.76	2	0.00	35.0	16900.81	8365.07
3448.36	0.91									
22	302.85	130.08	15.8	4.58	4.76	2	0.00	35.0	17041.10	8434.51
3477.00	0.91									
23	307.43	158.79	18.3	5.57	5.86	2	0.00	35.0	20802.01	10433.61
3457.48	0.90									
24	313.00	85.59	18.3	3.00	3.16	2	0.00	35.0	11212.78	5623.96
3459.33	0.90									
25	316.00	128.06	20.5	4.50	4.80	2	0.00	35.0	16775.92	8305.27
3412.07	0.90									
26	320.50	127.14	20.7	4.50	4.81	2	0.00	35.0	16655.78	7807.81
3368.98	0.90									
27	325.00	124.15	23.0	4.57	4.96	2	0.00	35.0	16263.60	7488.63
3200.93	0.90									
28	329.57	115.20	23.2	4.57	4.97	2	0.00	35.0	15091.76	6892.60
2965.17	0.90									
29	334.13	99.61	25.7	4.29	4.76	2	0.00	35.0	13049.00	6007.48
2694.98	0.89									
30	338.42	90.75	25.7	4.29	4.76	2	0.00	35.0	11888.23	5393.79
2451.98	0.89									
31	342.71	55.99	28.2	2.89	3.28	2	0.00	35.0	7335.28	3349.81
2212.82	0.89									
32	345.61	51.50	28.2	2.89	3.28	2	0.00	35.0	6746.76	3031.73
2032.12	0.89									
33	348.50	39.11	28.2	2.39	2.71	5	0.00	45.0	4302.40	1185.17
1422.42	0.82									
34	350.89	60.94	30.6	4.20	4.88	2	0.00	35.0	7983.52	0.00
1465.05	0.90									
35	355.09	50.46	30.7	4.20	4.89	2	0.00	35.0	6610.74	0.00
1211.76	0.90									
36	359.29	37.70	33.2	3.99	4.76	2	0.00	35.0	4938.42	0.00
932.73	0.90									
37	363.28	27.32	33.2	3.99	4.76	2	0.00	35.0	3578.28	0.00
675.84	0.90									
38	367.26	10.33	35.7	2.16	2.66	2	0.00	35.0	1352.71	0.00
459.81	0.90									
39	369.43	11.15	35.7	5.57	6.86	1	150.00	22.0	1460.58	0.00
152.93	1.02									

X-S Area:	3178.38	Path Length:	180.93	X-S Weight:	416938.66

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 6-2 Full Reservoir.gmf

Processed: 02 Dec 2020 14:40:45

DATA: Analysis 1 - Case 6-2 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    196.00        348.50    196.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    175.00        348.50    175.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    172.00        348.50    172.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    196.00        450.00    196.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    175.00        450.00    175.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    172.00        450.00    172.00

```

Slope Surface (8 points)

```

-----
100.00    175.00        250.00    175.00        325.00    200.00        400.00    200.00
405.00    195.00
410.00    195.00        415.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00        250.00    197.00        316.00    197.00        348.50    197.00
351.50    190.00
450.00    190.00

```

Failure Surface

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

```

Intersects: XL: 250.00    YL: 175.00    XR: 405.00    YR: 195.00
Centre: XC: 297.11    YC: 420.52    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 6-2 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 8.056

Analysis Summary

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

Critical (minimum) Factor of Safety: 3.85

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	250.79	175.26	400.00	200.00	289.59	403.62	231.63	3.850	
Critical Surface									
2	249.74	175.00	400.00	200.00	287.55	411.80	239.80	3.856	
3	251.32	175.44	400.00	200.00	290.66	399.56	227.55	3.856	
4	247.11	175.00	400.00	200.00	285.54	419.96	247.96	3.856	
5	248.68	175.00	400.00	200.00	286.60	415.91	243.88	3.859	
6	251.84	175.61	400.00	200.00	291.74	395.49	223.47	3.863	
7	246.05	175.00	400.00	200.00	284.61	424.07	252.04	3.865	
8	247.63	175.00	400.00	200.00	285.66	420.03	247.96	3.867	
9	249.21	175.00	400.00	200.00	286.73	415.97	243.88	3.870	
10	245.00	175.00	400.00	200.00	283.68	428.18	256.12	3.874	
11	246.58	175.00	400.00	200.00	284.73	424.14	252.04	3.875	
12	250.26	175.09	400.00	200.00	287.80	411.93	239.80	3.875	
13	248.16	175.00	400.00	200.00	285.78	420.09	247.96	3.878	
14	252.37	175.79	400.00	200.00	292.81	391.42	219.39	3.878	
15	252.89	175.96	400.00	200.00	293.88	387.33	215.31	3.881	
16	249.74	175.00	400.00	200.00	286.85	416.04	243.88	3.881	
17	245.53	175.00	400.00	200.00	283.80	428.25	256.12	3.884	
18	253.42	176.14	400.00	200.00	294.94	383.24	211.22	3.884	
19	250.79	175.26	400.00	200.00	288.88	407.88	235.71	3.886	
20	247.11	175.00	400.00	200.00	284.85	424.20	252.04	3.886	
21	253.95	176.32	400.00	200.00	296.00	379.14	207.14	3.888	
22	248.68	175.00	400.00	200.00	285.90	420.15	247.96	3.888	
23	251.32	175.44	400.00	200.00	289.96	403.83	231.63	3.889	
24	254.47	176.49	400.00	200.00	297.06	375.04	203.06	3.893	
25	246.05	175.00	400.00	200.00	283.92	428.31	256.12	3.894	
26	251.84	175.61	400.00	200.00	291.03	399.76	227.55	3.896	
27	251.32	175.44	400.53	199.47	291.10	403.63	231.63	3.899	
28	245.00	175.00	400.00	200.00	283.00	432.41	260.20	3.902	
29	252.37	175.79	400.00	200.00	292.11	395.70	223.47	3.903	
30	249.21	175.00	400.00	200.00	286.02	420.21	247.96	3.905	
31	246.05	175.00	400.53	199.47	285.13	428.12	256.12	3.905	
32	248.68	175.00	400.53	199.47	287.09	419.97	247.96	3.906	
33	248.16	175.00	400.00	200.00	285.09	424.32	252.04	3.907	
34	247.63	175.00	400.00	200.00	284.97	424.26	252.04	3.907	
35	247.63	175.00	400.53	199.47	286.17	424.08	252.04	3.908	
36	250.26	175.09	400.00	200.00	287.09	416.17	243.88	3.909	
37	246.58	175.00	400.00	200.00	284.04	428.37	256.12	3.910	
38	249.74	175.00	400.00	200.00	286.14	420.27	247.96	3.911	
39	249.21	175.00	400.53	199.47	287.22	420.03	247.96	3.912	
40	245.00	175.00	400.53	199.47	284.21	432.23	260.20	3.913	
41	247.11	175.00	400.00	200.00	284.16	428.43	256.12	3.914	
42	245.53	175.00	400.00	200.00	283.12	432.47	260.20	3.914	
43	251.84	175.61	400.53	199.47	292.16	399.56	227.55	3.914	
44	246.58	175.00	400.53	199.47	285.25	428.19	256.12	3.916	
45	252.89	175.96	400.00	200.00	293.18	391.62	219.39	3.917	
46	252.37	175.79	400.53	199.47	293.22	395.49	223.47	3.918	
47	248.68	175.00	400.00	200.00	285.21	424.38	252.04	3.918	
48	248.16	175.00	400.53	199.47	286.29	424.14	252.04	3.919	
49	251.32	175.44	400.00	200.00	289.26	408.08	235.71	3.920	
50	250.79	175.26	400.00	200.00	288.18	412.13	239.80	3.921	
51	253.42	176.14	400.00	200.00	294.24	387.54	215.31	3.921	
52	252.89	175.96	400.53	199.47	294.27	391.41	219.39	3.921	
53	249.74	175.00	400.53	199.47	287.34	420.09	247.96	3.922	
54	246.05	175.00	400.00	200.00	283.23	432.53	260.20	3.923	
55	250.79	175.26	400.53	199.47	289.35	411.94	239.80	3.924	
56	245.53	175.00	400.53	199.47	284.33	432.29	260.20	3.924	
57	253.95	176.32	400.00	200.00	295.30	383.45	211.22	3.926	
58	247.63	175.00	400.00	200.00	284.28	428.49	256.12	3.926	
59	247.11	175.00	400.53	199.47	285.37	428.25	256.12	3.926	
60	253.42	176.14	400.53	199.47	295.33	387.33	215.31	3.927	
61	251.84	175.61	400.00	200.00	290.33	404.03	231.63	3.928	
62	250.26	175.09	400.53	199.47	288.28	415.98	243.88	3.929	
63	248.68	175.00	400.53	199.47	286.41	424.20	252.04	3.930	
64	249.21	175.00	400.00	200.00	285.32	424.44	252.04	3.931	
65	251.32	175.44	400.53	199.47	290.41	407.89	235.71	3.931	
66	245.00	175.00	400.00	200.00	282.32	436.64	264.29	3.931	

67	254.47	176.49	400.00	200.00	296.36	379.35	207.14	3.932
68	253.95	176.32	400.53	199.47	296.38	383.24	211.22	3.933
69	246.05	175.00	400.53	199.47	284.45	432.35	260.20	3.934
70	246.58	175.00	400.00	200.00	283.35	432.59	260.20	3.934
71	247.63	175.00	400.53	199.47	285.49	428.31	256.12	3.937
72	250.26	175.09	400.00	200.00	286.39	420.40	247.96	3.93
73	248.16	175.00	400.00	200.00	284.39	428.55	256.12	3.938
74	255.00	176.67	400.00	200.00	297.42	375.25	203.06	3.938
75	254.47	176.49	400.53	199.47	297.42	379.13	207.14	3.939
76	249.21	175.00	400.53	199.47	286.53	424.26	252.04	3.941
77	245.00	175.00	400.53	199.47	283.55	436.46	264.29	3.943
78	245.53	175.00	400.00	200.00	282.43	436.70	264.29	3.943
79	249.74	175.00	400.00	200.00	285.44	424.50	252.04	3.943
80	246.58	175.00	400.53	199.47	284.58	432.41	260.20	3.945
81	250.79	175.26	400.00	200.00	287.47	416.37	243.88	3.945
82	247.11	175.00	400.00	200.00	283.47	432.65	260.20	3.946
83	250.26	175.09	400.53	199.47	287.59	420.22	247.96	3.946
84	248.16	175.00	400.53	199.47	285.61	428.37	256.12	3.948
85	252.37	175.79	400.00	200.00	291.41	399.97	227.55	3.948
86	251.84	175.61	400.53	199.47	291.48	403.83	231.63	3.948
87	248.68	175.00	400.00	200.00	284.51	428.60	256.12	3.950
88	252.89	175.96	400.00	200.00	292.48	395.90	223.47	3.952
89	245.53	175.00	400.53	199.47	283.67	436.52	264.29	3.953
90	252.37	175.79	400.53	199.47	292.54	399.77	227.55	3.953
91	251.32	175.44	400.00	200.00	288.55	412.33	239.80	3.953
92	246.05	175.00	400.00	200.00	282.55	436.75	264.29	3.954
93	250.79	175.26	400.53	199.47	288.66	416.18	243.88	3.954
94	247.11	175.00	400.53	199.47	284.70	432.47	260.20	3.955
95	247.63	175.00	400.00	200.00	283.58	432.71	260.20	3.957
96	253.42	176.14	400.00	200.00	293.54	391.83	219.39	3.958
97	252.89	175.96	400.53	199.47	293.59	395.70	223.47	3.958
98	249.21	175.00	401.05	198.95	287.74	424.08	252.04	3.958
99	245.00	175.00	401.05	198.95	284.77	436.28	264.29	3.959

Intersects:	XL:	250.79	YL:	175.26	XR:	400.00	YR:	200.00
Centre:	XC:	289.59	YC:	403.62			Radius:	R: 231.63
Generated failure surface: (20 points)								
	250.79	175.26	258.81	174.05		266.86	173.11	274.94
283.04	172.08							172.45
	291.15	172.00	299.26	172.19		307.35	172.67	315.42
323.47	174.48							173.44
	331.46	175.81	339.41	177.41		347.30	179.30	355.12
362.85	183.88							181.45
	370.50	186.58	378.05	189.55		385.48	192.77	392.81
400.00	200.00							196.26

Slice		X-S	Base							PoreWater
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	250.79	0.73	-8.6	1.73	1.75	2	0.00	35.0	95.35	2390.63
1394.24	1.04									
2	252.52	5.04	-8.6	3.14	3.18	3	100.00	18.0	667.35	4410.71
1505.50	1.02									
3	255.66	9.83	-8.6	3.14	3.18	3	100.00	18.0	1310.07	4505.38
1646.09	1.02									
4	258.81	19.31	-6.6	4.03	4.05	3	100.00	18.0	2577.85	5866.52
1794.30	1.02									
5	262.83	26.60	-6.6	4.03	4.05	3	100.00	18.0	3551.98	5985.04
1953.70	1.02									
6	266.86	33.74	-4.6	4.04	4.05	3	100.00	18.0	4502.80	6085.74
2100.51	1.01									
7	270.90	40.50	-4.6	4.04	4.05	3	100.00	18.0	5402.26	6168.44
2239.85	1.01									
8	274.94	47.09	-2.6	4.05	4.05	3	100.00	18.0	6276.03	6233.23
2365.88	1.00									
9	278.99	53.31	-2.6	4.05	4.05	3	100.00	18.0	7098.18	6280.15
2485.05	1.00									
10	283.04	56.60	-0.6	3.88	3.88	3	100.00	18.0	7528.81	6033.98
2588.11	1.00									
11	286.92	61.78	-0.6	3.88	3.88	3	100.00	18.0	8208.11	6044.07
2682.74	1.00									
12	290.80	73.03	1.2	4.23	4.23	3	100.00	18.0	9691.92	6589.66
2768.84	1.00									
13	295.03	78.56	1.4	4.23	4.23	3	100.00	18.0	10412.02	6563.05
2850.54	1.00									
14	299.26	80.06	3.4	4.05	4.05	3	100.00	18.0	10596.24	6245.63
2915.87	1.00									
15	303.30	84.54	3.4	4.05	4.05	3	100.00	18.0	11174.37	6184.82

2974.19	1.00									
16	307.35	61.51	5.4	2.82	2.84	3	100.00	18.0	8120.14	4282.49
3011.35	1.00									
17	310.18	63.42	5.4	2.82	2.84	3	100.00	18.0	8362.17	4235.27
3037.93	1.00									
18	313.00	55.96	5.4	2.42	2.44	3	100.00	18.0	7371.16	3597.89
3062.63	1.00									
19	315.42	95.61	7.4	4.02	4.05	3	100.00	18.0	12577.04	5895.19
3106.74	1.00									
20	319.44	98.90	7.4	4.02	4.05	3	100.00	18.0	12986.68	5763.01
3207.14	1.00									
21	323.47	38.58	9.4	1.53	1.56	3	100.00	18.0	5059.41	2173.58
3266.16	1.00									
22	325.00	39.97	9.4	1.59	1.61	3	100.00	18.0	5238.60	2226.57
3262.95	1.00									
23	326.59	119.88	9.4	4.87	4.94	2	0.00	35.0	15704.75	6657.96
3167.21	0.98									
24	331.46	94.55	11.4	3.97	4.05	2	0.00	35.0	12385.52	5259.83
3052.11	0.98									
25	335.44	91.36	11.4	3.97	4.05	2	0.00	35.0	11967.64	5056.76
2948.91	0.98									
26	339.41	87.21	13.4	3.94	4.05	2	0.00	35.0	11425.09	4836.09
2826.28	0.99									
27	343.36	83.50	13.4	3.94	4.05	2	0.00	35.0	10938.83	4597.97
2705.66	0.99									
28	347.30	24.65	15.4	1.20	1.25	2	0.00	35.0	3228.99	1362.54
2614.23	0.99									
29	348.50	59.88	15.4	3.00	3.11	5	0.00	45.0	6586.37	2613.69
2104.77	0.97									
30	351.50	68.87	15.4	3.62	3.75	2	0.00	35.0	9022.43	2117.50
2402.70	0.99									
31	355.12	69.39	17.4	3.87	4.05	2	0.00	35.0	9089.91	2008.50
2249.81	0.99									
32	358.98	64.69	17.4	3.87	4.05	2	0.00	35.0	8474.27	1701.14
2095.17	0.99									
33	362.85	59.04	19.4	3.82	4.05	2	0.00	35.0	7733.89	1376.79
1921.37	1.00									
34	366.68	53.88	19.4	3.82	4.05	2	0.00	35.0	7058.00	1035.37
1750.16	1.00									
35	370.50	47.83	21.4	3.77	4.05	2	0.00	35.0	6266.37	677.12
1561.03	1.00									
36	374.27	42.24	21.4	3.77	4.05	2	0.00	35.0	5533.58	302.08
1373.61	1.00									
37	378.05	10.67	23.5	1.04	1.14	2	0.00	35.0	1398.16	16.07
1242.72	1.01									
38	379.09	29.76	23.5	3.20	3.49	2	0.00	35.0	3898.23	0.00
1129.98	1.01									
39	382.29	25.32	23.5	3.20	3.49	2	0.00	35.0	3317.13	0.00
961.53	1.01									
40	385.48	21.74	25.5	3.39	3.75	2	0.00	35.0	2848.35	0.00
773.89	1.02									
41	388.87	16.28	25.5	3.39	3.75	2	0.00	35.0	2132.72	0.00
579.46	1.02									
42	392.26	11.68	27.2	3.87	4.35	1	150.00	22.0	1530.23	0.00
356.14	1.07									
43	396.13	3.89	27.5	3.87	4.36	1	150.00	22.0	510.08	0.00
105.76	1.07									

X-S Area:	----- 2210.99	Path Length:	----- 154.06	X-S Weight:	----- 289859.09

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 6-2 Rapid Drawdown.gmf

Processed: 02 Dec 2020 14:39:57

DATA: Analysis 1 - Case 6-2 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    196.00        348.50    196.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    175.00        348.50    175.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    172.00        348.50    172.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    196.00        450.00    196.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    175.00        450.00    175.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    172.00        450.00    172.00

```

Slope Surface (8 points)

```

-----
100.00    175.00        250.00    175.00        325.00    200.00        400.00    200.00
405.00    195.00
410.00    195.00        415.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    175.00        250.00    175.00        316.00    197.00        348.50    197.00
351.50    190.00
450.00    190.00

```

Failure Surface

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

```

Intersects: XL: 250.00    YL: 175.00    XR: 405.00    YR: 195.00
Centre: XC: 297.11    YC: 420.52    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 6-2 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.798

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.31

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	247.11	175.00	400.00	200.00	285.54	419.96	247.96	2.310	
Critical Surface									
2	249.74	175.00	400.00	200.00	287.55	411.80	239.80	2.313	
3	250.79	175.26	400.00	200.00	289.59	403.62	231.63	2.313	
4	248.68	175.00	400.00	200.00	286.60	415.91	243.88	2.314	
5	246.05	175.00	400.00	200.00	284.61	424.07	252.04	2.314	
6	247.63	175.00	400.00	200.00	285.66	420.03	247.96	2.318	
7	251.32	175.44	400.00	200.00	290.66	399.56	227.55	2.319	
8	245.00	175.00	400.00	200.00	283.68	428.18	256.12	2.319	
9	249.21	175.00	400.00	200.00	286.73	415.97	243.88	2.322	
10	246.58	175.00	400.00	200.00	284.73	424.14	252.04	2.322	
11	248.16	175.00	400.00	200.00	285.78	420.09	247.96	2.325	
12	251.84	175.61	400.00	200.00	291.74	395.49	223.47	2.325	
13	245.53	175.00	400.00	200.00	283.80	428.25	256.12	2.326	
14	250.26	175.09	400.00	200.00	287.80	411.93	239.80	2.327	
15	247.11	175.00	400.00	200.00	284.85	424.20	252.04	2.329	
16	249.74	175.00	400.00	200.00	286.85	416.04	243.88	2.329	
17	248.68	175.00	400.00	200.00	285.90	420.15	247.96	2.333	
18	246.05	175.00	400.00	200.00	283.92	428.31	256.12	2.333	
19	252.37	175.79	400.00	200.00	292.81	391.42	219.39	2.335	
20	250.79	175.26	400.00	200.00	288.88	407.88	235.71	2.335	
21	245.00	175.00	400.00	200.00	283.00	432.41	260.20	2.337	
22	251.32	175.44	400.00	200.00	289.96	403.83	231.63	2.339	
23	252.89	175.96	400.00	200.00	293.88	387.33	215.31	2.340	
24	246.05	175.00	400.53	199.47	285.13	428.12	256.12	2.340	
25	247.63	175.00	400.00	200.00	284.97	424.26	252.04	2.343	
26	249.21	175.00	400.00	200.00	286.02	420.21	247.96	2.343	
27	248.16	175.00	400.00	200.00	285.09	424.32	252.04	2.344	
28	247.63	175.00	400.53	199.47	286.17	424.08	252.04	2.344	
29	246.58	175.00	400.00	200.00	284.04	428.37	256.12	2.344	
30	248.68	175.00	400.53	199.47	287.09	419.97	247.96	2.344	
31	245.00	175.00	400.53	199.47	284.21	432.23	260.20	2.345	
32	253.42	176.14	400.00	200.00	294.94	383.24	211.22	2.345	
33	245.53	175.00	400.00	200.00	283.12	432.47	260.20	2.345	
34	251.84	175.61	400.00	200.00	291.03	399.76	227.55	2.346	
35	251.32	175.44	400.53	199.47	291.10	403.63	231.63	2.347	
36	247.11	175.00	400.00	200.00	284.16	428.43	256.12	2.347	
37	249.74	175.00	400.00	200.00	286.14	420.27	247.96	2.348	
38	246.58	175.00	400.53	199.47	285.25	428.19	256.12	2.348	
39	250.26	175.09	400.00	200.00	287.09	416.17	243.88	2.348	
40	249.21	175.00	400.53	199.47	287.22	420.03	247.96	2.349	
41	253.95	176.32	400.00	200.00	296.00	379.14	207.14	2.350	
42	248.16	175.00	400.53	199.47	286.29	424.14	252.04	2.352	
43	246.05	175.00	400.00	200.00	283.23	432.53	260.20	2.352	
44	248.68	175.00	400.00	200.00	285.21	424.38	252.04	2.352	
45	245.53	175.00	400.53	199.47	284.33	432.29	260.20	2.352	
46	252.37	175.79	400.00	200.00	292.11	395.70	223.47	2.353	
47	247.11	175.00	400.53	199.47	285.37	428.25	256.12	2.355	
48	247.63	175.00	400.00	200.00	284.28	428.49	256.12	2.356	
49	249.74	175.00	400.53	199.47	287.34	420.09	247.96	2.356	
50	245.00	175.00	400.00	200.00	282.32	436.64	264.29	2.356	
51	251.84	175.61	400.53	199.47	292.16	399.56	227.55	2.356	
52	254.47	176.49	400.00	200.00	297.06	375.04	203.06	2.356	
53	250.79	175.26	400.00	200.00	288.18	412.13	239.80	2.358	
54	248.68	175.00	400.53	199.47	286.41	424.20	252.04	2.359	
55	246.05	175.00	400.53	199.47	284.45	432.35	260.20	2.359	
56	251.32	175.44	400.00	200.00	289.26	408.08	235.71	2.359	
57	246.58	175.00	400.00	200.00	283.35	432.59	260.20	2.360	
58	250.79	175.26	400.53	199.47	289.35	411.94	239.80	2.360	
59	249.21	175.00	400.00	200.00	285.32	424.44	252.04	2.360	
60	250.26	175.09	400.53	199.47	288.28	415.98	243.88	2.361	
61	252.37	175.79	400.53	199.47	293.22	395.49	223.47	2.362	
62	247.63	175.00	400.53	199.47	285.49	428.31	256.12	2.363	
63	252.89	175.96	400.00	200.00	293.18	391.62	219.39	2.363	
64	245.00	175.00	400.53	199.47	283.55	436.46	264.29	2.363	
65	248.16	175.00	400.00	200.00	284.39	428.55	256.12	2.364	
66	245.53	175.00	400.00	200.00	282.43	436.70	264.29	2.364	

67	250.26	175.09	400.00	200.00	286.39	420.40	247.96	2.366
68	246.58	175.00	400.53	199.47	284.58	432.41	260.20	2.366
69	249.21	175.00	400.53	199.47	286.53	424.26	252.04	2.367
70	251.84	175.61	400.00	200.00	290.33	404.03	231.63	2.367
71	251.32	175.44	400.53	199.47	290.41	407.89	235.71	2.367
72	252.89	175.96	400.53	199.47	294.27	391.41	219.39	2.367
73	247.11	175.00	400.00	200.00	283.47	432.65	260.20	2.368
74	249.74	175.00	400.00	200.00	285.44	424.50	252.04	2.369
75	253.42	176.14	400.00	200.00	294.24	387.54	215.31	2.369
76	248.16	175.00	400.53	199.47	285.61	428.37	256.12	2.370
77	245.53	175.00	400.53	199.47	283.67	436.52	264.29	2.370
78	246.05	175.00	400.00	200.00	282.55	436.75	264.29	2.372
79	245.00	175.00	401.05	198.95	284.77	436.28	264.29	2.372
80	248.68	175.00	400.00	200.00	284.51	428.60	256.12	2.372
81	250.26	175.09	400.53	199.47	287.59	420.22	247.96	2.372
82	250.79	175.26	400.00	200.00	287.47	416.37	243.88	2.373
83	247.11	175.00	400.53	199.47	284.70	432.47	260.20	2.374
84	253.42	176.14	400.53	199.47	295.33	387.33	215.31	2.374
85	253.95	176.32	400.00	200.00	295.30	383.45	211.22	2.375
86	246.58	175.00	401.05	198.95	285.79	432.23	260.20	2.375
87	247.63	175.00	400.00	200.00	283.58	432.71	260.20	2.376
88	245.00	175.00	400.00	200.00	281.64	440.85	268.37	2.376
89	249.21	175.00	401.05	198.95	287.74	424.08	252.04	2.376
90	251.84	175.61	400.53	199.47	291.48	403.83	231.63	2.378
91	247.63	175.00	401.05	198.95	286.70	428.13	256.12	2.379
92	246.58	175.00	400.00	200.00	282.66	436.81	264.29	2.379
93	245.53	175.00	401.05	198.95	284.89	436.34	264.29	2.380
94	250.79	175.26	400.53	199.47	288.66	416.18	243.88	2.380
95	249.21	175.00	400.00	200.00	284.62	428.66	256.12	2.380
96	253.95	176.32	400.53	199.47	296.38	383.24	211.22	2.380
97	251.32	175.44	400.00	200.00	288.55	412.33	239.80	2.381
98	249.74	175.00	400.53	199.47	286.65	424.32	252.04	2.381
99	248.68	175.00	400.53	199.47	285.73	428.43	256.12	2.381

Critical Failure Surface (circle 1)

Intersects:	XL:	247.11	YL:	175.00	XR:	400.00	YR:	200.00	
Centre:	XC:	285.54	YC:	419.96		Radius:	R:	247.96	
Generated failure surface: (20 points)									
247.11	175.00	255.32	173.85	263.56	172.98	271.84	172.38		
280.12	172.06								
288.41	172.02	296.70	172.25	304.98	172.77	313.23	173.55		
321.46	174.62								
329.64	175.96	337.78	177.57	345.85	179.45	353.86	181.60		
361.79	184.02								
369.64	186.70	377.39	189.64	385.04	192.84	392.58	196.30		
400.00	200.00								

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

Slice	X-S		Base							PoreWater
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	247.11	0.59	-8.0	2.89	2.92	3	100.00	18.0	82.60	36.91
35.03	1.03									
2	250.00	2.75	-8.0	2.66	2.68	3	100.00	18.0	375.78	173.19
149.04	1.03									
3	252.66	6.09	-8.0	2.66	2.68	3	100.00	18.0	823.87	383.95
319.38	1.03									
4	255.32	15.78	-6.0	4.12	4.15	3	100.00	18.0	2123.07	989.96
523.74	1.02									
5	259.44	23.24	-6.0	4.12	4.15	3	100.00	18.0	3119.22	1458.49
767.27	1.02									
6	263.56	30.52	-4.1	4.14	4.15	3	100.00	18.0	4088.39	1909.64
997.20	1.01									
7	267.70	37.46	-4.1	4.14	4.15	3	100.00	18.0	5009.18	2343.50
1221.06	1.01									
8	271.84	44.19	-2.2	4.14	4.15	3	100.00	18.0	5901.15	2759.74
1430.17	1.01									
9	275.98	50.58	-2.2	4.14	4.15	3	100.00	18.0	6744.18	3158.44
1634.22	1.01									
10	280.12	56.72	-0.3	4.15	4.15	3	100.00	18.0	7552.58	3539.38
1822.50	1.00									
11	284.27	62.54	-0.3	4.15	4.15	3	100.00	18.0	8315.70	3902.46
2006.62	1.00									
12	288.41	68.04	1.6	4.14	4.15	3	100.00	18.0	9034.50	4247.47
2174.07	1.00									
13	292.56	73.28	1.6	4.14	4.15	3	100.00	18.0	9716.07	4574.58
2338.17	1.00									
14	296.70	78.11	3.5	4.14	4.15	3	100.00	18.0	10340.99	4883.48
2484.80	0.99									
15	300.84	82.76	3.5	4.14	4.15	3	100.00	18.0	10939.59	5174.22

2628.79	0.99										
16	304.98	84.37	5.5	4.01	4.03	3	100.00	18.0	11134.33	5288.60	
2752.89	0.99										
17	308.99	88.19	5.5	4.01	4.03	3	100.00	18.0	11620.02	5528.35	
2873.20	0.99										
18	313.00	68.35	7.2	3.00	3.02	3	100.00	18.0	8991.95	4298.96	
2964.34	0.99										
19	316.00	63.77	7.4	2.73	2.75	3	100.00	18.0	8378.28	3934.07	
3035.35	0.99										
20	318.73	65.28	7.4	2.73	2.75	3	100.00	18.0	8567.55	3873.42	
3103.10	0.99										
21	321.46	57.06	9.3	2.34	2.37	3	100.00	18.0	7479.92	3281.45	
3150.66	0.99										
22	323.80	29.73	9.3	1.20	1.22	2	0.00	35.0	3894.20	1666.56	
3147.58	0.97										
23	325.00	113.37	9.3	4.64	4.70	2	0.00	35.0	14851.05	6287.57	
3111.56	0.97										
24	329.64	96.15	11.2	4.07	4.15	2	0.00	35.0	12596.18	5340.39	
2994.60	0.96										
25	333.71	92.88	11.2	4.07	4.15	2	0.00	35.0	12167.01	5131.99	
2892.20	0.96										
26	337.78	88.68	13.1	4.04	4.15	2	0.00	35.0	11617.69	4906.06	
2765.36	0.96										
27	341.81	84.88	13.1	4.04	4.15	2	0.00	35.0	11119.90	4662.59	
2646.34	0.96										
28	345.85	53.48	15.0	2.65	2.74	2	0.00	35.0	7005.76	2942.09	
2527.22	0.96										
29	348.50	58.31	15.0	3.00	3.11	5	0.00	45.0	6414.19	2507.63	
1999.45	0.93										
30	351.50	44.18	15.0	2.36	2.44	2	0.00	35.0	5787.79	1329.49	
2308.29	0.96										
31	353.86	70.58	17.0	3.97	4.15	2	0.00	35.0	9245.70	2016.88	
2175.21	0.96										
32	357.83	65.78	17.0	3.97	4.15	2	0.00	35.0	8617.64	1704.13	
2023.86	0.96										
33	361.79	60.07	18.9	3.92	4.15	2	0.00	35.0	7869.80	1374.31	
1848.71	0.96										
34	365.72	54.81	18.9	3.92	4.15	2	0.00	35.0	7180.69	1027.42	
1681.70	0.96										
35	369.64	48.71	20.8	3.88	4.15	2	0.00	35.0	6380.73	663.66	
1492.73	0.96										
36	373.52	43.00	20.8	3.88	4.15	2	0.00	35.0	5633.57	283.01	
1310.41	0.96										
37	377.39	8.72	22.7	0.86	0.93	2	0.00	35.0	1142.04	10.38	
1184.68	0.96										
38	378.25	31.55	22.7	3.40	3.68	2	0.00	35.0	4133.67	0.00	
1080.01	0.96										
39	381.65	26.73	22.7	3.40	3.68	2	0.00	35.0	3501.40	0.00	
914.81	0.96										
40	385.04	21.95	24.6	3.45	3.79	2	0.00	35.0	2875.43	0.00	
732.56	0.97										
41	388.49	16.51	24.6	3.45	3.79	2	0.00	35.0	2162.46	0.00	
550.92	0.97										
42	391.94	2.49	24.6	0.65	0.71	1	150.00	22.0	325.86	0.00	
439.64	1.02										
43	392.58	10.31	26.5	3.71	4.15	1	150.00	22.0	1350.00	0.00	
304.89	1.03										
44	396.29	3.44	26.5	3.71	4.15	1	150.00	22.0	449.99	0.00	
81.75	1.03										

X-S Area:	----- 2186.00	Path Length:	----- 157.56	X-S Weight:	----- 286661.69

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 7-1 Full Reservoir.gmf

Processed: 02 Dec 2020 14:52:49

DATA: Analysis 1 - Case 7-1 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    188.00        348.50    188.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    144.00        348.50    144.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    141.00        348.50    141.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        500.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    188.00        500.00    188.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    144.00        500.00    144.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    141.00        500.00    141.00

```

Slope Surface (4 points)

```

-----
100.00    144.00    157.00    144.00    325.00    200.00    500.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00    157.00    197.00    316.00    197.00    348.50    197.00
351.50    170.00
500.00    170.00

```

Failure Surface

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

```

Intersects: XL: 157.00    YL: 144.00    XR: 480.00    YR: 200.00
Centre: XC: 237.81    YC: 637.43    Radius: R: 500.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 7-1 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 6.026

Analysis Summary

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

Critical (minimum) Factor of Safety: 4.38

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	156.21	144.00	475.00	200.00	216.38	736.87	595.92	4.377	
Critical Surface									
2	155.16	144.00	475.00	200.00	215.46	740.96	600.00	4.379	
3	158.32	144.44	475.00	200.00	221.16	716.51	575.51	4.381	
4	156.74	144.00	475.00	200.00	216.47	736.92	595.92	4.383	
5	155.68	144.00	475.00	200.00	215.55	741.01	600.00	4.385	
6	157.26	144.09	475.00	200.00	217.45	732.86	591.84	4.385	
7	157.79	144.26	475.00	200.00	219.31	724.69	583.67	4.386	
8	156.74	144.00	475.53	200.00	216.90	736.87	595.92	4.387	
9	155.68	144.00	475.53	200.00	215.99	740.96	600.00	4.389	
10	159.89	144.96	475.00	200.00	225.99	696.12	555.10	4.389	
11	157.26	144.09	475.53	200.00	217.88	732.81	591.84	4.389	
12	159.37	144.79	475.00	200.00	224.14	704.32	563.27	4.391	
13	156.21	144.00	475.00	200.00	215.64	741.05	600.00	4.391	
14	158.84	144.61	475.00	200.00	222.29	712.51	571.43	4.392	
15	158.32	144.44	475.00	200.00	220.43	720.69	579.59	4.394	
16	156.21	144.00	475.53	200.00	216.08	741.01	600.00	4.395	
17	157.79	144.26	475.00	200.00	218.57	728.87	587.76	4.395	
18	159.37	144.79	475.53	200.00	224.57	704.27	563.27	4.396	
19	157.79	144.26	475.53	200.00	219.74	724.64	583.67	4.396	
20	156.74	144.00	475.00	200.00	215.73	741.09	600.00	4.397	
21	158.84	144.61	475.53	200.00	222.71	712.46	571.43	4.397	
22	160.95	145.32	475.00	200.00	228.95	683.90	542.86	4.397	
23	156.21	144.00	476.05	200.00	216.51	740.96	600.00	4.399	
24	157.26	144.09	475.00	200.00	216.71	737.03	595.92	4.399	
25	157.79	144.26	475.53	200.00	219.00	728.82	587.76	4.399	
26	160.42	145.14	475.00	200.00	227.11	692.11	551.02	4.400	
27	156.74	144.00	475.53	200.00	216.17	741.05	600.00	4.401	
28	159.89	144.96	475.00	200.00	225.26	700.32	559.18	4.402	
29	158.84	144.61	476.05	200.00	223.14	712.41	571.43	4.402	
30	157.26	144.09	475.53	200.00	217.15	736.99	595.92	4.403	
31	158.32	144.44	476.05	200.00	221.29	720.60	579.59	4.403	
32	158.84	144.61	475.00	200.00	221.55	716.70	575.51	4.404	
33	158.32	144.44	475.53	200.00	220.86	720.65	579.59	4.405	
34	160.42	145.14	475.53	200.00	227.53	692.06	551.02	4.405	
35	156.74	144.00	476.05	200.00	216.61	741.01	600.00	4.405	
36	159.89	144.96	475.53	200.00	225.68	700.27	559.18	4.407	
37	157.79	144.26	476.05	200.00	219.44	728.78	587.76	4.407	
38	158.32	144.44	475.00	200.00	219.70	724.88	583.67	4.407	
39	157.26	144.09	476.05	200.00	217.58	736.95	595.92	4.407	
40	158.84	144.61	475.00	200.00	223.02	708.32	567.35	4.408	
41	159.37	144.79	475.53	200.00	223.83	708.46	567.35	4.408	
42	156.74	144.00	476.58	200.00	217.04	740.96	600.00	4.409	
43	157.79	144.26	475.00	200.00	217.84	733.05	591.84	4.410	
44	162.00	145.67	475.00	200.00	231.91	671.65	530.61	4.411	
45	158.32	144.44	475.53	200.00	220.13	724.83	583.67	4.411	
46	160.95	145.32	475.00	200.00	228.22	688.10	546.94	4.411	
47	157.26	144.09	476.58	200.00	218.01	736.90	595.92	4.412	
48	159.89	144.96	476.05	200.00	226.11	700.21	559.18	4.412	
49	159.37	144.79	475.00	200.00	223.41	708.51	567.35	4.412	
50	157.26	144.09	475.00	200.00	215.98	741.21	600.00	4.412	
51	160.42	145.14	475.00	200.00	226.38	696.31	555.10	4.413	
52	162.00	145.67	475.53	200.00	232.33	671.60	530.61	4.413	
53	159.37	144.79	476.05	200.00	224.26	708.41	567.35	4.413	
54	158.84	144.61	475.53	200.00	221.98	716.65	575.51	4.414	
55	157.79	144.26	475.53	200.00	218.27	733.00	591.84	4.414	
56	158.32	144.44	476.05	200.00	220.56	724.78	583.67	4.415	
57	161.47	145.49	475.00	200.00	230.07	679.88	538.78	4.416	
58	159.37	144.79	475.00	200.00	222.67	712.70	571.43	4.416	
59	157.26	144.09	475.53	200.00	216.41	741.17	600.00	4.417	
60	157.79	144.26	476.58	200.00	219.87	728.73	587.76	4.417	
61	157.79	144.26	476.05	200.00	218.70	732.96	591.84	4.418	
62	160.42	145.14	475.53	200.00	226.80	696.26	555.10	4.418	
63	161.47	145.49	475.53	200.00	230.49	679.83	538.78	4.419	
64	158.84	144.61	475.00	200.00	220.82	720.88	579.59	4.419	
65	159.89	144.96	475.53	200.00	224.95	704.46	563.27	4.420	
66	158.84	144.61	476.58	200.00	222.84	716.55	575.51	4.420	
67	158.32	144.44	475.00	200.00	218.96	729.06	587.76	4.421	
68	157.26	144.09	476.05	200.00	216.85	741.12	600.00	4.421	

69	161.47	145.49	476.05	200.00	230.91	679.77	538.78	4.422
70	159.89	144.96	475.00	200.00	224.53	704.51	563.27	4.422
71	157.79	144.26	476.58	200.00	219.14	732.91	591.84	4.422
72	158.84	144.61	475.53	200.00	221.25	720.84	579.59	4.423
73	159.37	144.79	475.53	200.00	223.10	712.65	571.43	4.423
74	160.95	145.32	475.53	200.00	228.64	688.05	546.94	4.423
75	157.79	144.26	475.00	200.00	217.10	737.22	595.92	4.423
76	158.84	144.61	476.05	200.00	222.41	716.60	575.51	4.424
77	159.89	144.96	476.05	200.00	225.38	704.41	563.27	4.425
78	160.95	145.32	475.00	200.00	227.49	692.30	551.02	4.425
79	158.32	144.44	475.53	200.00	219.40	729.01	587.76	4.426
80	157.26	144.09	476.58	200.00	217.28	741.08	600.00	4.426
81	159.37	144.79	476.58	200.00	224.69	708.36	567.35	4.426
82	158.32	144.44	477.11	200.00	221.42	724.69	583.67	4.426
83	158.32	144.44	476.58	200.00	220.99	724.74	583.67	4.426
84	162.00	145.67	475.00	200.00	231.18	675.87	534.69	4.426
85	160.95	145.32	476.05	200.00	229.07	688.00	546.94	4.426
86	158.84	144.61	476.05	200.00	221.68	720.79	579.59	4.427
87	157.79	144.26	475.53	200.00	217.54	737.18	595.92	4.428
88	159.89	144.96	475.00	200.00	223.79	708.70	567.35	4.428
89	157.79	144.26	477.11	200.00	219.57	732.87	591.84	4.428
90	162.00	145.67	475.53	200.00	231.60	675.81	534.69	4.429
91	160.95	145.32	476.58	200.00	229.49	687.94	546.94	4.429
92	158.32	144.44	476.05	200.00	219.83	728.97	587.76	4.430
93	157.26	144.09	477.11	200.00	217.72	741.03	600.00	4.430
94	160.42	145.14	476.05	200.00	227.22	696.21	555.10	4.430
95	161.47	145.49	475.00	200.00	229.34	684.09	542.86	4.430
96	159.37	144.79	476.58	200.00	223.96	712.56	571.43	4.431
97	162.00	145.67	476.05	200.00	232.02	675.76	534.69	4.431
98	160.42	145.14	475.53	200.00	226.07	700.46	559.18	4.431
99	159.37	144.79	475.00	200.00	221.94	716.89	575.51	4.431

Critical Failure Surface (circle 1)

Intersects:	XL:	156.21	YL:	144.00	XR:	475.00	YR:	200.00	
	Centre:	XC:	216.38	YC:	736.87		Radius:	R:	595.92
Generated failure surface: (20 points)									
156.21	144.00		173.40	142.51		190.62	141.51	207.86	141.02
225.12	141.02								
242.36	141.52		259.58	142.52		276.77	144.02	293.90	146.02
310.97	148.51								
327.97	151.50		344.86	154.97		361.65	158.93	378.32	163.38
394.85	168.31								
411.24	173.71		427.46	179.59		443.50	185.93	459.35	192.74
475.00	200.00								

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	156.21	13.25	-5.0	8.59	8.63	3	100.00	18.0	1768.38	28728.30
3442.74	1.01									
2	164.80	44.29	-5.0	8.59	8.63	3	100.00	18.0	5897.66	29130.14
3746.16	1.01									
3	173.40	74.43	-3.3	8.61	8.63	3	100.00	18.0	9899.93	29464.39
4030.17	1.01									
4	182.01	103.43	-3.3	8.61	8.63	3	100.00	18.0	13742.18	29732.25
4298.26	1.01									
5	190.62	131.54	-1.6	8.62	8.63	3	100.00	18.0	17456.78	29932.87
4545.84	1.00									
6	199.24	158.46	-1.6	8.62	8.63	3	100.00	18.0	21004.52	30066.37
4778.43	1.00									
7	207.86	184.38	0.0	8.63	8.63	3	100.00	18.0	24411.25	30132.63
4989.56	1.00									
8	216.49	209.17	0.0	8.63	8.63	3	100.00	18.0	27658.23	30131.82
5186.57	1.00									
9	225.12	232.77	1.7	8.62	8.63	3	100.00	18.0	30739.59	30063.75
5361.24	1.00									
10	233.74	255.39	1.7	8.62	8.63	3	100.00	18.0	33680.15	29928.43
5522.58	1.00									
11	242.36	276.56	3.3	8.61	8.63	3	100.00	18.0	36421.06	29726.05
5660.80	1.00									
12	250.97	296.96	3.3	8.61	8.63	3	100.00	18.0	39050.95	29456.50
5786.42	1.00									
13	259.58	310.67	5.0	8.46	8.49	3	100.00	18.0	40790.96	28679.78
5887.57	1.00									
14	268.04	328.29	5.0	8.46	8.49	3	100.00	18.0	43036.71	28288.29
5976.09	1.00									
15	276.51	253.12	6.6	6.25	6.29	2	0.00	35.0	33158.87	20656.36
6014.32	0.99									
16	282.75	261.58	6.6	6.25	6.29	2	0.00	35.0	34267.22	20373.62

6059.59	0.99										
17	289.00	211.26	6.6	4.90	4.94	2	0.00	35.0	27675.11	15792.51	
6100.46	0.99										
18	293.90	379.09	8.3	8.54	8.63	2	0.00	35.0	49660.75	27104.62	
6119.65	0.99										
19	302.44	392.74	8.3	8.54	8.63	2	0.00	35.0	51449.06	26434.14	
6149.11	0.99										
20	310.97	237.28	10.0	5.03	5.10	2	0.00	35.0	31083.43	15299.59	
6148.23	0.99										
21	316.00	434.84	10.0	9.00	9.14	2	0.00	35.0	56964.05	26694.20	
6236.18	0.99										
22	325.00	144.59	10.0	2.97	3.01	2	0.00	35.0	18941.87	8597.27	
6291.61	0.99										
23	327.97	402.47	11.6	8.45	8.63	2	0.00	35.0	52723.57	24025.04	
6130.17	0.99										
24	336.41	387.79	11.6	8.45	8.63	2	0.00	35.0	50800.43	23089.80	
5906.33	0.99										
25	344.86	162.20	13.3	3.64	3.74	2	0.00	35.0	21248.59	9700.06	
5724.40	0.99										
26	348.50	131.45	13.3	3.00	3.08	5	0.00	45.0	14459.39	5254.13	
4660.39	0.97										
27	351.50	429.11	13.3	10.15	10.43	2	0.00	35.0	56213.75	7983.46	
5362.97	0.99										
28	361.65	332.98	14.9	8.33	8.63	2	0.00	35.0	43620.46	5357.63	
5045.12	0.99										
29	369.99	314.45	14.9	8.33	8.63	2	0.00	35.0	41192.73	4160.77	
4760.07	0.99										
30	378.32	292.51	16.6	8.27	8.63	2	0.00	35.0	38319.34	2899.23	
4439.93	1.00										
31	386.59	272.15	16.6	8.27	8.63	2	0.00	35.0	35651.13	1573.01	
4124.84	1.00										
32	394.85	158.07	18.3	5.12	5.40	2	0.00	35.0	20706.75	284.61	
3840.81	1.00										
33	399.98	163.65	18.3	5.63	5.93	2	0.00	35.0	21438.10	0.00	
3617.45	1.00										
34	405.61	153.20	18.3	5.63	5.93	2	0.00	35.0	20068.81	0.00	
3386.38	1.00										
35	411.24	201.26	19.9	8.11	8.63	2	0.00	35.0	26365.19	0.00	
3072.90	1.01										
36	419.35	177.43	19.9	8.11	8.63	2	0.00	35.0	23243.59	0.00	
2709.08	1.01										
37	427.46	150.99	21.6	8.02	8.63	2	0.00	35.0	19780.02	0.00	
2319.20	1.01										
38	435.48	125.55	21.6	8.02	8.63	2	0.00	35.0	16447.14	0.00	
1928.42	1.01										
39	443.50	62.73	23.2	4.81	5.24	2	0.00	35.0	8217.30	0.00	
1597.61	1.02										
40	448.31	59.70	23.2	5.52	6.01	1	150.00	22.0	7820.36	0.00	
1348.64	1.05										
41	453.83	46.62	23.2	5.52	6.01	1	150.00	22.0	6106.97	0.00	
1050.07	1.05										
42	459.35	42.61	24.9	7.82	8.63	1	150.00	22.0	5581.69	0.00	
668.84	1.06										
43	467.18	14.20	24.9	7.82	8.63	1	150.00	22.0	1860.56	0.00	
212.78	1.06										

X-S Area:	9015.20	Path Length:	327.78	X-S Weight:	1180624.75

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 7-1 Rapid Drawdown.gmf

Processed: 02 Dec 2020 14:52:04

DATA: Analysis 1 - Case 7-1 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    188.00        348.50    188.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    144.00        348.50    144.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    141.00        348.50    141.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        500.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    188.00        500.00    188.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    144.00        500.00    144.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    141.00        500.00    141.00

```

Slope Surface (4 points)

```

-----
100.00    144.00    157.00    144.00    325.00    200.00    500.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    144.00    157.00    144.00    316.00    197.00    348.50    197.00
351.50    170.00
500.00    170.00

```

Failure Surface

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

```

Intersects: XL: 157.00    YL: 144.00    XR: 480.00    YR: 200.00
Centre: XC: 237.81    YC: 637.43    Radius: R: 500.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 7-1 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.352

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.40

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	156.21	144.00	475.00	200.00	216.38	736.87	595.92	2.405	
Critical Surface									
2	155.16	144.00	475.00	200.00	215.46	740.96	600.00	2.406	
3	158.32	144.44	475.00	200.00	221.16	716.51	575.51	2.408	
4	156.74	144.00	475.00	200.00	216.47	736.92	595.92	2.409	
5	155.68	144.00	475.00	200.00	215.55	741.01	600.00	2.409	
6	157.26	144.09	475.00	200.00	217.45	732.86	591.84	2.410	
7	157.79	144.26	475.00	200.00	219.31	724.69	583.67	2.411	
8	156.74	144.00	475.53	200.00	216.90	736.87	595.92	2.411	
9	155.68	144.00	475.53	200.00	215.99	740.96	600.00	2.412	
10	157.26	144.09	475.53	200.00	217.88	732.81	591.84	2.412	
11	156.21	144.00	475.00	200.00	215.64	741.05	600.00	2.413	
12	159.89	144.96	475.00	200.00	225.99	696.12	555.10	2.414	
13	159.37	144.79	475.00	200.00	224.14	704.32	563.27	2.414	
14	158.84	144.61	475.00	200.00	222.29	712.51	571.43	2.415	
15	156.21	144.00	475.53	200.00	216.08	741.01	600.00	2.416	
16	158.32	144.44	475.00	200.00	220.43	720.69	579.59	2.416	
17	157.79	144.26	475.00	200.00	218.57	728.87	587.76	2.416	
18	156.74	144.00	475.00	200.00	215.73	741.09	600.00	2.417	
19	157.79	144.26	475.53	200.00	219.74	724.64	583.67	2.417	
20	159.37	144.79	475.53	200.00	224.57	704.27	563.27	2.417	
21	156.21	144.00	476.05	200.00	216.51	740.96	600.00	2.418	
22	158.84	144.61	475.53	200.00	222.71	712.46	571.43	2.418	
23	157.26	144.09	475.00	200.00	216.71	737.03	595.92	2.418	
24	157.79	144.26	475.53	200.00	219.00	728.82	587.76	2.419	
25	156.74	144.00	475.53	200.00	216.17	741.05	600.00	2.419	
26	160.95	145.32	475.00	200.00	228.95	683.90	542.86	2.419	
27	160.42	145.14	475.00	200.00	227.11	692.11	551.02	2.421	
28	157.26	144.09	475.53	200.00	217.15	736.99	595.92	2.421	
29	158.84	144.61	476.05	200.00	223.14	712.41	571.43	2.421	
30	159.89	144.96	475.00	200.00	225.26	700.32	559.18	2.421	
31	158.32	144.44	476.05	200.00	221.29	720.60	579.59	2.421	
32	156.74	144.00	476.05	200.00	216.61	741.01	600.00	2.422	
33	158.84	144.61	475.00	200.00	221.55	716.70	575.51	2.422	
34	158.32	144.44	475.53	200.00	220.86	720.65	579.59	2.422	
35	157.79	144.26	476.05	200.00	219.44	728.78	587.76	2.423	
36	157.26	144.09	476.05	200.00	217.58	736.95	595.92	2.423	
37	158.32	144.44	475.00	200.00	219.70	724.88	583.67	2.423	
38	160.42	145.14	475.53	200.00	227.53	692.06	551.02	2.423	
39	158.84	144.61	475.00	200.00	223.02	708.32	567.35	2.424	
40	156.74	144.00	476.58	200.00	217.04	740.96	600.00	2.424	
41	159.89	144.96	475.53	200.00	225.68	700.27	559.18	2.424	
42	157.79	144.26	475.00	200.00	217.84	733.05	591.84	2.425	
43	159.37	144.79	475.53	200.00	223.83	708.46	567.35	2.425	
44	157.26	144.09	476.58	200.00	218.01	736.90	595.92	2.426	
45	158.32	144.44	475.53	200.00	220.13	724.83	583.67	2.426	
46	162.00	145.67	475.00	200.00	231.91	671.65	530.61	2.426	
47	157.26	144.09	475.00	200.00	215.98	741.21	600.00	2.426	
48	159.37	144.79	475.00	200.00	223.41	708.51	567.35	2.427	
49	157.79	144.26	475.53	200.00	218.27	733.00	591.84	2.427	
50	159.89	144.96	476.05	200.00	226.11	700.21	559.18	2.427	
51	158.84	144.61	475.53	200.00	221.98	716.65	575.51	2.428	
52	160.95	145.32	475.00	200.00	228.22	688.10	546.94	2.428	
53	161.47	145.49	475.00	200.00	230.07	679.88	538.78	2.428	
54	159.37	144.79	476.05	200.00	224.26	708.41	567.35	2.428	
55	162.00	145.67	475.53	200.00	232.33	671.60	530.61	2.428	
56	160.42	145.14	475.00	200.00	226.38	696.31	555.10	2.428	
57	158.32	144.44	476.05	200.00	220.56	724.78	583.67	2.428	
58	157.26	144.09	475.53	200.00	216.41	741.17	600.00	2.429	
59	157.79	144.26	476.58	200.00	219.87	728.73	587.76	2.429	
60	159.37	144.79	475.00	200.00	222.67	712.70	571.43	2.429	
61	157.79	144.26	476.05	200.00	218.70	732.96	591.84	2.430	
62	161.47	145.49	475.53	200.00	230.49	679.83	538.78	2.430	
63	158.84	144.61	475.00	200.00	220.82	720.88	579.59	2.431	
64	158.84	144.61	476.58	200.00	222.84	716.55	575.51	2.431	
65	157.26	144.09	476.05	200.00	216.85	741.12	600.00	2.431	
66	160.42	145.14	475.53	200.00	226.80	696.26	555.10	2.431	
67	160.95	145.32	475.53	200.00	228.64	688.05	546.94	2.432	
68	159.89	144.96	475.53	200.00	224.95	704.46	563.27	2.432	

69	158.32	144.44	475.00	200.00	218.96	729.06	587.76	2.432
70	157.79	144.26	476.58	200.00	219.14	732.91	591.84	2.432
71	159.37	144.79	476.58	200.00	224.69	708.36	567.35	2.432
72	157.79	144.26	475.00	200.00	217.10	737.22	595.92	2.433
73	161.47	145.49	476.05	200.00	230.91	679.77	538.78	2.433
74	159.89	144.96	475.00	200.00	224.53	704.51	563.27	2.433
75	158.84	144.61	475.53	200.00	221.25	720.84	579.59	2.433
76	159.37	144.79	475.53	200.00	223.10	712.65	571.43	2.433
77	158.84	144.61	476.05	200.00	222.41	716.60	575.51	2.434
78	157.26	144.09	476.58	200.00	217.28	741.08	600.00	2.434
79	158.32	144.44	475.53	200.00	219.40	729.01	587.76	2.434
80	160.95	145.32	476.05	200.00	229.07	688.00	546.94	2.435
81	158.32	144.44	476.58	200.00	220.99	724.74	583.67	2.435
82	158.32	144.44	477.11	200.00	221.42	724.69	583.67	2.435
83	162.00	145.67	475.00	200.00	231.18	675.87	534.69	2.435
84	159.89	144.96	476.05	200.00	225.38	704.41	563.27	2.435
85	157.79	144.26	475.53	200.00	217.54	737.18	595.92	2.435
86	158.84	144.61	476.05	200.00	221.68	720.79	579.59	2.435
87	160.95	145.32	475.00	200.00	227.49	692.30	551.02	2.436
88	158.84	144.61	477.11	200.00	223.27	716.51	575.51	2.436
89	160.42	145.14	476.05	200.00	227.22	696.21	555.10	2.436
90	157.79	144.26	477.11	200.00	219.57	732.87	591.84	2.436
91	161.47	145.49	475.00	200.00	229.34	684.09	542.86	2.436
92	157.26	144.09	477.11	200.00	217.72	741.03	600.00	2.436
93	158.32	144.44	476.05	200.00	219.83	728.97	587.76	2.437
94	159.89	144.96	475.00	200.00	223.79	708.70	567.35	2.437
95	160.95	145.32	476.58	200.00	229.49	687.94	546.94	2.437
96	162.00	145.67	475.53	200.00	231.60	675.81	534.69	2.437
97	157.79	144.26	476.05	200.00	217.97	737.13	595.92	2.438
98	159.37	144.79	476.58	200.00	223.96	712.56	571.43	2.438
99	160.42	145.14	476.58	200.00	227.65	696.16	555.10	2.438

Critical Failure Surface (circle 1)

Intersects:	XL:	156.21	YL:	144.00	XR:	475.00	YR:	200.00	
	Centre:	XC:	216.38	YC:	736.87		Radius:	R:	595.92
Generated failure surface: (20 points)									
156.21	144.00		173.40	142.51		190.62	141.51	207.86	141.02
225.12	141.02								
242.36	141.52		259.58	142.52		276.77	144.02	293.90	146.02
310.97	148.51								
327.97	151.50		344.86	154.97		361.65	158.93	378.32	163.38
394.85	168.31								
411.24	173.71		427.46	179.59		443.50	185.93	459.35	192.74
475.00	200.00								

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	156.21	13.25	-5.0	8.59	8.63	3	100.00	18.0	1768.38	830.18
210.74	1.02									
2	164.80	44.29	-5.0	8.59	8.63	3	100.00	18.0	5897.66	2773.84
694.28	1.02									
3	173.40	74.43	-3.3	8.61	8.63	3	100.00	18.0	9899.93	4651.99
1156.87	1.01									
4	182.01	103.43	-3.3	8.61	8.63	3	100.00	18.0	13742.18	6464.80
1604.91	1.01									
5	190.62	131.54	-1.6	8.62	8.63	3	100.00	18.0	17456.78	8211.40
2030.04	1.00									
6	199.24	158.46	-1.6	8.62	8.63	3	100.00	18.0	21004.52	9891.83
2442.35	1.00									
7	207.86	184.38	0.0	8.63	8.63	3	100.00	18.0	24411.25	11505.37
2830.02	1.00									
8	216.49	209.17	0.0	8.63	8.63	3	100.00	18.0	27658.23	13052.09
3206.45	1.00									
9	225.12	232.77	1.7	8.62	8.63	3	100.00	18.0	30739.59	14531.27
3556.66	1.00									
10	233.74	255.39	1.7	8.62	8.63	3	100.00	18.0	33680.15	15942.88
3897.02	1.00									
11	242.36	276.56	3.3	8.61	8.63	3	100.00	18.0	36421.06	17286.43
4209.78	0.99									
12	250.97	296.96	3.3	8.61	8.63	3	100.00	18.0	39050.95	18561.84
4513.96	0.99									
13	259.58	310.67	5.0	8.46	8.49	3	100.00	18.0	40790.96	19459.21
4787.28	0.99									
14	268.04	328.29	5.0	8.46	8.49	3	100.00	18.0	43036.71	20562.89
5051.11	0.99									
15	276.51	253.12	6.6	6.25	6.29	2	0.00	35.0	33158.87	15899.38
5217.89	0.97									
16	282.75	261.58	6.6	6.25	6.29	2	0.00	35.0	34267.22	16433.13

5391.34	0.97										
17	289.00	211.26	6.6	4.90	4.94	2	0.00	35.0	27675.11	13271.83	
5546.97	0.97										
18	293.90	379.09	8.3	8.54	8.63	2	0.00	35.0	49660.75	23905.87	
5694.12	0.97										
19	302.44	392.74	8.3	8.54	8.63	2	0.00	35.0	51449.06	24766.72	
5899.15	0.97										
20	310.97	237.28	10.0	5.03	5.10	2	0.00	35.0	31083.43	15032.86	
6026.90	0.97										
21	316.00	434.84	10.0	9.00	9.14	2	0.00	35.0	56964.05	26694.20	
6163.51	0.97										
22	325.00	144.59	10.0	2.97	3.01	2	0.00	35.0	18941.87	8597.27	
6216.28	0.97										
23	327.97	402.47	11.6	8.45	8.63	2	0.00	35.0	52723.57	24025.04	
6045.02	0.96										
24	336.41	387.79	11.6	8.45	8.63	2	0.00	35.0	50800.43	23089.80	
5824.12	0.96										
25	344.86	162.20	13.3	3.64	3.74	2	0.00	35.0	21248.59	9700.06	
5633.76	0.96										
26	348.50	131.45	13.3	3.00	3.08	5	0.00	45.0	14459.39	5254.13	
4541.37	0.94										
27	351.50	429.11	13.3	10.15	10.43	2	0.00	35.0	56213.75	7983.46	
5229.77	0.96										
28	361.65	332.98	14.9	8.33	8.63	2	0.00	35.0	43620.46	5357.63	
4901.44	0.96										
29	369.99	314.45	14.9	8.33	8.63	2	0.00	35.0	41192.73	4160.77	
4621.14	0.96										
30	378.32	292.51	16.6	8.27	8.63	2	0.00	35.0	38319.34	2899.23	
4292.27	0.96										
31	386.59	272.15	16.6	8.27	8.63	2	0.00	35.0	35651.13	1573.01	
3982.99	0.96										
32	394.85	158.07	18.3	5.12	5.40	2	0.00	35.0	20706.75	284.61	
3691.25	0.96										
33	399.98	163.65	18.3	5.63	5.93	2	0.00	35.0	21438.10	0.00	
3474.63	0.96										
34	405.61	153.20	18.3	5.63	5.93	2	0.00	35.0	20068.81	0.00	
3252.68	0.96										
35	411.24	201.26	19.9	8.11	8.63	2	0.00	35.0	26365.19	0.00	
2940.79	0.96										
36	419.35	177.43	19.9	8.11	8.63	2	0.00	35.0	23243.59	0.00	
2592.62	0.96										
37	427.46	150.99	21.6	8.02	8.63	2	0.00	35.0	19780.02	0.00	
2211.32	0.96										
38	435.48	125.55	21.6	8.02	8.63	2	0.00	35.0	16447.14	0.00	
1838.72	0.96										
39	443.50	62.73	23.2	4.81	5.24	2	0.00	35.0	8217.30	0.00	
1517.64	0.97										
40	448.31	59.70	23.2	5.52	6.01	1	150.00	22.0	7820.36	0.00	
1296.52	1.02										
41	453.83	46.62	23.2	5.52	6.01	1	150.00	22.0	6106.97	0.00	
1006.99	1.02										
42	459.35	42.61	24.9	7.82	8.63	1	150.00	22.0	5581.69	0.00	
634.95	1.02										
43	467.18	14.20	24.9	7.82	8.63	1	150.00	22.0	1860.56	0.00	
193.75	1.02										

X-S Area:	9015.20	Path Length:	327.78	X-S Weight:	1180624.75

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Full Reservoir.gmf

Processed: 04 Dec 2020 13:04:39

DATA: Analysis 1 - Case 7-2 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    198.00      348.50    198.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    144.00      348.50    144.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    141.00      348.50    141.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    198.00      450.00    198.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    144.00      450.00    144.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    141.00      450.00    141.00

```

Slope Surface (8 points)

```

-----
100.00    144.00      157.00    144.00      325.00    200.00      405.00    200.00
410.00    195.00
415.00    195.00      420.00    200.00      450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00      157.00    197.00      316.00    197.00      348.50    197.00
351.50    172.00
450.00    172.00

```

Failure Surface

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

```

Intersects: XL: 157.00    YL: 144.00    XR: 410.00    YR: 195.00
Centre: XC: 241.19    YC: 379.40    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 7-2 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 5.104

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.99

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	159.37	144.79	405.00	200.00	210.57	491.02	350.00	2.985	
Critical Surface									
2	159.89	144.96	405.00	200.00	211.84	486.96	345.92	2.988	
3	160.42	145.14	405.00	200.00	213.10	482.89	341.84	2.990	
4	160.95	145.32	405.00	200.00	214.37	478.82	337.76	2.992	
5	161.47	145.49	405.00	200.00	215.64	474.74	333.67	2.994	
6	162.00	145.67	405.00	200.00	216.91	470.65	329.59	2.996	
7	159.89	144.96	405.00	200.00	210.88	491.23	350.00	3.003	
8	160.95	145.32	405.00	200.00	213.41	483.10	341.84	3.005	
9	161.47	145.49	405.00	200.00	214.68	479.03	337.76	3.007	
10	160.42	145.14	405.00	200.00	212.15	487.17	345.92	3.009	
11	162.00	145.67	405.00	200.00	215.95	474.95	333.67	3.010	
12	159.89	144.96	405.53	199.47	211.95	491.07	350.00	3.015	
13	160.42	145.14	405.00	200.00	211.19	491.44	350.00	3.017	
14	160.42	145.14	405.53	199.47	213.21	487.01	345.92	3.017	
15	160.95	145.32	405.00	200.00	212.46	487.38	345.92	3.019	
16	160.95	145.32	405.53	199.47	214.47	482.94	341.84	3.019	
17	161.47	145.49	405.00	200.00	213.72	483.31	341.84	3.020	
18	161.47	145.49	405.53	199.47	215.73	478.86	337.76	3.022	
19	162.00	145.67	405.53	199.47	216.99	474.78	333.67	3.024	
20	162.00	145.67	405.00	200.00	214.99	479.24	337.76	3.027	
21	160.95	145.32	405.53	199.47	213.53	487.22	345.92	3.033	
22	161.47	145.49	405.53	199.47	214.78	483.15	341.84	3.035	
23	160.95	145.32	405.00	200.00	211.50	491.65	350.00	3.035	
24	160.42	145.14	405.53	199.47	212.27	491.28	350.00	3.037	
25	162.00	145.67	405.53	199.47	216.04	479.07	337.76	3.038	
26	161.47	145.49	405.00	200.00	212.77	487.59	345.92	3.038	
27	162.00	145.67	405.00	200.00	214.03	483.52	341.84	3.041	
28	160.42	145.14	406.05	198.95	213.34	491.12	350.00	3.046	
29	160.95	145.32	405.53	199.47	212.58	491.49	350.00	3.046	
30	161.47	145.49	405.53	199.47	213.84	487.42	345.92	3.048	
31	160.95	145.32	406.05	198.95	214.59	487.05	345.92	3.049	
32	161.47	145.49	406.05	198.95	215.84	482.98	341.84	3.051	
33	162.00	145.67	406.05	198.95	217.09	478.90	337.76	3.053	
34	161.47	145.49	405.00	200.00	211.81	491.85	350.00	3.054	
35	162.00	145.67	405.53	199.47	215.10	483.35	341.84	3.054	
36	162.00	145.67	405.00	200.00	213.08	487.79	345.92	3.058	
37	160.95	145.32	406.05	198.95	213.66	491.32	350.00	3.062	
38	161.47	145.49	406.05	198.95	214.91	487.26	345.92	3.065	
39	161.47	145.49	405.53	199.47	212.89	491.69	350.00	3.066	
40	162.00	145.67	406.05	198.95	216.16	483.19	341.84	3.067	
41	162.00	145.67	405.53	199.47	214.15	487.63	345.92	3.069	
42	162.00	145.67	405.00	200.00	212.12	492.06	350.00	3.073	
43	160.95	145.32	406.58	198.42	214.73	491.16	350.00	3.078	
44	161.47	145.49	406.05	198.95	213.97	491.53	350.00	3.078	
45	161.47	145.49	406.58	198.42	215.97	487.09	345.92	3.080	
46	162.00	145.67	406.58	198.42	217.21	483.01	341.84	3.083	
47	162.00	145.67	406.05	198.95	215.22	487.47	345.92	3.084	
48	162.00	145.67	405.53	199.47	213.21	491.90	350.00	3.086	
49	161.47	145.49	406.58	198.42	215.05	491.37	350.00	3.094	
50	160.95	145.32	407.11	197.89	215.81	490.99	350.00	3.096	
51	162.00	145.67	406.58	198.42	216.29	487.30	345.92	3.097	
52	161.47	145.49	407.11	197.89	217.04	486.92	345.92	3.098	
53	162.00	145.67	406.05	198.95	214.29	491.74	350.00	3.099	
54	162.00	145.67	407.11	197.89	218.27	482.84	341.84	3.100	
55	161.47	145.49	407.11	197.89	216.13	491.20	350.00	3.113	
56	162.00	145.67	406.58	198.42	215.37	491.57	350.00	3.115	
57	162.00	145.67	407.11	197.89	217.36	487.13	345.92	3.115	
58	162.00	145.67	406.58	198.42	218.14	478.72	337.76	3.122	
59	161.47	145.49	406.58	198.42	216.90	482.80	341.84	3.128	
60	162.00	145.67	407.11	197.89	216.45	491.41	350.00	3.130	
61	161.47	145.49	407.63	197.37	217.20	491.03	350.00	3.137	
62	162.00	145.67	407.63	197.37	218.42	486.95	345.92	3.138	
63	160.95	145.32	406.58	198.42	215.66	486.88	345.92	3.143	
64	162.00	145.67	407.63	197.37	217.52	491.24	350.00	3.154	
65	160.42	145.14	406.58	198.42	214.42	490.95	350.00	3.167	
66	162.00	145.67	408.16	196.84	218.59	491.06	350.00	3.171	

67	161.47	145.49	406.05	198.95	216.78	478.69	337.76	3.175
68	160.95	145.32	406.05	198.95	215.53	482.77	341.84	3.181
69	162.00	145.67	406.05	198.95	218.03	474.60	333.67	3.184
70	160.42	145.14	406.05	198.95	214.28	486.84	345.92	3.197
71	160.95	145.32	405.53	199.47	215.42	478.65	337.76	3.225
72	159.89	144.96	406.05	198.95	213.03	490.91	350.00	3.226
73	161.47	145.49	405.53	199.47	216.68	474.57	333.67	3.231
74	160.42	145.14	405.53	199.47	214.16	482.73	341.84	3.234
75	162.00	145.67	405.53	199.47	217.94	470.48	329.59	3.254
76	159.89	144.96	405.53	199.47	212.90	486.80	345.92	3.258
77	160.95	145.32	405.00	200.00	215.33	474.53	333.67	3.279
78	160.42	145.14	405.00	200.00	214.07	478.61	337.76	3.280
79	161.47	145.49	405.00	200.00	216.60	470.44	329.59	3.296
80	159.89	144.96	405.00	200.00	212.80	482.68	341.84	3.299
81	159.37	144.79	405.53	199.47	211.64	490.86	350.00	3.301
82	162.00	145.67	405.00	200.00	217.87	466.35	325.51	3.335
83	159.37	144.79	405.00	200.00	211.53	486.75	345.92	3.339
84	158.84	144.61	405.00	200.00	210.26	490.82	350.00	3.388
85	162.00	145.67	408.68	196.32	219.66	490.88	350.00	3.474
86	161.47	145.49	408.16	196.84	218.27	490.85	350.00	3.497
87	162.00	145.67	407.63	197.37	219.32	482.66	341.84	3.502
88	161.47	145.49	407.11	197.89	217.95	482.63	341.84	3.503
89	162.00	145.67	408.16	196.84	219.48	486.78	345.92	3.512
90	160.95	145.32	407.63	197.37	216.88	490.82	350.00	3.514
91	162.00	145.67	407.11	197.89	219.19	478.55	337.76	3.518
92	161.47	145.49	407.63	197.37	218.10	486.74	345.92	3.519
93	160.95	145.32	406.58	198.42	216.58	482.59	341.84	3.519
94	162.00	145.67	406.58	198.42	219.07	474.42	333.67	3.519
95	161.47	145.49	406.58	198.42	217.83	478.51	337.76	3.522
96	160.95	145.32	407.11	197.89	216.72	486.71	345.92	3.524
97	162.00	145.67	406.05	198.95	218.97	470.30	329.59	3.535
98	161.47	145.49	406.05	198.95	217.72	474.39	333.67	3.535
99	160.42	145.14	407.11	197.89	215.49	490.78	350.00	3.543

Intersects:	XL:	159.37	YL:	144.79	XR:	405.00	YR:	200.00
Centre:	XC:	210.57	YC:	491.02		Radius:	R:	350.00

213.40	159.37	144.79	172.81	143.07	186.31	141.87	199.85	141.19
280.69	226.95	141.41	240.47	142.30	253.95	143.72	267.37	145.66
345.37	293.92	151.09	307.02	154.58	319.97	158.56	332.76	163.05
405.00	357.77	173.49	369.95	179.42	381.90	185.83	393.59	192.69
	405.00	200.00						

Slice Normal	X-S	Base							PoreWater	
Test X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	
Stress 1	159.37	8.76	-7.3	6.16	6.21	2	0.00	35.0	1147.37	20389.60
3383.11	1.04									
2	165.53	32.94	-7.3	7.28	7.34	3	100.00	18.0	4349.41	24495.27
3660.10	1.02									
3	172.81	51.50	-5.1	6.75	6.78	3	100.00	18.0	6829.25	22933.39
3928.09	1.01									
4	179.56	70.74	-5.1	6.75	6.78	3	100.00	18.0	9390.27	23187.28
4169.07	1.01									
5	186.31	89.35	-2.9	6.77	6.78	3	100.00	18.0	11861.27	23385.83
4386.38	1.01									
6	193.08	106.92	-2.9	6.77	6.78	3	100.00	18.0	14184.71	23529.01
4589.89	1.01									
7	199.85	123.75	-0.6	6.78	6.78	3	100.00	18.0	16403.68	23616.76
4768.19	1.00									
8	206.62	139.57	-0.6	6.78	6.78	3	100.00	18.0	18481.68	23649.04
4934.10	1.00									
9	213.40	154.45	1.6	6.77	6.78	3	100.00	18.0	20427.79	23626.06
5073.47	1.00									
10	220.18	168.49	1.6	6.77	6.78	3	100.00	18.0	22253.95	23547.42
5201.72	1.00									
11	226.95	181.29	3.8	6.76	6.78	3	100.00	18.0	23909.35	23413.04
5302.29	1.00									
12	233.71	193.50	3.8	6.76	6.78	3	100.00	18.0	25478.51	23223.45
5392.86	1.00									
13	240.47	204.12	6.0	6.74	6.78	3	100.00	18.0	26830.46	22978.62
5454.81	0.99									
14	247.21	214.48	6.0	6.74	6.78	3	100.00	18.0	28139.44	22678.56
5507.74	0.99									
15	253.95	62.50	8.2	1.91	1.93	3	100.00	18.0	8189.62	6388.83

5525.78	0.99										
16	255.86	192.72	8.2	5.75	5.81	2	0.00	35.0	25245.70	19074.78	
5503.65	0.98										
17	261.61	198.96	8.2	5.75	5.81	2	0.00	35.0	26063.94	18772.91	
5523.75	0.98										
18	267.37	237.39	10.4	6.66	6.78	2	0.00	35.0	31097.52	21448.21	
5507.25	0.97										
19	274.03	244.00	10.4	6.66	6.78	2	0.00	35.0	31963.93	20928.50	
5495.82	0.97										
20	280.69	247.73	12.7	6.61	6.78	2	0.00	35.0	32452.37	20354.44	
5445.18	0.97										
21	287.31	252.47	12.7	6.61	6.78	2	0.00	35.0	33074.09	19726.01	
5399.22	0.97										
22	293.92	253.89	14.9	6.55	6.78	2	0.00	35.0	33258.99	19043.69	
5313.42	0.97										
23	300.47	256.78	14.9	6.55	6.78	2	0.00	35.0	33638.28	18307.49	
5233.33	0.97										
24	307.02	177.37	17.1	4.49	4.70	2	0.00	35.0	23235.19	12238.67	
5130.49	0.98										
25	311.51	177.88	17.1	4.49	4.70	2	0.00	35.0	23302.82	11833.27	
5051.58	0.98										
26	316.00	119.09	17.1	3.00	3.14	2	0.00	35.0	15600.95	7677.30	
5014.88	0.98										
27	319.00	238.35	19.0	6.00	6.34	2	0.00	35.0	31223.91	14935.39	
4991.35	0.98										
28	325.00	297.30	19.3	7.76	8.22	2	0.00	35.0	38946.07	18119.63	
4804.96	0.98										
29	332.76	225.08	21.5	6.30	6.78	2	0.00	35.0	29484.93	13830.97	
4454.24	0.98										
30	339.06	209.39	21.5	6.30	6.78	2	0.00	35.0	27430.15	12778.70	
4142.72	0.98										
31	345.37	98.04	23.8	3.13	3.42	2	0.00	35.0	12842.67	6043.11	
3879.96	0.99										
32	348.50	89.81	23.8	3.00	3.28	5	0.00	45.0	9878.57	2952.55	
2985.41	0.95										
33	351.50	82.91	23.8	2.90	3.16	2	0.00	35.0	10861.32	125.81	
3404.07	0.99										
34	354.40	92.01	23.8	3.38	3.69	2	0.00	35.0	12053.04	0.00	
3236.44	0.99										
35	357.77	152.48	26.0	6.09	6.78	2	0.00	35.0	19974.48	0.00	
2942.52	1.00										
36	363.86	134.39	26.0	6.09	6.78	2	0.00	35.0	17605.41	0.00	
2593.51	1.00										
37	369.95	113.33	28.2	5.97	6.78	2	0.00	35.0	14845.75	0.00	
2208.06	1.01										
38	375.93	94.20	28.2	5.97	6.78	2	0.00	35.0	12340.33	0.00	
1835.42	1.01										
39	381.90	72.79	30.4	5.84	6.78	2	0.00	35.0	9535.82	0.00	
1434.24	1.02										
40	387.74	52.74	30.4	5.84	6.78	2	0.00	35.0	6909.08	0.00	
1039.17	1.02										
41	393.59	24.80	32.6	4.15	4.92	2	0.00	35.0	3248.36	0.00	
681.31	1.03										
42	397.73	13.79	32.6	4.15	4.92	2	0.00	35.0	1806.82	0.00	
378.96	1.03										
43	401.88	3.12	32.6	3.12	3.71	1	150.00	22.0	409.09	0.00	
90.94	1.09										

X-S Area:	----- 6155.14	Path Length:	----- 257.51	X-S Weight:	----- 806206.38

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Rapid Drawdown.gmf

Processed: 04 Dec 2020 13:03:24

DATA: Analysis 1 - Case 7-2 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    198.00      348.50    198.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    144.00      348.50    144.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    141.00      348.50    141.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    198.00      450.00    198.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    144.00      450.00    144.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    141.00      450.00    141.00

```

Slope Surface (8 points)

```

-----
100.00    144.00    157.00    144.00    325.00    200.00    405.00    200.00
410.00    195.00
415.00    195.00    420.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    144.00    157.00    144.00    316.00    197.00    348.50    197.00
351.50    172.00
450.00    172.00

```

Failure Surface

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

```

Intersects: XL: 157.00    YL: 144.00    XR: 410.00    YR: 195.00
Centre: XC: 241.19    YC: 379.40    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:          XL          XR          R
Range of variation:          10.00        10.00        200.00
Trial positions within range: 20          20          50

```

RESULTS: Analysis 1 - Case 7-2 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.769

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	159.37	144.79	405.00	200.00	210.57	491.02	350.00	1.579	
Critical Surface									
2	159.89	144.96	405.00	200.00	211.84	486.96	345.92	1.580	
3	160.42	145.14	405.00	200.00	213.10	482.89	341.84	1.581	
4	160.95	145.32	405.00	200.00	214.37	478.82	337.76	1.583	
5	161.47	145.49	405.00	200.00	215.64	474.74	333.67	1.584	
6	162.00	145.67	405.00	200.00	216.91	470.65	329.59	1.585	
7	159.89	144.96	405.00	200.00	210.88	491.23	350.00	1.589	
8	160.95	145.32	405.00	200.00	213.41	483.10	341.84	1.590	
9	161.47	145.49	405.00	200.00	214.68	479.03	337.76	1.592	
10	160.42	145.14	405.00	200.00	212.15	487.17	345.92	1.593	
11	162.00	145.67	405.00	200.00	215.95	474.95	333.67	1.594	
12	159.89	144.96	405.53	199.47	211.95	491.07	350.00	1.596	
13	160.42	145.14	405.00	200.00	211.19	491.44	350.00	1.598	
14	160.42	145.14	405.53	199.47	213.21	487.01	345.92	1.598	
15	160.95	145.32	405.00	200.00	212.46	487.38	345.92	1.599	
16	160.95	145.32	405.53	199.47	214.47	482.94	341.84	1.599	
17	161.47	145.49	405.00	200.00	213.72	483.31	341.84	1.600	
18	161.47	145.49	405.53	199.47	215.73	478.86	337.76	1.600	
19	162.00	145.67	405.53	199.47	216.99	474.78	333.67	1.602	
20	162.00	145.67	405.00	200.00	214.99	479.24	337.76	1.603	
21	160.95	145.32	405.53	199.47	213.53	487.22	345.92	1.607	
22	161.47	145.49	405.53	199.47	214.78	483.15	341.84	1.609	
23	160.95	145.32	405.00	200.00	211.50	491.65	350.00	1.609	
24	160.42	145.14	405.53	199.47	212.27	491.28	350.00	1.609	
25	162.00	145.67	405.53	199.47	216.04	479.07	337.76	1.610	
26	161.47	145.49	405.00	200.00	212.77	487.59	345.92	1.610	
27	162.00	145.67	405.00	200.00	214.03	483.52	341.84	1.612	
28	160.42	145.14	406.05	198.95	213.34	491.12	350.00	1.614	
29	160.95	145.32	405.53	199.47	212.58	491.49	350.00	1.615	
30	160.95	145.32	406.05	198.95	214.59	487.05	345.92	1.616	
31	161.47	145.49	405.53	199.47	213.84	487.42	345.92	1.616	
32	161.47	145.49	406.05	198.95	215.84	482.98	341.84	1.617	
33	162.00	145.67	406.05	198.95	217.09	478.90	337.76	1.618	
34	162.00	145.67	405.53	199.47	215.10	483.35	341.84	1.620	
35	161.47	145.49	405.00	200.00	211.81	491.85	350.00	1.620	
36	162.00	145.67	405.00	200.00	213.08	487.79	345.92	1.622	
37	160.95	145.32	406.05	198.95	213.66	491.32	350.00	1.624	
38	161.47	145.49	406.05	198.95	214.91	487.26	345.92	1.625	
39	161.47	145.49	405.53	199.47	212.89	491.69	350.00	1.627	
40	162.00	145.67	406.05	198.95	216.16	483.19	341.84	1.627	
41	162.00	145.67	405.53	199.47	214.15	487.63	345.92	1.629	
42	162.00	145.67	405.00	200.00	212.12	492.06	350.00	1.632	
43	160.95	145.32	406.58	198.42	214.73	491.16	350.00	1.632	
44	161.47	145.49	406.05	198.95	213.97	491.53	350.00	1.633	
45	161.47	145.49	406.58	198.42	215.97	487.09	345.92	1.634	
46	162.00	145.67	406.58	198.42	217.21	483.01	341.84	1.635	
47	162.00	145.67	406.05	198.95	215.22	487.47	345.92	1.637	
48	162.00	145.67	405.53	199.47	213.21	491.90	350.00	1.639	
49	160.95	145.32	407.11	197.89	215.81	490.99	350.00	1.641	
50	161.47	145.49	406.58	198.42	215.05	491.37	350.00	1.642	
51	161.47	145.49	407.11	197.89	217.04	486.92	345.92	1.643	
52	162.00	145.67	407.11	197.89	218.27	482.84	341.84	1.644	
53	162.00	145.67	406.58	198.42	216.29	487.30	345.92	1.644	
54	162.00	145.67	406.05	198.95	214.29	491.74	350.00	1.646	
55	161.47	145.49	407.11	197.89	216.13	491.20	350.00	1.652	
56	162.00	145.67	407.11	197.89	217.36	487.13	345.92	1.653	
57	162.00	145.67	406.58	198.42	215.37	491.57	350.00	1.654	
58	162.00	145.67	406.58	198.42	218.14	478.72	337.76	1.658	
59	161.47	145.49	406.58	198.42	216.90	482.80	341.84	1.661	
60	161.47	145.49	407.63	197.37	217.20	491.03	350.00	1.662	
61	162.00	145.67	407.11	197.89	216.45	491.41	350.00	1.662	
62	162.00	145.67	407.63	197.37	218.42	486.95	345.92	1.663	
63	160.95	145.32	406.58	198.42	215.66	486.88	345.92	1.670	
64	162.00	145.67	407.63	197.37	217.52	491.24	350.00	1.672	
65	162.00	145.67	408.16	196.84	218.59	491.06	350.00	1.681	
66	160.42	145.14	406.58	198.42	214.42	490.95	350.00	1.684	

67	161.47	145.49	406.05	198.95	216.78	478.69	337.76	1.690
68	160.95	145.32	406.05	198.95	215.53	482.77	341.84	1.693
69	162.00	145.67	406.05	198.95	218.03	474.60	333.67	1.695
70	160.42	145.14	406.05	198.95	214.28	486.84	345.92	1.702
71	160.95	145.32	405.53	199.47	215.42	478.65	337.76	1.719
72	159.89	144.96	406.05	198.95	213.03	490.91	350.00	1.720
73	161.47	145.49	405.53	199.47	216.68	474.57	333.67	1.723
74	160.42	145.14	405.53	199.47	214.16	482.73	341.84	1.724
75	162.00	145.67	405.53	199.47	217.94	470.48	329.59	1.736
76	159.89	144.96	405.53	199.47	212.90	486.80	345.92	1.738
77	160.95	145.32	405.00	200.00	215.33	474.53	333.67	1.750
78	160.42	145.14	405.00	200.00	214.07	478.61	337.76	1.751
79	161.47	145.49	405.00	200.00	216.60	470.44	329.59	1.760
80	159.89	144.96	405.00	200.00	212.80	482.68	341.84	1.762
81	159.37	144.79	405.53	199.47	211.64	490.86	350.00	1.763
82	162.00	145.67	405.00	200.00	217.87	466.35	325.51	1.783
83	159.37	144.79	405.00	200.00	211.53	486.75	345.92	1.785
84	158.84	144.61	405.00	200.00	210.26	490.82	350.00	1.814
85	162.00	145.67	408.68	196.32	219.66	490.88	350.00	1.856
86	161.47	145.49	408.16	196.84	218.27	490.85	350.00	1.870
87	162.00	145.67	407.63	197.37	219.32	482.66	341.84	1.875
88	161.47	145.49	407.11	197.89	217.95	482.63	341.84	1.879
89	162.00	145.67	408.16	196.84	219.48	486.78	345.92	1.879
90	160.95	145.32	407.63	197.37	216.88	490.82	350.00	1.883
91	161.47	145.49	407.63	197.37	218.10	486.74	345.92	1.884
92	162.00	145.67	407.11	197.89	219.19	478.55	337.76	1.885
93	160.95	145.32	406.58	198.42	216.58	482.59	341.84	1.889
94	162.00	145.67	406.58	198.42	219.07	474.42	333.67	1.889
95	161.47	145.49	406.58	198.42	217.83	478.51	337.76	1.891
96	160.95	145.32	407.11	197.89	216.72	486.71	345.92	1.891
97	162.00	145.67	406.05	198.95	218.97	470.30	329.59	1.899
98	161.47	145.49	406.05	198.95	217.72	474.39	333.67	1.899
99	160.42	145.14	407.11	197.89	215.49	490.78	350.00	1.902

Critical Failure Surface (circle 1)

Intersects:	XL:	159.37	YL:	144.79	XR:	405.00	YR:	200.00	
	Centre:	XC:	210.57	YC:	491.02		Radius:	R:	350.00
Generated failure surface: (20 points)									
159.37	144.79		172.81	143.07		186.31	141.87	199.85	141.19
213.40	141.04								
226.95	141.41		240.47	142.30		253.95	143.72	267.37	145.66
280.69	148.12								
293.92	151.09		307.02	154.58		319.97	158.56	332.76	163.05
345.37	168.02								
357.77	173.49		369.95	179.42		381.90	185.83	393.59	192.69
405.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	159.37	8.76	-7.3	6.16	6.21	2	0.00	35.0	1147.37	551.00
192.10	1.07									
2	165.53	32.94	-7.3	7.28	7.34	3	100.00	18.0	4349.41	2072.40
614.11	1.04									
3	172.81	51.50	-5.1	6.75	6.78	3	100.00	18.0	6829.25	3226.05
1027.47	1.02									
4	179.56	70.74	-5.1	6.75	6.78	3	100.00	18.0	9390.27	4431.39
1410.63	1.02									
5	186.31	89.35	-2.9	6.77	6.78	3	100.00	18.0	11861.27	5582.66
1765.36	1.01									
6	193.08	106.92	-2.9	6.77	6.78	3	100.00	18.0	14184.71	6679.86
2110.53	1.01									
7	199.85	123.75	-0.6	6.78	6.78	3	100.00	18.0	16403.68	7722.18
2424.45	1.00									
8	206.62	139.57	-0.6	6.78	6.78	3	100.00	18.0	18481.68	8709.61
2731.48	1.00									
9	213.40	154.45	1.6	6.77	6.78	3	100.00	18.0	20427.79	9641.49
3004.84	0.99									
10	220.18	168.49	1.6	6.77	6.78	3	100.00	18.0	22253.95	10517.69
3273.62	0.99									
11	226.95	181.29	3.8	6.76	6.78	3	100.00	18.0	23909.35	11337.45
3506.70	0.99									
12	233.71	193.50	3.8	6.76	6.78	3	100.00	18.0	25478.51	12101.01
3737.16	0.99									
13	240.47	204.12	6.0	6.74	6.78	3	100.00	18.0	26830.46	12807.71
3930.24	0.98									
14	247.21	214.48	6.0	6.74	6.78	3	100.00	18.0	28139.44	13457.58
4122.37	0.98									
15	253.95	62.50	8.2	1.91	1.93	3	100.00	18.0	8189.62	3940.34

4220.72	0.98										
16	255.86	192.72	8.2	5.75	5.81	2	0.00	35.0	25245.70	12150.57	
4249.42	0.95										
17	261.61	198.96	8.2	5.75	5.81	2	0.00	35.0	26063.94	12544.39	
4387.15	0.95										
18	267.37	237.39	10.4	6.66	6.78	2	0.00	35.0	31097.52	15062.64	
4481.52	0.94										
19	274.03	244.00	10.4	6.66	6.78	2	0.00	35.0	31963.93	15482.31	
4606.38	0.94										
20	280.69	247.73	12.7	6.61	6.78	2	0.00	35.0	32452.37	15843.90	
4675.29	0.93										
21	287.31	252.47	12.7	6.61	6.78	2	0.00	35.0	33074.09	16147.44	
4764.86	0.93										
22	293.92	253.89	14.9	6.55	6.78	2	0.00	35.0	33258.99	16392.66	
4797.83	0.93										
23	300.47	256.78	14.9	6.55	6.78	2	0.00	35.0	33638.28	16579.61	
4852.54	0.93										
24	307.02	177.37	17.1	4.49	4.70	2	0.00	35.0	23235.19	11580.01	
4847.37	0.92										
25	311.51	177.88	17.1	4.49	4.70	2	0.00	35.0	23302.82	11613.71	
4861.48	0.92										
26	316.00	119.09	17.1	3.00	3.14	2	0.00	35.0	15600.95	7677.30	
4869.50	0.92										
27	319.00	238.35	19.0	6.00	6.34	2	0.00	35.0	31223.91	14935.39	
4826.97	0.92										
28	325.00	297.30	19.3	7.76	8.22	2	0.00	35.0	38946.07	18119.63	
4639.97	0.92										
29	332.76	225.08	21.5	6.30	6.78	2	0.00	35.0	29484.93	13830.97	
4284.81	0.91										
30	339.06	209.39	21.5	6.30	6.78	2	0.00	35.0	27430.15	12778.70	
3984.26	0.91										
31	345.37	98.04	23.8	3.13	3.42	2	0.00	35.0	12842.67	6043.11	
3717.16	0.91										
32	348.50	89.81	23.8	3.00	3.28	5	0.00	45.0	9878.57	2952.55	
2771.22	0.85										
33	351.50	82.91	23.8	2.90	3.16	2	0.00	35.0	10861.32	125.81	
3145.10	0.91										
34	354.40	92.01	23.8	3.38	3.69	2	0.00	35.0	12053.04	0.00	
2987.31	0.91										
35	357.77	152.48	26.0	6.09	6.78	2	0.00	35.0	19974.48	0.00	
2696.11	0.91										
36	363.86	134.39	26.0	6.09	6.78	2	0.00	35.0	17605.41	0.00	
2376.33	0.91										
37	369.95	113.33	28.2	5.97	6.78	2	0.00	35.0	14845.75	0.00	
2008.17	0.92										
38	375.93	94.20	28.2	5.97	6.78	2	0.00	35.0	12340.33	0.00	
1669.27	0.92										
39	381.90	72.79	30.4	5.84	6.78	2	0.00	35.0	9535.82	0.00	
1294.62	0.92										
40	387.74	52.74	30.4	5.84	6.78	2	0.00	35.0	6909.08	0.00	
938.01	0.92										
41	393.59	24.80	32.6	4.15	4.92	2	0.00	35.0	3248.36	0.00	
610.30	0.92										
42	397.73	13.79	32.6	4.15	4.92	2	0.00	35.0	1806.82	0.00	
339.46	0.92										
43	401.88	3.12	32.6	3.12	3.71	1	150.00	22.0	409.09	0.00	
60.27	1.02										

X-S Area:	6155.14	Path Length:	257.51	X-S Weight:	806206.38

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 8-1 Full Reservoir.gmf

Processed: 02 Dec 2020 15:11:52

DATA: Analysis 1 - Case 8-1 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    182.00        348.50    182.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    163.00        348.50    163.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    160.00        348.50    160.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        500.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    182.00        500.00    182.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    163.00        500.00    163.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    160.00        500.00    160.00

```

Slope Surface (4 points)

```

-----
100.00    163.00        214.00    163.00        325.00    200.00        500.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00        214.00    197.00        316.00    197.00        348.50    197.00
351.50    172.00
500.00    172.00

```

Failure Surface

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

```

Intersects: XL: 214.00    YL: 163.00    XR: 475.00    YR: 200.00
Centre: XC: 276.80    YC: 659.04    Radius: R: 500.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-1 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 7.474

Analysis Summary

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

Critical (minimum) Factor of Safety: 5.42

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	212.68	163.00	470.00	200.00	268.72	686.54	526.53	5.415	
Critical Surface									
2	213.21	163.00	470.00	200.00	268.83	686.58	526.53	5.416	
3	209.53	163.00	470.00	200.00	266.28	698.78	538.78	5.425	
4	210.58	163.00	470.00	200.00	267.09	694.70	534.69	5.427	
5	213.74	163.00	470.00	200.00	269.54	682.46	522.45	5.427	
6	211.63	163.00	470.00	200.00	267.91	690.62	530.61	5.429	
7	212.68	163.00	470.53	200.00	268.54	690.66	530.61	5.430	
8	212.16	163.00	470.53	200.00	268.43	690.62	530.61	5.430	
9	209.00	163.00	470.00	200.00	265.59	702.90	542.86	5.431	
10	213.21	163.00	470.00	200.00	268.23	690.75	530.61	5.432	
11	210.05	163.00	470.00	200.00	266.39	698.82	538.78	5.433	
12	212.68	163.00	470.00	200.00	268.12	690.71	530.61	5.437	
13	209.00	163.00	470.00	200.00	264.99	707.06	546.94	5.437	
14	210.05	163.00	470.00	200.00	265.80	702.99	542.86	5.438	
15	214.26	163.09	470.00	200.00	270.42	678.40	518.37	5.438	
16	211.11	163.00	470.00	200.00	266.61	698.91	538.78	5.440	
17	209.00	163.00	470.53	200.00	266.00	702.86	542.86	5.440	
18	213.21	163.00	470.53	200.00	269.25	686.54	526.53	5.441	
19	210.05	163.00	470.53	200.00	266.81	698.78	538.78	5.441	
20	212.16	163.00	470.00	200.00	267.42	694.83	534.69	5.442	
21	211.11	163.00	470.53	200.00	267.62	694.70	534.69	5.443	
22	212.16	163.00	471.05	200.00	268.26	694.74	534.69	5.444	
23	211.63	163.00	471.05	200.00	268.15	694.70	534.69	5.445	
24	213.74	163.00	470.00	200.00	268.94	686.63	526.53	5.445	
25	212.68	163.00	470.53	200.00	267.94	694.83	534.69	5.446	
26	209.53	163.00	470.00	200.00	265.10	707.11	546.94	5.447	
27	213.74	163.00	470.00	200.00	268.33	690.80	530.61	5.447	
28	209.53	163.00	470.53	200.00	266.11	702.90	542.86	5.448	
29	209.53	163.00	470.00	200.00	265.69	702.94	542.86	5.448	
30	210.58	163.00	470.00	200.00	265.91	703.03	542.86	5.449	
31	210.58	163.00	470.00	200.00	266.50	698.87	538.78	5.449	
32	214.79	163.26	470.00	200.00	272.06	670.24	510.20	5.449	
33	213.74	163.00	470.53	200.00	269.36	686.58	526.53	5.449	
34	210.58	163.00	470.53	200.00	266.92	698.82	538.78	5.450	
35	211.63	163.00	470.00	200.00	267.31	694.79	534.69	5.451	
36	214.26	163.09	470.53	200.00	270.83	678.36	518.37	5.451	
37	211.11	163.00	470.00	200.00	267.20	694.74	534.69	5.451	
38	211.63	163.00	470.00	200.00	266.71	698.95	538.78	5.451	
39	212.16	163.00	470.53	200.00	267.84	694.79	534.69	5.452	
40	213.21	163.00	470.00	200.00	267.63	694.92	534.69	5.452	
41	212.16	163.00	470.53	200.00	267.24	698.95	538.78	5.452	
42	212.16	163.00	470.00	200.00	268.01	690.66	530.61	5.453	
43	209.53	163.00	470.53	200.00	265.52	707.06	546.94	5.453	
44	212.68	163.00	470.00	200.00	267.52	694.87	534.69	5.454	
45	210.58	163.00	470.53	200.00	266.33	702.99	542.86	5.455	
46	212.68	163.00	471.05	200.00	268.96	690.62	530.61	5.455	
47	209.00	163.00	470.00	200.00	264.40	711.23	551.02	5.456	
48	209.53	163.00	471.05	200.00	266.53	702.86	542.86	5.456	
49	211.63	163.00	470.53	200.00	267.13	698.91	538.78	5.456	
50	213.74	163.00	470.53	200.00	268.75	690.75	530.61	5.457	
51	210.05	163.00	470.00	200.00	265.21	707.15	546.94	5.458	
52	215.32	163.44	470.00	200.00	273.70	662.07	502.04	5.458	
53	214.79	163.26	470.53	200.00	272.48	670.20	510.20	5.458	
54	210.58	163.00	471.05	200.00	267.34	698.78	538.78	5.458	
55	211.11	163.00	471.58	200.00	267.86	698.78	538.78	5.460	
56	213.21	163.00	470.53	200.00	268.65	690.71	530.61	5.460	
57	211.11	163.00	470.00	200.00	266.01	703.07	542.86	5.460	
58	214.26	163.09	470.00	200.00	269.81	682.57	522.45	5.461	
59	212.16	163.00	471.05	200.00	267.66	698.91	538.78	5.461	
60	214.26	163.09	470.00	200.00	269.21	686.74	526.53	5.461	
61	209.00	163.00	470.53	200.00	264.82	711.19	551.02	5.461	
62	213.21	163.00	470.53	200.00	268.05	694.87	534.69	5.462	
63	209.00	163.00	471.05	200.00	265.83	706.98	546.94	5.463	
64	212.16	163.00	470.00	200.00	266.82	699.00	538.78	5.463	
65	210.05	163.00	470.53	200.00	265.63	707.11	546.94	5.463	
66	213.21	163.00	471.05	200.00	269.07	690.66	530.61	5.463	
67	209.00	163.00	470.53	200.00	265.41	707.02	546.94	5.464	
68	210.05	163.00	471.05	200.00	266.64	702.90	542.86	5.464	

69	213.74	163.00	471.05	200.00	269.77	686.54	526.53	5.464
70	210.05	163.00	470.53	200.00	266.22	702.94	542.86	5.465
71	214.79	163.26	470.00	200.00	271.46	674.42	514.29	5.465
72	211.11	163.00	470.53	200.00	266.43	703.03	542.86	5.466
73	211.11	163.00	470.53	200.00	267.03	698.87	538.78	5.466
74	214.26	163.09	470.53	200.00	270.23	682.53	522.45	5.466
75	215.84	163.61	470.00	200.00	275.34	653.90	493.88	5.466
76	211.11	163.00	471.05	200.00	267.45	698.82	538.78	5.466
77	215.32	163.44	470.53	200.00	274.11	662.02	502.04	5.466
78	209.53	163.00	470.00	200.00	264.51	711.27	551.02	5.467
79	211.63	163.00	471.05	200.00	266.96	703.03	542.86	5.467
80	212.68	163.00	470.53	200.00	267.35	699.00	538.78	5.467
81	213.74	163.00	470.00	200.00	267.73	694.96	534.69	5.467
82	211.63	163.00	471.05	200.00	267.55	698.87	538.78	5.468
83	211.63	163.00	470.53	200.00	267.73	694.74	534.69	5.468
84	209.00	163.00	471.05	200.00	265.24	711.14	551.02	5.469
85	212.16	163.00	471.58	200.00	268.67	694.70	534.69	5.469
86	210.58	163.00	470.00	200.00	265.31	707.19	546.94	5.469
87	210.05	163.00	471.05	200.00	266.05	707.06	546.94	5.470
88	209.00	163.00	471.58	200.00	266.25	706.93	546.94	5.471
89	214.26	163.09	470.53	200.00	269.63	686.70	526.53	5.471
90	211.63	163.00	471.58	200.00	267.97	698.82	538.78	5.471
91	211.11	163.00	471.05	200.00	266.85	702.99	542.86	5.471
92	213.21	163.00	471.05	200.00	268.47	694.83	534.69	5.471
93	211.63	163.00	470.00	200.00	266.12	703.12	542.86	5.472
94	213.21	163.00	470.00	200.00	267.03	699.08	538.78	5.472
95	209.53	163.00	470.53	200.00	264.93	711.23	551.02	5.472
96	210.05	163.00	471.58	200.00	267.06	702.86	542.86	5.473
97	214.79	163.26	470.53	200.00	271.88	674.37	514.29	5.473
98	215.32	163.44	470.00	200.00	273.10	666.25	506.12	5.474
99	216.37	163.79	470.00	200.00	276.97	645.71	485.71	5.474

Critical Failure Surface (circle 1)

Intersects:	XL:	212.68	YL:	163.00	XR:	470.00	YR:	200.00	
	Centre:	XC:	268.72	YC:	686.54		Radius:	R:	526.53
Generated failure surface: (20 points)									
212.68	163.00		226.45	161.71		240.24	160.78	254.06	160.21
267.88	160.01								
281.70	160.17		295.52	160.69		309.31	161.58	323.08	162.82
336.81	164.43								
350.50	166.40		364.12	168.72		377.69	171.41	391.17	174.45
404.58	177.84								
417.88	181.58		431.09	185.67		444.18	190.11	457.16	194.88
470.00	200.00								

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	212.68	0.08	-5.4	1.32	1.32	3	100.00	18.0	11.45	2808.93
2132.07	1.01									
2	214.00	9.04	-5.4	6.22	6.25	3	100.00	18.0	1210.31	13425.59
2253.64	1.01									
3	220.22	25.59	-5.4	6.22	6.25	3	100.00	18.0	3414.31	13653.24
2479.33	1.01									
4	226.45	47.05	-3.9	6.90	6.91	3	100.00	18.0	6268.52	15322.16
2703.06	1.01									
5	233.35	66.11	-3.9	6.90	6.91	3	100.00	18.0	8797.19	15522.53
2927.04	1.01									
6	240.24	84.67	-2.3	6.91	6.91	3	100.00	18.0	11255.20	15683.74
3136.46	1.00									
7	247.15	102.53	-2.3	6.91	6.91	3	100.00	18.0	13614.00	15805.96
3334.78	1.00									
8	254.06	119.85	-0.8	6.91	6.91	3	100.00	18.0	15896.77	15888.96
3517.93	1.00									
9	260.97	136.48	-0.8	6.91	6.91	3	100.00	18.0	18081.99	15932.90
3690.47	1.00									
10	267.88	66.96	0.7	3.12	3.12	3	100.00	18.0	8864.27	7201.59
3807.08	1.00									
11	271.00	122.09	0.7	5.35	5.35	3	100.00	18.0	16150.19	12330.27
3897.00	1.00									
12	276.35	131.31	0.7	5.35	5.35	3	100.00	18.0	17354.10	12309.66
4010.58	1.00									
13	281.70	182.48	2.2	6.91	6.91	3	100.00	18.0	24091.97	15829.79
4124.52	1.00									
14	288.61	196.59	2.2	6.91	6.91	3	100.00	18.0	25921.09	15717.15
4245.33	1.00									
15	295.52	209.77	3.7	6.90	6.91	3	100.00	18.0	27623.52	15565.40
4349.49	1.00									
16	302.42	222.58	3.7	6.90	6.91	3	100.00	18.0	29271.13	15374.58

4444.39	1.00										
17	309.31	227.37	5.2	6.69	6.71	3	100.00	18.0	29860.00	14712.55	
4521.23	1.00										
18	316.00	252.68	5.2	7.08	7.11	3	100.00	18.0	33136.75	15308.15	
4663.44	1.00										
19	323.08	55.37	6.7	1.51	1.52	3	100.00	18.0	7254.22	3230.83	
4787.80	1.00										
20	324.59	223.93	6.7	6.11	6.15	2	0.00	35.0	29334.45	12916.68	
4759.85	0.99										
21	330.70	219.55	6.7	6.11	6.15	2	0.00	35.0	28761.61	12641.95	
4666.85	0.99										
22	336.81	205.39	8.2	5.84	5.90	2	0.00	35.0	26905.68	11842.83	
4557.06	0.99										
23	342.66	200.48	8.2	5.84	5.90	2	0.00	35.0	26262.36	11533.25	
4448.04	0.99										
24	348.50	67.40	8.2	2.00	2.02	5	0.00	45.0	7413.90	2823.34	
3652.11	0.98										
25	350.50	224.99	9.7	6.81	6.91	2	0.00	35.0	29473.69	2165.16	
4238.93	0.99										
26	357.31	217.06	9.7	6.81	6.91	2	0.00	35.0	28435.48	1663.47	
4088.29	0.99										
27	364.12	207.53	11.2	6.78	6.91	2	0.00	35.0	27185.84	1123.29	
3913.20	0.99										
28	370.91	198.43	11.2	6.78	6.91	2	0.00	35.0	25993.96	544.60	
3739.74	0.99										
29	377.69	74.33	12.7	2.63	2.69	2	0.00	35.0	9737.27	49.72	
3602.36	1.00										
30	380.31	148.72	12.7	5.43	5.57	2	0.00	35.0	19481.81	0.00	
3486.32	1.00										
31	385.74	142.07	12.7	5.43	5.57	2	0.00	35.0	18611.79	0.00	
3330.61	1.00										
32	391.17	165.56	14.2	6.70	6.91	2	0.00	35.0	21688.19	0.00	
3133.89	1.00										
33	397.87	154.20	14.2	6.70	6.91	2	0.00	35.0	20199.59	0.00	
2918.79	1.00										
34	404.58	141.25	15.7	6.65	6.91	2	0.00	35.0	18503.50	0.00	
2683.12	1.00										
35	411.23	128.80	15.7	6.65	6.91	2	0.00	35.0	16872.49	0.00	
2446.61	1.00										
36	417.88	24.69	17.2	1.36	1.42	2	0.00	35.0	3234.43	0.00	
2293.65	1.01										
37	419.24	101.21	17.2	5.92	6.20	1	150.00	22.0	13258.86	0.00	
2178.87	1.02										
38	425.17	90.34	17.2	5.92	6.20	1	150.00	22.0	11834.56	0.00	
1943.90	1.02										
39	431.09	86.56	18.7	6.55	6.91	1	150.00	22.0	11338.86	0.00	
1680.09	1.03										
40	437.64	72.04	18.7	6.55	6.91	1	150.00	22.0	9436.83	0.00	
1396.72	1.03										
41	444.18	56.43	20.2	6.49	6.91	1	150.00	22.0	7392.44	0.00	
1099.27	1.04										
42	450.67	40.94	20.2	6.49	6.91	1	150.00	22.0	5362.57	0.00	
794.70	1.04										
43	457.16	24.64	21.7	6.42	6.91	1	150.00	22.0	3228.00	0.00	
477.47	1.05										
44	463.58	8.21	21.7	6.42	6.91	1	150.00	22.0	1076.00	0.00	
152.01	1.05										

X-S Area:	5483.32	Path Length:	262.67	X-S Weight:	719101.12

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 8-1 Rapid Drawdown.gmf

Processed: 02 Dec 2020 15:11:08

DATA: Analysis 1 - Case 8-1 Rapid Drawdown

Material Properties (5 materials)

```

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

```

Water Properties

```

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

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Material Profiles (9 profiles)

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-----
Profile: 1 (2 points)  Material beneath: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    182.00      348.50    182.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    163.00      348.50    163.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    160.00      348.50    160.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      500.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    182.00      500.00    182.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    163.00      500.00    163.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    160.00      500.00    160.00

```

Slope Surface (4 points)

```

-----
100.00    163.00    214.00    163.00    325.00    200.00    500.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    163.00    214.00    163.00    316.00    197.00    348.50    197.00
351.50    172.00
500.00    172.00

```

Failure Surface

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

```

Intersects: XL: 214.00  YL: 163.00  XR: 475.00  YR: 200.00
Centre: XC: 276.80  YC: 659.04  Radius: R: 500.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00   10.00   200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-1 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.371

Analysis Summary

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

Critical (minimum) Factor of Safety: 3.15

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	212.68	163.00	470.00	200.00	268.72	686.54	526.53	3.147	
Critical Surface									
2	213.21	163.00	470.00	200.00	268.83	686.58	526.53	3.147	
3	209.53	163.00	470.00	200.00	266.28	698.78	538.78	3.147	
4	210.58	163.00	470.00	200.00	267.09	694.70	534.69	3.149	
5	209.00	163.00	470.00	200.00	265.59	702.90	542.86	3.151	
6	211.63	163.00	470.00	200.00	267.91	690.62	530.61	3.151	
7	210.05	163.00	470.00	200.00	266.39	698.82	538.78	3.152	
8	213.74	163.00	470.00	200.00	269.54	682.46	522.45	3.153	
9	209.00	163.00	470.00	200.00	264.99	707.06	546.94	3.154	
10	212.68	163.00	470.53	200.00	268.54	690.66	530.61	3.155	
11	212.16	163.00	470.53	200.00	268.43	690.62	530.61	3.155	
12	210.05	163.00	470.00	200.00	265.80	702.99	542.86	3.156	
13	209.00	163.00	470.53	200.00	266.00	702.86	542.86	3.156	
14	213.21	163.00	470.00	200.00	268.23	690.75	530.61	3.157	
15	210.05	163.00	470.53	200.00	266.81	698.78	538.78	3.157	
16	211.11	163.00	470.00	200.00	266.61	698.91	538.78	3.157	
17	211.11	163.00	470.53	200.00	267.62	694.70	534.69	3.159	
18	212.68	163.00	470.00	200.00	268.12	690.71	530.61	3.159	
19	212.16	163.00	470.00	200.00	267.42	694.83	534.69	3.160	
20	214.26	163.09	470.00	200.00	270.42	678.40	518.37	3.160	
21	209.53	163.00	470.00	200.00	265.10	707.11	546.94	3.161	
22	213.21	163.00	470.53	200.00	269.25	686.54	526.53	3.161	
23	209.53	163.00	470.00	200.00	265.69	702.94	542.86	3.161	
24	209.53	163.00	470.53	200.00	266.11	702.90	542.86	3.161	
25	210.58	163.00	470.00	200.00	266.50	698.87	538.78	3.162	
26	210.58	163.00	470.00	200.00	265.91	703.03	542.86	3.163	
27	210.58	163.00	470.53	200.00	266.92	698.82	538.78	3.163	
28	212.16	163.00	471.05	200.00	268.26	694.74	534.69	3.163	
29	211.11	163.00	470.00	200.00	267.20	694.74	534.69	3.164	
30	213.74	163.00	470.00	200.00	268.94	686.63	526.53	3.164	
31	211.63	163.00	471.05	200.00	268.15	694.70	534.69	3.164	
32	211.63	163.00	470.00	200.00	267.31	694.79	534.69	3.164	
33	209.53	163.00	470.53	200.00	265.52	707.06	546.94	3.165	
34	211.63	163.00	470.00	200.00	266.71	698.95	538.78	3.165	
35	212.68	163.00	470.53	200.00	267.94	694.83	534.69	3.165	
36	212.16	163.00	470.00	200.00	268.01	690.66	530.61	3.165	
37	209.00	163.00	470.00	200.00	264.40	711.23	551.02	3.166	
38	213.74	163.00	470.00	200.00	268.33	690.80	530.61	3.166	
39	213.74	163.00	470.53	200.00	269.36	686.58	526.53	3.166	
40	209.53	163.00	471.05	200.00	266.53	702.86	542.86	3.166	
41	210.58	163.00	470.53	200.00	266.33	702.99	542.86	3.166	
42	214.26	163.09	470.53	200.00	270.83	678.36	518.37	3.167	
43	214.79	163.26	470.00	200.00	272.06	670.24	510.20	3.167	
44	212.68	163.00	470.00	200.00	267.52	694.87	534.69	3.167	
45	210.05	163.00	470.00	200.00	265.21	707.15	546.94	3.168	
46	210.58	163.00	471.05	200.00	267.34	698.78	538.78	3.168	
47	211.63	163.00	470.53	200.00	267.13	698.91	538.78	3.168	
48	212.16	163.00	470.53	200.00	267.84	694.79	534.69	3.169	
49	209.00	163.00	470.53	200.00	264.82	711.19	551.02	3.169	
50	212.68	163.00	471.05	200.00	268.96	690.62	530.61	3.169	
51	213.21	163.00	470.00	200.00	267.63	694.92	534.69	3.169	
52	212.16	163.00	470.53	200.00	267.24	698.95	538.78	3.169	
53	209.00	163.00	471.05	200.00	265.83	706.98	546.94	3.170	
54	211.11	163.00	470.00	200.00	266.01	703.07	542.86	3.170	
55	209.00	163.00	470.53	200.00	265.41	707.02	546.94	3.170	
56	213.74	163.00	470.53	200.00	268.75	690.75	530.61	3.171	
57	210.05	163.00	470.53	200.00	265.63	707.11	546.94	3.171	
58	210.05	163.00	470.53	200.00	266.22	702.94	542.86	3.171	
59	210.05	163.00	471.05	200.00	266.64	702.90	542.86	3.171	
60	212.16	163.00	470.00	200.00	266.82	699.00	538.78	3.172	
61	214.79	163.26	470.53	200.00	272.48	670.20	510.20	3.172	
62	211.11	163.00	471.58	200.00	267.86	698.78	538.78	3.173	
63	209.53	163.00	470.00	200.00	264.51	711.27	551.02	3.173	
64	213.21	163.00	470.53	200.00	268.65	690.71	530.61	3.173	
65	211.11	163.00	470.53	200.00	267.03	698.87	538.78	3.173	
66	211.11	163.00	470.53	200.00	266.43	703.03	542.86	3.173	
67	211.11	163.00	471.05	200.00	267.45	698.82	538.78	3.173	
68	214.26	163.09	470.00	200.00	269.81	682.57	522.45	3.173	

69	215.32	163.44	470.00	200.00	273.70	662.07	502.04	3.174
70	212.16	163.00	471.05	200.00	267.66	698.91	538.78	3.174
71	209.00	163.00	471.05	200.00	265.24	711.14	551.02	3.174
72	213.21	163.00	471.05	200.00	269.07	690.66	530.61	3.174
73	213.21	163.00	470.53	200.00	268.05	694.87	534.69	3.174
74	214.26	163.09	470.00	200.00	269.21	686.74	526.53	3.174
75	213.74	163.00	471.05	200.00	269.77	686.54	526.53	3.174
76	211.63	163.00	470.53	200.00	267.73	694.74	534.69	3.174
77	209.00	163.00	471.58	200.00	266.25	706.93	546.94	3.175
78	210.58	163.00	470.00	200.00	265.31	707.19	546.94	3.175
79	210.05	163.00	471.05	200.00	266.05	707.06	546.94	3.175
80	214.26	163.09	470.53	200.00	270.23	682.53	522.45	3.176
81	209.53	163.00	470.53	200.00	264.93	711.23	551.02	3.176
82	210.05	163.00	471.58	200.00	267.06	702.86	542.86	3.177
83	214.79	163.26	470.00	200.00	271.46	674.42	514.29	3.177
84	211.11	163.00	471.05	200.00	266.85	702.99	542.86	3.177
85	211.63	163.00	470.00	200.00	266.12	703.12	542.86	3.177
86	212.16	163.00	471.58	200.00	268.67	694.70	534.69	3.177
87	209.00	163.00	470.00	200.00	263.81	715.39	555.10	3.177
88	211.63	163.00	471.05	200.00	267.55	698.87	538.78	3.178
89	212.68	163.00	470.53	200.00	267.35	699.00	538.78	3.178
90	211.63	163.00	471.05	200.00	266.96	703.03	542.86	3.178
91	213.74	163.00	470.00	200.00	267.73	694.96	534.69	3.178
92	210.58	163.00	470.53	200.00	265.73	707.15	546.94	3.178
93	215.32	163.44	470.53	200.00	274.11	662.02	502.04	3.179
94	211.63	163.00	471.58	200.00	267.97	698.82	538.78	3.179
95	213.21	163.00	471.05	200.00	268.47	694.83	534.69	3.179
96	212.68	163.00	470.00	200.00	266.92	699.04	538.78	3.179
97	209.53	163.00	471.05	200.00	265.35	711.19	551.02	3.180
98	214.26	163.09	470.53	200.00	269.63	686.70	526.53	3.180
99	210.05	163.00	470.00	200.00	264.61	711.31	551.02	3.180

Critical Failure Surface (circle 1)

Intersects:	XL:	212.68	YL:	163.00	XR:	470.00	YR:	200.00	
	Centre:	XC:	268.72	YC:	686.54		Radius:	R:	526.53
Generated failure surface: (20 points)									
212.68	163.00		226.45	161.71		240.24	160.78	254.06	160.21
267.88	160.01								
281.70	160.17		295.52	160.69		309.31	161.58	323.08	162.82
336.81	164.43								
350.50	166.40		364.12	168.72		377.69	171.41	391.17	174.45
404.58	177.84								
417.88	181.58		431.09	185.67		444.18	190.11	457.16	194.88
470.00	200.00								

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	212.68	0.08	-5.4	1.32	1.32	3	100.00	18.0	11.45	5.09
11.76	1.01									
2	214.00	9.04	-5.4	6.22	6.25	3	100.00	18.0	1210.31	566.68
198.47	1.01									
3	220.22	25.59	-5.4	6.22	6.25	3	100.00	18.0	3414.31	1603.75
554.40	1.01									
4	226.45	47.05	-3.9	6.90	6.91	3	100.00	18.0	6268.52	2942.54
914.45	1.01									
5	233.35	66.11	-3.9	6.90	6.91	3	100.00	18.0	8797.19	4134.47
1282.45	1.01									
6	240.24	84.67	-2.3	6.91	6.91	3	100.00	18.0	11255.20	5288.02
1634.63	1.01									
7	247.15	102.53	-2.3	6.91	6.91	3	100.00	18.0	13614.00	6403.21
1976.92	1.01									
8	254.06	119.85	-0.8	6.91	6.91	3	100.00	18.0	15896.77	7479.61
2302.34	1.00									
9	260.97	136.48	-0.8	6.91	6.91	3	100.00	18.0	18081.99	8517.27
2618.75	1.00									
10	267.88	66.96	0.7	3.12	3.12	3	100.00	18.0	8864.27	4178.46
2837.72	1.00									
11	271.00	122.09	0.7	5.35	5.35	3	100.00	18.0	16150.19	7618.92
3015.70	1.00									
12	276.35	131.31	0.7	5.35	5.35	3	100.00	18.0	17354.10	8193.99
3240.54	1.00									
13	281.70	182.48	2.2	6.91	6.91	3	100.00	18.0	24091.97	11395.18
3479.48	1.00									
14	288.61	196.59	2.2	6.91	6.91	3	100.00	18.0	25921.09	12275.67
3743.75	1.00									
15	295.52	209.77	3.7	6.90	6.91	3	100.00	18.0	27623.52	13116.39
3988.57	1.00									
16	302.42	222.58	3.7	6.90	6.91	3	100.00	18.0	29271.13	13917.38

4226.61	1.00										
17	309.31	227.37	5.2	6.69	6.71	3	100.00	18.0	29860.00	14245.74	
4441.46	0.99										
18	316.00	252.68	5.2	7.08	7.11	3	100.00	18.0	33136.75	15308.15	
4652.50	0.99										
19	323.08	55.37	6.7	1.51	1.52	3	100.00	18.0	7254.22	3230.83	
4772.94	0.99										
20	324.59	223.93	6.7	6.11	6.15	2	0.00	35.0	29334.45	12916.68	
4731.55	0.98										
21	330.70	219.55	6.7	6.11	6.15	2	0.00	35.0	28761.61	12641.95	
4639.06	0.98										
22	336.81	205.39	8.2	5.84	5.90	2	0.00	35.0	26905.68	11842.83	
4523.93	0.98										
23	342.66	200.48	8.2	5.84	5.90	2	0.00	35.0	26262.36	11533.25	
4415.64	0.98										
24	348.50	67.40	8.2	2.00	2.02	5	0.00	45.0	7413.90	2823.34	
3610.86	0.97										
25	350.50	224.99	9.7	6.81	6.91	2	0.00	35.0	29473.69	2165.16	
4178.75	0.98										
26	357.31	217.06	9.7	6.81	6.91	2	0.00	35.0	28435.48	1663.47	
4029.30	0.98										
27	364.12	207.53	11.2	6.78	6.91	2	0.00	35.0	27185.84	1123.29	
3846.94	0.98										
28	370.91	198.43	11.2	6.78	6.91	2	0.00	35.0	25993.96	544.60	
3675.07	0.98										
29	377.69	74.33	12.7	2.63	2.69	2	0.00	35.0	9737.27	49.72	
3530.69	0.98										
30	380.31	148.72	12.7	5.43	5.57	2	0.00	35.0	19481.81	0.00	
3416.60	0.98										
31	385.74	142.07	12.7	5.43	5.57	2	0.00	35.0	18611.79	0.00	
3264.00	0.98										
32	391.17	165.56	14.2	6.70	6.91	2	0.00	35.0	21688.19	0.00	
3063.91	0.98										
33	397.87	154.20	14.2	6.70	6.91	2	0.00	35.0	20199.59	0.00	
2853.61	0.98										
34	404.58	141.25	15.7	6.65	6.91	2	0.00	35.0	18503.50	0.00	
2616.93	0.98										
35	411.23	128.80	15.7	6.65	6.91	2	0.00	35.0	16872.49	0.00	
2386.26	0.98										
36	417.88	24.69	17.2	1.36	1.42	2	0.00	35.0	3234.43	0.00	
2231.69	0.98										
37	419.24	101.21	17.2	5.92	6.20	1	150.00	22.0	13258.86	0.00	
2138.01	1.01										
38	425.17	90.34	17.2	5.92	6.20	1	150.00	22.0	11834.56	0.00	
1906.80	1.01										
39	431.09	86.56	18.7	6.55	6.91	1	150.00	22.0	11338.86	0.00	
1644.27	1.01										
40	437.64	72.04	18.7	6.55	6.91	1	150.00	22.0	9436.83	0.00	
1365.85	1.01										
41	444.18	56.43	20.2	6.49	6.91	1	150.00	22.0	7392.44	0.00	
1071.45	1.02										
42	450.67	40.94	20.2	6.49	6.91	1	150.00	22.0	5362.57	0.00	
772.64	1.02										
43	457.16	24.64	21.7	6.42	6.91	1	150.00	22.0	3228.00	0.00	
460.17	1.02										
44	463.58	8.21	21.7	6.42	6.91	1	150.00	22.0	1076.00	0.00	
141.34	1.02										

X-S Area:	5483.32	Path Length:	262.67	X-S Weight:	719101.12

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 8-2 Full Reservoir.gmf

Processed: 02 Dec 2020 15:24:10

DATA: Analysis 1 - Case 8-2 Full Reservoir

Material Properties (5 materials)

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

```

Water Properties

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

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Material Profiles (9 profiles)

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-----
Profile: 1 (2 points)   Material beneath: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    198.00        348.50    198.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    162.00        348.50    162.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    159.00        348.50    159.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    198.00        450.00    198.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    162.00        450.00    162.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    159.00        450.00    159.00

```

Slope Surface (4 points)

```

-----
100.00    162.00        211.00    162.00        325.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00        211.00    197.00        316.00    197.00        348.50    197.00
351.50    172.00
450.00    172.00

```

Failure Surface

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

```

Intersects: XL: 211.00    YL: 162.00    XR: 390.00    YR: 200.00
Centre: XC: 252.19    YC: 408.58    Radius: R: 250.00

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Variable Restraints

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Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-2 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.099

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.93

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	210.21	162.00	385.00	200.00	248.47	406.99	247.96	2.931	
Critical Surface									
2	212.32	162.44	385.00	200.00	252.21	394.75	235.71	2.933	
3	212.84	162.61	385.00	200.00	253.46	390.66	231.63	2.933	
4	211.26	162.09	385.00	200.00	249.72	402.91	243.88	2.934	
5	213.37	162.79	385.00	200.00	254.70	386.55	227.55	2.935	
6	208.63	162.00	385.00	200.00	247.25	411.07	252.04	2.935	
7	213.89	162.96	385.00	200.00	255.95	382.44	223.47	2.935	
8	207.05	162.00	385.00	200.00	246.03	415.14	256.12	2.937	
9	210.74	162.00	385.00	200.00	248.57	407.06	247.96	2.938	
10	211.79	162.26	385.00	200.00	250.96	398.84	239.80	2.939	
11	209.16	162.00	385.00	200.00	247.35	411.13	252.04	2.941	
12	209.68	162.00	385.00	200.00	247.45	411.20	252.04	2.942	
13	207.58	162.00	385.00	200.00	246.13	415.20	256.12	2.943	
14	207.58	162.00	385.53	200.00	246.55	415.14	256.12	2.945	
15	206.00	162.00	385.00	200.00	244.92	419.28	260.20	2.945	
16	210.74	162.00	385.53	200.00	249.00	406.99	247.96	2.947	
17	209.16	162.00	385.53	200.00	247.77	411.07	252.04	2.948	
18	208.11	162.00	385.00	200.00	246.23	415.27	256.12	2.949	
19	210.21	162.00	385.00	200.00	247.55	411.26	252.04	2.949	
20	212.84	162.61	385.00	200.00	252.52	394.96	235.71	2.950	
21	212.32	162.44	385.00	200.00	251.28	399.05	239.80	2.951	
22	206.53	162.00	385.00	200.00	245.02	419.34	260.20	2.951	
23	211.79	162.26	385.00	200.00	250.03	403.12	243.88	2.951	
24	208.11	162.00	385.53	200.00	246.65	415.20	256.12	2.952	
25	206.00	162.00	385.53	200.00	245.34	419.21	260.20	2.953	
26	213.89	162.96	385.00	200.00	255.01	386.77	227.55	2.953	
27	211.26	162.09	385.00	200.00	248.78	407.19	247.96	2.953	
28	214.42	163.14	385.00	200.00	256.26	382.66	223.47	2.954	
29	208.63	162.00	385.00	200.00	246.33	415.33	256.12	2.954	
30	209.68	162.00	385.53	200.00	247.87	411.13	252.04	2.955	
31	214.95	163.32	385.00	200.00	257.50	378.54	219.39	2.955	
32	215.47	163.49	385.00	200.00	258.75	374.40	215.31	2.956	
33	216.00	163.67	385.00	200.00	259.99	370.26	211.22	2.956	
34	210.74	162.00	385.00	200.00	247.64	411.32	252.04	2.956	
35	207.05	162.00	385.00	200.00	245.12	419.41	260.20	2.957	
36	213.37	162.79	385.00	200.00	253.77	390.87	231.63	2.957	
37	206.53	162.00	385.53	200.00	245.44	419.28	260.20	2.958	
38	212.32	162.44	385.53	200.00	251.70	398.98	239.80	2.958	
39	211.79	162.26	385.53	200.00	250.45	403.06	243.88	2.959	
40	209.68	162.00	385.00	200.00	246.52	415.46	256.12	2.959	
41	208.63	162.00	385.53	200.00	246.75	415.27	256.12	2.959	
42	209.16	162.00	385.00	200.00	246.43	415.40	256.12	2.960	
43	210.21	162.00	385.53	200.00	247.97	411.20	252.04	2.961	
44	211.26	162.09	385.53	200.00	249.21	407.13	247.96	2.961	
45	213.37	162.79	385.53	200.00	254.19	390.80	231.63	2.961	
46	207.58	162.00	385.00	200.00	245.21	419.47	260.20	2.962	
47	209.68	162.00	386.05	200.00	248.30	411.07	252.04	2.962	
48	213.89	162.96	385.53	200.00	255.43	386.69	227.55	2.962	
49	206.53	162.00	386.05	200.00	245.87	419.21	260.20	2.963	
50	214.42	163.14	385.53	200.00	256.67	382.58	223.47	2.963	
51	208.11	162.00	386.05	200.00	247.08	415.14	256.12	2.964	
52	207.05	162.00	385.53	200.00	245.54	419.34	260.20	2.964	
53	214.95	163.32	385.53	200.00	257.91	378.45	219.39	2.964	
54	206.00	162.00	385.00	200.00	244.01	423.54	264.29	2.964	
55	215.47	163.49	385.53	200.00	259.16	374.32	215.31	2.965	
56	212.84	162.61	385.53	200.00	252.94	394.89	235.71	2.965	
57	210.21	162.00	385.00	200.00	246.62	415.52	256.12	2.966	
58	210.74	162.00	385.53	200.00	248.07	411.26	252.04	2.966	
59	209.16	162.00	385.53	200.00	246.85	415.33	256.12	2.967	
60	211.79	162.26	386.05	200.00	250.88	402.99	243.88	2.967	
61	208.11	162.00	385.00	200.00	245.31	419.53	260.20	2.967	
62	210.21	162.00	386.05	200.00	248.40	411.13	252.04	2.968	
63	211.26	162.09	386.05	200.00	249.63	407.06	247.96	2.969	
64	212.84	162.61	386.05	200.00	253.36	394.82	235.71	2.969	
65	206.53	162.00	385.00	200.00	244.11	423.60	264.29	2.970	
66	207.58	162.00	385.53	200.00	245.64	419.41	260.20	2.970	
67	208.63	162.00	386.05	200.00	247.18	415.20	256.12	2.970	
68	207.05	162.00	386.05	200.00	245.97	419.28	260.20	2.970	

69	208.11	162.00	385.53	200.00	245.74	419.47	260.20	2.970
70	211.79	162.26	385.00	200.00	249.10	407.40	247.96	2.970
71	211.26	162.09	385.00	200.00	247.85	411.46	252.04	2.971
72	213.37	162.79	386.05	200.00	254.60	390.72	231.63	2.971
73	212.32	162.44	385.00	200.00	250.34	403.33	243.88	2.971
74	212.84	162.61	385.00	200.00	251.59	399.26	239.80	2.971
75	213.37	162.79	385.00	200.00	252.84	395.18	235.71	2.972
76	213.89	162.96	386.05	200.00	255.84	386.62	227.55	2.972
77	206.00	162.00	385.53	200.00	244.44	423.48	264.29	2.972
78	214.42	163.14	385.00	200.00	255.32	386.99	227.55	2.972
79	208.63	162.00	385.00	200.00	245.41	419.59	260.20	2.972
80	213.89	162.96	385.00	200.00	254.08	391.09	231.63	2.972
81	210.74	162.00	385.00	200.00	246.72	415.58	256.12	2.972
82	214.42	163.14	386.05	200.00	257.09	382.50	223.47	2.973
83	214.95	163.32	386.05	200.00	258.33	378.37	219.39	2.973
84	209.68	162.00	385.53	200.00	246.95	415.40	256.12	2.973
85	212.32	162.44	386.05	200.00	252.12	398.91	239.80	2.974
86	206.00	162.00	386.05	200.00	244.87	423.41	264.29	2.974
87	207.05	162.00	385.00	200.00	244.21	423.66	264.29	2.975
88	210.74	162.00	386.05	200.00	248.50	411.20	252.04	2.975
89	215.47	163.49	385.00	200.00	257.81	378.76	219.39	2.975
90	209.16	162.00	386.05	200.00	247.28	415.27	256.12	2.976
91	210.21	162.00	386.58	200.00	248.83	411.07	252.04	2.976
92	216.00	163.67	385.00	200.00	259.05	374.62	215.31	2.977
93	208.63	162.00	385.53	200.00	245.84	419.53	260.20	2.977
94	208.63	162.00	386.58	200.00	247.61	415.14	256.12	2.977
95	207.58	162.00	386.05	200.00	246.07	419.34	260.20	2.977
96	206.53	162.00	385.53	200.00	244.54	423.54	264.29	2.977
97	209.16	162.00	385.00	200.00	245.51	419.65	260.20	2.977
98	212.32	162.44	386.58	200.00	252.54	398.84	239.80	2.978
99	211.26	162.09	386.58	200.00	250.06	406.99	247.96	2.978

Critical Failure Surface (circle 1)

Intersects:	XL:	210.21	YL:	162.00	XR:	385.00	YR:	200.00	
	Centre:	XC:	248.47	YC:	406.99		Radius:	R:	247.96
Generated failure surface: (20 points)									
210.21	162.00		219.75	160.70		229.34	159.77	238.95	159.21
248.58	159.03								
258.21	159.22		267.83	159.79		277.41	160.72	286.95	162.03
296.44	163.71								
305.85	165.76		315.17	168.17		324.40	170.94	333.50	174.07
342.49	177.54								
351.32	181.37		360.01	185.53		368.52	190.03	376.86	194.85
385.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 42 slices)

Slice		X-S		Base					PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	210.21	0.04	-7.8	0.79	0.80	3	100.00	18.0	5.99	1742.84
2196.38	1.02									
2	211.00	4.97	-7.8	4.38	4.42	3	100.00	18.0	668.74	9758.71
2297.27	1.02									
3	215.38	13.97	-7.8	4.38	4.42	3	100.00	18.0	1873.38	9923.18
2483.74	1.02									
4	219.75	25.16	-5.5	4.79	4.82	3	100.00	18.0	3369.87	10977.73
2662.60	1.02									
5	224.55	35.05	-5.5	4.79	4.82	3	100.00	18.0	4687.12	11117.43
2839.32	1.02									
6	229.34	44.63	-3.3	4.81	4.82	3	100.00	18.0	5960.67	11228.93
2998.71	1.01									
7	234.15	53.67	-3.3	4.81	4.82	3	100.00	18.0	7158.48	11312.52
3148.74	1.01									
8	238.95	62.36	-1.1	4.81	4.82	3	100.00	18.0	8306.08	11368.08
3280.29	1.00									
9	243.77	70.53	-1.1	4.81	4.82	3	100.00	18.0	9380.32	11395.55
3403.51	1.00									
10	248.58	78.25	1.1	4.81	4.82	3	100.00	18.0	10391.00	11395.04
3507.29	1.00									
11	253.40	85.51	1.1	4.81	4.82	3	100.00	18.0	11338.25	11366.30
3603.67	1.00									
12	258.21	92.18	3.4	4.81	4.82	3	100.00	18.0	12202.51	11309.36
3679.76	1.00									
13	263.02	98.53	3.4	4.81	4.82	3	100.00	18.0	13020.07	11224.47
3749.28	1.00									
14	267.83	104.09	5.6	4.79	4.82	3	100.00	18.0	13731.30	11111.72
3797.79	0.99									
15	272.62	109.50	5.6	4.79	4.82	3	100.00	18.0	14417.35	10970.80
3840.47	0.99									
16	277.41	110.95	7.8	4.65	4.69	3	100.00	18.0	14578.40	10526.95

3861.37	0.99									
17	282.06	115.18	7.8	4.65	4.69	3	100.00	18.0	15103.85	10340.26
3876.87	0.99									
18	286.71	124.65	9.9	4.86	4.94	2	0.00	35.0	16328.63	10655.05
3845.09	0.97									
19	291.57	128.34	10.0	4.86	4.94	2	0.00	35.0	16813.14	10393.31
3840.62	0.97									
20	296.44	127.23	12.3	4.71	4.82	2	0.00	35.0	16667.37	9848.64
3808.49	0.97									
21	301.14	129.80	12.3	4.71	4.82	2	0.00	35.0	17003.63	9541.25
3780.22	0.97									
22	305.85	130.69	14.5	4.66	4.82	2	0.00	35.0	17120.23	9206.40
3723.00	0.97									
23	310.51	132.32	14.5	4.66	4.82	2	0.00	35.0	17333.45	8844.34
3670.36	0.97									
24	315.17	23.68	16.7	0.83	0.87	2	0.00	35.0	3101.56	1550.03
3619.94	0.97									
25	316.00	85.90	16.7	3.00	3.13	2	0.00	35.0	11252.41	5498.71
3617.21	0.97									
26	319.00	155.22	16.7	5.40	5.63	2	0.00	35.0	20333.81	9445.53
3628.88	0.97									
27	324.40	128.81	18.9	4.55	4.82	2	0.00	35.0	16873.50	7596.17
3543.44	0.98									
28	328.95	121.69	18.9	4.55	4.82	2	0.00	35.0	15940.83	7126.47
3346.79	0.98									
29	333.50	112.56	21.2	4.49	4.82	2	0.00	35.0	14744.90	6630.27
3122.13	0.98									
30	337.99	104.75	21.2	4.49	4.82	2	0.00	35.0	13722.02	6107.79
2904.44	0.98									
31	342.49	65.58	23.4	3.01	3.28	2	0.00	35.0	8590.92	3845.27
2699.03	0.99									
32	345.49	61.67	23.4	3.01	3.28	2	0.00	35.0	8078.42	3579.29
2536.97	0.99									
33	348.50	37.38	23.4	1.92	2.10	5	0.00	45.0	4111.66	1101.74
1930.95	0.95									
34	350.42	16.98	23.4	0.90	0.98	5	0.00	45.0	1867.87	0.00
1804.75	0.95									
35	351.32	76.39	25.6	4.34	4.82	2	0.00	35.0	10006.65	0.00
2067.72	1.00									
36	355.67	67.35	25.6	4.34	4.82	2	0.00	35.0	8822.34	0.00
1823.00	1.00									
37	360.01	56.82	27.8	4.26	4.82	2	0.00	35.0	7443.46	0.00
1552.26	1.00									
38	364.27	47.24	27.8	4.26	4.82	2	0.00	35.0	6188.93	0.00
1290.64	1.00									
39	368.52	36.53	30.1	4.17	4.82	2	0.00	35.0	4784.88	0.00
1008.65	1.02									
40	372.69	26.47	30.1	4.17	4.82	2	0.00	35.0	3467.64	0.00
730.98	1.02									
41	376.86	17.78	32.3	4.98	5.89	2	0.00	35.0	2329.17	0.00
406.62	1.03									
42	381.84	3.16	32.3	3.16	3.74	1	150.00	22.0	414.52	0.00
90.74	1.09									

X-S Area:	----- 3123.54	Path Length:	----- 182.99	X-S Weight:	----- 409535.38

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 8-2 Rapid Drawdown.gmf

Processed: 02 Dec 2020 15:23:32

DATA: Analysis 1 - Case 8-2 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    198.00        348.50    198.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    162.00        348.50    162.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    159.00        348.50    159.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    198.00        450.00    198.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    162.00        450.00    162.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    159.00        450.00    159.00

```

Slope Surface (4 points)

```

-----
100.00    162.00        211.00    162.00        325.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    162.00        211.00    162.00        316.00    197.00        348.50    197.00
351.50    172.00
450.00    172.00

```

Failure Surface

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

```

Intersects: XL: 211.00    YL: 162.00    XR: 390.00    YR: 200.00
Centre: XC: 252.19    YC: 408.58    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-2 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.303

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.61

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	210.21	162.00	385.00	200.00	248.47	406.99	247.96	1.607	
Critical Surface									
2	211.26	162.09	385.00	200.00	249.72	402.91	243.88	1.608	
3	212.32	162.44	385.00	200.00	252.21	394.75	235.71	1.608	
4	208.63	162.00	385.00	200.00	247.25	411.07	252.04	1.608	
5	212.84	162.61	385.00	200.00	253.46	390.66	231.63	1.609	
6	207.05	162.00	385.00	200.00	246.03	415.14	256.12	1.609	
7	213.37	162.79	385.00	200.00	254.70	386.55	227.55	1.610	
8	213.89	162.96	385.00	200.00	255.95	382.44	223.47	1.610	
9	211.79	162.26	385.00	200.00	250.96	398.84	239.80	1.611	
10	210.74	162.00	385.00	200.00	248.57	407.06	247.96	1.611	
11	209.16	162.00	385.00	200.00	247.35	411.13	252.04	1.612	
12	207.58	162.00	385.00	200.00	246.13	415.20	256.12	1.613	
13	209.68	162.00	385.00	200.00	247.45	411.20	252.04	1.614	
14	206.00	162.00	385.00	200.00	244.92	419.28	260.20	1.614	
15	207.58	162.00	385.53	200.00	246.55	415.14	256.12	1.615	
16	210.74	162.00	385.53	200.00	249.00	406.99	247.96	1.616	
17	208.11	162.00	385.00	200.00	246.23	415.27	256.12	1.617	
18	209.16	162.00	385.53	200.00	247.77	411.07	252.04	1.617	
19	206.53	162.00	385.00	200.00	245.02	419.34	260.20	1.618	
20	210.21	162.00	385.00	200.00	247.55	411.26	252.04	1.618	
21	206.00	162.00	385.53	200.00	245.34	419.21	260.20	1.619	
22	212.84	162.61	385.00	200.00	252.52	394.96	235.71	1.619	
23	211.79	162.26	385.00	200.00	250.03	403.12	243.88	1.619	
24	212.32	162.44	385.00	200.00	251.28	399.05	239.80	1.619	
25	208.11	162.00	385.53	200.00	246.65	415.20	256.12	1.620	
26	211.26	162.09	385.00	200.00	248.78	407.19	247.96	1.620	
27	208.63	162.00	385.00	200.00	246.33	415.33	256.12	1.620	
28	209.68	162.00	385.53	200.00	247.87	411.13	252.04	1.620	
29	207.05	162.00	385.00	200.00	245.12	419.41	260.20	1.621	
30	213.89	162.96	385.00	200.00	255.01	386.77	227.55	1.621	
31	206.53	162.00	385.53	200.00	245.44	419.28	260.20	1.622	
32	210.74	162.00	385.00	200.00	247.64	411.32	252.04	1.622	
33	214.42	163.14	385.00	200.00	256.26	382.66	223.47	1.622	
34	214.95	163.32	385.00	200.00	257.50	378.54	219.39	1.623	
35	213.37	162.79	385.00	200.00	253.77	390.87	231.63	1.623	
36	209.16	162.00	385.00	200.00	246.43	415.40	256.12	1.624	
37	212.32	162.44	385.53	200.00	251.70	398.98	239.80	1.624	
38	211.79	162.26	385.53	200.00	250.45	403.06	243.88	1.624	
39	208.63	162.00	385.53	200.00	246.75	415.27	256.12	1.624	
40	215.47	163.49	385.00	200.00	258.75	374.40	215.31	1.624	
41	210.21	162.00	385.53	200.00	247.97	411.20	252.04	1.624	
42	216.00	163.67	385.00	200.00	259.99	370.26	211.22	1.624	
43	207.58	162.00	385.00	200.00	245.21	419.47	260.20	1.625	
44	209.68	162.00	385.00	200.00	246.52	415.46	256.12	1.625	
45	211.26	162.09	385.53	200.00	249.21	407.13	247.96	1.625	
46	209.68	162.00	386.05	200.00	248.30	411.07	252.04	1.625	
47	206.53	162.00	386.05	200.00	245.87	419.21	260.20	1.626	
48	208.11	162.00	386.05	200.00	247.08	415.14	256.12	1.626	
49	207.05	162.00	385.53	200.00	245.54	419.34	260.20	1.626	
50	206.00	162.00	385.00	200.00	244.01	423.54	264.29	1.626	
51	213.37	162.79	385.53	200.00	254.19	390.80	231.63	1.626	
52	213.89	162.96	385.53	200.00	255.43	386.69	227.55	1.627	
53	208.11	162.00	385.00	200.00	245.31	419.53	260.20	1.628	
54	210.74	162.00	385.53	200.00	248.07	411.26	252.04	1.628	
55	214.42	163.14	385.53	200.00	256.67	382.58	223.47	1.628	
56	212.84	162.61	385.53	200.00	252.94	394.89	235.71	1.628	
57	209.16	162.00	385.53	200.00	246.85	415.33	256.12	1.628	
58	211.79	162.26	386.05	200.00	250.88	402.99	243.88	1.629	
59	210.21	162.00	385.00	200.00	246.62	415.52	256.12	1.629	
60	214.95	163.32	385.53	200.00	257.91	378.45	219.39	1.629	
61	210.21	162.00	386.05	200.00	248.40	411.13	252.04	1.629	
62	206.53	162.00	385.00	200.00	244.11	423.60	264.29	1.629	
63	207.58	162.00	385.53	200.00	245.64	419.41	260.20	1.629	
64	215.47	163.49	385.53	200.00	259.16	374.32	215.31	1.629	
65	208.63	162.00	386.05	200.00	247.18	415.20	256.12	1.630	
66	211.26	162.09	386.05	200.00	249.63	407.06	247.96	1.630	
67	207.05	162.00	386.05	200.00	245.97	419.28	260.20	1.630	
68	206.00	162.00	385.53	200.00	244.44	423.48	264.29	1.630	

69	212.84	162.61	386.05	200.00	253.36	394.82	235.71	1.631
70	208.11	162.00	385.53	200.00	245.74	419.47	260.20	1.631
71	211.79	162.26	385.00	200.00	249.10	407.40	247.96	1.631
72	211.26	162.09	385.00	200.00	247.85	411.46	252.04	1.631
73	208.63	162.00	385.00	200.00	245.41	419.59	260.20	1.631
74	212.32	162.44	385.00	200.00	250.34	403.33	243.88	1.632
75	213.37	162.79	386.05	200.00	254.60	390.72	231.63	1.632
76	209.68	162.00	385.53	200.00	246.95	415.40	256.12	1.632
77	212.84	162.61	385.00	200.00	251.59	399.26	239.80	1.632
78	207.05	162.00	385.00	200.00	244.21	423.66	264.29	1.632
79	210.74	162.00	385.00	200.00	246.72	415.58	256.12	1.633
80	213.89	162.96	386.05	200.00	255.84	386.62	227.55	1.633
81	213.37	162.79	385.00	200.00	252.84	395.18	235.71	1.633
82	212.32	162.44	386.05	200.00	252.12	398.91	239.80	1.633
83	210.74	162.00	386.05	200.00	248.50	411.20	252.04	1.633
84	206.00	162.00	386.05	200.00	244.87	423.41	264.29	1.633
85	209.16	162.00	386.05	200.00	247.28	415.27	256.12	1.633
86	213.89	162.96	385.00	200.00	254.08	391.09	231.63	1.633
87	214.42	163.14	386.05	200.00	257.09	382.50	223.47	1.634
88	214.42	163.14	385.00	200.00	255.32	386.99	227.55	1.634
89	210.21	162.00	386.58	200.00	248.83	411.07	252.04	1.634
90	206.53	162.00	385.53	200.00	244.54	423.54	264.29	1.634
91	207.58	162.00	386.05	200.00	246.07	419.34	260.20	1.634
92	208.63	162.00	386.58	200.00	247.61	415.14	256.12	1.634
93	214.95	163.32	386.05	200.00	258.33	378.37	219.39	1.634
94	209.16	162.00	385.00	200.00	245.51	419.65	260.20	1.634
95	208.63	162.00	385.53	200.00	245.84	419.53	260.20	1.635
96	211.26	162.09	386.58	200.00	250.06	406.99	247.96	1.635
97	207.05	162.00	386.58	200.00	246.39	419.21	260.20	1.635
98	207.58	162.00	385.00	200.00	244.30	423.72	264.29	1.635
99	212.32	162.44	386.58	200.00	252.54	398.84	239.80	1.635

Critical Failure Surface (circle 1)

Intersects:	XL:	210.21	YL:	162.00	XR:	385.00	YR:	200.00	
	Centre:	XC:	248.47	YC:	406.99		Radius:	R:	247.96
Generated failure surface: (20 points)									
210.21	162.00		219.75	160.70		229.34	159.77	238.95	159.21
248.58	159.03								
258.21	159.22		267.83	159.79		277.41	160.72	286.95	162.03
296.44	163.71								
305.85	165.76		315.17	168.17		324.40	170.94	333.50	174.07
342.49	177.54								
351.32	181.37		360.01	185.53		368.52	190.03	376.86	194.85
385.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 42 slices)

Slice		X-S	Base						PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	210.21	0.04	-7.8	0.79	0.80	3	100.00	18.0	5.99	2.68
16.44	1.04									
2	211.00	4.97	-7.8	4.38	4.42	3	100.00	18.0	668.74	312.95
163.85	1.04									
3	215.38	13.97	-7.8	4.38	4.42	3	100.00	18.0	1873.38	879.52
443.27	1.04									
4	219.75	25.16	-5.5	4.79	4.82	3	100.00	18.0	3369.87	1577.55
716.75	1.02									
5	224.55	35.05	-5.5	4.79	4.82	3	100.00	18.0	4687.12	2197.28
994.50	1.02									
6	229.34	44.63	-3.3	4.81	4.82	3	100.00	18.0	5960.67	2789.68
1251.38	1.01									
7	234.15	53.67	-3.3	4.81	4.82	3	100.00	18.0	7158.48	3354.81
1502.11	1.01									
8	238.95	62.36	-1.1	4.81	4.82	3	100.00	18.0	8306.08	3892.22
1729.93	1.00									
9	243.77	70.53	-1.1	4.81	4.82	3	100.00	18.0	9380.32	4401.91
1953.51	1.00									
10	248.58	78.25	1.1	4.81	4.82	3	100.00	18.0	10391.00	4883.55
2152.46	1.00									
11	253.40	85.51	1.1	4.81	4.82	3	100.00	18.0	11338.25	5337.04
2348.80	1.00									
12	258.21	92.18	3.4	4.81	4.82	3	100.00	18.0	12202.51	5762.02
2519.06	0.99									
13	263.02	98.53	3.4	4.81	4.82	3	100.00	18.0	13020.07	6158.61
2688.10	0.99									
14	267.83	104.09	5.6	4.79	4.82	3	100.00	18.0	13731.30	6526.55
2829.85	0.99									
15	272.62	109.50	5.6	4.79	4.82	3	100.00	18.0	14417.35	6865.66
2971.58	0.99									
16	277.41	110.95	7.8	4.65	4.69	3	100.00	18.0	14578.40	6987.92

3083.57	0.98									
17	282.06	115.18	7.8	4.65	4.69	3	100.00	18.0	15103.85	7254.82
3195.07	0.98									
18	286.71	124.65	9.9	4.86	4.94	2	0.00	35.0	16328.63	7896.17
3232.35	0.94									
19	291.57	128.34	10.0	4.86	4.94	2	0.00	35.0	16813.14	8133.25
3326.88	0.94									
20	296.44	127.23	12.3	4.71	4.82	2	0.00	35.0	16667.37	8124.72
3381.53	0.93									
21	301.14	129.80	12.3	4.71	4.82	2	0.00	35.0	17003.63	8288.64
3449.75	0.93									
22	305.85	130.69	14.5	4.66	4.82	2	0.00	35.0	17120.23	8422.95
3477.45	0.93									
23	310.51	132.32	14.5	4.66	4.82	2	0.00	35.0	17333.45	8527.85
3520.76	0.93									
24	315.17	23.68	16.7	0.83	0.87	2	0.00	35.0	3101.56	1542.57
3515.69	0.92									
25	316.00	85.90	16.7	3.00	3.13	2	0.00	35.0	11252.41	5498.71
3519.84	0.92									
26	319.00	155.22	16.7	5.40	5.63	2	0.00	35.0	20333.81	9445.53
3526.79	0.92									
27	324.40	128.81	18.9	4.55	4.82	2	0.00	35.0	16873.50	7596.17
3427.86	0.92									
28	328.95	121.69	18.9	4.55	4.82	2	0.00	35.0	15940.83	7126.47
3237.03	0.92									
29	333.50	112.56	21.2	4.49	4.82	2	0.00	35.0	14744.90	6630.27
3008.26	0.92									
30	337.99	104.75	21.2	4.49	4.82	2	0.00	35.0	13722.02	6107.79
2797.69	0.92									
31	342.49	65.58	23.4	3.01	3.28	2	0.00	35.0	8590.92	3845.27
2589.69	0.92									
32	345.49	61.67	23.4	3.01	3.28	2	0.00	35.0	8078.42	3579.29
2433.42	0.92									
33	348.50	37.38	23.4	1.92	2.10	5	0.00	45.0	4111.66	1101.74
1796.27	0.86									
34	350.42	16.98	23.4	0.90	0.98	5	0.00	45.0	1867.87	0.00
1631.75	0.86									
35	351.32	76.39	25.6	4.34	4.82	2	0.00	35.0	10006.65	0.00
1906.21	0.92									
36	355.67	67.35	25.6	4.34	4.82	2	0.00	35.0	8822.34	0.00
1680.61	0.92									
37	360.01	56.82	27.8	4.26	4.82	2	0.00	35.0	7443.46	0.00
1421.00	0.92									
38	364.27	47.24	27.8	4.26	4.82	2	0.00	35.0	6188.93	0.00
1181.51	0.92									
39	368.52	36.53	30.1	4.17	4.82	2	0.00	35.0	4784.88	0.00
916.81	0.92									
40	372.69	26.47	30.1	4.17	4.82	2	0.00	35.0	3467.64	0.00
664.43	0.92									
41	376.86	17.78	32.3	4.98	5.89	2	0.00	35.0	2329.17	0.00
366.94	0.93									
42	381.84	3.16	32.3	3.16	3.74	1	150.00	22.0	414.52	0.00
62.11	1.02									

X-S Area:	----- 3123.54	Path Length:	----- 182.99	X-S Weight:	----- 409535.38

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 8-3 Full Reservoir.gmf

Processed: 02 Dec 2020 15:34:28

DATA: Analysis 1 - Case 8-3 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    193.00      348.50    193.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    171.00      348.50    171.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    168.00      348.50    168.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    193.00      450.00    193.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    171.00      450.00    171.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    168.00      450.00    168.00

```

Slope Surface (4 points)

```

-----
100.00    171.00    238.00    171.00    325.00    200.00    450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00    238.00    197.00    316.00    197.00    348.50    197.00
351.50    178.00
450.00    178.00

```

Failure Surface

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

```

Intersects: XL: 238.00    YL: 171.00    XR: 405.00    YR: 200.00
Centre: XC: 281.26    YC: 417.23    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-3 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 6.013

Analysis Summary

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

Critical (minimum) Factor of Safety: 3.79

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	234.05	171.00	400.00	200.00	273.90	432.26	264.29	3.790	
Critical Surface									
2	233.00	171.00	400.00	200.00	272.93	436.38	268.37	3.795	
3	237.21	171.00	400.00	200.00	276.09	424.15	256.12	3.798	
4	234.58	171.00	400.00	200.00	274.02	432.33	264.29	3.799	
5	235.63	171.00	400.00	200.00	274.99	428.21	260.20	3.801	
6	233.53	171.00	400.00	200.00	273.05	436.44	268.37	3.803	
7	236.68	171.00	400.00	200.00	275.22	428.33	260.20	3.806	
8	235.11	171.00	400.00	200.00	274.13	432.39	264.29	3.808	
9	237.74	171.00	400.00	200.00	276.20	424.22	256.12	3.810	
10	236.16	171.00	400.00	200.00	275.11	428.27	260.20	3.810	
11	238.26	171.09	400.00	200.00	277.20	420.10	252.04	3.811	
12	234.05	171.00	400.00	200.00	273.16	436.50	268.37	3.812	
13	236.16	171.00	400.53	200.00	275.52	428.21	260.20	3.813	
14	233.53	171.00	400.53	200.00	273.46	436.38	268.37	3.815	
15	233.00	171.00	400.00	200.00	272.20	440.61	272.45	3.816	
16	234.58	171.00	400.53	200.00	274.43	432.26	264.29	3.816	
17	235.63	171.00	400.00	200.00	274.25	432.45	264.29	3.816	
18	237.21	171.00	400.00	200.00	275.33	428.40	260.20	3.818	
19	238.79	171.26	400.00	200.00	278.32	416.05	247.96	3.818	
20	234.58	171.00	400.00	200.00	273.28	436.56	268.37	3.820	
21	235.63	171.00	400.53	200.00	274.66	432.39	264.29	3.821	
22	237.74	171.00	400.53	200.00	276.62	424.15	256.12	3.823	
23	234.05	171.00	400.53	200.00	273.58	436.44	268.37	3.823	
24	233.53	171.00	400.00	200.00	272.31	440.67	272.45	3.824	
25	236.68	171.00	400.53	200.00	275.63	428.27	260.20	3.825	
26	235.11	171.00	400.53	200.00	274.54	432.33	264.29	3.825	
27	236.68	171.00	400.00	200.00	274.47	432.57	264.29	3.825	
28	239.32	171.44	400.00	200.00	279.44	411.99	243.88	3.826	
29	233.00	171.00	400.53	200.00	272.61	440.55	272.45	3.827	
30	238.26	171.09	400.53	200.00	277.61	420.04	252.04	3.828	
31	235.11	171.00	401.05	200.00	274.96	432.26	264.29	3.828	
32	235.11	171.00	400.00	200.00	273.39	436.62	268.37	3.828	
33	238.26	171.09	400.00	200.00	276.44	424.35	256.12	3.830	
34	238.79	171.26	400.53	200.00	278.73	415.98	247.96	3.830	
35	237.74	171.00	400.00	200.00	275.45	428.46	260.20	3.830	
36	236.16	171.00	400.00	200.00	274.36	432.51	264.29	3.832	
37	234.05	171.00	400.00	200.00	272.42	440.73	272.45	3.832	
38	236.16	171.00	400.53	200.00	274.77	432.45	264.29	3.833	
39	237.21	171.00	400.53	200.00	275.75	428.33	260.20	3.834	
40	239.84	171.61	400.00	200.00	280.55	407.93	239.80	3.836	
41	233.53	171.00	400.53	200.00	272.73	440.61	272.45	3.836	
42	233.00	171.00	400.00	200.00	271.46	444.84	276.53	3.836	
43	235.63	171.00	400.00	200.00	273.50	436.68	268.37	3.836	
44	234.58	171.00	401.05	200.00	274.10	436.44	268.37	3.836	
45	237.21	171.00	400.00	200.00	274.58	432.63	264.29	3.837	
46	236.68	171.00	401.05	200.00	276.05	428.21	260.20	3.837	
47	234.58	171.00	400.53	200.00	273.69	436.50	268.37	3.838	
48	239.32	171.44	400.53	200.00	279.84	411.92	243.88	3.838	
49	233.00	171.00	401.05	200.00	273.02	440.49	272.45	3.839	
50	238.79	171.26	400.00	200.00	277.56	420.30	252.04	3.839	
51	234.58	171.00	400.00	200.00	272.53	440.79	272.45	3.840	
52	235.63	171.00	401.05	200.00	275.07	432.33	264.29	3.840	
53	234.05	171.00	401.05	200.00	273.99	436.38	268.37	3.840	
54	235.63	171.00	400.53	200.00	273.91	436.62	268.37	3.841	
55	238.26	171.09	400.53	200.00	276.86	424.29	256.12	3.842	
56	233.53	171.00	400.00	200.00	271.58	444.90	276.53	3.844	
57	237.74	171.00	400.53	200.00	275.86	428.40	260.20	3.844	
58	234.05	171.00	400.53	200.00	272.84	440.67	272.45	3.844	
59	240.37	171.79	400.00	200.00	281.67	403.86	235.71	3.845	
60	236.68	171.00	400.53	200.00	274.88	432.51	264.29	3.846	
61	235.11	171.00	400.53	200.00	273.80	436.56	268.37	3.847	
62	237.21	171.00	401.05	200.00	276.16	428.27	260.20	3.847	
63	235.11	171.00	400.00	200.00	272.64	440.85	272.45	3.847	
64	239.84	171.61	400.53	200.00	280.96	407.86	239.80	3.848	
65	233.00	171.00	400.53	200.00	271.88	444.78	276.53	3.848	
66	236.68	171.00	400.00	200.00	275.98	424.09	256.12	3.848	
67	235.11	171.00	401.05	200.00	274.22	436.50	268.37	3.849	
68	239.32	171.44	400.00	200.00	278.68	416.25	247.96	3.849	

69	237.74	171.00	400.00	200.00	274.69	432.69	264.29	3.849
70	236.16	171.00	401.05	200.00	275.19	432.39	264.29	3.849
71	238.26	171.09	400.00	200.00	275.68	428.59	260.20	3.849
72	234.05	171.00	400.00	200.00	271.68	444.96	276.53	3.851
73	233.53	171.00	401.58	200.00	273.55	440.49	272.45	3.852
74	236.16	171.00	400.00	200.00	273.61	436.74	268.37	3.852
75	238.79	171.26	400.53	200.00	277.97	420.24	252.04	3.852
76	234.58	171.00	400.53	200.00	272.95	440.73	272.45	3.852
77	235.63	171.00	401.58	200.00	275.48	432.26	264.29	3.852
78	236.16	171.00	400.53	200.00	274.03	436.68	268.37	3.853
79	233.53	171.00	401.05	200.00	273.14	440.55	272.45	3.854
80	237.21	171.00	400.53	200.00	275.00	432.57	264.29	3.854
81	233.00	171.00	400.00	200.00	270.73	449.06	280.61	3.855
82	235.63	171.00	400.00	200.00	272.75	440.91	272.45	3.855
83	237.21	171.00	400.00	200.00	273.83	436.86	268.37	3.855
84	234.58	171.00	401.58	200.00	274.51	436.38	268.37	3.855
85	233.00	171.00	401.58	200.00	273.43	440.43	272.45	3.856
86	233.53	171.00	400.53	200.00	271.99	444.84	276.53	3.856
87	237.74	171.00	401.05	200.00	276.27	428.33	260.20	3.857
88	234.58	171.00	401.05	200.00	273.36	440.67	272.45	3.857
89	238.26	171.09	401.05	200.00	277.27	424.22	256.12	3.857
90	236.68	171.00	401.05	200.00	275.30	432.45	264.29	3.858
91	234.58	171.00	400.00	200.00	271.79	445.02	276.53	3.858
92	238.79	171.26	400.00	200.00	276.81	424.55	256.12	3.859
93	239.84	171.61	400.00	200.00	279.80	412.20	243.88	3.859
94	237.21	171.00	401.58	200.00	276.57	428.21	260.20	3.860
95	233.00	171.00	401.05	200.00	272.29	444.72	276.53	3.860
96	235.63	171.00	400.53	200.00	273.17	440.85	272.45	3.860
97	236.68	171.00	400.00	200.00	273.72	436.80	268.37	3.860
98	240.89	171.96	400.00	200.00	282.78	399.78	231.63	3.860
99	235.63	171.00	401.05	200.00	274.33	436.56	268.37	3.861

Critical Failure Surface (circle 1)

Intersects:	XL:	234.05	YL:	171.00	XR:	400.00	YR:	200.00	
	Centre:	XC:	273.90	YC:	432.26		Radius:	R:	264.29
Generated failure surface: (20 points)									
234.05	171.00		242.99	169.79		251.97	168.89	260.98	168.29
270.00	168.01								
279.02	168.03		288.04	168.36		297.04	168.99	306.01	169.94
314.95	171.18								
323.84	172.74		332.67	174.59		341.43	176.75	350.11	179.20
358.71	181.95								
367.20	184.99		375.59	188.32		383.86	191.94	392.00	195.83
400.00	200.00								

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	234.05	1.05	-7.7	3.95	3.98	3	100.00	18.0	148.41	6528.68
1663.85	1.02									
2	238.00	8.51	-7.7	4.99	5.04	3	100.00	18.0	1157.94	8451.18
1807.36	1.02									
3	242.99	17.27	-5.7	4.49	4.51	3	100.00	18.0	2326.57	7723.44
1995.18	1.01									
4	247.48	26.01	-5.7	4.49	4.51	3	100.00	18.0	3492.05	7850.41
2162.63	1.01									
5	251.97	34.52	-3.8	4.50	4.51	3	100.00	18.0	4623.27	7955.69
2316.80	1.01									
6	256.47	42.61	-3.8	4.50	4.51	3	100.00	18.0	5697.12	8039.47
2462.42	1.01									
7	260.98	50.45	-1.8	4.51	4.51	3	100.00	18.0	6734.25	8101.70
2593.98	1.00									
8	265.49	57.88	-1.8	4.51	4.51	3	100.00	18.0	7713.56	8142.15
2717.66	1.00									
9	270.00	64.99	0.1	4.51	4.51	3	100.00	18.0	8648.49	8160.90
2826.62	1.00									
10	274.51	71.73	0.1	4.51	4.51	3	100.00	18.0	9530.86	8158.05
2928.31	1.00									
11	279.02	78.07	2.1	4.51	4.51	3	100.00	18.0	10357.00	8133.45
3014.66	1.00									
12	283.53	84.10	2.1	4.51	4.51	3	100.00	18.0	11140.21	8087.19
3094.31	1.00									
13	288.04	89.62	4.0	4.50	4.51	3	100.00	18.0	11852.02	8019.27
3158.10	1.00									
14	292.54	94.94	4.0	4.50	4.51	3	100.00	18.0	12534.59	7929.70
3215.69	1.00									
15	297.04	76.88	6.0	3.48	3.50	3	100.00	18.0	10134.67	6077.59
3252.98	1.00									
16	300.52	79.65	6.0	3.48	3.50	3	100.00	18.0	10484.27	5997.67

3280.54	1.00										
17	304.00	47.28	6.0	2.01	2.02	3	100.00	18.0	6216.89	3428.87	
3302.28	1.00										
18	306.01	91.75	8.0	3.81	3.84	3	100.00	18.0	12049.89	6427.38	
3310.33	1.00										
19	309.82	94.56	8.0	3.81	3.84	3	100.00	18.0	12397.09	6299.77	
3321.82	1.00										
20	313.62	33.53	8.0	1.32	1.34	2	0.00	35.0	4391.81	2159.94	
3310.95	0.98										
21	314.95	26.88	9.9	1.05	1.07	2	0.00	35.0	3521.00	1714.28	
3302.89	0.98										
22	316.00	101.65	9.9	3.92	3.98	2	0.00	35.0	13316.02	6276.93	
3341.46	0.98										
23	319.92	104.08	9.9	3.92	3.98	2	0.00	35.0	13634.97	6106.97	
3418.97	0.98										
24	323.84	31.35	11.9	1.16	1.19	2	0.00	35.0	4106.41	1790.61	
3454.24	0.98										
25	325.00	102.03	11.9	3.83	3.92	2	0.00	35.0	13365.85	5772.39	
3411.25	0.98										
26	328.83	98.94	11.9	3.83	3.92	2	0.00	35.0	12961.12	5575.39	
3307.77	0.98										
27	332.67	108.94	13.8	4.38	4.51	2	0.00	35.0	14271.36	6156.19	
3175.22	0.99										
28	337.05	104.22	13.8	4.38	4.51	2	0.00	35.0	13652.61	5852.66	
3037.21	0.99										
29	341.43	80.43	15.8	3.54	3.67	2	0.00	35.0	10536.28	4527.65	
2893.52	0.99										
30	344.96	76.90	15.8	3.54	3.67	2	0.00	35.0	10073.61	4298.63	
2766.03	0.99										
31	348.50	33.90	15.8	1.61	1.68	5	0.00	45.0	3728.85	1350.59	
2208.03	0.97										
32	350.11	23.50	17.7	1.14	1.20	5	0.00	45.0	2584.51	283.15	
2109.40	0.97										
33	351.25	73.93	17.7	3.73	3.91	2	0.00	35.0	9684.84	0.00	
2453.38	0.99										
34	354.98	69.49	17.7	3.73	3.91	2	0.00	35.0	9102.77	0.00	
2305.91	0.99										
35	358.71	73.43	19.7	4.25	4.51	2	0.00	35.0	9619.10	0.00	
2124.03	1.00										
36	362.95	66.97	19.7	4.25	4.51	2	0.00	35.0	8773.03	0.00	
1937.21	1.00										
37	367.20	59.43	21.7	4.19	4.51	2	0.00	35.0	7785.89	0.00	
1729.84	1.00										
38	371.40	52.45	21.7	4.19	4.51	2	0.00	35.0	6871.48	0.00	
1526.68	1.00										
39	375.59	44.54	23.6	4.13	4.51	2	0.00	35.0	5834.33	0.00	
1305.83	1.01										
40	379.72	37.07	23.6	4.13	4.51	2	0.00	35.0	4855.82	0.00	
1086.83	1.01										
41	383.86	16.74	25.6	2.22	2.46	2	0.00	35.0	2192.34	0.00	
906.51	1.02										
42	386.08	18.62	25.6	2.96	3.28	1	150.00	22.0	2439.09	0.00	
766.29	1.05										
43	389.04	14.43	25.6	2.96	3.28	1	150.00	22.0	1890.45	0.00	
589.87	1.05										
44	392.00	12.51	27.5	4.00	4.51	1	150.00	22.0	1638.99	0.00	
368.54	1.07										
45	396.00	4.17	27.5	4.00	4.51	1	150.00	22.0	546.32	0.00	
109.82	1.07										

X-S Area: 2581.96

Path Length: 171.44

X-S Weight: 338617.97

Project: West Farm Pit Expansion

File: C:\Galena Models\West Farm Expansion Case 8-3 Rapid Drawdown.gmf

Processed: 02 Dec 2020 15:33:12

DATA: Analysis 1 - Case 8-3 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    193.00        348.50    193.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    171.00        348.50    171.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    168.00        348.50    168.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    193.00        450.00    193.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    171.00        450.00    171.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    168.00        450.00    168.00

```

Slope Surface (4 points)

```

-----
100.00    171.00        238.00    171.00        325.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    171.00        238.00    171.00        316.00    197.00        348.50    197.00
351.50    178.00
450.00    178.00

```

Failure Surface

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

```

Intersects: XL: 238.00    YL: 171.00    XR: 405.00    YR: 200.00
Centre: XC: 281.26    YC: 417.23    Radius: R: 250.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-3 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.571

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.21

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	234.05	171.00	400.00	200.00	273.90	432.26	264.29	2.210	
Critical Surface									
2	233.00	171.00	400.00	200.00	272.93	436.38	268.37	2.212	
3	234.58	171.00	400.00	200.00	274.02	432.33	264.29	2.216	
4	235.63	171.00	400.00	200.00	274.99	428.21	260.20	2.217	
5	237.21	171.00	400.00	200.00	276.09	424.15	256.12	2.218	
6	233.53	171.00	400.00	200.00	273.05	436.44	268.37	2.218	
7	235.11	171.00	400.00	200.00	274.13	432.39	264.29	2.222	
8	236.16	171.00	400.00	200.00	275.11	428.27	260.20	2.223	
9	236.68	171.00	400.00	200.00	275.22	428.33	260.20	2.223	
10	234.05	171.00	400.00	200.00	273.16	436.50	268.37	2.223	
11	233.53	171.00	400.53	200.00	273.46	436.38	268.37	2.225	
12	237.74	171.00	400.00	200.00	276.20	424.22	256.12	2.225	
13	234.58	171.00	400.53	200.00	274.43	432.26	264.29	2.225	
14	233.00	171.00	400.00	200.00	272.20	440.61	272.45	2.226	
15	238.26	171.09	400.00	200.00	277.20	420.10	252.04	2.226	
16	236.16	171.00	400.53	200.00	275.52	428.21	260.20	2.226	
17	235.63	171.00	400.00	200.00	274.25	432.45	264.29	2.228	
18	234.58	171.00	400.00	200.00	273.28	436.56	268.37	2.229	
19	237.21	171.00	400.00	200.00	275.33	428.40	260.20	2.231	
20	234.05	171.00	400.53	200.00	273.58	436.44	268.37	2.231	
21	233.53	171.00	400.00	200.00	272.31	440.67	272.45	2.231	
22	235.11	171.00	400.53	200.00	274.54	432.33	264.29	2.232	
23	238.79	171.26	400.00	200.00	278.32	416.05	247.96	2.232	
24	235.63	171.00	400.53	200.00	274.66	432.39	264.29	2.232	
25	233.00	171.00	400.53	200.00	272.61	440.55	272.45	2.233	
26	237.74	171.00	400.53	200.00	276.62	424.15	256.12	2.233	
27	236.68	171.00	400.53	200.00	275.63	428.27	260.20	2.234	
28	235.11	171.00	401.05	200.00	274.96	432.26	264.29	2.235	
29	235.11	171.00	400.00	200.00	273.39	436.62	268.37	2.235	
30	236.68	171.00	400.00	200.00	274.47	432.57	264.29	2.236	
31	238.26	171.09	400.53	200.00	277.61	420.04	252.04	2.236	
32	236.16	171.00	400.00	200.00	274.36	432.51	264.29	2.237	
33	234.05	171.00	400.00	200.00	272.42	440.73	272.45	2.237	
34	237.74	171.00	400.00	200.00	275.45	428.46	260.20	2.238	
35	239.32	171.44	400.00	200.00	279.44	411.99	243.88	2.238	
36	238.26	171.09	400.00	200.00	276.44	424.35	256.12	2.238	
37	233.53	171.00	400.53	200.00	272.73	440.61	272.45	2.238	
38	233.00	171.00	400.00	200.00	271.46	444.84	276.53	2.239	
39	238.79	171.26	400.53	200.00	278.73	415.98	247.96	2.239	
40	234.58	171.00	400.53	200.00	273.69	436.50	268.37	2.239	
41	236.16	171.00	400.53	200.00	274.77	432.45	264.29	2.240	
42	233.00	171.00	401.05	200.00	273.02	440.49	272.45	2.240	
43	237.21	171.00	400.53	200.00	275.75	428.33	260.20	2.240	
44	234.05	171.00	401.05	200.00	273.99	436.38	268.37	2.240	
45	235.63	171.00	400.00	200.00	273.50	436.68	268.37	2.241	
46	234.58	171.00	401.05	200.00	274.10	436.44	268.37	2.241	
47	236.68	171.00	401.05	200.00	276.05	428.21	260.20	2.241	
48	234.58	171.00	400.00	200.00	272.53	440.79	272.45	2.242	
49	235.63	171.00	401.05	200.00	275.07	432.33	264.29	2.243	
50	237.21	171.00	400.00	200.00	274.58	432.63	264.29	2.243	
51	233.53	171.00	400.00	200.00	271.58	444.90	276.53	2.244	
52	234.05	171.00	400.53	200.00	272.84	440.67	272.45	2.244	
53	235.63	171.00	400.53	200.00	273.91	436.62	268.37	2.245	
54	239.84	171.61	400.00	200.00	280.55	407.93	239.80	2.245	
55	235.11	171.00	400.53	200.00	273.80	436.56	268.37	2.245	
56	238.79	171.26	400.00	200.00	277.56	420.30	252.04	2.245	
57	239.32	171.44	400.53	200.00	279.84	411.92	243.88	2.246	
58	233.00	171.00	400.53	200.00	271.88	444.78	276.53	2.246	
59	238.26	171.09	400.53	200.00	276.86	424.29	256.12	2.246	
60	237.74	171.00	400.53	200.00	275.86	428.40	260.20	2.246	
61	236.68	171.00	400.53	200.00	274.88	432.51	264.29	2.247	
62	235.11	171.00	400.00	200.00	272.64	440.85	272.45	2.247	
63	237.21	171.00	401.05	200.00	276.16	428.27	260.20	2.248	
64	235.11	171.00	401.05	200.00	274.22	436.50	268.37	2.248	
65	233.53	171.00	401.05	200.00	273.14	440.55	272.45	2.249	
66	236.16	171.00	401.05	200.00	275.19	432.39	264.29	2.249	
67	236.68	171.00	400.00	200.00	275.98	424.09	256.12	2.249	
68	234.05	171.00	400.00	200.00	271.68	444.96	276.53	2.249	

69	233.00	171.00	401.58	200.00	273.43	440.43	272.45	2.249
70	236.16	171.00	400.00	200.00	273.61	436.74	268.37	2.249
71	234.58	171.00	400.53	200.00	272.95	440.73	272.45	2.250
72	235.63	171.00	401.58	200.00	275.48	432.26	264.29	2.250
73	233.53	171.00	401.58	200.00	273.55	440.49	272.45	2.250
74	237.74	171.00	400.00	200.00	274.69	432.69	264.29	2.250
75	233.00	171.00	400.00	200.00	270.73	449.06	280.61	2.251
76	238.26	171.09	400.00	200.00	275.68	428.59	260.20	2.251
77	234.58	171.00	401.58	200.00	274.51	436.38	268.37	2.251
78	233.53	171.00	400.53	200.00	271.99	444.84	276.53	2.251
79	236.16	171.00	400.53	200.00	274.03	436.68	268.37	2.252
80	240.37	171.79	400.00	200.00	281.67	403.86	235.71	2.252
81	239.84	171.61	400.53	200.00	280.96	407.86	239.80	2.253
82	235.63	171.00	400.00	200.00	272.75	440.91	272.45	2.253
83	239.32	171.44	400.00	200.00	278.68	416.25	247.96	2.253
84	237.21	171.00	400.53	200.00	275.00	432.57	264.29	2.253
85	233.00	171.00	401.05	200.00	272.29	444.72	276.53	2.253
86	238.79	171.26	400.53	200.00	277.97	420.24	252.04	2.253
87	234.58	171.00	401.05	200.00	273.36	440.67	272.45	2.254
88	234.58	171.00	400.00	200.00	271.79	445.02	276.53	2.254
89	237.74	171.00	401.05	200.00	276.27	428.33	260.20	2.254
90	234.05	171.00	401.05	200.00	273.25	440.61	272.45	2.254
91	236.68	171.00	401.05	200.00	275.30	432.45	264.29	2.255
92	237.21	171.00	400.00	200.00	273.83	436.86	268.37	2.255
93	236.68	171.00	400.00	200.00	273.72	436.80	268.37	2.255
94	238.26	171.09	401.05	200.00	277.27	424.22	256.12	2.255
95	237.21	171.00	401.58	200.00	276.57	428.21	260.20	2.256
96	235.63	171.00	401.05	200.00	274.33	436.56	268.37	2.256
97	233.53	171.00	400.00	200.00	270.84	449.12	280.61	2.256
98	236.16	171.00	401.58	200.00	275.60	432.33	264.29	2.256
99	234.05	171.00	400.53	200.00	272.10	444.90	276.53	2.257

Critical Failure Surface (circle 1)

Intersects:	XL:	234.05	YL:	171.00	XR:	400.00	YR:	200.00	
	Centre:	XC:	273.90	YC:	432.26		Radius:	R:	264.29
Generated failure surface: (20 points)									
	234.05	171.00		242.99	169.79		251.97	168.89	260.98
270.00	168.01								
	279.02	168.03		288.04	168.36		297.04	168.99	306.01
314.95	171.18								
	323.84	172.74		332.67	174.59		341.43	176.75	350.11
358.71	181.95								
	367.20	184.99		375.59	188.32		383.86	191.94	392.00
400.00	200.00								

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	234.05	1.05	-7.7	3.95	3.98	3	100.00	18.0	148.41	66.28
44.26	1.03									
2	238.00	8.51	-7.7	4.99	5.04	3	100.00	18.0	1157.94	535.67
240.61	1.03									
3	242.99	17.27	-5.7	4.49	4.51	3	100.00	18.0	2326.57	1083.00
527.06	1.02									
4	247.48	26.01	-5.7	4.49	4.51	3	100.00	18.0	3492.05	1631.26
788.75	1.02									
5	251.97	34.52	-3.8	4.50	4.51	3	100.00	18.0	4623.27	2158.48
1035.38	1.01									
6	256.47	42.61	-3.8	4.50	4.51	3	100.00	18.0	5697.12	2664.72
1275.16	1.01									
7	260.98	50.45	-1.8	4.51	4.51	3	100.00	18.0	6734.25	3149.71
1498.56	1.01									
8	265.49	57.88	-1.8	4.51	4.51	3	100.00	18.0	7713.56	3613.34
1716.27	1.01									
9	270.00	64.99	0.1	4.51	4.51	3	100.00	18.0	8648.49	4055.39
1916.46	1.00									
10	274.51	71.73	0.1	4.51	4.51	3	100.00	18.0	9530.86	4475.91
2111.99	1.00									
11	279.02	78.07	2.1	4.51	4.51	3	100.00	18.0	10357.00	4874.58
2288.97	1.00									
12	283.53	84.10	2.1	4.51	4.51	3	100.00	18.0	11140.21	5251.43
2462.20	1.00									
13	288.04	89.62	4.0	4.50	4.51	3	100.00	18.0	11852.02	5606.24
2616.02	0.99									
14	292.54	94.94	4.0	4.50	4.51	3	100.00	18.0	12534.59	5939.02
2766.89	0.99									
15	297.04	76.88	6.0	3.48	3.50	3	100.00	18.0	10134.67	4823.68
2883.19	0.99									
16	300.52	79.65	6.0	3.48	3.50	3	100.00	18.0	10484.27	4997.22

2982.84	0.99									
17	304.00	47.28	6.0	2.01	2.02	3	100.00	18.0	6216.89	2966.37
3061.45	0.99									
18	306.01	91.75	8.0	3.81	3.84	3	100.00	18.0	12049.89	5780.97
3125.81	0.99									
19	309.82	94.56	8.0	3.81	3.84	3	100.00	18.0	12397.09	5957.71
3216.11	0.99									
20	313.62	33.53	8.0	1.32	1.34	2	0.00	35.0	4391.81	2112.31
3245.34	0.97									
21	314.95	26.88	9.9	1.05	1.07	2	0.00	35.0	3521.00	1702.60
3254.80	0.96									
22	316.00	101.65	9.9	3.92	3.98	2	0.00	35.0	13316.02	6276.93
3302.87	0.96									
23	319.92	104.08	9.9	3.92	3.98	2	0.00	35.0	13634.97	6106.97
3377.76	0.96									
24	323.84	31.35	11.9	1.16	1.19	2	0.00	35.0	4106.41	1790.61
3403.52	0.96									
25	325.00	102.03	11.9	3.83	3.92	2	0.00	35.0	13365.85	5772.39
3360.79	0.96									
26	328.83	98.94	11.9	3.83	3.92	2	0.00	35.0	12961.12	5575.39
3258.70	0.96									
27	332.67	108.94	13.8	4.38	4.51	2	0.00	35.0	14271.36	6156.19
3120.60	0.96									
28	337.05	104.22	13.8	4.38	4.51	2	0.00	35.0	13652.61	5852.66
2984.72	0.96									
29	341.43	80.43	15.8	3.54	3.67	2	0.00	35.0	10536.28	4527.65
2836.58	0.95									
30	344.96	76.90	15.8	3.54	3.67	2	0.00	35.0	10073.61	4298.63
2711.32	0.95									
31	348.50	33.90	15.8	1.61	1.68	5	0.00	45.0	3728.85	1350.59
2141.73	0.92									
32	350.11	23.50	17.7	1.14	1.20	5	0.00	45.0	2584.51	283.15
2010.64	0.92									
33	351.25	73.93	17.7	3.73	3.91	2	0.00	35.0	9684.84	0.00
2359.22	0.95									
34	354.98	69.49	17.7	3.73	3.91	2	0.00	35.0	9102.77	0.00
2217.41	0.95									
35	358.71	73.43	19.7	4.25	4.51	2	0.00	35.0	9619.10	0.00
2033.80	0.95									
36	362.95	66.97	19.7	4.25	4.51	2	0.00	35.0	8773.03	0.00
1854.92	0.95									
37	367.20	59.43	21.7	4.19	4.51	2	0.00	35.0	7785.89	0.00
1649.24	0.96									
38	371.40	52.45	21.7	4.19	4.51	2	0.00	35.0	6871.48	0.00
1455.54	0.96									
39	375.59	44.54	23.6	4.13	4.51	2	0.00	35.0	5834.33	0.00
1239.59	0.96									
40	379.72	37.07	23.6	4.13	4.51	2	0.00	35.0	4855.82	0.00
1031.70	0.96									
41	383.86	16.74	25.6	2.22	2.46	2	0.00	35.0	2192.34	0.00
856.76	0.96									
42	386.08	18.62	25.6	2.96	3.28	1	150.00	22.0	2439.09	0.00
728.14	1.02									
43	389.04	14.43	25.6	2.96	3.28	1	150.00	22.0	1890.45	0.00
557.63	1.02									
44	392.00	12.51	27.5	4.00	4.51	1	150.00	22.0	1638.99	0.00
341.71	1.03									
45	396.00	4.17	27.5	4.00	4.51	1	150.00	22.0	546.32	0.00
92.37	1.03									

X-S Area:

2581.96

Path Length:

171.44

X-S Weight:

338617.97

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Full Reservoir.gmf

Processed: 03 Dec 2020 09:48:13

DATA: Analysis 1 - Case 8-4 Full Reservoir

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00      348.50    200.00
Profile: 2 (2 points)  Material beneath: 2 - Sand and Gravel
100.00    182.00      348.50    182.00
Profile: 3 (2 points)  Material beneath: 3 - Weathered Bedrock
100.00    164.00      348.50    164.00
Profile: 4 (2 points)  Material beneath: 4 - Stable Bedrock
100.00    161.00      348.50    161.00
Profile: 5 (2 points)  Material beneath: 5 - Slurry Wall
348.50    200.00      351.50    200.00
Profile: 6 (2 points)  Material beneath: 1 - Overburden
351.50    200.00      450.00    200.00
Profile: 7 (2 points)  Material beneath: 2 - Sand and Gravel
351.50    182.00      450.00    182.00
Profile: 8 (2 points)  Material beneath: 3 - Weathered Bedrock
351.50    164.00      450.00    164.00
Profile: 9 (2 points)  Material beneath: 4 - Stable Bedrock
348.50    161.00      450.00    161.00

```

Slope Surface (4 points)

```

-----
100.00    164.00      217.00    164.00      325.00    200.00      450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    197.00      217.00    197.00      316.00    197.00      348.50    197.00
351.50    172.00
450.00    172.00

```

Failure Surface

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

```

Intersects: XL: 217.00    YL: 164.00    XR: 380.00    YR: 200.00
Centre: XC: 192.18    YC: 663.38    Radius: R: 500.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-4 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.977

Analysis Summary

There were: 11023 successful analyses from a total of 20001 trial failure surfaces
8978 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 2.82

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	217.79	164.26	375.00	200.00	166.43	753.87	591.84	2.821	
Critical Surface									
2	217.26	164.09	375.00	200.00	170.56	733.60	571.43	2.821	
3	217.26	164.09	375.00	200.00	171.47	729.58	567.35	2.821	
4	217.79	164.26	375.00	200.00	165.52	757.88	595.92	2.821	
5	217.26	164.09	375.00	200.00	172.39	725.56	563.27	2.821	
6	217.26	164.09	375.00	200.00	173.30	721.54	559.18	2.822	
7	217.79	164.26	375.00	200.00	164.60	761.90	600.00	2.822	
8	217.26	164.09	375.00	200.00	174.22	717.52	555.10	2.822	
9	217.26	164.09	375.00	200.00	175.13	713.50	551.02	2.823	
10	216.74	164.00	375.00	200.00	180.48	689.28	526.53	2.823	
11	217.26	164.09	375.00	200.00	176.05	709.47	546.94	2.823	
12	216.74	164.00	375.00	200.00	181.39	685.25	522.45	2.823	
13	217.26	164.09	375.00	200.00	176.97	705.45	542.86	2.823	
14	217.26	164.09	375.00	200.00	177.88	701.42	538.78	2.824	
15	216.74	164.00	375.00	200.00	182.31	681.22	518.37	2.824	
16	217.26	164.09	375.00	200.00	178.80	697.40	534.69	2.824	
17	216.74	164.00	375.00	200.00	183.23	677.19	514.29	2.825	
18	217.79	164.26	375.00	200.00	167.34	749.85	587.76	2.825	
19	217.26	164.09	375.00	200.00	179.72	693.37	530.61	2.825	
20	217.79	164.26	375.00	200.00	168.26	745.83	583.67	2.825	
21	216.74	164.00	375.00	200.00	184.14	673.16	510.20	2.825	
22	217.79	164.26	375.00	200.00	169.17	741.81	579.59	2.825	
23	217.26	164.09	375.00	200.00	180.63	689.34	526.53	2.825	
24	217.79	164.26	375.00	200.00	170.08	737.79	575.51	2.825	
25	217.79	164.26	375.00	200.00	171.00	733.77	571.43	2.826	
26	216.74	164.00	375.00	200.00	185.06	669.13	506.12	2.826	
27	217.26	164.09	375.00	200.00	181.55	685.31	522.45	2.826	
28	217.79	164.26	375.00	200.00	171.91	729.75	567.35	2.826	
29	218.32	164.44	375.00	200.00	169.61	741.98	579.59	2.826	
30	217.79	164.26	375.00	200.00	172.82	725.73	563.27	2.826	
31	217.26	164.09	375.00	200.00	182.47	681.29	518.37	2.827	
32	216.74	164.00	375.00	200.00	185.98	665.10	502.04	2.827	
33	217.79	164.26	375.00	200.00	173.74	721.71	559.18	2.827	
34	218.32	164.44	375.00	200.00	168.70	746.00	583.67	2.827	
35	217.79	164.26	375.00	200.00	174.65	717.69	555.10	2.827	
36	217.26	164.09	375.00	200.00	183.39	677.26	514.29	2.827	
37	216.74	164.00	375.00	200.00	186.90	661.06	497.96	2.827	
38	217.79	164.26	375.00	200.00	175.57	713.66	551.02	2.827	
39	218.32	164.44	375.00	200.00	167.79	750.02	587.76	2.827	
40	217.79	164.26	375.00	200.00	176.48	709.64	546.94	2.828	
41	217.26	164.09	375.00	200.00	184.30	673.23	510.20	2.828	
42	218.32	164.44	375.00	200.00	166.88	754.04	591.84	2.828	
43	216.74	164.00	375.00	200.00	187.81	657.03	493.88	2.828	
44	217.79	164.26	375.00	200.00	177.40	705.62	542.86	2.828	
45	217.26	164.09	375.00	200.00	185.22	669.19	506.12	2.829	
46	217.79	164.26	375.00	200.00	178.31	701.59	538.78	2.829	
47	218.32	164.44	375.00	200.00	165.97	758.05	595.92	2.829	
48	216.74	164.00	375.00	200.00	188.73	652.99	489.80	2.829	
49	217.79	164.26	375.00	200.00	179.23	697.56	534.69	2.829	
50	218.32	164.44	375.00	200.00	165.05	762.07	600.00	2.829	
51	217.26	164.09	375.00	200.00	186.14	665.16	502.04	2.829	
52	216.74	164.00	375.00	200.00	164.01	761.68	600.00	2.830	
53	217.79	164.26	375.00	200.00	180.14	693.54	530.61	2.830	
54	216.74	164.00	375.00	200.00	164.92	757.66	595.92	2.830	
55	216.74	164.00	375.00	200.00	165.84	753.64	591.84	2.830	
56	216.74	164.00	375.00	200.00	189.65	648.96	485.71	2.830	
57	216.74	164.00	375.00	200.00	166.75	749.63	587.76	2.830	
58	216.74	164.00	375.00	200.00	167.67	745.61	583.67	2.830	
59	217.26	164.09	375.00	200.00	187.06	661.13	497.96	2.830	
60	217.79	164.26	375.00	200.00	181.06	689.51	526.53	2.830	
61	216.74	164.00	375.00	200.00	168.58	741.59	579.59	2.830	
62	216.74	164.00	375.00	200.00	169.49	737.57	575.51	2.830	
63	218.32	164.44	375.00	200.00	170.53	737.96	575.51	2.830	
64	216.74	164.00	375.00	200.00	170.41	733.55	571.43	2.831	
65	218.32	164.44	375.00	200.00	171.44	733.94	571.43	2.831	
66	216.74	164.00	375.00	200.00	171.32	729.53	567.35	2.831	
67	217.79	164.26	375.00	200.00	181.97	685.48	522.45	2.831	

16	276.79	49.28	11.2	4.18	4.26	2	0.00	35.0	6455.76	6420.73
2280.55	0.97									
17	280.96	51.65	11.2	4.18	4.26	2	0.00	35.0	6766.48	6201.96
2266.31	0.97									
18	285.14	53.73	12.0	4.16	4.26	2	0.00	35.0	7038.99	5975.28
2245.13	0.97									
19	289.30	55.83	12.0	4.16	4.26	2	0.00	35.0	7313.97	5740.67
2222.84	0.97									
20	293.46	57.62	12.8	4.15	4.26	2	0.00	35.0	7547.77	5498.27
2193.40	0.97									
21	297.61	59.44	12.8	4.15	4.26	2	0.00	35.0	7786.92	5247.69
2163.10	0.97									
22	301.76	60.93	13.6	4.14	4.26	2	0.00	35.0	7981.37	4989.09
2125.46	0.97									
23	305.90	62.48	13.6	4.14	4.26	2	0.00	35.0	8184.92	4722.74
2087.18	0.97									
24	310.04	45.94	14.5	2.98	3.08	2	0.00	35.0	6018.29	3246.91
2047.80	0.97									
25	313.02	46.61	14.5	2.98	3.08	2	0.00	35.0	6106.30	3099.22
2014.36	0.97									
26	316.00	36.07	14.5	2.28	2.35	2	0.00	35.0	4725.47	2268.73
2007.14	0.97									
27	318.28	53.83	15.3	3.36	3.48	1	150.00	22.0	7052.13	3195.39
2039.94	1.00									
28	321.64	54.51	15.3	3.36	3.48	1	150.00	22.0	7141.14	2995.81
2063.27	1.00									
29	325.00	24.01	15.3	1.49	1.54	1	150.00	22.0	3144.80	1263.84
2048.81	1.00									
30	326.49	62.66	16.1	4.09	4.26	1	150.00	22.0	8208.39	3272.94
1943.59	1.00									
31	330.58	57.83	16.1	4.09	4.26	1	150.00	22.0	7576.11	2959.46
1792.17	1.00									
32	334.67	52.66	16.9	4.07	4.26	1	150.00	22.0	6898.71	2638.21
1634.01	1.00									
33	338.74	47.62	16.9	4.07	4.26	1	150.00	22.0	6237.78	2309.14
1475.24	1.00									
34	342.81	30.21	17.8	2.85	2.99	1	150.00	22.0	3958.16	1420.46
1334.84	1.00									
35	345.65	27.62	17.8	2.85	2.99	1	150.00	22.0	3618.76	1250.70
1218.27	1.00									
36	348.50	6.60	17.8	0.72	0.76	5	0.00	45.0	726.53	148.07
922.67	0.94									
37	349.22	14.82	17.8	1.69	1.78	5	0.00	45.0	1630.74	0.00
864.57	0.94									
38	350.92	31.48	18.6	4.03	4.26	1	150.00	22.0	4123.52	0.00
958.17	1.01									
39	354.95	26.01	18.6	4.03	4.26	1	150.00	22.0	3407.10	0.00
788.74	1.01									
40	358.98	20.32	19.4	4.01	4.26	1	150.00	22.0	2662.19	0.00
613.52	1.01									
41	363.00	14.65	19.4	4.01	4.26	1	150.00	22.0	1918.86	0.00
437.24	1.01									
42	367.01	8.81	20.2	3.99	4.26	1	150.00	22.0	1154.35	0.00
255.97	1.01									
43	371.01	2.94	20.2	3.99	4.26	1	150.00	22.0	384.78	0.00
72.92	1.01									

X-S Area: -----

1485.13

Path Length: -----

161.72

X-S Weight: -----

194102.33

Project: West Farm Pit Expansion

File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Rapid Drawdown.gmf

Processed: 03 Dec 2020 09:47:09

DATA: Analysis 1 - Case 8-4 Rapid Drawdown

Material Properties (5 materials)

```

-----
Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00     35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00     45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    182.00        348.50    182.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    164.00        348.50    164.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    161.00        348.50    161.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    182.00        450.00    182.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    164.00        450.00    164.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    161.00        450.00    161.00

```

Slope Surface (4 points)

```

-----
100.00    164.00        217.00    164.00        325.00    200.00        450.00    200.00

```

Phreatic Surface (6 points)

```

-----
100.00    164.00        217.00    164.00        316.00    197.00        348.50    197.00
351.50    172.00
450.00    172.00

```

Failure Surface

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

```

Intersects: XL: 217.00    YL: 164.00    XR: 380.00    YR: 200.00
Centre: XC: 192.18    YC: 663.38    Radius: R: 500.00

```

Variable Restraints

```

-----
Parameter descriptor:      XL      XR      R
Range of variation:      10.00    10.00    200.00
Trial positions within range: 20      20      50

```

RESULTS: Analysis 1 - Case 8-4 Rapid Drawdown

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.682

Analysis Summary

There were: 11023 successful analyses from a total of 20001 trial failure surfaces
8978 analyses terminated due to unacceptable geometry

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	216.74	164.00	375.00	200.00	180.48	689.28	526.53	1.592	< -
Critical Surface									
2	216.74	164.00	375.00	200.00	181.39	685.25	522.45	1.592	
3	216.74	164.00	375.00	200.00	182.31	681.22	518.37	1.592	
4	216.74	164.00	375.00	200.00	183.23	677.19	514.29	1.593	
5	216.74	164.00	375.00	200.00	184.14	673.16	510.20	1.593	
6	216.74	164.00	375.00	200.00	185.06	669.13	506.12	1.593	
7	216.74	164.00	375.00	200.00	185.98	665.10	502.04	1.593	
8	216.74	164.00	375.00	200.00	186.90	661.06	497.96	1.593	
9	216.74	164.00	375.00	200.00	187.81	657.03	493.88	1.593	
10	216.74	164.00	375.00	200.00	188.73	652.99	489.80	1.593	
11	216.74	164.00	375.00	200.00	189.65	648.96	485.71	1.594	
12	216.74	164.00	375.00	200.00	190.57	644.92	481.63	1.594	
13	217.26	164.09	375.00	200.00	176.05	709.47	546.94	1.594	
14	217.26	164.09	375.00	200.00	175.13	713.50	551.02	1.594	
15	217.26	164.09	375.00	200.00	176.97	705.45	542.86	1.594	
16	217.26	164.09	375.00	200.00	174.22	717.52	555.10	1.594	
17	217.26	164.09	375.00	200.00	177.88	701.42	538.78	1.594	
18	217.26	164.09	375.00	200.00	173.30	721.54	559.18	1.594	
19	217.26	164.09	375.00	200.00	178.80	697.40	534.69	1.594	
20	217.26	164.09	375.00	200.00	172.39	725.56	563.27	1.594	
21	217.26	164.09	375.00	200.00	179.72	693.37	530.61	1.594	
22	217.26	164.09	375.00	200.00	171.47	729.58	567.35	1.594	
23	217.26	164.09	375.00	200.00	170.56	733.60	571.43	1.594	
24	217.26	164.09	375.00	200.00	180.63	689.34	526.53	1.594	
25	216.74	164.00	375.00	200.00	191.49	640.88	477.55	1.594	
26	217.26	164.09	375.00	200.00	181.55	685.31	522.45	1.594	
27	217.26	164.09	375.00	200.00	182.47	681.29	518.37	1.594	
28	217.26	164.09	375.00	200.00	183.39	677.26	514.29	1.594	
29	216.74	164.00	375.00	200.00	192.41	636.84	473.47	1.594	
30	217.26	164.09	375.00	200.00	184.30	673.23	510.20	1.595	
31	217.26	164.09	375.00	200.00	185.22	669.19	506.12	1.595	
32	216.74	164.00	375.00	200.00	193.32	632.80	469.39	1.595	
33	217.26	164.09	375.00	200.00	186.14	665.16	502.04	1.595	
34	217.26	164.09	375.00	200.00	187.06	661.13	497.96	1.595	
35	216.74	164.00	375.00	200.00	194.24	628.76	465.31	1.595	
36	216.74	164.00	375.00	200.00	199.77	604.49	440.82	1.595	
37	217.26	164.09	375.00	200.00	187.98	657.10	493.88	1.595	
38	217.26	164.09	375.00	200.00	188.89	653.06	489.80	1.595	
39	216.74	164.00	375.00	200.00	195.16	624.72	461.22	1.595	
40	217.26	164.09	375.00	200.00	189.81	649.03	485.71	1.596	
41	216.74	164.00	375.00	200.00	198.84	608.54	444.90	1.596	
42	216.74	164.00	375.00	200.00	196.08	620.68	457.14	1.596	
43	217.26	164.09	375.00	200.00	190.73	644.99	481.63	1.596	
44	217.26	164.09	375.00	200.00	191.65	640.95	477.55	1.596	
45	216.74	164.00	375.00	200.00	197.00	616.63	453.06	1.596	
46	216.74	164.00	375.00	200.00	197.92	612.59	448.98	1.596	
47	217.26	164.09	375.00	200.00	192.57	636.91	473.47	1.596	
48	217.79	164.26	375.00	200.00	166.43	753.87	591.84	1.597	
49	217.26	164.09	375.00	200.00	193.49	632.87	469.39	1.597	
50	217.26	164.09	375.00	200.00	194.41	628.83	465.31	1.597	
51	217.79	164.26	375.00	200.00	165.52	757.88	595.92	1.597	
52	216.74	164.00	375.00	200.00	179.56	693.31	530.61	1.597	
53	216.74	164.00	375.00	200.00	178.65	697.34	534.69	1.597	
54	216.74	164.00	375.00	200.00	177.73	701.36	538.78	1.597	
55	216.74	164.00	375.00	200.00	176.81	705.39	542.86	1.597	
56	217.26	164.09	375.00	200.00	195.33	624.79	461.22	1.597	
57	216.74	164.00	375.00	200.00	175.90	709.41	546.94	1.597	
58	216.74	164.00	375.00	200.00	174.98	713.44	551.02	1.597	
59	217.26	164.09	375.00	200.00	199.94	604.56	440.82	1.597	
60	216.74	164.00	375.00	200.00	174.07	717.46	555.10	1.597	
61	216.74	164.00	375.00	200.00	173.15	721.48	559.18	1.598	
62	216.74	164.00	375.00	200.00	172.24	725.50	563.27	1.598	
63	217.79	164.26	375.00	200.00	164.60	761.90	600.00	1.598	
64	217.26	164.09	375.00	200.00	196.25	620.75	457.14	1.598	
65	216.74	164.00	375.00	200.00	171.32	729.53	567.35	1.598	
66	216.74	164.00	375.00	200.00	170.41	733.55	571.43	1.598	
67	216.74	164.00	375.00	200.00	200.69	600.44	436.73	1.598	

16	280.48	55.16	10.9	4.21	4.29	2	0.00	35.0	7226.37	3505.99
1645.94	0.94									
17	284.69	57.30	11.9	4.20	4.29	2	0.00	35.0	7506.26	3653.79
1709.45	0.94									
18	288.88	59.46	11.9	4.20	4.29	2	0.00	35.0	7789.90	3791.85
1774.03	0.94									
19	293.08	61.26	12.8	4.18	4.29	2	0.00	35.0	8024.91	3920.20
1827.75	0.93									
20	297.26	63.11	12.8	4.18	4.29	2	0.00	35.0	8267.46	4038.68
1882.98	0.93									
21	301.44	64.56	13.7	4.17	4.29	2	0.00	35.0	8457.01	4147.20
1927.03	0.93									
22	305.61	66.10	13.7	4.17	4.29	2	0.00	35.0	8658.47	4246.00
1972.95	0.93									
23	309.77	50.33	14.7	3.11	3.22	2	0.00	35.0	6593.07	3246.52
2002.88	0.93									
24	312.89	51.02	14.7	3.11	3.22	2	0.00	35.0	6683.66	3291.13
2030.40	0.93									
25	316.00	34.28	14.7	2.07	2.14	2	0.00	35.0	4491.20	2165.51
2051.08	0.93									
26	318.07	57.17	15.6	3.42	3.55	2	0.00	35.0	7489.06	3425.39
2058.20	0.92									
27	321.48	59.49	15.6	3.52	3.65	1	150.00	22.0	7792.85	3304.44
2105.47	0.97									
28	325.00	22.37	15.6	1.33	1.38	1	150.00	22.0	2930.16	1190.93
2091.53	0.97									
29	326.33	65.92	16.5	4.11	4.29	1	150.00	22.0	8635.15	3488.18
1984.37	0.97									
30	330.44	60.90	16.5	4.11	4.29	1	150.00	22.0	7977.42	3161.35
1830.24	0.97									
31	334.55	55.46	17.5	4.09	4.29	1	150.00	22.0	7265.24	2825.51
1666.11	0.97									
32	338.64	50.19	17.5	4.09	4.29	1	150.00	22.0	6574.97	2480.79
1503.90	0.97									
33	342.73	32.15	18.4	2.88	3.04	1	150.00	22.0	4212.29	1545.60
1357.16	0.97									
34	345.62	29.38	18.4	2.88	3.04	1	150.00	22.0	3849.35	1363.39
1236.48	0.97									
35	348.50	7.41	18.4	0.77	0.82	5	0.00	45.0	815.24	170.65
907.50	0.87									
36	349.27	14.64	18.4	1.59	1.68	5	0.00	45.0	1610.26	0.00
835.46	0.87									
37	350.87	33.21	19.3	4.05	4.29	1	150.00	22.0	4350.21	0.00
956.85	0.97									
38	354.91	27.46	19.3	4.05	4.29	1	150.00	22.0	3597.19	0.00
785.96	0.97									
39	358.96	21.45	20.3	4.02	4.29	1	150.00	22.0	2810.26	0.00
606.92	0.97									
40	362.98	15.47	20.3	4.02	4.29	1	150.00	22.0	2026.97	0.00
428.89	0.97									
41	367.00	9.30	21.2	4.00	4.29	1	150.00	22.0	1218.89	0.00
244.28	0.98									
42	371.00	3.10	21.2	4.00	4.29	1	150.00	22.0	406.30	0.00
59.24	0.98									

X-S Area: 1574.95

Path Length: 162.95

X-S Weight: 205854.88

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 3-1\West Farm Expansion Case 3-1 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:24:23

DATA: Analysis 1 - Case 3-1 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 184.00 348.50 184.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 140.00 348.50 140.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 137.00 348.50 137.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 184.00 450.00 184.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 140.00 450.00 140.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 137.00 450.00 137.00

Slope Surface (8 points)

100.00	140.00	145.00	140.00	325.00	200.00	410.00	200.00
415.00	195.00						
420.00	195.00	425.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	197.00	145.00	197.00	316.00	197.00	348.50	197.00
351.50	175.00						
450.00	175.00						

Failure Surface

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

Intersects:	XL:	145.00	YL:	140.00	XR:	415.00	YR:	195.00
	Centre:	XC:	238.36	YC:	371.91	Radius:	R:	250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

-- -- -- -- --
RESULTS: Analysis 1 - Case 3-1 Full Reservoir - Pseudostatic

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.551 Final Angle of Interslice Forces
(Theta): 9.4 degrees

Analysis Summary

There were: 19802 successful analyses from a total of 20001 trial failure surfaces (Theta filter applied)
151 analyses that failed to produce a valid result
48 analyses rejected due to Theta being outside valid range

Critical (minimum) Factor of Safety: 2.57 Final Angle of Interslice Forces: 11.0
degrees

Results Summary - Lowest 99 Factor of Safety circles

Circle X-Left Y-Left X-Right Y-Right X-Centre Y-Centre Radius FoS Theta
1 150.00 141.67 410.00 200.00 209.15 486.63 350.00 2.573 11.0
<-- Critical Surface
2 149.47 141.49 410.00 200.00 208.84 486.42 350.00 2.651 11.0
3 150.00 141.67 410.53 199.47 210.17 486.46 350.00 2.652 10.9
4 150.00 141.67 410.00 200.00 210.11 482.32 345.92 2.656 11.0
5 148.95 141.32 410.00 200.00 208.54 486.21 350.00 2.730 10.9
6 150.00 141.67 411.05 198.95 211.20 486.28 350.00 2.730 10.9
7 149.47 141.49 410.53 199.47 209.87 486.24 350.00 2.732 10.9
8 149.47 141.49 410.00 200.00 209.81 482.11 345.92 2.734 11.0
9 150.00 141.67 410.53 199.47 211.13 482.14 345.92 2.737 10.9
10 150.00 141.67 410.00 200.00 211.08 478.00 341.84 2.742 11.0
11 149.47 141.49 410.53 199.47 210.83 481.93 345.92 2.793 10.9
12 150.00 141.67 411.58 198.42 212.22 486.09 350.00 2.796 10.7
13 148.95 141.32 410.00 200.00 209.51 481.89 345.92 2.798 10.9
14 149.47 141.49 411.05 198.95 210.89 486.06 350.00 2.798 10.8
15 148.95 141.32 410.53 199.47 209.56 486.03 350.00 2.802 10.9
16 149.47 141.49 410.00 200.00 210.78 477.79 341.84 2.805 10.9
17 150.00 141.67 410.53 199.47 212.09 477.82 341.84 2.805 10.9
18 150.00 141.67 411.05 198.95 212.14 481.96 345.92 2.805 10.8
19 148.42 141.14 410.00 200.00 208.24 485.99 350.00 2.807 10.9
20 150.00 141.67 410.00 200.00 212.06 473.67 337.76 2.810 10.9
21 148.42 141.14 410.53 199.47 209.26 485.81 350.00 2.857 10.8
22 148.95 141.32 410.00 200.00 210.48 477.57 341.84 2.858 10.9
23 148.95 141.32 410.53 199.47 210.52 481.71 345.92 2.859 10.9
24 148.42 141.14 410.00 200.00 209.21 481.68 345.92 2.859 10.9
25 150.00 141.67 410.53 199.47 213.05 473.48 337.76 2.859 10.9
26 150.00 141.67 411.58 198.42 213.15 481.77 345.92 2.859 10.7
27 150.00 141.67 411.05 198.95 213.09 477.63 341.84 2.860 10.8
28 148.95 141.32 411.05 198.95 210.58 485.85 350.00 2.860 10.8
29 150.00 141.67 412.11 197.89 213.24 485.91 350.00 2.861 10.7
30 149.47 141.49 410.53 199.47 211.79 477.60 341.84 2.862 10.9
31 149.47 141.49 411.05 198.95 211.84 481.74 345.92 2.862 10.8
32 149.47 141.49 411.58 198.42 211.91 485.88 350.00 2.863 10.7
33 149.47 141.49 410.00 200.00 211.75 473.45 337.76 2.863 10.9
34 147.89 140.96 410.00 200.00 207.93 485.78 350.00 2.863 10.9
35 150.00 141.67 410.00 200.00 213.03 469.33 333.67 2.866 10.9
36 148.42 141.14 410.53 199.47 210.22 481.49 345.92 2.907 10.8
37 148.42 141.14 410.00 200.00 210.18 477.35 341.84 2.910 10.8
38 148.95 141.32 410.53 199.47 211.48 477.38 341.84 2.911 10.8
39 148.95 141.32 410.00 200.00 211.45 473.24 337.76 2.911 10.9
40 149.47 141.49 410.53 199.47 212.75 473.27 337.76 2.911 10.9
41 148.95 141.32 411.05 198.95 211.53 481.53 345.92 2.912 10.8
42 149.47 141.49 411.05 198.95 212.79 477.41 341.84 2.912 10.8
43 149.47 141.49 411.58 198.42 212.85 481.56 345.92 2.913 10.7
44 147.89 140.96 410.53 199.47 208.95 485.60 350.00 2.913 10.8
45 148.95 141.32 411.58 198.42 211.60 485.66 350.00 2.914 10.7
46 150.00 141.67 411.58 198.42 214.09 477.44 341.84 2.914 10.7
47 149.47 141.49 412.11 197.89 212.92 485.69 350.00 2.914 10.6
48 150.00 141.67 410.53 199.47 214.01 469.14 333.67 2.914 10.9
49 148.42 141.14 411.05 198.95 210.27 485.63 350.00 2.914 10.7
50 150.00 141.67 411.05 198.95 214.04 473.29 337.76 2.914 10.8
51 147.37 140.79 410.00 200.00 207.63 485.56 350.00 2.915 10.8
52 150.00 141.67 412.11 197.89 214.16 481.58 345.92 2.915 10.7
53 149.47 141.49 410.00 200.00 212.73 469.11 333.67 2.918 10.9
54 150.00 141.67 412.63 197.37 214.25 485.72 350.00 2.919 10.6
55 150.00 141.67 410.00 200.00 214.00 464.98 329.59 2.922 10.9
56 147.89 140.96 410.00 200.00 208.90 481.46 345.92 2.924 10.8
57 147.37 140.79 410.00 200.00 208.60 481.24 345.92 2.956 10.8

58	146.84	140.61	410.00	200.00	207.33	485.35	350.00	2.956	10.8
59	147.37	140.79	410.53	199.47	208.65	485.38	350.00	2.956	10.8
60	147.89	140.96	410.53	199.47	209.91	481.28	345.92	2.957	10.8
61	147.89	140.96	410.00	200.00	209.88	477.14	341.84	2.957	10.8
62	148.42	141.14	410.00	200.00	211.15	473.02	337.76	2.961	10.8
63	148.95	141.32	410.53	199.47	212.45	473.05	337.76	2.962	10.8
64	148.95	141.32	411.05	198.95	212.48	477.20	341.84	2.964	10.8
65	148.95	141.32	411.58	198.42	212.54	481.34	345.92	2.965	10.7
66	149.47	141.49	410.53	199.47	213.71	468.92	333.67	2.965	10.9
67	149.47	141.49	411.58	198.42	213.79	477.22	341.84	2.965	10.7
68	149.47	141.49	411.05	198.95	213.74	473.08	337.76	2.966	10.8
69	148.95	141.32	412.11	197.89	212.61	485.48	350.00	2.966	10.6
70	148.42	141.14	411.58	198.42	211.29	485.45	350.00	2.966	10.6
71	148.42	141.14	410.53	199.47	211.18	477.17	341.84	2.967	10.8
72	149.47	141.49	412.11	197.89	213.85	481.37	345.92	2.967	10.6
73	147.89	140.96	411.05	198.95	209.97	485.42	350.00	2.968	10.7
74	150.00	141.67	411.58	198.42	215.04	473.10	337.76	2.968	10.7
75	150.00	141.67	410.53	199.47	214.98	464.79	329.59	2.969	10.9
76	150.00	141.67	411.05	198.95	215.00	468.95	333.67	2.969	10.8
77	150.00	141.67	412.11	197.89	215.09	477.25	341.84	2.970	10.7
78	148.95	141.32	410.00	200.00	212.43	468.89	333.67	2.970	10.8
79	149.47	141.49	412.63	197.37	213.94	485.50	350.00	2.971	10.6
80	149.47	141.49	410.00	200.00	213.71	464.76	329.59	2.972	10.9
81	150.00	141.67	412.63	197.37	215.17	481.39	345.92	2.973	10.6
82	148.42	141.14	411.05	198.95	211.23	481.31	345.92	2.976	10.7
83	150.00	141.67	410.00	200.00	214.98	460.62	325.51	2.978	10.9
84	150.00	141.67	413.16	196.84	215.27	485.53	350.00	2.978	10.5
85	146.84	140.61	410.00	200.00	208.30	481.03	345.92	2.996	10.8
86	146.84	140.61	410.53	199.47	208.34	485.17	350.00	2.996	10.7
87	147.37	140.79	410.53	199.47	209.61	481.06	345.92	2.996	10.8
88	146.32	140.44	410.00	200.00	207.02	485.13	350.00	2.997	10.7
89	147.37	140.79	410.00	200.00	209.58	476.92	341.84	2.997	10.8
90	147.89	140.96	410.53	199.47	210.88	476.95	341.84	2.998	10.8
91	147.89	140.96	410.00	200.00	210.86	472.80	337.76	3.000	10.8
92	148.42	141.14	410.00	200.00	212.13	468.67	333.67	3.005	10.9
93	147.37	140.79	411.05	198.95	209.66	485.20	350.00	3.007	10.7
94	148.42	141.14	410.53	199.47	212.15	472.83	337.76	3.007	10.8
95	147.89	140.96	411.05	198.95	210.92	481.09	345.92	3.009	10.7
96	150.00	141.67	411.58	198.42	215.98	468.75	333.67	3.011	10.7
97	149.47	141.49	410.53	199.47	214.68	464.57	329.59	3.011	10.8
98	148.42	141.14	411.05	198.95	212.18	476.98	341.84	3.012	10.7
99	148.95	141.32	410.53	199.47	213.41	468.70	333.67	3.012	10.8

Critical Failure Surface (circle 1)

Intersects:	XL:	150.00	YL:	141.67	XR:	410.00	YR:	200.00	
Centre:	XC:	209.15	YC:	486.63		Radius:	R:	350.00	
Generated failure surface: (20 points)									
150.00	141.67		164.23	139.53	178.53	137.97	192.88	137.01	
207.26	136.64								
221.65	136.86		236.01	137.67	250.33	139.06	264.58	141.05	
278.73	143.62								
292.77	146.77		306.67	150.49	320.40	154.78	333.94	159.64	
347.27	165.04								
360.37	170.99		373.22	177.47	385.78	184.47	398.05	191.99	
410.00	200.00								

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

Slice	X-S		Base							PoreWater
--- Left Hand Side ---										
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Side Force	l/h	l'/h								
1	150.00	7.43	-8.6	5.54	5.60	2	0.00	35.0	973.02	19495.48
0.00	0.00	0.00								
2	155.54	22.28	-8.6	5.54	5.60	2	0.00	35.0	2919.06	19786.90
204.57	0.36	0.33								
3	161.08	19.24	-8.6	3.14	3.18	3	100.00	18.0	2527.80	11351.65
818.28	0.27	0.33								
4	164.23	60.51	-6.2	7.15	7.19	3	100.00	18.0	7988.23	25970.75
1244.55	0.27	0.33								
5	171.38	83.11	-6.2	7.15	7.19	3	100.00	18.0	11004.08	26319.23
2262.26	0.27	0.33								
6	178.53	105.06	-3.8	7.18	7.19	3	100.00	18.0	13925.87	26601.95
3553.12	0.26	0.33								
7	185.71	125.69	-3.8	7.18	7.19	3	100.00	18.0	16662.71	26818.19
4755.58	0.26	0.33								
8	192.88	145.55	-1.5	7.19	7.19	4	2000.00	20.0	19289.14	26968.17
6135.79	0.26	0.33								
9	200.07	164.13	-1.5	7.19	7.19	4	2000.00	20.0	21736.16	27051.94
13001.71	0.16	0.33								
10	207.26	181.68	0.9	7.19	7.19	4	2000.00	20.0	24038.50	27068.96
19987.30	0.15	0.33								

11	214.46	198.14	0.9	7.19	7.19	4	2000.00	20.0	26186.69	27020.03
26432.88	0.15	0.33								
12	221.65	74.22	3.2	2.56	2.56	4	2000.00	20.0	9801.83	9593.58
32931.83	0.15	0.33								
13	224.20	178.42	3.2	5.90	5.91	3	100.00	18.0	23540.01	22078.80
35005.60	0.15	0.33								
14	230.11	188.07	3.2	5.90	5.91	3	100.00	18.0	24785.29	21956.06
35110.90	0.17	0.33								
15	236.01	239.94	5.6	7.16	7.19	3	100.00	18.0	31574.48	26475.69
35208.32	0.18	0.33								
16	243.17	252.02	5.6	7.16	7.19	3	100.00	18.0	33106.47	26161.74
34614.92	0.20	0.33								
17	250.33	246.42	7.9	6.71	6.78	3	100.00	18.0	32312.57	24312.66
33978.16	0.21	0.33								
18	257.05	286.87	7.9	7.53	7.61	2	0.00	35.0	37580.42	26805.45
32643.81	0.22	0.33								
19	264.58	243.95	10.3	6.21	6.31	2	0.00	35.0	31957.90	21814.91
33625.69	0.22	0.33								
20	270.79	249.81	10.3	6.21	6.31	2	0.00	35.0	32724.78	21370.80
33732.73	0.21	0.33								
21	277.00	70.78	10.3	1.73	1.76	2	0.00	35.0	9272.79	5886.85
33842.34	0.21	0.33								
22	278.73	290.16	12.6	7.02	7.19	2	0.00	35.0	38010.50	23606.50
33873.38	0.21	0.33								
23	285.75	295.52	12.6	7.02	7.19	2	0.00	35.0	38713.56	22899.59
33155.11	0.20	0.33								
24	292.77	296.78	15.0	6.95	7.19	2	0.00	35.0	38878.67	22128.33
32423.53	0.20	0.33								
25	299.72	299.94	15.0	6.95	7.19	2	0.00	35.0	39292.07	21292.65
30840.86	0.19	0.33								
26	306.67	202.73	17.4	4.67	4.89	2	0.00	35.0	26557.53	13965.53
29241.36	0.19	0.33								
27	311.33	203.18	17.4	4.67	4.89	2	0.00	35.0	26616.86	13520.61
27590.45	0.19	0.33								
28	316.00	191.93	17.4	4.40	4.61	2	0.00	35.0	25142.83	12336.92
25935.85	0.19	0.33								
29	320.40	200.74	19.7	4.60	4.89	2	0.00	35.0	26296.94	12624.72
24365.31	0.19	0.33								
30	325.00	191.20	19.7	4.47	4.75	2	0.00	35.0	25047.47	11784.59
22123.06	0.19	0.33								
31	329.47	184.04	19.7	4.47	4.75	2	0.00	35.0	24109.33	11309.89
19969.49	0.20	0.33								
32	333.94	260.07	22.1	6.67	7.19	2	0.00	35.0	34068.55	16164.19
17894.15	0.21	0.33								
33	340.61	242.05	22.1	6.67	7.19	2	0.00	35.0	31708.66	14951.24
14190.63	0.24	0.33								
34	347.27	42.51	24.4	1.23	1.35	2	0.00	35.0	5568.55	2661.15
10733.32	0.29	0.33								
35	348.50	101.16	24.4	3.00	3.29	5	0.00	45.0	11127.93	4054.54
9999.47	0.31	0.33								
36	351.50	142.12	24.4	4.44	4.87	2	0.00	35.0	18617.37	2138.27
10054.64	0.30	0.33								
37	355.94	133.18	24.4	4.44	4.87	2	0.00	35.0	17446.50	1525.74
9348.77	0.30	0.33								
38	360.37	214.64	26.8	7.95	8.90	2	0.00	35.0	28117.44	1114.02
8789.49	0.31	0.33								
39	368.32	116.35	26.8	4.90	5.48	2	0.00	35.0	15241.26	0.00
7596.43	0.30	0.33								
40	373.22	122.41	29.1	5.86	6.71	2	0.00	35.0	16036.07	0.00
7053.95	0.29	0.29								
41	379.07	103.29	29.1	5.86	6.71	2	0.00	35.0	13530.70	0.00
6084.43	0.28	0.28								
42	384.93	92.08	31.2	6.56	7.67	1	150.00	22.0	12062.60	0.00
5173.56	0.25	0.25								
43	391.49	65.73	31.5	6.56	7.69	1	150.00	22.0	8610.42	0.00
3066.93	0.25	0.25								
44	398.05	35.90	33.8	5.97	7.19	1	150.00	22.0	4702.75	0.00
1465.29	0.27	0.27								
45	404.03	11.97	33.8	5.97	7.19	1	150.00	22.0	1567.59	0.00
369.14	0.36	0.36								
RHS	410.00	-----		-----					-----	
54.10	0.00	0.00								
X-S Area:		7183.01	Path Length:		273.34	X-S Weight:		940979.94		

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 3-1\West Farm Expansion Case 3-1 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:23:46

DATA: Analysis 1 - Case 3-1 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 184.00 348.50 184.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 140.00 348.50 140.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 137.00 348.50 137.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 184.00 450.00 184.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 140.00 450.00 140.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 137.00 450.00 137.00

Slope Surface (8 points)

100.00	140.00	145.00	140.00	325.00	200.00	410.00	200.00
415.00	195.00						
420.00	195.00	425.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	140.00	145.00	140.00	316.00	197.00	348.50	197.00
351.50	175.00						
450.00	175.00						

Failure Surface

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

Intersects: XL:	145.00	YL:	140.00	XR:	415.00	YR:	195.00
Centre: XC:	238.36	YC:	371.91	Radius: R:	250.00		

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

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RESULTS: Analysis 1 - Case 3-1 Rapid Drawdown - Pseudostatic

Spencer-Wright Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.175 Final Angle of Interslice Forces
(Theta): 9.8 degrees

Analysis Summary

There were: 18292 successful analyses from a total of 20001 trial failure surfaces (Theta filter applied)
78 analyses that failed to produce a valid result
1631 analyses rejected due to Theta being outside valid range

Critical (minimum) Factor of Safety: 1.54 Final Angle of Interslice Forces: 10.6
degrees

Negative interslice forces exist on 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	Theta
1	150.00	141.67	410.00	200.00	209.15	486.63	350.00	1.543	10.6
<-- Critical Surface									
2	149.47	141.49	410.00	200.00	208.84	486.42	350.00	1.592	10.7
3	150.00	141.67	410.53	199.47	210.17	486.46	350.00	1.594	10.6
4	150.00	141.67	410.00	200.00	210.11	482.32	345.92	1.595	10.7
5	148.95	141.32	410.00	200.00	208.54	486.21	350.00	1.642	10.7
6	149.47	141.49	410.53	199.47	209.87	486.24	350.00	1.644	10.6
7	150.00	141.67	411.05	198.95	211.20	486.28	350.00	1.645	10.6
8	149.47	141.49	410.00	200.00	209.81	482.11	345.92	1.645	10.7
9	150.00	141.67	410.53	199.47	211.13	482.14	345.92	1.648	10.6
10	150.00	141.67	410.00	200.00	211.08	478.00	341.84	1.651	10.7
11	149.47	141.49	410.53	199.47	210.83	481.93	345.92	1.684	10.6
12	148.95	141.32	410.00	200.00	209.51	481.89	345.92	1.686	10.7
13	150.00	141.67	411.58	198.42	212.22	486.09	350.00	1.687	10.5
14	149.47	141.49	411.05	198.95	210.89	486.06	350.00	1.688	10.6
15	148.95	141.32	410.53	199.47	209.56	486.03	350.00	1.690	10.6
16	149.47	141.49	410.00	200.00	210.78	477.79	341.84	1.690	10.7
17	148.42	141.14	410.00	200.00	208.24	485.99	350.00	1.691	10.7
18	150.00	141.67	410.53	199.47	212.09	477.82	341.84	1.691	10.7
19	150.00	141.67	410.00	200.00	212.06	473.67	337.76	1.692	10.7
20	150.00	141.67	411.05	198.95	212.14	481.96	345.92	1.693	10.6
21	148.95	141.32	410.00	200.00	210.48	477.57	341.84	1.724	10.6
22	148.42	141.14	410.00	200.00	209.21	481.68	345.92	1.724	10.6
23	148.95	141.32	410.53	199.47	210.52	481.71	345.92	1.725	10.6
24	148.42	141.14	410.53	199.47	209.26	485.81	350.00	1.725	10.6
25	148.95	141.32	411.05	198.95	210.58	485.85	350.00	1.726	10.5
26	150.00	141.67	410.53	199.47	213.05	473.48	337.76	1.727	10.6
27	147.89	140.96	410.00	200.00	207.93	485.78	350.00	1.727	10.6
28	149.47	141.49	410.53	199.47	211.79	477.60	341.84	1.727	10.6
29	150.00	141.67	411.05	198.95	213.09	477.63	341.84	1.728	10.6
30	149.47	141.49	410.00	200.00	211.75	473.45	337.76	1.728	10.7
31	150.00	141.67	411.58	198.42	213.15	481.77	345.92	1.728	10.5
32	149.47	141.49	411.05	198.95	211.84	481.74	345.92	1.728	10.6
33	150.00	141.67	410.00	200.00	213.03	469.33	333.67	1.728	10.7
34	149.47	141.49	411.58	198.42	211.91	485.88	350.00	1.730	10.5
35	150.00	141.67	412.11	197.89	213.24	485.91	350.00	1.730	10.5
36	148.42	141.14	410.00	200.00	210.18	477.35	341.84	1.757	10.6
37	148.42	141.14	410.53	199.47	210.22	481.49	345.92	1.757	10.6
38	148.95	141.32	410.00	200.00	211.45	473.24	337.76	1.757	10.6
39	148.95	141.32	410.53	199.47	211.48	477.38	341.84	1.758	10.6
40	149.47	141.49	410.53	199.47	212.75	473.27	337.76	1.759	10.6
41	147.37	140.79	410.00	200.00	207.63	485.56	350.00	1.759	10.6
42	148.95	141.32	411.05	198.95	211.53	481.53	345.92	1.760	10.5
43	147.89	140.96	410.53	199.47	208.95	485.60	350.00	1.761	10.5
44	148.42	141.14	411.05	198.95	210.27	485.63	350.00	1.761	10.5
45	149.47	141.49	411.05	198.95	212.79	477.41	341.84	1.761	10.6
46	149.47	141.49	410.00	200.00	212.73	469.11	333.67	1.761	10.7
47	148.95	141.32	411.58	198.42	211.60	485.66	350.00	1.762	10.5
48	149.47	141.49	411.58	198.42	212.85	481.56	345.92	1.762	10.5
49	150.00	141.67	410.53	199.47	214.01	469.14	333.67	1.762	10.7
50	150.00	141.67	411.05	198.95	214.04	473.29	337.76	1.763	10.6
51	150.00	141.67	411.58	198.42	214.09	477.44	341.84	1.763	10.5
52	149.47	141.49	412.11	197.89	212.92	485.69	350.00	1.764	10.4
53	150.00	141.67	410.00	200.00	214.00	464.98	329.59	1.764	10.7
54	150.00	141.67	412.11	197.89	214.16	481.58	345.92	1.765	10.5
55	147.89	140.96	410.00	200.00	208.90	481.46	345.92	1.766	10.6

56	150.00	141.67	412.63	197.37	214.25	485.72	350.00	1.768	10.4
57	146.84	140.61	410.00	200.00	207.33	485.35	350.00	1.785	10.5
58	147.37	140.79	410.00	200.00	208.60	481.24	345.92	1.785	10.6
59	147.89	140.96	410.00	200.00	209.88	477.14	341.84	1.787	10.6
60	147.37	140.79	410.53	199.47	208.65	485.38	350.00	1.788	10.5
61	147.89	140.96	410.53	199.47	209.91	481.28	345.92	1.788	10.5
62	148.42	141.14	410.00	200.00	211.15	473.02	337.76	1.789	10.6
63	148.95	141.32	410.53	199.47	212.45	473.05	337.76	1.791	10.6
64	148.95	141.32	411.05	198.95	212.48	477.20	341.84	1.793	10.5
65	148.42	141.14	410.53	199.47	211.18	477.17	341.84	1.793	10.6
66	149.47	141.49	410.53	199.47	213.71	468.92	333.67	1.794	10.6
67	147.89	140.96	411.05	198.95	209.97	485.42	350.00	1.794	10.5
68	148.95	141.32	411.58	198.42	212.54	481.34	345.92	1.794	10.5
69	149.47	141.49	411.05	198.95	213.74	473.08	337.76	1.795	10.6
70	148.42	141.14	411.58	198.42	211.29	485.45	350.00	1.795	10.4
71	149.47	141.49	411.58	198.42	213.79	477.22	341.84	1.795	10.5
72	148.95	141.32	410.00	200.00	212.43	468.89	333.67	1.796	10.6
73	149.47	141.49	410.00	200.00	213.71	464.76	329.59	1.796	10.7
74	148.95	141.32	412.11	197.89	212.61	485.48	350.00	1.796	10.4
75	149.47	141.49	412.11	197.89	213.85	481.37	345.92	1.797	10.4
76	150.00	141.67	410.53	199.47	214.98	464.79	329.59	1.797	10.7
77	150.00	141.67	411.05	198.95	215.00	468.95	333.67	1.798	10.6
78	150.00	141.67	411.58	198.42	215.04	473.10	337.76	1.798	10.5
79	150.00	141.67	412.11	197.89	215.09	477.25	341.84	1.799	10.5
80	148.42	141.14	411.05	198.95	211.23	481.31	345.92	1.800	10.5
81	150.00	141.67	410.00	200.00	214.98	460.62	325.51	1.800	10.7
82	149.47	141.49	412.63	197.37	213.94	485.50	350.00	1.800	10.4
83	150.00	141.67	412.63	197.37	215.17	481.39	345.92	1.802	10.4
84	150.00	141.67	413.16	196.84	215.27	485.53	350.00	1.805	10.3
85	146.32	140.44	410.00	200.00	207.02	485.13	350.00	1.811	10.5
86	146.84	140.61	410.00	200.00	208.30	481.03	345.92	1.811	10.6
87	147.37	140.79	410.00	200.00	209.58	476.92	341.84	1.812	10.6
88	146.84	140.61	410.53	199.47	208.34	485.17	350.00	1.813	10.5
89	147.37	140.79	410.53	199.47	209.61	481.06	345.92	1.813	10.5
90	147.89	140.96	410.00	200.00	210.86	472.80	337.76	1.814	10.6
91	147.89	140.96	410.53	199.47	210.88	476.95	341.84	1.815	10.6
92	148.42	141.14	410.00	200.00	212.13	468.67	333.67	1.817	10.6
93	147.37	140.79	411.05	198.95	209.66	485.20	350.00	1.819	10.5
94	148.42	141.14	410.53	199.47	212.15	472.83	337.76	1.819	10.6
95	147.89	140.96	411.05	198.95	210.92	481.09	345.92	1.820	10.5
96	148.95	141.32	410.00	200.00	213.41	464.54	329.59	1.822	10.7
97	148.42	141.14	411.05	198.95	212.18	476.98	341.84	1.823	10.5
98	148.95	141.32	410.53	199.47	213.41	468.70	333.67	1.823	10.6
99	149.47	141.49	410.53	199.47	214.68	464.57	329.59	1.823	10.6

Critical Failure Surface (circle 1)

Intersects: XL: 150.00 YL: 141.67 XR: 410.00 YR: 200.00
Centre: XC: 209.15 YC: 486.63 Radius: R: 350.00

Generated failure surface: (20 points)

150.00	141.67	164.23	139.53	178.53	137.97	192.88	137.01
207.26	136.64						
221.65	136.86	236.01	137.67	250.33	139.06	264.58	141.05
278.73	143.62						
292.77	146.77	306.67	150.49	320.40	154.78	333.94	159.64
347.27	165.04						
360.37	170.99	373.22	177.47	385.78	184.47	398.05	191.99
410.00	200.00						

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

Slice	X-S		Base							PoreWater
--- Left Hand Side ---										
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Side Force	l/h	l'/h								
1	150.00	7.43	-8.6	5.54	5.60	2	0.00	35.0	973.02	468.70
0.00	0.00	0.00								
2	155.54	22.28	-8.6	5.54	5.60	2	0.00	35.0	2919.06	1406.08
391.49	0.35	0.33								
3	161.08	19.24	-8.6	3.14	3.18	3	100.00	18.0	2527.80	1214.04
1565.95	0.26	0.33								
4	164.23	60.51	-6.2	7.15	7.19	3	100.00	18.0	7988.23	3797.95
2363.15	0.26	0.33								
5	171.38	83.11	-6.2	7.15	7.19	3	100.00	18.0	11004.08	5216.34
4324.21	0.26	0.33								
6	178.53	105.06	-3.8	7.18	7.19	3	100.00	18.0	13925.87	6570.67
6842.04	0.26	0.33								
7	185.71	125.69	-3.8	7.18	7.19	3	100.00	18.0	16662.71	7860.75
9301.11	0.25	0.33								
8	192.88	145.55	-1.5	7.19	7.19	4	2000.00	20.0	19289.14	9085.58
12152.99	0.25	0.33								
9	200.07	164.13	-1.5	7.19	7.19	4	2000.00	20.0	21736.16	10245.19
24413.04	0.16	0.33								

10	207.26	181.68	0.9	7.19	7.19	4	2000.00	20.0	24038.50	11338.39
36956.39	0.15	0.33								
11	214.46	198.14	0.9	7.19	7.19	4	2000.00	20.0	26186.69	12365.50
48574.43	0.15	0.33								
12	221.65	74.22	3.2	2.56	2.56	4	2000.00	20.0	9801.83	4638.92
60341.30	0.15	0.33								
13	224.20	178.42	3.2	5.90	5.91	3	100.00	18.0	23540.01	11150.91
64097.20	0.15	0.33								
14	230.11	188.07	3.2	5.90	5.91	3	100.00	18.0	24785.29	11754.39
64882.75	0.16	0.33								
15	236.01	239.94	5.6	7.16	7.19	3	100.00	18.0	31574.48	15043.65
65673.45	0.18	0.33								
16	243.17	252.02	5.6	7.16	7.19	3	100.00	18.0	33106.47	15800.83
65328.38	0.19	0.33								
17	250.33	246.42	7.9	6.71	6.78	3	100.00	18.0	32312.57	15525.32
64897.78	0.20	0.33								
18	257.05	286.87	7.9	7.53	7.61	2	0.00	35.0	37580.42	18073.96
63071.73	0.20	0.33								
19	264.58	243.95	10.3	6.21	6.31	2	0.00	35.0	31957.90	15471.55
65039.00	0.20	0.33								
20	270.79	249.81	10.3	6.21	6.31	2	0.00	35.0	32724.78	15842.81
65157.39	0.20	0.33								
21	277.00	70.78	10.3	1.73	1.76	2	0.00	35.0	9272.79	4489.17
65274.56	0.19	0.33								
22	278.73	290.16	12.6	7.02	7.19	2	0.00	35.0	38010.50	18555.86
65307.71	0.19	0.33								
23	285.75	295.52	12.6	7.02	7.19	2	0.00	35.0	38713.56	18899.09
63709.23	0.19	0.33								
24	292.77	296.78	15.0	6.95	7.19	2	0.00	35.0	38878.67	19172.66
62081.14	0.18	0.33								
25	299.72	299.94	15.0	6.95	7.19	2	0.00	35.0	39292.07	19376.53
58701.39	0.18	0.33								
26	306.67	202.73	17.4	4.67	4.89	2	0.00	35.0	26557.53	13253.74
55285.69	0.17	0.33								
27	311.33	203.18	17.4	4.67	4.89	2	0.00	35.0	26616.86	13283.34
51800.06	0.17	0.33								
28	316.00	191.93	17.4	4.40	4.61	2	0.00	35.0	25142.83	12336.92
48306.64	0.17	0.33								
29	320.40	200.74	19.7	4.60	4.89	2	0.00	35.0	26296.94	12624.72
45098.18	0.17	0.33								
30	325.00	191.20	19.7	4.47	4.75	2	0.00	35.0	25047.47	11784.59
40782.65	0.16	0.33								
31	329.47	184.04	19.7	4.47	4.75	2	0.00	35.0	24109.33	11309.89
36775.10	0.17	0.33								
32	333.94	260.07	22.1	6.67	7.19	2	0.00	35.0	34068.55	16164.19
32932.00	0.18	0.33								
33	340.61	242.05	22.1	6.67	7.19	2	0.00	35.0	31708.66	14951.24
26041.92	0.20	0.33								
34	347.27	42.51	24.4	1.23	1.35	2	0.00	35.0	5568.55	2661.15
19668.69	0.23	0.33								
35	348.50	101.16	24.4	3.00	3.29	5	0.00	45.0	11127.93	4054.54
18311.07	0.25	0.33								
36	351.50	142.12	24.4	4.44	4.87	2	0.00	35.0	18617.37	2138.27
17235.56	0.25	0.33								
37	355.94	133.18	24.4	4.44	4.87	2	0.00	35.0	17446.50	1525.74
15540.07	0.25	0.33								
38	360.37	214.64	26.8	7.95	8.90	2	0.00	35.0	28117.44	1114.02
14152.33	0.25	0.33								
39	368.32	116.35	26.8	4.90	5.48	2	0.00	35.0	15241.26	0.00
11326.37	0.25	0.33								
40	373.22	122.41	29.1	5.86	6.71	2	0.00	35.0	16036.07	0.00
10046.83	0.24	0.24								
41	379.07	103.29	29.1	5.86	6.71	2	0.00	35.0	13530.70	0.00
8047.74	0.23	0.23								
42	384.93	92.08	31.2	6.56	7.67	1	150.00	22.0	12062.60	0.00
6360.95	0.20	0.20								
43	391.49	65.73	31.5	6.56	7.69	1	150.00	22.0	8610.42	0.00
3152.67	0.19	0.19								
44	398.05	35.90	33.8	5.97	7.19	1	150.00	22.0	4702.75	0.00
1028.52	0.17	0.17								
45	404.03	11.97	33.8	5.97	7.19	1	150.00	22.0	1567.59	0.00
-36.49	0.36	0.36								
RHS	410.00	-----								
64.72	0.00	0.00								
X-S Area:	7183.01		Path Length:	273.34			X-S Weight:	940979.94		

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 3-2\West Farm Expansion Case 3-2 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:32:00

DATA: Analysis 1 - Case 3-2 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 178.00 348.50 178.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 135.00 348.50 135.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 132.00 348.50 132.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 178.00 450.00 178.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 135.00 450.00 135.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 132.00 450.00 132.00

Slope Surface (4 points)

100.00	135.00	130.00	135.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	197.00	130.00	197.00	316.00	197.00	348.50	197.00
351.50	174.00						
450.00	174.00						

Failure Surface

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

Intersects: XL:	130.00	YL:	135.00	XR:	405.00	YR:	200.00
Centre: XC:	220.06	YC:	368.22	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 3-2 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.362

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	135.00	136.67	400.00	200.00	192.56	481.90	350.00	2.137	
Critical Surface									
2	135.00	136.67	400.53	200.00	192.99	481.83	350.00	2.228	
3	135.00	136.67	401.05	200.00	193.42	481.76	350.00	2.312	
4	134.47	136.49	400.00	200.00	192.27	481.69	350.00	2.374	
5	135.00	136.67	400.00	200.00	193.59	477.59	345.92	2.390	
6	135.00	136.67	401.58	200.00	193.84	481.68	350.00	2.398	
7	134.47	136.49	400.53	200.00	192.70	481.61	350.00	2.409	
8	135.00	136.67	400.53	200.00	194.02	477.51	345.92	2.423	
9	135.00	136.67	402.11	200.00	194.27	481.61	350.00	2.433	
10	134.47	136.49	401.05	200.00	193.12	481.54	350.00	2.443	
11	135.00	136.67	401.05	200.00	194.44	477.44	345.92	2.449	
12	135.00	136.67	402.63	200.00	194.70	481.54	350.00	2.463	
13	133.95	136.32	400.00	200.00	191.98	481.47	350.00	2.464	
14	134.47	136.49	400.00	200.00	193.30	477.37	345.92	2.468	
15	134.47	136.49	401.58	200.00	193.55	481.47	350.00	2.474	
16	135.00	136.67	400.00	200.00	194.62	473.26	341.84	2.475	
17	135.00	136.67	401.58	200.00	194.87	477.36	345.92	2.481	
18	135.00	136.67	403.16	200.00	195.12	481.46	350.00	2.492	
19	133.95	136.32	400.53	200.00	192.41	481.40	350.00	2.493	
20	134.47	136.49	400.53	200.00	193.73	477.30	345.92	2.497	
21	135.00	136.67	400.53	200.00	195.05	473.19	341.84	2.499	
22	134.47	136.49	402.11	200.00	193.98	481.40	350.00	2.507	
23	135.00	136.67	402.11	200.00	195.30	477.29	345.92	2.513	
24	133.95	136.32	401.05	200.00	192.83	481.33	350.00	2.516	
25	134.47	136.49	401.05	200.00	194.15	477.22	345.92	2.522	
26	135.00	136.67	403.68	200.00	195.55	481.39	350.00	2.522	
27	135.00	136.67	401.05	200.00	195.47	473.11	341.84	2.531	
28	134.47	136.49	402.63	200.00	194.41	481.32	350.00	2.536	
29	133.42	136.14	400.00	200.00	191.69	481.26	350.00	2.538	
30	133.95	136.32	400.00	200.00	193.01	477.15	345.92	2.542	
31	135.00	136.67	402.63	200.00	195.72	477.21	345.92	2.543	
32	133.95	136.32	401.58	200.00	193.26	481.25	350.00	2.547	
33	134.47	136.49	400.00	200.00	194.33	473.05	341.84	2.548	
34	135.00	136.67	404.21	200.00	195.97	481.31	350.00	2.552	
35	134.47	136.49	401.58	200.00	194.58	477.15	345.92	2.554	
36	135.00	136.67	400.00	200.00	195.66	468.93	337.76	2.558	
37	135.00	136.67	401.58	200.00	195.90	473.03	341.84	2.563	
38	134.47	136.49	403.16	200.00	194.83	481.25	350.00	2.565	
39	133.42	136.14	400.53	200.00	192.11	481.18	350.00	2.567	
40	133.95	136.32	400.53	200.00	193.44	477.08	345.92	2.570	
41	135.00	136.67	403.16	200.00	196.15	477.14	345.92	2.572	
42	134.47	136.49	400.53	200.00	194.76	472.97	341.84	2.577	
43	133.95	136.32	402.11	200.00	193.69	481.18	350.00	2.579	
44	135.00	136.67	404.74	200.00	196.40	481.24	350.00	2.581	
45	135.00	136.67	400.53	200.00	196.08	468.85	337.76	2.582	
46	134.47	136.49	402.11	200.00	195.01	477.07	345.92	2.585	
47	133.42	136.14	401.05	200.00	192.54	481.11	350.00	2.589	
48	133.95	136.32	401.05	200.00	193.86	477.01	345.92	2.594	
49	134.47	136.49	403.68	200.00	195.26	481.17	350.00	2.594	
50	135.00	136.67	402.11	200.00	196.32	472.96	341.84	2.595	
51	135.00	136.67	403.68	200.00	196.57	477.06	345.92	2.602	
52	134.47	136.49	401.05	200.00	195.18	472.89	341.84	2.602	
53	133.95	136.32	402.63	200.00	194.11	481.11	350.00	2.608	
54	135.00	136.67	405.26	200.00	196.82	481.16	350.00	2.611	
55	132.89	135.96	400.00	200.00	191.40	481.04	350.00	2.611	
56	133.42	136.14	400.00	200.00	192.72	476.94	345.92	2.614	
57	135.00	136.67	401.05	200.00	196.51	468.77	337.76	2.614	
58	134.47	136.49	402.63	200.00	195.43	477.00	345.92	2.615	
59	133.42	136.14	401.58	200.00	192.97	481.04	350.00	2.619	
60	133.95	136.32	400.00	200.00	194.05	472.83	341.84	2.620	
61	134.47	136.49	404.21	200.00	195.68	481.10	350.00	2.623	
62	135.00	136.67	402.63	200.00	196.75	472.88	341.84	2.624	
63	133.95	136.32	401.58	200.00	194.29	476.93	345.92	2.625	
64	134.47	136.49	400.00	200.00	195.37	468.71	337.76	2.629	

65	135.00	136.67	404.21	200.00	196.99	476.98	345.92	2.632
66	134.47	136.49	401.58	200.00	195.61	472.82	341.84	2.634
67	135.00	136.67	400.00	200.00	196.70	464.59	333.67	2.636
68	133.95	136.32	403.16	200.00	194.54	481.03	350.00	2.636
69	132.89	135.96	400.53	200.00	191.82	480.97	350.00	2.639
70	135.00	136.67	405.79	200.00	197.25	481.09	350.00	2.640
71	133.42	136.14	400.53	200.00	193.15	476.86	345.92	2.642
72	134.47	136.49	403.16	200.00	195.85	476.92	345.92	2.644
73	135.00	136.67	401.58	200.00	196.93	468.70	337.76	2.647
74	134.47	136.49	400.53	200.00	195.80	468.63	337.76	2.648
75	133.95	136.32	400.53	200.00	194.47	472.75	341.84	2.649
76	133.42	136.14	402.11	200.00	193.40	480.96	350.00	2.650
77	134.47	136.49	404.74	200.00	196.11	481.02	350.00	2.652
78	135.00	136.67	403.16	200.00	197.17	472.80	341.84	2.654
79	135.00	136.67	400.53	200.00	197.12	464.51	333.67	2.655
80	133.95	136.32	402.11	200.00	194.71	476.85	345.92	2.656
81	135.00	136.67	402.11	200.00	197.35	468.62	337.76	2.657
82	135.00	136.67	404.74	200.00	197.42	476.91	345.92	2.662
83	133.42	136.14	401.05	200.00	193.57	476.79	345.92	2.664
84	133.95	136.32	403.68	200.00	194.96	480.96	350.00	2.665
85	134.47	136.49	402.11	200.00	196.03	472.74	341.84	2.665
86	132.89	135.96	401.05	200.00	192.25	480.90	350.00	2.667
87	133.95	136.32	401.05	200.00	194.90	472.68	341.84	2.669
88	135.00	136.67	406.32	200.00	197.67	481.01	350.00	2.670
89	135.00	136.67	403.68	200.00	197.59	472.72	341.84	2.671
90	134.47	136.49	403.68	200.00	196.28	476.84	345.92	2.673
91	134.47	136.49	401.05	200.00	196.22	468.55	337.76	2.673
92	134.47	136.49	402.63	200.00	196.46	472.66	341.84	2.676
93	135.00	136.67	401.05	200.00	197.54	464.43	333.67	2.678
94	133.42	136.14	402.63	200.00	193.82	480.89	350.00	2.679
95	134.47	136.49	405.26	200.00	196.53	480.95	350.00	2.681
96	133.42	136.14	400.00	200.00	193.76	472.61	341.84	2.681
97	135.00	136.67	405.26	200.00	197.84	476.83	345.92	2.684
98	133.95	136.32	402.63	200.00	195.14	476.78	345.92	2.685
99	132.89	135.96	400.00	200.00	192.43	476.72	345.92	2.685

Critical Failure Surface (circle 1)

Intersects:	XL:	135.00	YL:	136.67	XR:	400.00	YR:	200.00	
Centre:	XC:	192.56	YC:	481.90		Radius:	R:	350.00	
Generated failure surface: (20 points)									
135.00	136.67		149.58	134.55		164.23	133.05	178.93	132.17
193.66	131.90								
208.38	132.26		223.08	133.23		237.72	134.83	252.28	137.03
266.74	139.85								
281.06	143.28		295.23	147.30		309.22	151.91	322.99	157.11
336.54	162.89								
349.84	169.23		362.85	176.12		375.57	183.56	387.96	191.52
400.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 46 slices)

Slice	X-S		Base						PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	135.00	7.88	-8.3	5.74	5.80	2	0.00	35.0	1032.78	21988.64
3889.72	1.06									
2	140.74	23.65	-8.3	5.74	5.80	2	0.00	35.0	3098.32	22290.28
4139.56	1.06									
3	146.48	19.29	-8.3	3.10	3.13	3	100.00	18.0	2534.55	12143.42
4329.37	1.03									
4	149.58	62.79	-5.8	7.33	7.36	3	100.00	18.0	8285.52	28869.15
4530.75	1.02									
5	156.90	86.17	-5.8	7.33	7.36	3	100.00	18.0	11404.15	29214.04
4807.66	1.02									
6	164.23	108.83	-3.4	7.35	7.36	3	100.00	18.0	14416.55	29488.14
5054.00	1.01									
7	171.58	130.09	-3.4	7.35	7.36	3	100.00	18.0	17233.82	29691.11
5286.22	1.01									
8	178.93	92.92	-1.0	4.66	4.66	3	100.00	18.0	12306.16	18847.86
5450.89	1.00									
9	183.58	100.53	-1.0	4.66	4.66	3	100.00	18.0	13307.16	18872.08
5569.41	1.00									
10	188.24	126.54	-1.0	5.42	5.42	4	2000.00	20.0	16741.32	21986.35
5714.12	1.00									
11	193.66	100.06	1.4	4.01	4.01	4	2000.00	20.0	13230.05	16292.34
5770.43	1.00									
12	197.67	141.30	1.4	5.36	5.36	3	100.00	18.0	18668.02	21707.42
5883.38	1.00									
13	203.02	150.17	1.4	5.36	5.36	3	100.00	18.0	19822.74	21664.12
5987.18	1.00									
14	208.38	219.32	3.8	7.35	7.36	3	100.00	18.0	28914.99	29637.84

6073.42	0.99										
15	215.73	233.74	3.8	7.35	7.36	3	100.00	18.0	30767.44	29413.73	
6171.40	0.99										
16	223.08	246.08	6.2	7.32	7.36	3	100.00	18.0	32336.82	29119.15	
6230.93	0.99										
17	230.40	258.12	6.2	7.32	7.36	3	100.00	18.0	33855.18	28753.18	
6284.36	0.99										
18	237.72	41.37	8.6	1.14	1.16	3	100.00	18.0	5420.76	4480.43	
6294.36	0.99										
19	238.86	247.55	8.6	6.71	6.79	2	0.00	35.0	32429.22	26038.18	
6248.43	0.96										
20	245.57	255.73	8.6	6.71	6.79	2	0.00	35.0	33501.08	25607.57	
6264.67	0.96										
21	252.28	263.39	11.0	6.72	6.85	2	0.00	35.0	34504.15	25341.48	
6228.12	0.96										
22	259.00	310.91	11.0	7.74	7.88	2	0.00	35.0	40728.71	28475.59	
6204.71	0.96										
23	266.74	294.12	13.4	7.16	7.36	2	0.00	35.0	38529.83	25867.44	
6125.11	0.95										
24	273.90	298.96	13.4	7.16	7.36	2	0.00	35.0	39163.99	25080.95	
6061.28	0.95										
25	281.06	299.33	15.9	7.08	7.36	2	0.00	35.0	39211.62	24225.67	
5941.49	0.95										
26	288.14	301.80	15.9	7.08	7.36	2	0.00	35.0	39536.35	23301.37	
5837.92	0.95										
27	295.23	299.23	18.3	6.99	7.36	2	0.00	35.0	39199.63	22308.78	
5678.28	0.95										
28	302.22	299.40	18.3	6.99	7.36	2	0.00	35.0	39221.07	21248.34	
5535.71	0.95										
29	309.22	289.54	20.7	6.78	7.25	2	0.00	35.0	37930.29	19822.94	
5338.81	0.95										
30	316.00	296.38	20.7	6.99	7.48	2	0.00	35.0	38826.37	19223.55	
5222.79	0.95										
31	322.99	84.46	23.1	2.01	2.18	2	0.00	35.0	11064.48	5366.65	
5143.75	0.95										
32	325.00	235.50	23.1	5.77	6.27	2	0.00	35.0	30850.04	14799.71	
4978.97	0.95										
33	330.77	221.30	23.1	5.77	6.27	2	0.00	35.0	28989.81	13836.47	
4677.36	0.95										
34	336.54	213.33	25.5	5.98	6.62	2	0.00	35.0	27946.20	13508.32	
4318.59	0.96										
35	342.52	196.29	25.5	5.98	6.62	2	0.00	35.0	25713.38	12330.00	
3971.53	0.96										
36	348.50	41.58	25.5	1.34	1.48	5	0.00	45.0	4574.30	2123.32	
3057.29	0.91										
37	349.84	50.42	27.9	1.66	1.88	5	0.00	45.0	5546.33	1256.36	
2806.30	0.91										
38	351.50	205.22	27.9	7.34	8.31	2	0.00	35.0	26884.19	1008.56	
3137.36	0.96										
39	358.84	99.98	27.9	4.01	4.54	2	0.00	35.0	13097.46	0.00	
2783.79	0.96										
40	362.85	73.60	30.3	3.21	3.72	2	0.00	35.0	9641.88	0.00	
2521.71	0.97										
41	366.06	97.95	30.3	4.75	5.51	1	150.00	22.0	12831.62	0.00	
2394.19	1.04										
42	370.81	84.74	30.3	4.75	5.51	1	150.00	22.0	11101.17	0.00	
2066.35	1.04										
43	375.57	89.52	32.7	6.19	7.36	1	150.00	22.0	11726.94	0.00	
1647.67	1.06										
44	381.76	64.85	32.7	6.19	7.36	1	150.00	22.0	8495.58	0.00	
1182.57	1.06										
45	387.96	38.29	35.1	6.02	7.36	1	150.00	22.0	5015.73	0.00	
691.50	1.08										
46	393.98	12.76	35.1	6.02	7.36	1	150.00	22.0	1671.90	0.00	
201.43	1.08										

X-S Area:

7415.01

Path Length:

279.84

X-S Weight:

971309.69

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 3-2\West Farm Expansion Case 3-2 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:31:28

DATA: Analysis 1 - Case 3-2 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

```

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    178.00        348.50    178.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    135.00        348.50    135.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    132.00        348.50    132.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    178.00        450.00    178.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    135.00        450.00    135.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    132.00        450.00    132.00

```

Slope Surface (4 points)

100.00	135.00	130.00	135.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	135.00	130.00	135.00	316.00	197.00	348.50	197.00
351.50	174.00						
450.00	174.00						

Failure Surface

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

Intersects: XL:	130.00	YL:	135.00	XR:	405.00	YR:	200.00
Centre: XC:	220.06	YC:	368.22	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 3-2 Rapid Drawdown - Pseudostatic

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: 1.24

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	135.00	136.67	400.00	200.00	192.56	481.90	350.00	1.243	
Critical Surface									
2	135.00	136.67	400.53	200.00	192.99	481.83	350.00	1.302	
3	135.00	136.67	401.05	200.00	193.42	481.76	350.00	1.357	
4	134.47	136.49	400.00	200.00	192.27	481.69	350.00	1.395	
5	135.00	136.67	400.00	200.00	193.59	477.59	345.92	1.405	
6	135.00	136.67	401.58	200.00	193.84	481.68	350.00	1.412	
7	134.47	136.49	400.53	200.00	192.70	481.61	350.00	1.418	
8	135.00	136.67	400.53	200.00	194.02	477.51	345.92	1.427	
9	135.00	136.67	402.11	200.00	194.27	481.61	350.00	1.434	
10	134.47	136.49	401.05	200.00	193.12	481.54	350.00	1.441	
11	135.00	136.67	401.05	200.00	194.44	477.44	345.92	1.445	
12	133.95	136.32	400.00	200.00	191.98	481.47	350.00	1.452	
13	135.00	136.67	402.63	200.00	194.70	481.54	350.00	1.454	
14	134.47	136.49	400.00	200.00	193.30	477.37	345.92	1.455	
15	135.00	136.67	400.00	200.00	194.62	473.26	341.84	1.459	
16	134.47	136.49	401.58	200.00	193.55	481.47	350.00	1.461	
17	135.00	136.67	401.58	200.00	194.87	477.36	345.92	1.465	
18	133.95	136.32	400.53	200.00	192.41	481.40	350.00	1.471	
19	135.00	136.67	403.16	200.00	195.12	481.46	350.00	1.473	
20	134.47	136.49	400.53	200.00	193.73	477.30	345.92	1.474	
21	135.00	136.67	400.53	200.00	195.05	473.19	341.84	1.477	
22	134.47	136.49	402.11	200.00	193.98	481.40	350.00	1.481	
23	135.00	136.67	402.11	200.00	195.30	477.29	345.92	1.485	
24	133.95	136.32	401.05	200.00	192.83	481.33	350.00	1.488	
25	134.47	136.49	401.05	200.00	194.15	477.22	345.92	1.491	
26	135.00	136.67	403.68	200.00	195.55	481.39	350.00	1.492	
27	135.00	136.67	401.05	200.00	195.47	473.11	341.84	1.497	
28	133.42	136.14	400.00	200.00	191.69	481.26	350.00	1.499	
29	134.47	136.49	402.63	200.00	194.41	481.32	350.00	1.500	
30	133.95	136.32	400.00	200.00	193.01	477.15	345.92	1.501	
31	135.00	136.67	402.63	200.00	195.72	477.21	345.92	1.505	
32	134.47	136.49	400.00	200.00	194.33	473.05	341.84	1.505	
33	133.95	136.32	401.58	200.00	193.26	481.25	350.00	1.507	
34	134.47	136.49	401.58	200.00	194.58	477.15	345.92	1.511	
35	135.00	136.67	404.21	200.00	195.97	481.31	350.00	1.511	
36	135.00	136.67	400.00	200.00	195.66	468.93	337.76	1.512	
37	135.00	136.67	401.58	200.00	195.90	473.03	341.84	1.517	
38	133.42	136.14	400.53	200.00	192.11	481.18	350.00	1.518	
39	134.47	136.49	403.16	200.00	194.83	481.25	350.00	1.519	
40	133.95	136.32	400.53	200.00	193.44	477.08	345.92	1.520	
41	135.00	136.67	403.16	200.00	196.15	477.14	345.92	1.524	
42	134.47	136.49	400.53	200.00	194.76	472.97	341.84	1.525	
43	133.95	136.32	402.11	200.00	193.69	481.18	350.00	1.527	
44	135.00	136.67	400.53	200.00	196.08	468.85	337.76	1.529	
45	135.00	136.67	404.74	200.00	196.40	481.24	350.00	1.531	
46	134.47	136.49	402.11	200.00	195.01	477.07	345.92	1.531	
47	133.42	136.14	401.05	200.00	192.54	481.11	350.00	1.534	
48	133.95	136.32	401.05	200.00	193.86	477.01	345.92	1.537	
49	135.00	136.67	402.11	200.00	196.32	472.96	341.84	1.537	
50	134.47	136.49	403.68	200.00	195.26	481.17	350.00	1.538	
51	134.47	136.49	401.05	200.00	195.18	472.89	341.84	1.542	
52	135.00	136.67	403.68	200.00	196.57	477.06	345.92	1.543	
53	132.89	135.96	400.00	200.00	191.40	481.04	350.00	1.545	
54	133.95	136.32	402.63	200.00	194.11	481.11	350.00	1.546	
55	133.42	136.14	400.00	200.00	192.72	476.94	345.92	1.547	
56	135.00	136.67	401.05	200.00	196.51	468.77	337.76	1.549	
57	135.00	136.67	405.26	200.00	196.82	481.16	350.00	1.550	
58	134.47	136.49	402.63	200.00	195.43	477.00	345.92	1.550	
59	133.95	136.32	400.00	200.00	194.05	472.83	341.84	1.551	
60	133.42	136.14	401.58	200.00	192.97	481.04	350.00	1.553	
61	133.95	136.32	401.58	200.00	194.29	476.93	345.92	1.556	
62	135.00	136.67	402.63	200.00	196.75	472.88	341.84	1.556	
63	134.47	136.49	404.21	200.00	195.68	481.10	350.00	1.557	
64	134.47	136.49	400.00	200.00	195.37	468.71	337.76	1.557	

65	135.00	136.67	400.00	200.00	196.70	464.59	333.67	1.561
66	134.47	136.49	401.58	200.00	195.61	472.82	341.84	1.562
67	135.00	136.67	404.21	200.00	196.99	476.98	345.92	1.562
68	132.89	135.96	400.53	200.00	191.82	480.97	350.00	1.563
69	133.95	136.32	403.16	200.00	194.54	481.03	350.00	1.564
70	133.42	136.14	400.53	200.00	193.15	476.86	345.92	1.565
71	134.47	136.49	403.16	200.00	195.85	476.92	345.92	1.569
72	135.00	136.67	405.79	200.00	197.25	481.09	350.00	1.569
73	133.95	136.32	400.53	200.00	194.47	472.75	341.84	1.570
74	135.00	136.67	401.58	200.00	196.93	468.70	337.76	1.570
75	134.47	136.49	400.53	200.00	195.80	468.63	337.76	1.571
76	133.42	136.14	402.11	200.00	193.40	480.96	350.00	1.572
77	135.00	136.67	400.53	200.00	197.12	464.51	333.67	1.575
78	134.47	136.49	404.74	200.00	196.11	481.02	350.00	1.576
79	135.00	136.67	403.16	200.00	197.17	472.80	341.84	1.576
80	133.95	136.32	402.11	200.00	194.71	476.85	345.92	1.576
81	135.00	136.67	402.11	200.00	197.35	468.62	337.76	1.577
82	132.89	135.96	401.05	200.00	192.25	480.90	350.00	1.581
83	133.42	136.14	401.05	200.00	193.57	476.79	345.92	1.581
84	134.47	136.49	402.11	200.00	196.03	472.74	341.84	1.582
85	135.00	136.67	404.74	200.00	197.42	476.91	345.92	1.582
86	133.95	136.32	403.68	200.00	194.96	480.96	350.00	1.583
87	133.95	136.32	401.05	200.00	194.90	472.68	341.84	1.584
88	135.00	136.67	403.68	200.00	197.59	472.72	341.84	1.586
89	134.47	136.49	401.05	200.00	196.22	468.55	337.76	1.587
90	134.47	136.49	403.68	200.00	196.28	476.84	345.92	1.588
91	135.00	136.67	406.32	200.00	197.67	481.01	350.00	1.588
92	134.47	136.49	402.63	200.00	196.46	472.66	341.84	1.589
93	135.00	136.67	401.05	200.00	197.54	464.43	333.67	1.589
94	133.42	136.14	400.00	200.00	193.76	472.61	341.84	1.590
95	133.42	136.14	402.63	200.00	193.82	480.89	350.00	1.590
96	132.89	135.96	400.00	200.00	192.43	476.72	345.92	1.592
97	133.95	136.32	400.00	200.00	195.08	468.49	337.76	1.593
98	134.47	136.49	405.26	200.00	196.53	480.95	350.00	1.594
99	133.95	136.32	402.63	200.00	195.14	476.78	345.92	1.594

Critical Failure Surface (circle 1)

Intersects:	XL:	135.00	YL:	136.67	XR:	400.00	YR:	200.00	
Centre:	XC:	192.56	YC:	481.90		Radius:	R:	350.00	
Generated failure surface: (20 points)									
135.00	136.67		149.58	134.55		164.23	133.05	178.93	132.17
193.66	131.90								
208.38	132.26		223.08	133.23		237.72	134.83	252.28	137.03
266.74	139.85								
281.06	143.28		295.23	147.30		309.22	151.91	322.99	157.11
336.54	162.89								
349.84	169.23		362.85	176.12		375.57	183.56	387.96	191.52
400.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 46 slices)

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	135.00	7.88	-8.3	5.74	5.80	2	0.00	35.0	1032.78	497.11
188.31	1.10									
2	140.74	23.65	-8.3	5.74	5.80	2	0.00	35.0	3098.32	1491.31
564.91	1.10									
3	146.48	19.29	-8.3	3.10	3.13	3	100.00	18.0	2534.55	1216.61
848.01	1.05									
4	149.58	62.79	-5.8	7.33	7.36	3	100.00	18.0	8285.52	3938.42
1155.88	1.03									
5	156.90	86.17	-5.8	7.33	7.36	3	100.00	18.0	11404.15	5405.38
1587.81	1.03									
6	164.23	108.83	-3.4	7.35	7.36	3	100.00	18.0	14416.55	6803.34
1982.64	1.02									
7	171.58	130.09	-3.4	7.35	7.36	3	100.00	18.0	17233.82	8132.24
2369.12	1.02									
8	178.93	92.92	-1.0	4.66	4.66	3	100.00	18.0	12306.16	5799.05
2651.60	1.00									
9	183.58	100.53	-1.0	4.66	4.66	3	100.00	18.0	13307.16	6274.09
2867.16	1.00									
10	188.24	126.54	-1.0	5.42	5.42	4	2000.00	20.0	16741.32	7897.11
3128.79	1.01									
11	193.66	100.06	1.4	4.01	4.01	4	2000.00	20.0	13230.05	6245.50
3246.20	0.99									
12	197.67	141.30	1.4	5.36	5.36	3	100.00	18.0	18668.02	8819.94
3472.15	0.99									
13	203.02	150.17	1.4	5.36	5.36	3	100.00	18.0	19822.74	9373.44
3687.05	0.99									
14	208.38	219.32	3.8	7.35	7.36	3	100.00	18.0	28914.99	13715.94

3894.52	0.99										
15	215.73	233.74	3.8	7.35	7.36	3	100.00	18.0	30767.44	14617.37	
4144.42	0.99										
16	223.08	246.08	6.2	7.32	7.36	3	100.00	18.0	32336.82	15446.05	
4344.35	0.98										
17	230.40	258.12	6.2	7.32	7.36	3	100.00	18.0	33855.18	16201.50	
4548.86	0.98										
18	237.72	41.37	8.6	1.14	1.16	3	100.00	18.0	5420.76	2611.11	
4634.48	0.97										
19	238.86	247.55	8.6	6.71	6.79	2	0.00	35.0	32429.22	15623.64	
4634.36	0.93										
20	245.57	255.73	8.6	6.71	6.79	2	0.00	35.0	33501.08	16140.03	
4787.53	0.93										
21	252.28	263.39	11.0	6.72	6.85	2	0.00	35.0	34504.15	16744.89	
4868.03	0.92										
22	259.00	310.91	11.0	7.74	7.88	2	0.00	35.0	40728.71	19765.68	
4992.30	0.92										
23	266.74	294.12	13.4	7.16	7.36	2	0.00	35.0	38529.83	18870.01	
5045.23	0.91										
24	273.90	298.96	13.4	7.16	7.36	2	0.00	35.0	39163.99	19180.58	
5128.25	0.91										
25	281.06	299.33	15.9	7.08	7.36	2	0.00	35.0	39211.62	19416.35	
5135.45	0.90										
26	288.14	301.80	15.9	7.08	7.36	2	0.00	35.0	39536.35	19577.15	
5177.96	0.90										
27	295.23	299.23	18.3	6.99	7.36	2	0.00	35.0	39199.63	19662.73	
5145.27	0.89										
28	302.22	299.40	18.3	6.99	7.36	2	0.00	35.0	39221.07	19673.47	
5148.06	0.89										
29	309.22	289.54	20.7	6.78	7.25	2	0.00	35.0	37930.29	19311.22	
5077.19	0.88										
30	316.00	296.38	20.7	6.99	7.48	2	0.00	35.0	38826.37	19223.55	
5028.34	0.88										
31	322.99	84.46	23.1	2.01	2.18	2	0.00	35.0	11064.48	5366.65	
4926.56	0.88										
32	325.00	235.50	23.1	5.77	6.27	2	0.00	35.0	30850.04	14799.71	
4766.75	0.88										
33	330.77	221.30	23.1	5.77	6.27	2	0.00	35.0	28989.81	13836.47	
4477.13	0.88										
34	336.54	213.33	25.5	5.98	6.62	2	0.00	35.0	27946.20	13508.32	
4116.70	0.87										
35	342.52	196.29	25.5	5.98	6.62	2	0.00	35.0	25713.38	12330.00	
3784.62	0.87										
36	348.50	41.58	25.5	1.34	1.48	5	0.00	45.0	4574.30	2123.32	
2868.86	0.80										
37	349.84	50.42	27.9	1.66	1.88	5	0.00	45.0	5546.33	1256.36	
2539.01	0.79										
38	351.50	205.22	27.9	7.34	8.31	2	0.00	35.0	26884.19	1008.56	
2847.43	0.87										
39	358.84	99.98	27.9	4.01	4.54	2	0.00	35.0	13097.46	0.00	
2516.19	0.87										
40	362.85	73.60	30.3	3.21	3.72	2	0.00	35.0	9641.88	0.00	
2260.32	0.87										
41	366.06	97.95	30.3	4.75	5.51	1	150.00	22.0	12831.62	0.00	
2209.42	0.97										
42	370.81	84.74	30.3	4.75	5.51	1	150.00	22.0	11101.17	0.00	
1903.48	0.97										
43	375.57	89.52	32.7	6.19	7.36	1	150.00	22.0	11726.94	0.00	
1501.72	0.98										
44	381.76	64.85	32.7	6.19	7.36	1	150.00	22.0	8495.58	0.00	
1070.24	0.98										
45	387.96	38.29	35.1	6.02	7.36	1	150.00	22.0	5015.73	0.00	
608.72	1.00										
46	393.98	12.76	35.1	6.02	7.36	1	150.00	22.0	1671.90	0.00	
156.82	1.00										

X-S Area:

7415.01

Path Length:

279.84

X-S Weight:

971309.69

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:36:33

DATA: Analysis 1 - Case 3-3 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 183.00 348.50 183.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 144.00 348.50 144.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 141.00 348.50 141.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 183.00 450.00 183.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 144.00 450.00 144.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 141.00 450.00 141.00

Slope Surface (4 points)

100.00	144.00	157.00	144.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	197.00	157.00	197.00	316.00	197.00	348.50	197.00
351.50	182.00						
450.00	182.00						

Failure Surface

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

Intersects: XL:	157.00	YL:	144.00	XR:	395.00	YR:	200.00
Centre: XC:	226.05	YC:	384.27	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 3-3 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.403

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.99

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	162.00	145.67	390.00	200.00	213.78	433.91	292.86	1.987	
Critical Surface									
2	161.47	145.49	390.00	200.00	212.46	438.02	296.94	1.987	
3	160.95	145.32	390.00	200.00	211.14	442.12	301.02	1.988	
4	160.42	145.14	390.00	200.00	209.82	446.22	305.10	1.988	
5	159.89	144.96	390.00	200.00	208.50	450.30	309.18	1.988	
6	158.32	144.44	390.00	200.00	204.54	462.53	321.43	1.989	
7	161.47	145.49	390.53	200.00	212.89	437.94	296.94	1.990	
8	158.84	144.61	390.00	200.00	205.86	458.46	317.35	1.990	
9	155.68	144.00	390.00	200.00	200.51	474.65	333.67	1.990	
10	160.95	145.32	390.53	200.00	211.57	442.05	301.02	1.990	
11	157.79	144.26	390.00	200.00	203.22	466.59	325.51	1.990	
12	160.42	145.14	390.53	200.00	210.25	446.15	305.10	1.991	
13	159.89	144.96	390.53	200.00	208.93	450.24	309.18	1.991	
14	159.37	144.79	390.53	200.00	207.61	454.32	313.27	1.991	
15	154.11	144.00	390.00	200.00	199.24	478.73	337.76	1.992	
16	157.79	144.26	390.53	200.00	203.66	466.53	325.51	1.992	
17	157.26	144.09	390.00	200.00	201.90	470.64	329.59	1.992	
18	156.21	144.00	390.00	200.00	200.60	474.71	333.67	1.993	
19	159.37	144.79	390.00	200.00	207.18	454.38	313.27	1.993	
20	158.32	144.44	390.53	200.00	204.97	462.46	321.43	1.993	
21	159.37	144.79	391.05	200.00	208.04	454.25	313.27	1.994	
22	157.26	144.09	390.53	200.00	202.34	470.58	329.59	1.994	
23	152.53	144.00	390.00	200.00	197.97	482.80	341.84	1.994	
24	158.84	144.61	391.05	200.00	206.73	458.33	317.35	1.994	
25	158.32	144.44	391.05	200.00	205.41	462.40	321.43	1.994	
26	156.21	144.00	390.53	200.00	201.04	474.65	333.67	1.995	
27	154.63	144.00	390.00	200.00	199.32	478.79	337.76	1.995	
28	156.74	144.00	390.00	200.00	200.68	474.77	333.67	1.996	
29	158.84	144.61	390.53	200.00	206.29	458.39	317.35	1.996	
30	154.63	144.00	390.53	200.00	199.76	478.73	337.76	1.997	
31	153.05	144.00	390.00	200.00	198.06	482.86	341.84	1.997	
32	155.16	144.00	390.00	200.00	199.41	478.84	337.76	1.998	
33	160.42	145.14	390.00	200.00	208.79	450.52	309.18	1.998	
34	156.74	144.00	390.53	200.00	201.12	474.71	333.67	1.998	
35	162.00	145.67	390.00	200.00	212.75	438.24	296.94	1.998	
36	161.47	145.49	390.00	200.00	211.43	442.34	301.02	1.998	
37	153.05	144.00	390.53	200.00	198.50	482.80	341.84	1.999	
38	159.89	144.96	390.00	200.00	207.47	454.60	313.27	1.999	
39	159.37	144.79	390.00	200.00	206.15	458.67	317.35	2.000	
40	153.58	144.00	390.00	200.00	198.14	482.92	341.84	2.000	
41	155.16	144.00	390.53	200.00	199.85	478.79	337.76	2.000	
42	156.74	144.00	391.05	200.00	201.56	474.65	333.67	2.000	
43	162.00	145.67	390.53	200.00	213.18	438.16	296.94	2.000	
44	158.84	144.61	390.00	200.00	204.83	462.74	321.43	2.000	
45	161.47	145.49	390.53	200.00	211.86	442.26	301.02	2.000	
46	159.89	144.96	390.53	200.00	207.91	454.53	313.27	2.000	
47	160.95	145.32	390.53	200.00	210.54	446.36	305.10	2.000	
48	155.68	144.00	390.00	200.00	199.49	478.90	337.76	2.000	
49	158.32	144.44	390.00	200.00	203.51	466.80	325.51	2.001	
50	159.37	144.79	390.53	200.00	206.59	458.60	317.35	2.001	
51	157.79	144.26	390.00	200.00	202.19	470.85	329.59	2.001	
52	160.95	145.32	390.00	200.00	210.11	446.43	305.10	2.001	
53	155.16	144.00	391.05	200.00	200.29	478.73	337.76	2.002	
54	153.58	144.00	390.53	200.00	198.58	482.86	341.84	2.002	
55	152.00	144.00	390.00	200.00	196.88	486.99	345.92	2.002	
56	158.84	144.61	390.53	200.00	205.27	462.67	321.43	2.002	
57	154.11	144.00	390.00	200.00	198.23	482.98	341.84	2.002	
58	155.68	144.00	390.53	200.00	199.94	478.84	337.76	2.003	
59	157.26	144.09	390.00	200.00	200.87	474.90	333.67	2.003	
60	158.32	144.44	390.53	200.00	203.95	466.73	325.51	2.003	
61	160.95	145.32	391.05	200.00	210.97	446.29	305.10	2.003	
62	160.42	145.14	391.05	200.00	209.66	450.38	309.18	2.003	
63	156.21	144.00	390.00	200.00	199.58	478.96	337.76	2.003	
64	157.79	144.26	390.53	200.00	202.63	470.79	329.59	2.003	

65	159.37	144.79	391.05	200.00	207.02	458.54	317.35	2.003
66	153.58	144.00	391.05	200.00	199.02	482.80	341.84	2.003
67	158.84	144.61	391.05	200.00	205.71	462.61	321.43	2.003
68	152.00	144.00	390.53	200.00	197.32	486.94	345.92	2.004
69	160.42	145.14	390.53	200.00	209.22	450.45	309.18	2.004
70	158.32	144.44	391.05	200.00	204.39	466.67	325.51	2.004
71	152.53	144.00	390.00	200.00	196.97	487.05	345.92	2.004
72	154.11	144.00	390.53	200.00	198.67	482.92	341.84	2.004
73	155.68	144.00	391.05	200.00	200.38	478.79	337.76	2.005
74	157.26	144.09	390.53	200.00	201.32	474.84	333.67	2.005
75	162.00	145.67	391.05	200.00	213.61	438.09	296.94	2.005
76	154.63	144.00	390.00	200.00	198.31	483.03	341.84	2.005
77	157.79	144.26	391.05	200.00	203.07	470.73	329.59	2.005
78	159.89	144.96	391.58	200.00	208.77	454.39	313.27	2.005
79	156.21	144.00	390.53	200.00	200.02	478.90	337.76	2.005
80	162.00	145.67	391.58	200.00	214.03	438.01	296.94	2.005
81	152.00	144.00	391.05	200.00	197.76	486.88	345.92	2.005
82	161.47	145.49	391.05	200.00	212.29	442.19	301.02	2.006
83	156.74	144.00	390.00	200.00	199.66	479.02	337.76	2.006
84	158.32	144.44	391.58	200.00	204.83	466.61	325.51	2.006
85	162.00	145.67	392.11	200.00	214.46	437.94	296.94	2.006
86	155.68	144.00	391.58	200.00	200.82	478.73	337.76	2.006
87	154.11	144.00	391.05	200.00	199.11	482.86	341.84	2.006
88	152.53	144.00	390.53	200.00	197.41	486.99	345.92	2.006
89	161.47	145.49	391.58	200.00	212.72	442.12	301.02	2.007
90	158.84	144.61	391.58	200.00	206.14	462.54	321.43	2.007
91	159.89	144.96	391.05	200.00	208.34	454.46	313.27	2.007
92	157.26	144.09	391.05	200.00	201.76	474.78	333.67	2.007
93	161.47	145.49	392.11	200.00	213.14	442.04	301.02	2.007
94	157.79	144.26	391.58	200.00	203.51	470.67	329.59	2.007
95	153.05	144.00	390.00	200.00	197.05	487.11	345.92	2.007
96	154.63	144.00	390.53	200.00	198.75	482.98	341.84	2.007
97	156.21	144.00	391.05	200.00	200.46	478.84	337.76	2.007
98	160.95	145.32	391.58	200.00	211.40	446.22	305.10	2.008
99	155.16	144.00	390.00	200.00	198.40	483.09	341.84	2.008

Critical Failure Surface (circle 1)

Intersects:	XL:	162.00	YL:	145.67	XR:	390.00	YR:	200.00	
Centre:	XC:	213.78	YC:	433.91			Radius:	R:	292.86
Generated failure surface: (20 points)									
162.00	145.67		174.54	143.69		187.15	142.27	199.81	141.39
212.49	141.05								
225.18	141.27		237.85	142.04		250.47	143.36	263.02	145.22
275.48	147.63								
287.83	150.57		300.04	154.04		312.08	158.04	323.94	162.56
335.59	167.58								
347.01	173.11		358.19	179.13		369.09	185.62	379.70	192.59
390.00	200.00								

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	162.00	6.88	-8.9	5.30	5.36	2	0.00	35.0	901.27	17310.29
3323.56	1.07									
2	167.30	20.64	-8.9	5.30	5.36	2	0.00	35.0	2703.79	17588.98
3564.28	1.07									
3	172.59	11.04	-8.9	1.95	1.97	3	100.00	18.0	1449.21	6532.55
3725.99	1.04									
4	174.54	47.66	-6.5	6.30	6.35	3	100.00	18.0	6285.53	21247.59
3889.51	1.03									
5	180.84	65.41	-6.5	6.30	6.35	3	100.00	18.0	8656.07	21530.27
4138.12	1.03									
6	187.15	82.66	-4.0	6.33	6.35	3	100.00	18.0	10951.62	21758.74
4358.52	1.01									
7	193.48	98.80	-4.0	6.33	6.35	3	100.00	18.0	13094.12	21933.05
4567.38	1.01									
8	199.81	114.32	-1.5	6.34	6.35	3	100.00	18.0	15147.35	22053.15
4745.57	1.00									
9	206.15	128.78	-1.5	6.34	6.35	3	100.00	18.0	17052.31	22118.67
4914.63	1.00									
10	212.49	142.40	1.0	6.34	6.35	3	100.00	18.0	18837.86	22129.51
5050.94	1.00									
11	218.84	155.12	1.0	6.34	6.35	3	100.00	18.0	20497.51	22086.15
5180.19	1.00									
12	225.18	166.68	3.5	6.33	6.35	3	100.00	18.0	21995.63	21988.42
5274.99	0.99									
13	231.51	177.62	3.5	6.33	6.35	3	100.00	18.0	23404.16	21836.28
5364.51	0.99									
14	237.85	187.00	6.0	6.31	6.35	3	100.00	18.0	24599.13	21629.87

5418.20	0.99										
15	244.16	196.12	6.0	6.31	6.35	3	100.00	18.0	25752.57	21369.23	
5468.14	0.99										
16	250.47	139.18	8.4	4.32	4.37	3	100.00	18.0	18245.79	14539.20	
5479.50	0.99										
17	254.79	135.72	8.4	4.12	4.16	2	0.00	35.0	17778.93	13679.95	
5438.06	0.96										
18	258.91	138.85	8.4	4.12	4.16	2	0.00	35.0	18189.29	13521.42	
5449.60	0.96										
19	263.02	189.37	10.9	5.49	5.59	2	0.00	35.0	24807.83	17874.80	
5414.33	0.95										
20	268.51	193.60	10.9	5.49	5.59	2	0.00	35.0	25361.62	17505.38	
5397.74	0.95										
21	274.00	53.09	10.9	1.48	1.51	2	0.00	35.0	6954.55	4671.11	
5387.20	0.95										
22	275.48	223.21	13.4	6.17	6.35	2	0.00	35.0	29240.97	19258.59	
5323.65	0.95										
23	281.66	226.84	13.4	6.17	6.35	2	0.00	35.0	29715.41	18676.26	
5268.98	0.95										
24	287.83	226.98	15.9	6.10	6.35	2	0.00	35.0	29733.77	18041.00	
5161.95	0.94										
25	293.93	228.79	15.9	6.10	6.35	2	0.00	35.0	29971.51	17353.27	
5072.11	0.94										
26	300.04	226.67	18.4	6.02	6.35	2	0.00	35.0	29694.04	16613.49	
4929.89	0.94										
27	306.06	226.72	18.4	6.02	6.35	2	0.00	35.0	29700.02	15821.71	
4805.57	0.94										
28	312.08	147.27	20.9	3.92	4.20	2	0.00	35.0	19292.78	10005.10	
4656.07	0.94										
29	316.00	148.33	20.9	3.97	4.25	2	0.00	35.0	19431.35	9729.31	
4587.33	0.94										
30	319.97	147.58	20.9	3.97	4.25	2	0.00	35.0	19333.14	9328.61	
4554.35	0.94										
31	323.94	39.33	23.3	1.06	1.16	2	0.00	35.0	5151.71	2468.85	
4493.16	0.95										
32	325.00	189.79	23.3	5.30	5.77	2	0.00	35.0	24862.88	11818.59	
4346.06	0.95										
33	330.30	177.70	23.3	5.30	5.77	2	0.00	35.0	23278.20	10996.49	
4067.48	0.95										
34	335.59	177.26	25.8	5.71	6.35	2	0.00	35.0	23220.84	11099.69	
3727.96	0.95										
35	341.30	161.47	25.8	5.71	6.35	2	0.00	35.0	21153.01	10005.48	
3393.55	0.95										
36	347.01	39.35	28.3	1.49	1.69	2	0.00	35.0	5155.35	2473.20	
3150.22	0.95										
37	348.50	75.84	28.3	3.00	3.41	5	0.00	45.0	8342.50	3142.53	
2384.50	0.89										
38	351.50	151.63	28.3	6.69	7.60	2	0.00	35.0	19863.19	2214.41	
2542.75	0.95										
39	358.19	93.67	30.8	4.82	5.61	2	0.00	35.0	12270.42	502.54	
2119.77	0.96										
40	363.01	29.37	30.8	1.68	1.95	2	0.00	35.0	3848.03	0.00	
1894.66	0.96										
41	364.69	69.10	30.8	4.40	5.13	1	150.00	22.0	9051.70	0.00	
1792.91	1.04										
42	369.09	67.04	33.3	5.31	6.35	1	150.00	22.0	8781.72	0.00	
1416.70	1.06										
43	374.40	48.57	33.3	5.31	6.35	1	150.00	22.0	6362.66	0.00	
1014.40	1.06										
44	379.70	28.64	35.8	5.15	6.35	1	150.00	22.0	3751.31	0.00	
588.03	1.07										
45	384.85	9.55	35.8	5.15	6.35	1	150.00	22.0	1250.43	0.00	
164.40	1.07										

X-S Area:

5611.62

Path Length:

241.12

X-S Weight:

735123.06

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 3-3\West Farm Expansion Case 3-3 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:36:02

DATA: Analysis 1 - Case 3-3 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 183.00 348.50 183.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 144.00 348.50 144.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 141.00 348.50 141.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 183.00 450.00 183.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 144.00 450.00 144.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 141.00 450.00 141.00

Slope Surface (4 points)

100.00	144.00	157.00	144.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	144.00	157.00	144.00	316.00	197.00	348.50	197.00
351.50	182.00						
450.00	182.00						

Failure Surface

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

Intersects: XL:	157.00	YL:	144.00	XR:	395.00	YR:	200.00
Centre: XC:	226.05	YC:	384.27	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 3-3 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.059

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.16

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	162.00	145.67	390.00	200.00	213.78	433.91	292.86	1.156	
Critical Surface									
2	161.47	145.49	390.00	200.00	212.46	438.02	296.94	1.156	
3	160.95	145.32	390.00	200.00	211.14	442.12	301.02	1.156	
4	160.42	145.14	390.00	200.00	209.82	446.22	305.10	1.156	
5	159.89	144.96	390.00	200.00	208.50	450.30	309.18	1.156	
6	158.32	144.44	390.00	200.00	204.54	462.53	321.43	1.157	
7	155.68	144.00	390.00	200.00	200.51	474.65	333.67	1.157	
8	158.84	144.61	390.00	200.00	205.86	458.46	317.35	1.157	
9	157.79	144.26	390.00	200.00	203.22	466.59	325.51	1.157	
10	161.47	145.49	390.53	200.00	212.89	437.94	296.94	1.158	
11	160.95	145.32	390.53	200.00	211.57	442.05	301.02	1.158	
12	160.42	145.14	390.53	200.00	210.25	446.15	305.10	1.158	
13	154.11	144.00	390.00	200.00	199.24	478.73	337.76	1.158	
14	159.89	144.96	390.53	200.00	208.93	450.24	309.18	1.158	
15	159.37	144.79	390.53	200.00	207.61	454.32	313.27	1.158	
16	157.26	144.09	390.00	200.00	201.90	470.64	329.59	1.158	
17	157.79	144.26	390.53	200.00	203.66	466.53	325.51	1.159	
18	156.21	144.00	390.00	200.00	200.60	474.71	333.67	1.159	
19	159.37	144.79	390.00	200.00	207.18	454.38	313.27	1.159	
20	152.53	144.00	390.00	200.00	197.97	482.80	341.84	1.160	
21	158.32	144.44	390.53	200.00	204.97	462.46	321.43	1.160	
22	157.26	144.09	390.53	200.00	202.34	470.58	329.59	1.160	
23	154.63	144.00	390.00	200.00	199.32	478.79	337.76	1.160	
24	159.37	144.79	391.05	200.00	208.04	454.25	313.27	1.160	
25	158.84	144.61	391.05	200.00	206.73	458.33	317.35	1.160	
26	156.21	144.00	390.53	200.00	201.04	474.65	333.67	1.160	
27	158.32	144.44	391.05	200.00	205.41	462.40	321.43	1.160	
28	156.74	144.00	390.00	200.00	200.68	474.77	333.67	1.161	
29	158.84	144.61	390.53	200.00	206.29	458.39	317.35	1.161	
30	153.05	144.00	390.00	200.00	198.06	482.86	341.84	1.161	
31	154.63	144.00	390.53	200.00	199.76	478.73	337.76	1.162	
32	155.16	144.00	390.00	200.00	199.41	478.84	337.76	1.162	
33	156.74	144.00	390.53	200.00	201.12	474.71	333.67	1.162	
34	160.42	145.14	390.00	200.00	208.79	450.52	309.18	1.163	
35	161.47	145.49	390.00	200.00	211.43	442.34	301.02	1.163	
36	162.00	145.67	390.00	200.00	212.75	438.24	296.94	1.163	
37	153.05	144.00	390.53	200.00	198.50	482.80	341.84	1.163	
38	159.89	144.96	390.00	200.00	207.47	454.60	313.27	1.163	
39	153.58	144.00	390.00	200.00	198.14	482.92	341.84	1.163	
40	159.37	144.79	390.00	200.00	206.15	458.67	317.35	1.164	
41	155.16	144.00	390.53	200.00	199.85	478.79	337.76	1.164	
42	155.68	144.00	390.00	200.00	199.49	478.90	337.76	1.164	
43	158.84	144.61	390.00	200.00	204.83	462.74	321.43	1.164	
44	156.74	144.00	391.05	200.00	201.56	474.65	333.67	1.164	
45	158.32	144.44	390.00	200.00	203.51	466.80	325.51	1.164	
46	159.89	144.96	390.53	200.00	207.91	454.53	313.27	1.164	
47	157.79	144.26	390.00	200.00	202.19	470.85	329.59	1.165	
48	152.00	144.00	390.00	200.00	196.88	486.99	345.92	1.165	
49	162.00	145.67	390.53	200.00	213.18	438.16	296.94	1.165	
50	160.95	145.32	390.53	200.00	210.54	446.36	305.10	1.165	
51	161.47	145.49	390.53	200.00	211.86	442.26	301.02	1.165	
52	159.37	144.79	390.53	200.00	206.59	458.60	317.35	1.165	
53	153.58	144.00	390.53	200.00	198.58	482.86	341.84	1.165	
54	160.95	145.32	390.00	200.00	210.11	446.43	305.10	1.165	
55	154.11	144.00	390.00	200.00	198.23	482.98	341.84	1.165	
56	155.16	144.00	391.05	200.00	200.29	478.73	337.76	1.165	
57	157.26	144.09	390.00	200.00	200.87	474.90	333.67	1.165	
58	158.84	144.61	390.53	200.00	205.27	462.67	321.43	1.165	
59	155.68	144.00	390.53	200.00	199.94	478.84	337.76	1.166	
60	156.21	144.00	390.00	200.00	199.58	478.96	337.76	1.166	
61	158.32	144.44	390.53	200.00	203.95	466.73	325.51	1.166	
62	157.79	144.26	390.53	200.00	202.63	470.79	329.59	1.166	
63	152.00	144.00	390.53	200.00	197.32	486.94	345.92	1.166	
64	153.58	144.00	391.05	200.00	199.02	482.80	341.84	1.166	

65	152.53	144.00	390.00	200.00	196.97	487.05	345.92	1.166
66	160.42	145.14	391.05	200.00	209.66	450.38	309.18	1.167
67	160.95	145.32	391.05	200.00	210.97	446.29	305.10	1.167
68	158.84	144.61	391.05	200.00	205.71	462.61	321.43	1.167
69	159.37	144.79	391.05	200.00	207.02	458.54	317.35	1.167
70	154.11	144.00	390.53	200.00	198.67	482.92	341.84	1.167
71	160.42	145.14	390.53	200.00	209.22	450.45	309.18	1.167
72	154.63	144.00	390.00	200.00	198.31	483.03	341.84	1.167
73	157.26	144.09	390.53	200.00	201.32	474.84	333.67	1.167
74	162.00	145.67	391.05	200.00	213.61	438.09	296.94	1.167
75	155.68	144.00	391.05	200.00	200.38	478.79	337.76	1.167
76	158.32	144.44	391.05	200.00	204.39	466.67	325.51	1.167
77	161.47	145.49	391.05	200.00	212.29	442.19	301.02	1.167
78	156.21	144.00	390.53	200.00	200.02	478.90	337.76	1.167
79	156.74	144.00	390.00	200.00	199.66	479.02	337.76	1.167
80	157.79	144.26	391.05	200.00	203.07	470.73	329.59	1.168
81	152.00	144.00	391.05	200.00	197.76	486.88	345.92	1.168
82	152.53	144.00	390.53	200.00	197.41	486.99	345.92	1.168
83	153.05	144.00	390.00	200.00	197.05	487.11	345.92	1.168
84	154.11	144.00	391.05	200.00	199.11	482.86	341.84	1.168
85	162.00	145.67	391.58	200.00	214.03	438.01	296.94	1.168
86	159.89	144.96	391.58	200.00	208.77	454.39	313.27	1.168
87	158.32	144.44	391.58	200.00	204.83	466.61	325.51	1.169
88	154.63	144.00	390.53	200.00	198.75	482.98	341.84	1.169
89	155.16	144.00	390.00	200.00	198.40	483.09	341.84	1.169
90	157.26	144.09	391.05	200.00	201.76	474.78	333.67	1.169
91	155.68	144.00	391.58	200.00	200.82	478.73	337.76	1.169
92	161.47	145.49	391.58	200.00	212.72	442.12	301.02	1.169
93	159.89	144.96	391.05	200.00	208.34	454.46	313.27	1.169
94	158.84	144.61	391.58	200.00	206.14	462.54	321.43	1.169
95	156.21	144.00	391.05	200.00	200.46	478.84	337.76	1.169
96	160.95	145.32	391.58	200.00	211.40	446.22	305.10	1.169
97	157.79	144.26	391.58	200.00	203.51	470.67	329.59	1.169
98	160.42	145.14	391.58	200.00	210.09	450.31	309.18	1.169
99	156.74	144.00	390.53	200.00	200.11	478.96	337.76	1.169

Critical Failure Surface (circle 1)

Intersects:	XL:	162.00	YL:	145.67	XR:	390.00	YR:	200.00	
Centre:	XC:	213.78	YC:	433.91		Radius:	R:	292.86	
Generated failure surface: (20 points)									
162.00	145.67	174.54	143.69	187.15	142.27	199.81	141.39		
212.49	141.05								
225.18	141.27	237.85	142.04	250.47	143.36	263.02	145.22		
275.48	147.63								
287.83	150.57	300.04	154.04	312.08	158.04	323.94	162.56		
335.59	167.58								
347.01	173.11	358.19	179.13	369.09	185.62	379.70	192.59		
390.00	200.00								

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

Slice	X-S	Base							PoreWater
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Force
Stress	X-Left								
1	162.00	6.88	-8.9	5.30	5.36	2	0.00	35.0	434.59
179.59	1.12								
2	167.30	20.64	-8.9	5.30	5.36	2	0.00	35.0	1303.76
538.78	1.12								
3	172.59	11.04	-8.9	1.95	1.97	3	100.00	18.0	697.37
777.20	1.06								
4	174.54	47.66	-6.5	6.30	6.35	3	100.00	18.0	2993.11
1024.31	1.04								
5	180.84	65.41	-6.5	6.30	6.35	3	100.00	18.0	8656.07
1406.88	1.04								
6	187.15	82.66	-4.0	6.33	6.35	3	100.00	18.0	10951.62
1754.51	1.02								
7	193.48	98.80	-4.0	6.33	6.35	3	100.00	18.0	13094.12
2096.55	1.02								
8	199.81	114.32	-1.5	6.34	6.35	3	100.00	18.0	15147.35
2399.59	1.01								
9	206.15	128.78	-1.5	6.34	6.35	3	100.00	18.0	17052.31
2701.07	1.01								
10	212.49	142.40	1.0	6.34	6.35	3	100.00	18.0	18837.86
2960.19	1.00								
11	218.84	155.12	1.0	6.34	6.35	3	100.00	18.0	20497.51
3221.13	1.00								
12	225.18	166.68	3.5	6.33	6.35	3	100.00	18.0	21995.63
3436.97	0.99								
13	231.51	177.62	3.5	6.33	6.35	3	100.00	18.0	23404.16
3657.44	0.99								
14	237.85	187.00	6.0	6.31	6.35	3	100.00	18.0	24599.13

3830.66	0.98										
15	244.16	196.12	6.0	6.31	6.35	3	100.00	18.0	25752.57	12304.09	
4010.78	0.98										
16	250.47	139.18	8.4	4.32	4.37	3	100.00	18.0	18245.79	8779.55	
4120.23	0.97										
17	254.79	135.72	8.4	4.12	4.16	2	0.00	35.0	17778.93	8561.41	
4133.57	0.93										
18	258.91	138.85	8.4	4.12	4.16	2	0.00	35.0	18189.29	8759.02	
4228.99	0.93										
19	263.02	189.37	10.9	5.49	5.59	2	0.00	35.0	24807.83	12034.81	
4272.43	0.91										
20	268.51	193.60	10.9	5.49	5.59	2	0.00	35.0	25361.62	12303.47	
4367.83	0.91										
21	274.00	53.09	10.9	1.48	1.51	2	0.00	35.0	6954.55	3373.80	
4428.42	0.91										
22	275.48	223.21	13.4	6.17	6.35	2	0.00	35.0	29240.97	14318.56	
4424.30	0.90										
23	281.66	226.84	13.4	6.17	6.35	2	0.00	35.0	29715.41	14550.88	
4496.06	0.90										
24	287.83	226.98	15.9	6.10	6.35	2	0.00	35.0	29733.77	14725.73	
4496.78	0.89										
25	293.93	228.79	15.9	6.10	6.35	2	0.00	35.0	29971.51	14843.46	
4532.73	0.89										
26	300.04	226.67	18.4	6.02	6.35	2	0.00	35.0	29694.04	14903.81	
4498.44	0.88										
27	306.06	226.72	18.4	6.02	6.35	2	0.00	35.0	29700.02	14906.81	
4499.34	0.88										
28	312.08	147.27	20.9	3.92	4.20	2	0.00	35.0	19292.78	9833.99	
4437.06	0.87										
29	316.00	148.33	20.9	3.97	4.25	2	0.00	35.0	19431.35	9729.31	
4407.14	0.87										
30	319.97	147.58	20.9	3.97	4.25	2	0.00	35.0	19333.14	9328.61	
4369.34	0.87										
31	323.94	39.33	23.3	1.06	1.16	2	0.00	35.0	5151.71	2468.85	
4288.69	0.86										
32	325.00	189.79	23.3	5.30	5.77	2	0.00	35.0	24862.88	11818.59	
4146.92	0.86										
33	330.30	177.70	23.3	5.30	5.77	2	0.00	35.0	23278.20	10996.49	
3880.14	0.86										
34	335.59	177.26	25.8	5.71	6.35	2	0.00	35.0	23220.84	11099.69	
3540.28	0.86										
35	341.30	161.47	25.8	5.71	6.35	2	0.00	35.0	21153.01	10005.48	
3221.24	0.86										
36	347.01	39.35	28.3	1.49	1.69	2	0.00	35.0	5155.35	2473.20	
2976.82	0.86										
37	348.50	75.84	28.3	3.00	3.41	5	0.00	45.0	8342.50	3142.53	
2190.04	0.77										
38	351.50	151.63	28.3	6.69	7.60	2	0.00	35.0	19863.19	2214.41	
2311.03	0.86										
39	358.19	93.67	30.8	4.82	5.61	2	0.00	35.0	12270.42	502.54	
1894.47	0.86										
40	363.01	29.37	30.8	1.68	1.95	2	0.00	35.0	3848.03	0.00	
1684.40	0.86										
41	364.69	69.10	30.8	4.40	5.13	1	150.00	22.0	9051.70	0.00	
1636.82	0.96										
42	369.09	67.04	33.3	5.31	6.35	1	150.00	22.0	8781.72	0.00	
1277.12	0.97										
43	374.40	48.57	33.3	5.31	6.35	1	150.00	22.0	6362.66	0.00	
906.23	0.97										
44	379.70	28.64	35.8	5.15	6.35	1	150.00	22.0	3751.31	0.00	
507.32	0.98										
45	384.85	9.55	35.8	5.15	6.35	1	150.00	22.0	1250.43	0.00	
119.33	0.98										

X-S Area:

5611.62

Path Length:

241.12

X-S Weight:

735123.06

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:42:41

DATA: Analysis 1 - Case 4-1 Full Reservoir - Pseudostatic

Material Properties (5 materials)

 Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 190.00 348.50 190.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 157.00 348.50 157.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 154.00 348.50 154.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 190.00 450.00 190.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 157.00 450.00 157.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 154.00 450.00 154.00

Slope Surface (4 points)

 100.00 157.00 196.00 157.00 325.00 200.00 450.00 200.00

Phreatic Surface (6 points)

 100.00 197.00 196.00 197.00 316.00 197.00 348.50 197.00
 351.50 178.00
 450.00 178.00

Failure Surface

 Initial circular surface for critical search defined by: XL,XR,R
 Intersects: XL: 196.00 YL: 157.00 XR: 405.00 YR: 200.00
 Centre: XC: 254.94 YC: 399.95 Radius: R: 250.00

Earthquake Force

 Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

 Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 200.00
 Trial positions within range: 20 20 50

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RESULTS: Analysis 1 - Case 4-1 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.017

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.32

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	198.89	157.96	400.00	200.00	246.02	434.59	280.61	2.323	
Critical Surface									
2	199.95	158.32	400.00	200.00	248.45	426.41	272.45	2.328	
3	199.42	158.14	400.00	200.00	247.24	430.51	276.53	2.330	
4	194.68	157.00	400.00	200.00	237.72	463.17	309.18	2.336	
5	198.37	157.79	400.00	200.00	243.91	442.95	288.78	2.336	
6	198.89	157.96	400.00	200.00	245.12	438.88	284.69	2.338	
7	197.32	157.44	400.53	200.00	241.89	451.01	296.94	2.338	
8	195.21	157.00	400.00	200.00	237.82	463.23	309.18	2.340	
9	196.79	157.26	400.00	200.00	240.24	455.13	301.02	2.340	
10	199.42	158.14	400.00	200.00	246.34	434.80	280.61	2.340	
11	197.84	157.61	400.53	200.00	243.11	446.95	292.86	2.340	
12	196.26	157.09	400.00	200.00	239.02	459.18	305.10	2.340	
13	193.63	157.00	400.00	200.00	236.64	467.30	313.27	2.341	
14	197.32	157.44	400.00	200.00	241.47	451.08	296.94	2.341	
15	192.05	157.00	400.00	200.00	235.47	471.36	317.35	2.342	
16	197.84	157.61	400.00	200.00	242.69	447.02	292.86	2.342	
17	199.95	158.32	400.00	200.00	247.56	430.72	276.53	2.342	
18	198.37	157.79	400.53	200.00	244.33	442.88	288.78	2.342	
19	195.21	157.00	400.53	200.00	238.25	463.17	309.18	2.343	
20	195.74	157.00	400.00	200.00	237.92	463.29	309.18	2.343	
21	196.79	157.26	400.53	200.00	240.67	455.07	301.02	2.343	
22	200.47	158.49	400.00	200.00	248.77	426.62	272.45	2.343	
23	196.26	157.09	400.53	200.00	239.45	459.12	305.10	2.344	
24	195.74	157.00	401.05	200.00	238.77	463.17	309.18	2.344	
25	194.16	157.00	400.00	200.00	236.74	467.36	313.27	2.344	
26	198.89	157.96	400.53	200.00	245.54	438.81	284.69	2.344	
27	197.32	157.44	401.05	200.00	242.31	450.95	296.94	2.344	
28	192.58	157.00	400.00	200.00	235.56	471.42	317.35	2.345	
29	199.95	158.32	400.53	200.00	247.97	430.64	276.53	2.346	
30	199.42	158.14	400.53	200.00	246.76	434.73	280.61	2.346	
31	191.00	157.00	400.00	200.00	234.40	475.49	321.43	2.346	
32	197.84	157.61	401.05	200.00	243.53	446.89	292.86	2.347	
33	195.74	157.00	400.53	200.00	238.35	463.23	309.18	2.347	
34	194.16	157.00	400.53	200.00	237.17	467.30	313.27	2.348	
35	194.68	157.00	400.00	200.00	236.83	467.42	313.27	2.348	
36	198.37	157.79	401.05	200.00	244.75	442.82	288.78	2.348	
37	201.00	158.67	400.53	200.00	250.40	422.45	268.37	2.348	
38	198.89	157.96	401.05	200.00	245.96	438.74	284.69	2.348	
39	199.42	158.14	401.05	200.00	247.18	434.66	280.61	2.348	
40	193.11	157.00	400.00	200.00	235.66	471.48	317.35	2.349	
41	201.00	158.67	400.00	200.00	249.99	422.53	268.37	2.349	
42	192.58	157.00	400.53	200.00	235.99	471.36	317.35	2.349	
43	191.00	157.00	400.53	200.00	234.83	475.43	321.43	2.350	
44	198.37	157.79	400.00	200.00	243.01	447.22	292.86	2.350	
45	191.53	157.00	400.00	200.00	234.49	475.54	321.43	2.350	
46	200.47	158.49	401.05	200.00	249.60	426.47	272.45	2.351	
47	200.47	158.49	400.53	200.00	249.19	426.55	272.45	2.351	
48	197.32	157.44	400.53	200.00	241.00	455.27	301.02	2.351	
49	195.21	157.00	400.00	200.00	236.93	467.48	313.27	2.351	
50	194.68	157.00	400.53	200.00	237.26	467.36	313.27	2.351	
51	201.00	158.67	401.05	200.00	250.81	422.37	268.37	2.352	
52	193.63	157.00	400.00	200.00	235.76	471.54	317.35	2.352	
53	196.26	157.09	400.00	200.00	238.13	463.42	309.18	2.352	
54	196.79	157.26	400.00	200.00	239.35	459.38	305.10	2.352	
55	193.11	157.00	400.53	200.00	236.09	471.42	317.35	2.352	
56	198.89	157.96	400.00	200.00	244.23	443.16	288.78	2.352	
57	199.95	158.32	401.58	200.00	248.80	430.50	276.53	2.353	
58	192.05	157.00	400.00	200.00	234.59	475.60	321.43	2.353	
59	191.53	157.00	400.53	200.00	234.92	475.49	321.43	2.353	
60	197.84	157.61	400.53	200.00	242.22	451.22	296.94	2.353	
61	199.95	158.32	401.05	200.00	248.39	430.57	276.53	2.354	
62	197.32	157.44	400.00	200.00	240.57	455.33	301.02	2.354	
63	196.26	157.09	401.05	200.00	238.99	463.31	309.18	2.354	
64	200.47	158.49	401.58	200.00	250.01	426.40	272.45	2.354	

65	195.74	157.00	400.00	200.00	237.02	467.53	313.27	2.355
66	194.68	157.00	401.05	200.00	237.69	467.30	313.27	2.355
67	195.21	157.00	400.53	200.00	237.36	467.42	313.27	2.355
68	196.79	157.26	401.05	200.00	240.21	459.26	305.10	2.355
69	197.84	157.61	400.00	200.00	241.79	451.28	296.94	2.355
70	199.42	158.14	400.00	200.00	245.45	439.09	284.69	2.355
71	194.16	157.00	400.00	200.00	235.85	471.60	317.35	2.356
72	193.11	157.00	401.05	200.00	236.52	471.36	317.35	2.356
73	196.26	157.09	400.53	200.00	238.56	463.36	309.18	2.356
74	193.63	157.00	400.53	200.00	236.19	471.48	317.35	2.356
75	196.79	157.26	400.53	200.00	239.78	459.32	305.10	2.356
76	198.37	157.79	400.53	200.00	243.43	447.16	292.86	2.356
77	199.42	158.14	401.58	200.00	247.59	434.59	280.61	2.357
78	192.58	157.00	400.00	200.00	234.69	475.66	321.43	2.357
79	191.53	157.00	401.05	200.00	235.35	475.43	321.43	2.357
80	192.05	157.00	400.53	200.00	235.02	475.54	321.43	2.357
81	195.21	157.00	401.58	200.00	238.22	467.30	313.27	2.357
82	197.32	157.44	401.05	200.00	241.42	455.21	301.02	2.357
83	199.95	158.32	400.00	200.00	246.66	435.01	280.61	2.358
84	191.00	157.00	400.00	200.00	233.53	479.72	325.51	2.358
85	195.74	157.00	400.53	200.00	237.46	467.48	313.27	2.358
86	195.21	157.00	401.05	200.00	237.79	467.36	313.27	2.359
87	198.89	157.96	400.53	200.00	244.65	443.09	288.78	2.359
88	194.68	157.00	400.00	200.00	235.95	471.65	317.35	2.359
89	194.16	157.00	400.53	200.00	236.28	471.54	317.35	2.359
90	193.63	157.00	401.05	200.00	236.62	471.42	317.35	2.359
91	193.11	157.00	400.00	200.00	234.78	475.72	321.43	2.360
92	197.84	157.61	401.05	200.00	242.64	451.15	296.94	2.360
93	200.47	158.49	400.00	200.00	247.88	430.93	276.53	2.360
94	196.26	157.09	401.58	200.00	239.42	463.25	309.18	2.360
95	192.58	157.00	400.53	200.00	235.12	475.60	321.43	2.361
96	192.05	157.00	401.05	200.00	235.45	475.49	321.43	2.361
97	191.53	157.00	400.00	200.00	233.62	479.78	325.51	2.361
98	201.00	158.67	400.00	200.00	249.09	426.84	272.45	2.361
99	199.42	158.14	400.53	200.00	245.87	439.02	284.69	2.362

Critical Failure Surface (circle 1)

Intersects:	XL:	198.89	YL:	157.96	XR:	400.00	YR:	200.00	
Centre:	XC:	246.02	YC:	434.59		Radius:	R:	280.61	
Generated failure surface: (20 points)									
198.89	157.96		209.84	156.32		220.85	155.11	231.89	154.34
242.95	154.00								
254.02	154.09		265.08	154.63		276.11	155.60	287.09	157.00
298.00	158.84								
308.84	161.10		319.58	163.79		330.20	166.90	340.69	170.43
351.04	174.37								
361.22	178.72		371.22	183.46		381.03	188.59	390.63	194.11
400.00	200.00								

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	198.89	9.99	-8.5	6.43	6.50	2	0.00	35.0	1308.25	16027.30
2577.53	1.06									
2	205.32	18.98	-8.5	4.52	4.57	3	100.00	18.0	2502.06	11504.37
2821.53	1.03									
3	209.84	35.83	-6.3	5.50	5.53	3	100.00	18.0	4747.41	14154.06
3025.70	1.02									
4	215.34	49.25	-6.3	5.50	5.53	3	100.00	18.0	6538.65	14363.08
3239.55	1.02									
5	220.85	62.31	-4.0	5.52	5.53	3	100.00	18.0	8277.27	14534.56
3431.87	1.01									
6	226.37	74.61	-4.0	5.52	5.53	3	100.00	18.0	9910.27	14668.46
3614.34	1.01									
7	231.89	85.52	-1.8	5.47	5.48	3	100.00	18.0	11353.01	14607.72
3772.79	1.00									
8	237.36	96.42	-1.8	5.47	5.48	3	100.00	18.0	12790.79	14665.04
3922.21	1.00									
9	242.84	109.21	0.5	5.59	5.59	3	100.00	18.0	14472.79	15001.84
4049.24	1.00									
10	248.43	119.36	0.5	5.59	5.59	3	100.00	18.0	15800.16	14984.76
4169.86	1.00									
11	254.02	127.35	2.8	5.53	5.53	3	100.00	18.0	16835.93	14772.83
4264.09	0.99									
12	259.55	136.06	2.8	5.53	5.53	3	100.00	18.0	17962.54	14680.68
4352.17	0.99									
13	265.08	143.77	5.0	5.51	5.53	3	100.00	18.0	18951.42	14550.86
4413.25	0.99									
14	270.59	151.23	5.0	5.51	5.53	3	100.00	18.0	19902.03	14383.43

4469.91	0.99										
15	276.11	157.29	7.3	5.49	5.53	3	100.00	18.0	20662.64	14168.74	
4498.71	0.99										
16	281.59	163.48	7.3	5.49	5.53	3	100.00	18.0	21434.47	13926.67	
4524.03	0.99										
17	287.08	121.53	9.5	3.96	4.02	2	0.00	35.0	15920.13	9939.97	
4478.87	0.97										
18	291.04	124.12	9.5	3.96	4.02	2	0.00	35.0	16259.47	9773.22	
4479.98	0.97										
19	295.00	95.87	9.5	3.00	3.05	2	0.00	35.0	12559.12	7301.69	
4480.99	0.97										
20	298.00	176.09	11.8	5.42	5.53	2	0.00	35.0	23067.53	12985.33	
4443.50	0.96										
21	303.42	179.74	11.8	5.42	5.53	2	0.00	35.0	23545.42	12594.14	
4416.30	0.96										
22	308.84	120.51	14.1	3.58	3.69	2	0.00	35.0	15786.75	8164.54	
4358.98	0.96										
23	312.42	121.57	14.1	3.58	3.69	2	0.00	35.0	15925.75	7957.93	
4321.91	0.96										
24	316.00	122.54	14.1	3.58	3.69	2	0.00	35.0	16052.36	7745.47	
4319.44	0.96										
25	319.58	187.13	16.3	5.42	5.65	2	0.00	35.0	24514.12	11428.52	
4318.12	0.96										
26	325.00	176.09	16.3	5.20	5.42	2	0.00	35.0	23068.13	10435.37	
4231.74	0.96										
27	330.20	169.00	18.6	5.25	5.53	2	0.00	35.0	22139.23	10089.91	
3999.40	0.96										
28	335.45	159.75	18.6	5.25	5.53	2	0.00	35.0	20926.60	9480.52	
3779.42	0.96										
29	340.69	112.51	20.8	3.90	4.18	2	0.00	35.0	14738.72	6730.53	
3553.10	0.96										
30	344.60	106.71	20.8	3.90	4.18	2	0.00	35.0	13978.66	6343.13	
3368.88	0.96										
31	348.50	66.29	20.8	2.54	2.72	5	0.00	45.0	7291.38	2554.84	
2600.16	0.92										
32	351.04	105.09	23.1	4.25	4.62	2	0.00	35.0	13766.62	784.71	
2888.73	0.96										
33	355.29	97.38	23.1	4.25	4.62	2	0.00	35.0	12756.47	261.57	
2665.29	0.96										
34	359.54	36.35	23.1	1.68	1.83	2	0.00	35.0	4762.01	0.00	
2511.98	0.96										
35	361.22	100.51	25.4	5.00	5.53	2	0.00	35.0	13167.13	0.00	
2303.56	0.97										
36	366.22	88.65	25.4	5.00	5.53	2	0.00	35.0	11613.42	0.00	
2031.75	0.97										
37	371.22	74.82	27.6	4.90	5.53	2	0.00	35.0	9801.10	0.00	
1726.32	0.97										
38	376.13	62.23	27.6	4.90	5.53	2	0.00	35.0	8152.25	0.00	
1435.89	0.97										
39	381.03	26.20	29.9	2.45	2.82	2	0.00	35.0	3432.17	0.00	
1195.10	0.98										
40	383.48	32.08	29.9	3.57	4.12	1	150.00	22.0	4201.93	0.00	
1034.85	1.05										
41	387.05	24.73	29.9	3.57	4.12	1	150.00	22.0	3239.66	0.00	
790.14	1.05										
42	390.63	20.70	32.1	4.69	5.53	1	150.00	22.0	2712.06	0.00	
485.13	1.06										
43	395.31	6.90	32.1	4.69	5.53	1	150.00	22.0	904.03	0.00	
137.32	1.06										

X-S Area:	----- 4255.71	Path Length:	----- 210.33	X-S Weight:	----- 557731.94

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 4-1\West Farm Expansion Case 4-1 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:41:21

DATA: Analysis 1 - Case 4-1 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 190.00 348.50 190.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 157.00 348.50 157.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 154.00 348.50 154.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 190.00 450.00 190.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 157.00 450.00 157.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 154.00 450.00 154.00

Slope Surface (4 points)

100.00	157.00	196.00	157.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	157.00	196.00	157.00	316.00	197.00	348.50	197.00
351.50	178.00						
450.00	178.00						

Failure Surface

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

Intersects: XL:	196.00	YL:	157.00	XR:	405.00	YR:	200.00
Centre: XC:	254.94	YC:	399.95	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 4-1 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.532

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.42

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	198.89	157.96	400.00	200.00	246.02	434.59	280.61	1.422	
Critical Surface									
2	199.95	158.32	400.00	200.00	248.45	426.41	272.45	1.426	
3	199.42	158.14	400.00	200.00	247.24	430.51	276.53	1.427	
4	194.68	157.00	400.00	200.00	237.72	463.17	309.18	1.427	
5	195.21	157.00	400.00	200.00	237.82	463.23	309.18	1.430	
6	193.63	157.00	400.00	200.00	236.64	467.30	313.27	1.430	
7	192.05	157.00	400.00	200.00	235.47	471.36	317.35	1.431	
8	196.26	157.09	400.00	200.00	239.02	459.18	305.10	1.431	
9	196.79	157.26	400.00	200.00	240.24	455.13	301.02	1.431	
10	198.37	157.79	400.00	200.00	243.91	442.95	288.78	1.431	
11	197.32	157.44	400.00	200.00	241.47	451.08	296.94	1.432	
12	197.32	157.44	400.53	200.00	241.89	451.01	296.94	1.432	
13	195.74	157.00	400.00	200.00	237.92	463.29	309.18	1.433	
14	198.89	157.96	400.00	200.00	245.12	438.88	284.69	1.433	
15	195.21	157.00	400.53	200.00	238.25	463.17	309.18	1.433	
16	194.16	157.00	400.00	200.00	236.74	467.36	313.27	1.433	
17	197.84	157.61	400.00	200.00	242.69	447.02	292.86	1.433	
18	192.58	157.00	400.00	200.00	235.56	471.42	317.35	1.433	
19	197.84	157.61	400.53	200.00	243.11	446.95	292.86	1.434	
20	196.26	157.09	400.53	200.00	239.45	459.12	305.10	1.434	
21	196.79	157.26	400.53	200.00	240.67	455.07	301.02	1.434	
22	191.00	157.00	400.00	200.00	234.40	475.49	321.43	1.434	
23	199.42	158.14	400.00	200.00	246.34	434.80	280.61	1.434	
24	198.37	157.79	400.53	200.00	244.33	442.88	288.78	1.435	
25	199.95	158.32	400.00	200.00	247.56	430.72	276.53	1.435	
26	194.68	157.00	400.00	200.00	236.83	467.42	313.27	1.435	
27	195.74	157.00	400.53	200.00	238.35	463.23	309.18	1.436	
28	193.11	157.00	400.00	200.00	235.66	471.48	317.35	1.436	
29	194.16	157.00	400.53	200.00	237.17	467.30	313.27	1.436	
30	195.74	157.00	401.05	200.00	238.77	463.17	309.18	1.436	
31	197.32	157.44	401.05	200.00	242.31	450.95	296.94	1.436	
32	192.58	157.00	400.53	200.00	235.99	471.36	317.35	1.436	
33	191.53	157.00	400.00	200.00	234.49	475.54	321.43	1.436	
34	200.47	158.49	400.00	200.00	248.77	426.62	272.45	1.436	
35	198.89	157.96	400.53	200.00	245.54	438.81	284.69	1.437	
36	191.00	157.00	400.53	200.00	234.83	475.43	321.43	1.437	
37	197.84	157.61	401.05	200.00	243.53	446.89	292.86	1.438	
38	199.42	158.14	400.53	200.00	246.76	434.73	280.61	1.438	
39	195.21	157.00	400.00	200.00	236.93	467.48	313.27	1.438	
40	199.95	158.32	400.53	200.00	247.97	430.64	276.53	1.438	
41	193.63	157.00	400.00	200.00	235.76	471.54	317.35	1.438	
42	194.68	157.00	400.53	200.00	237.26	467.36	313.27	1.438	
43	198.37	157.79	401.05	200.00	244.75	442.82	288.78	1.439	
44	192.05	157.00	400.00	200.00	234.59	475.60	321.43	1.439	
45	193.11	157.00	400.53	200.00	236.09	471.42	317.35	1.439	
46	196.26	157.09	400.00	200.00	238.13	463.42	309.18	1.439	
47	191.53	157.00	400.53	200.00	234.92	475.49	321.43	1.439	
48	198.89	157.96	401.05	200.00	245.96	438.74	284.69	1.439	
49	196.79	157.26	400.00	200.00	239.35	459.38	305.10	1.439	
50	199.42	158.14	401.05	200.00	247.18	434.66	280.61	1.440	
51	201.00	158.67	400.00	200.00	249.99	422.53	268.37	1.440	
52	195.74	157.00	400.00	200.00	237.02	467.53	313.27	1.440	
53	201.00	158.67	400.53	200.00	250.40	422.45	268.37	1.440	
54	197.32	157.44	400.00	200.00	240.57	455.33	301.02	1.441	
55	194.16	157.00	400.00	200.00	235.85	471.60	317.35	1.441	
56	198.37	157.79	400.00	200.00	243.01	447.22	292.86	1.441	
57	195.21	157.00	400.53	200.00	237.36	467.42	313.27	1.441	
58	197.32	157.44	400.53	200.00	241.00	455.27	301.02	1.441	
59	192.58	157.00	400.00	200.00	234.69	475.66	321.43	1.441	
60	193.63	157.00	400.53	200.00	236.19	471.48	317.35	1.441	
61	194.68	157.00	401.05	200.00	237.69	467.30	313.27	1.441	
62	193.11	157.00	401.05	200.00	236.52	471.36	317.35	1.442	
63	192.05	157.00	400.53	200.00	235.02	475.54	321.43	1.442	
64	191.00	157.00	400.00	200.00	233.53	479.72	325.51	1.442	

65	200.47	158.49	400.53	200.00	249.19	426.55	272.45	1.442
66	196.26	157.09	400.53	200.00	238.56	463.36	309.18	1.442
67	197.84	157.61	400.00	200.00	241.79	451.28	296.94	1.442
68	191.53	157.00	401.05	200.00	235.35	475.43	321.43	1.442
69	200.47	158.49	401.05	200.00	249.60	426.47	272.45	1.442
70	196.79	157.26	400.53	200.00	239.78	459.32	305.10	1.442
71	198.89	157.96	400.00	200.00	244.23	443.16	288.78	1.442
72	196.26	157.09	401.05	200.00	238.99	463.31	309.18	1.443
73	197.84	157.61	400.53	200.00	242.22	451.22	296.94	1.443
74	194.68	157.00	400.00	200.00	235.95	471.65	317.35	1.443
75	201.00	158.67	401.05	200.00	250.81	422.37	268.37	1.443
76	196.79	157.26	401.05	200.00	240.21	459.26	305.10	1.443
77	193.11	157.00	400.00	200.00	234.78	475.72	321.43	1.443
78	195.74	157.00	400.53	200.00	237.46	467.48	313.27	1.443
79	199.95	158.32	401.05	200.00	248.39	430.57	276.53	1.444
80	194.16	157.00	400.53	200.00	236.28	471.54	317.35	1.444
81	195.21	157.00	401.05	200.00	237.79	467.36	313.27	1.444
82	191.53	157.00	400.00	200.00	233.62	479.78	325.51	1.444
83	199.95	158.32	401.58	200.00	248.80	430.50	276.53	1.444
84	192.58	157.00	400.53	200.00	235.12	475.60	321.43	1.444
85	193.63	157.00	401.05	200.00	236.62	471.42	317.35	1.444
86	199.42	158.14	400.00	200.00	245.45	439.09	284.69	1.444
87	198.37	157.79	400.53	200.00	243.43	447.16	292.86	1.445
88	192.05	157.00	401.05	200.00	235.45	475.49	321.43	1.445
89	195.21	157.00	401.58	200.00	238.22	467.30	313.27	1.445
90	191.00	157.00	400.53	200.00	233.96	479.66	325.51	1.445
91	197.32	157.44	401.05	200.00	241.42	455.21	301.02	1.445
92	200.47	158.49	401.58	200.00	250.01	426.40	272.45	1.445
93	195.21	157.00	400.00	200.00	236.04	471.71	317.35	1.445
94	199.42	158.14	401.58	200.00	247.59	434.59	280.61	1.446
95	193.63	157.00	400.00	200.00	234.87	475.77	321.43	1.446
96	199.95	158.32	400.00	200.00	246.66	435.01	280.61	1.446
97	194.68	157.00	400.53	200.00	236.38	471.60	317.35	1.446
98	192.05	157.00	400.00	200.00	233.72	479.83	325.51	1.446
99	198.89	157.96	400.53	200.00	244.65	443.09	288.78	1.446

Critical Failure Surface (circle 1)

Intersects:	XL:	198.89	YL:	157.96	XR:	400.00	YR:	200.00	
Centre:	XC:	246.02	YC:	434.59		Radius:	R:	280.61	
Generated failure surface: (20 points)									
198.89	157.96		209.84	156.32		220.85	155.11	231.89	154.34
242.95	154.00								
254.02	154.09		265.08	154.63		276.11	155.60	287.09	157.00
298.00	158.84								
308.84	161.10		319.58	163.79		330.20	166.90	340.69	170.43
351.04	174.37								
361.22	178.72		371.22	183.46		381.03	188.59	390.63	194.11
400.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	198.89	9.99	-8.5	6.43	6.50	2	0.00	35.0	1308.25	630.15
212.04	1.09									
2	205.32	18.98	-8.5	4.52	4.57	3	100.00	18.0	2502.06	1197.79
574.87	1.05									
3	209.84	35.83	-6.3	5.50	5.53	3	100.00	18.0	4747.41	2249.14
882.59	1.03									
4	215.34	49.25	-6.3	5.50	5.53	3	100.00	18.0	6538.65	3091.56
1212.64	1.03									
5	220.85	62.31	-4.0	5.52	5.53	3	100.00	18.0	8277.27	3897.56
1517.12	1.02									
6	226.37	74.61	-4.0	5.52	5.53	3	100.00	18.0	9910.27	4667.11
1815.43	1.02									
7	231.89	85.52	-1.8	5.47	5.48	3	100.00	18.0	11353.01	5338.70
2084.05	1.01									
8	237.36	96.42	-1.8	5.47	5.48	3	100.00	18.0	12790.79	6019.51
2347.71	1.01									
9	242.84	109.21	0.5	5.59	5.59	3	100.00	18.0	14472.79	6814.73
2584.41	1.00									
10	248.43	119.36	0.5	5.59	5.59	3	100.00	18.0	15800.16	7448.38
2821.15	1.00									
11	254.02	127.35	2.8	5.53	5.53	3	100.00	18.0	16835.93	7955.80
3024.41	0.99									
12	259.55	136.06	2.8	5.53	5.53	3	100.00	18.0	17962.54	8500.10
3227.03	0.99									
13	265.08	143.77	5.0	5.51	5.53	3	100.00	18.0	18951.42	9005.91
3395.47	0.98									
14	270.59	151.23	5.0	5.51	5.53	3	100.00	18.0	19902.03	9473.25

3566.15	0.98									
15	276.11	157.29	7.3	5.49	5.53	3	100.00	18.0	20662.64	9894.74
3701.29	0.98									
16	281.59	163.48	7.3	5.49	5.53	3	100.00	18.0	21434.47	10283.86
3839.97	0.98									
17	287.08	121.53	9.5	3.96	4.02	2	0.00	35.0	15920.13	7689.71
3859.14	0.94									
18	291.04	124.12	9.5	3.96	4.02	2	0.00	35.0	16259.47	7853.72
3941.33	0.94									
19	295.00	95.87	9.5	3.00	3.05	2	0.00	35.0	12559.12	6066.35
4013.66	0.94									
20	298.00	176.09	11.8	5.42	5.53	2	0.00	35.0	23067.53	11225.35
4049.65	0.93									
21	303.42	179.74	11.8	5.42	5.53	2	0.00	35.0	23545.42	11457.91
4133.57	0.93									
22	308.84	120.51	14.1	3.58	3.69	2	0.00	35.0	15786.75	7752.25
4155.87	0.92									
23	312.42	121.57	14.1	3.58	3.69	2	0.00	35.0	15925.75	7820.50
4192.47	0.92									
24	316.00	122.54	14.1	3.58	3.69	2	0.00	35.0	16052.36	7745.47
4224.95	0.92									
25	319.58	187.13	16.3	5.42	5.65	2	0.00	35.0	24514.12	11428.52
4205.94	0.91									
26	325.00	176.09	16.3	5.20	5.42	2	0.00	35.0	23068.13	10435.37
4119.04	0.91									
27	330.20	169.00	18.6	5.25	5.53	2	0.00	35.0	22139.23	10089.91
3879.53	0.91									
28	335.45	159.75	18.6	5.25	5.53	2	0.00	35.0	20926.60	9480.52
3665.60	0.91									
29	340.69	112.51	20.8	3.90	4.18	2	0.00	35.0	14738.72	6730.53
3434.24	0.90									
30	344.60	106.71	20.8	3.90	4.18	2	0.00	35.0	13978.66	6343.13
3255.62	0.90									
31	348.50	66.29	20.8	2.54	2.72	5	0.00	45.0	7291.38	2554.84
2464.26	0.84									
32	351.04	105.09	23.1	4.25	4.62	2	0.00	35.0	13766.62	784.71
2705.72	0.90									
33	355.29	97.38	23.1	4.25	4.62	2	0.00	35.0	12756.47	261.57
2489.69	0.90									
34	359.54	36.35	23.1	1.68	1.83	2	0.00	35.0	4762.01	0.00
2342.89	0.90									
35	361.22	100.51	25.4	5.00	5.53	2	0.00	35.0	13167.13	0.00
2134.52	0.90									
36	366.22	88.65	25.4	5.00	5.53	2	0.00	35.0	11613.42	0.00
1882.66	0.90									
37	371.22	74.82	27.6	4.90	5.53	2	0.00	35.0	9801.10	0.00
1589.17	0.90									
38	376.13	62.23	27.6	4.90	5.53	2	0.00	35.0	8152.25	0.00
1321.82	0.90									
39	381.03	26.20	29.9	2.45	2.82	2	0.00	35.0	3432.17	0.00
1092.90	0.90									
40	383.48	32.08	29.9	3.57	4.12	1	150.00	22.0	4201.93	0.00
958.33	0.99									
41	387.05	24.73	29.9	3.57	4.12	1	150.00	22.0	3239.66	0.00
726.93	0.99									
42	390.63	20.70	32.1	4.69	5.53	1	150.00	22.0	2712.06	0.00
434.83	1.00									
43	395.31	6.90	32.1	4.69	5.53	1	150.00	22.0	904.03	0.00
107.45	1.00									

X-S Area:

4255.71

Path Length:

210.33

X-S Weight:

557731.94

Project: West Farm Pit Expansion
File: C:\Galena Models\Case 4-2\West Farm Expansion Case 4-2 Full Reservoir-EQ.gmf
Processed: 04 Dec 2020 12:45:00

DATA: Analysis 1 - Case 4-2 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden	
Cohesion	Phi UnitWeight Ru
150.00	22.0 131.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel	
Cohesion	Phi UnitWeight Ru
0.00	35.0 131.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock	
Cohesion	Phi UnitWeight Ru
100.00	18.0 141.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock	
Cohesion	Phi UnitWeight Ru
2000.00	20.0 141.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall	
Cohesion	Phi UnitWeight Ru
0.00	45.0 110.00 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: 1 - Overburden
100.00 200.00	348.50 200.00
Profile: 2 (2 points)	Material beneath: 2 - Sand and Gravel
100.00 188.00	348.50 188.00
Profile: 3 (2 points)	Material beneath: 3 - Weathered Bedrock
100.00 146.00	348.50 146.00
Profile: 4 (2 points)	Material beneath: 4 - Stable Bedrock
100.00 143.00	348.50 143.00
Profile: 5 (2 points)	Material beneath: 5 - Slurry Wall
348.50 200.00	351.50 200.00
Profile: 6 (2 points)	Material beneath: 1 - Overburden
351.50 200.00	450.00 200.00
Profile: 7 (2 points)	Material beneath: 2 - Sand and Gravel
351.50 188.00	450.00 188.00
Profile: 8 (2 points)	Material beneath: 3 - Weathered Bedrock
351.50 146.00	450.00 146.00
Profile: 9 (2 points)	Material beneath: 4 - Stable Bedrock
348.50 143.00	450.00 143.00

Slope Surface (8 points)

100.00	146.00	163.00	146.00	325.00	200.00	410.00	200.00
415.00	195.00						
420.00	195.00	425.00	200.00	450.00	200.00		

Phreatic Surface (5 points)

100.00	197.00	316.00	197.00	348.50	197.00	351.50	170.00
450.00	170.00						

Failure Surface

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

Intersects:	XL:	163.00	YL:	146.00	XR:	415.00	YR:	195.00
	Centre:	XC:	248.05	YC:	381.09		Radius:	R: 250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

.....

RESULTS: Analysis 1 - Case 4-2 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.966

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.31

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	166.42	147.14	410.00	200.00	219.78	488.92	345.92	2.308	
Critical Surface									
2	166.95	147.32	410.00	200.00	221.02	484.85	341.84	2.310	
3	167.47	147.49	410.00	200.00	222.26	480.77	337.76	2.313	
4	168.00	147.67	410.00	200.00	223.51	476.69	333.67	2.316	
5	166.42	147.14	410.00	200.00	218.85	493.19	350.00	2.317	
6	166.95	147.32	410.00	200.00	220.09	489.13	345.92	2.320	
7	167.47	147.49	410.00	200.00	221.34	485.06	341.84	2.323	
8	168.00	147.67	410.00	200.00	222.58	480.98	337.76	2.327	
9	166.42	147.14	410.53	199.47	219.93	493.03	350.00	2.328	
10	166.95	147.32	410.00	200.00	219.17	493.40	350.00	2.330	
11	165.89	146.96	410.00	200.00	218.53	492.98	350.00	2.331	
12	166.95	147.32	410.53	199.47	221.16	488.96	345.92	2.331	
13	167.47	147.49	410.00	200.00	220.41	489.34	345.92	2.333	
14	167.47	147.49	410.53	199.47	222.40	484.89	341.84	2.334	
15	168.00	147.67	410.53	199.47	223.63	480.81	337.76	2.336	
16	168.00	147.67	410.00	200.00	221.65	485.27	341.84	2.337	
17	166.95	147.32	410.53	199.47	220.25	493.23	350.00	2.341	
18	167.47	147.49	410.00	200.00	219.48	493.61	350.00	2.343	
19	167.47	147.49	410.53	199.47	221.48	489.17	345.92	2.344	
20	168.00	147.67	410.00	200.00	220.73	489.54	345.92	2.347	
21	168.00	147.67	410.53	199.47	222.72	485.10	341.84	2.348	
22	166.95	147.32	411.05	198.95	221.33	493.07	350.00	2.353	
23	167.47	147.49	410.53	199.47	220.57	493.44	350.00	2.354	
24	167.47	147.49	411.05	198.95	222.56	489.00	345.92	2.354	
25	168.00	147.67	411.05	198.95	223.78	484.92	341.84	2.356	
26	168.00	147.67	410.53	199.47	221.80	489.38	345.92	2.358	
27	168.00	147.67	410.00	200.00	219.80	493.81	350.00	2.359	
28	167.47	147.49	411.05	198.95	221.65	493.27	350.00	2.365	
29	168.00	147.67	411.05	198.95	222.88	489.20	345.92	2.368	
30	168.00	147.67	410.53	199.47	220.89	493.65	350.00	2.369	
31	167.47	147.49	411.58	198.42	222.73	493.10	350.00	2.375	
32	168.00	147.67	411.58	198.42	223.95	489.03	345.92	2.376	
33	168.00	147.67	411.05	198.95	221.97	493.48	350.00	2.378	
34	168.00	147.67	411.58	198.42	223.06	493.31	350.00	2.388	
35	168.00	147.67	412.11	197.89	224.14	493.14	350.00	2.397	
36	168.00	147.67	412.63	197.37	225.21	492.96	350.00	2.458	
37	168.00	147.67	412.11	197.89	225.02	488.85	345.92	2.493	
38	167.47	147.49	412.11	197.89	223.81	492.93	350.00	2.509	
39	168.00	147.67	411.58	198.42	224.84	484.74	341.84	2.534	
40	167.47	147.49	411.58	198.42	223.62	488.82	345.92	2.535	
41	166.95	147.32	411.58	198.42	222.41	492.89	350.00	2.548	
42	167.47	147.49	411.05	198.95	223.46	484.71	341.84	2.568	
43	166.95	147.32	411.05	198.95	222.23	488.79	345.92	2.570	
44	168.00	147.67	411.05	198.95	224.69	480.63	337.76	2.581	
45	166.42	147.14	411.05	198.95	221.01	492.86	350.00	2.584	
46	166.95	147.32	410.53	199.47	222.08	484.68	341.84	2.598	
47	166.42	147.14	410.53	199.47	220.85	488.75	345.92	2.604	
48	167.47	147.49	410.53	199.47	223.32	480.60	337.76	2.607	
49	168.00	147.67	410.53	199.47	224.55	476.51	333.67	2.622	
50	165.89	146.96	410.53	199.47	219.61	492.82	350.00	2.624	
51	168.00	147.67	410.00	200.00	224.44	472.39	329.59	2.624	
52	166.42	147.14	410.00	200.00	220.70	484.64	341.84	2.631	
53	166.95	147.32	410.00	200.00	221.95	480.56	337.76	2.632	
54	167.47	147.49	410.00	200.00	223.19	476.48	333.67	2.633	
55	165.89	146.96	410.00	200.00	219.46	488.71	345.92	2.646	
56	165.37	146.79	410.00	200.00	218.21	492.78	350.00	2.690	
57	168.00	147.67	412.63	197.37	226.08	488.67	345.92	2.760	
58	168.00	147.67	412.11	197.89	225.90	484.56	341.84	2.761	
59	168.00	147.67	413.16	196.84	226.29	492.78	350.00	2.763	
60	168.00	147.67	411.58	198.42	225.74	480.45	337.76	2.766	
61	167.47	147.49	412.11	197.89	224.69	488.64	345.92	2.768	
62	167.47	147.49	412.63	197.37	224.88	492.75	350.00	2.770	
63	167.47	147.49	411.58	198.42	224.52	484.53	341.84	2.772	

14	246.70	204.59	5.6	6.68	6.71	3	100.00	18.0	26909.62	22032.45
5368.76	0.99									
15	253.38	215.10	5.6	6.68	6.71	3	100.00	18.0	28243.10	21759.52
5428.17	0.99									
16	260.06	157.81	7.8	4.72	4.76	3	100.00	18.0	20688.77	15245.23
5451.91	0.99									
17	264.77	147.32	7.8	4.29	4.33	2	0.00	35.0	19299.49	13698.95
5426.16	0.97									
18	269.06	150.94	7.8	4.29	4.33	2	0.00	35.0	19772.83	13540.23
5444.98	0.97									
19	273.35	238.70	10.0	6.61	6.71	2	0.00	35.0	31269.13	20616.29
5424.80	0.96									
20	279.96	245.53	10.0	6.61	6.71	2	0.00	35.0	32165.02	20127.56
5419.33	0.96									
21	286.57	92.04	12.2	2.43	2.49	2	0.00	35.0	12057.88	7338.94
5381.07	0.96									
22	289.00	204.38	12.2	5.34	5.46	2	0.00	35.0	26773.65	15815.45
5357.53	0.96									
23	294.34	207.70	12.2	5.34	5.46	2	0.00	35.0	27208.17	15420.28
5325.19	0.96									
24	299.68	256.29	14.5	6.50	6.71	2	0.00	35.0	33574.41	18340.63
5243.20	0.96									
25	306.18	259.47	14.5	6.50	6.71	2	0.00	35.0	33990.96	17638.84
5169.74	0.96									
26	312.67	133.84	16.7	3.33	3.47	2	0.00	35.0	17532.50	8838.74
5075.67	0.96									
27	316.00	181.66	16.7	4.50	4.70	2	0.00	35.0	23798.01	11614.52
5053.60	0.96									
28	320.50	182.34	16.7	4.50	4.70	2	0.00	35.0	23886.92	11219.01
5064.69	0.96									
29	325.00	261.06	18.7	6.61	6.98	2	0.00	35.0	34198.55	15894.72
4902.42	0.96									
30	331.61	246.08	18.9	6.61	6.99	2	0.00	35.0	32236.82	14923.57
4617.84	0.96									
31	338.22	180.34	21.1	5.14	5.51	2	0.00	35.0	23624.33	11033.37
4325.03	0.96									
32	343.36	170.13	21.1	5.14	5.51	2	0.00	35.0	22287.28	10350.56
4079.11	0.96									
33	348.50	70.95	21.1	2.24	2.40	5	0.00	45.0	7804.19	2787.31
3151.59	0.92									
34	350.74	88.61	23.4	2.89	3.15	2	0.00	35.0	11608.39	122.89
3551.54	0.96									
35	353.63	136.59	23.4	4.71	5.13	2	0.00	35.0	17893.91	0.00
3356.78	0.96									
36	358.35	127.00	23.4	4.71	5.13	2	0.00	35.0	16637.22	0.00
3121.03	0.96									
37	363.06	148.15	25.6	6.05	6.71	2	0.00	35.0	19408.21	0.00
2800.19	0.97									
38	369.11	130.62	25.6	6.05	6.71	2	0.00	35.0	17111.37	0.00
2468.81	0.97									
39	375.16	110.21	27.8	5.93	6.71	2	0.00	35.0	14437.86	0.00
2097.11	0.97									
40	381.10	91.64	27.8	5.93	6.71	2	0.00	35.0	12004.69	0.00
1743.68	0.97									
41	387.03	41.98	30.0	3.25	3.75	2	0.00	35.0	5499.99	0.00
1441.96	0.98									
42	390.28	45.17	30.0	4.19	4.84	1	150.00	22.0	5917.84	0.00
1249.49	1.05									
43	394.46	35.04	30.0	4.19	4.84	1	150.00	22.0	4590.72	0.00
961.63	1.05									
44	398.65	30.47	32.2	5.67	6.71	1	150.00	22.0	3992.05	0.00
596.60	1.06									
45	404.33	10.16	32.2	5.67	6.71	1	150.00	22.0	1330.68	0.00
174.24	1.06									

X-S Area:

6122.06

Path Length:

254.97

X-S Weight:

802280.44

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 4-2\West Farm Expansion Case 4-2 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:43:58

DATA: Analysis 1 - Case 4-2 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 188.00 348.50 188.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 146.00 348.50 146.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 143.00 348.50 143.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 188.00 450.00 188.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 146.00 450.00 146.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 143.00 450.00 143.00

Slope Surface (8 points)

100.00	146.00	163.00	146.00	325.00	200.00	410.00	200.00
415.00	195.00						
420.00	195.00	425.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	146.00	163.00	146.00	316.00	197.00	348.50	197.00
351.50	170.00						
450.00	170.00						

Failure Surface

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

Intersects: XL:	163.00	YL:	146.00	XR:	415.00	YR:	195.00
Centre: XC:	248.05	YC:	381.09	Radius: R:	250.00		

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

RESULTS: Analysis 1 - Case 4-2 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.440

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.38

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	166.42	147.14	410.00	200.00	219.78	488.92	345.92	1.381	<--
Critical Surface									
2	166.95	147.32	410.00	200.00	221.02	484.85	341.84	1.383	
3	167.47	147.49	410.00	200.00	222.26	480.77	337.76	1.385	
4	168.00	147.67	410.00	200.00	223.51	476.69	333.67	1.386	
5	166.42	147.14	410.00	200.00	218.85	493.19	350.00	1.388	
6	166.95	147.32	410.00	200.00	220.09	489.13	345.92	1.390	
7	167.47	147.49	410.00	200.00	221.34	485.06	341.84	1.392	
8	168.00	147.67	410.00	200.00	222.58	480.98	337.76	1.394	
9	166.42	147.14	410.53	199.47	219.93	493.03	350.00	1.395	
10	166.95	147.32	410.00	200.00	219.17	493.40	350.00	1.396	
11	165.89	146.96	410.00	200.00	218.53	492.98	350.00	1.396	
12	166.95	147.32	410.53	199.47	221.16	488.96	345.92	1.397	
13	167.47	147.49	410.00	200.00	220.41	489.34	345.92	1.398	
14	167.47	147.49	410.53	199.47	222.40	484.89	341.84	1.399	
15	168.00	147.67	410.53	199.47	223.63	480.81	337.76	1.400	
16	168.00	147.67	410.00	200.00	221.65	485.27	341.84	1.401	
17	166.95	147.32	410.53	199.47	220.25	493.23	350.00	1.404	
18	167.47	147.49	410.00	200.00	219.48	493.61	350.00	1.405	
19	167.47	147.49	410.53	199.47	221.48	489.17	345.92	1.406	
20	168.00	147.67	410.00	200.00	220.73	489.54	345.92	1.408	
21	168.00	147.67	410.53	199.47	222.72	485.10	341.84	1.408	
22	166.95	147.32	411.05	198.95	221.33	493.07	350.00	1.411	
23	167.47	147.49	410.53	199.47	220.57	493.44	350.00	1.413	
24	167.47	147.49	411.05	198.95	222.56	489.00	345.92	1.413	
25	168.00	147.67	411.05	198.95	223.78	484.92	341.84	1.414	
26	168.00	147.67	410.53	199.47	221.80	489.38	345.92	1.415	
27	168.00	147.67	410.00	200.00	219.80	493.81	350.00	1.416	
28	167.47	147.49	411.05	198.95	221.65	493.27	350.00	1.420	
29	168.00	147.67	411.05	198.95	222.88	489.20	345.92	1.422	
30	168.00	147.67	410.53	199.47	220.89	493.65	350.00	1.423	
31	167.47	147.49	411.58	198.42	222.73	493.10	350.00	1.427	
32	168.00	147.67	411.58	198.42	223.95	489.03	345.92	1.428	
33	168.00	147.67	411.05	198.95	221.97	493.48	350.00	1.429	
34	168.00	147.67	411.58	198.42	223.06	493.31	350.00	1.436	
35	168.00	147.67	412.11	197.89	224.14	493.14	350.00	1.442	
36	168.00	147.67	412.63	197.37	225.21	492.96	350.00	1.482	
37	168.00	147.67	412.11	197.89	225.02	488.85	345.92	1.505	
38	167.47	147.49	412.11	197.89	223.81	492.93	350.00	1.515	
39	168.00	147.67	411.58	198.42	224.84	484.74	341.84	1.531	
40	167.47	147.49	411.58	198.42	223.62	488.82	345.92	1.532	
41	166.95	147.32	411.58	198.42	222.41	492.89	350.00	1.540	
42	167.47	147.49	411.05	198.95	223.46	484.71	341.84	1.553	
43	166.95	147.32	411.05	198.95	222.23	488.79	345.92	1.554	
44	168.00	147.67	411.05	198.95	224.69	480.63	337.76	1.562	
45	166.42	147.14	411.05	198.95	221.01	492.86	350.00	1.563	
46	166.95	147.32	410.53	199.47	222.08	484.68	341.84	1.571	
47	166.42	147.14	410.53	199.47	220.85	488.75	345.92	1.575	
48	167.47	147.49	410.53	199.47	223.32	480.60	337.76	1.577	
49	168.00	147.67	410.53	199.47	224.55	476.51	333.67	1.587	
50	168.00	147.67	410.00	200.00	224.44	472.39	329.59	1.588	
51	165.89	146.96	410.53	199.47	219.61	492.82	350.00	1.589	
52	166.42	147.14	410.00	200.00	220.70	484.64	341.84	1.592	
53	166.95	147.32	410.00	200.00	221.95	480.56	337.76	1.593	
54	167.47	147.49	410.00	200.00	223.19	476.48	333.67	1.594	
55	165.89	146.96	410.00	200.00	219.46	488.71	345.92	1.602	
56	165.37	146.79	410.00	200.00	218.21	492.78	350.00	1.629	
57	168.00	147.67	412.63	197.37	226.08	488.67	345.92	1.680	
58	168.00	147.67	412.11	197.89	225.90	484.56	341.84	1.680	
59	168.00	147.67	413.16	196.84	226.29	492.78	350.00	1.681	
60	168.00	147.67	411.58	198.42	225.74	480.45	337.76	1.683	
61	167.47	147.49	412.11	197.89	224.69	488.64	345.92	1.684	
62	167.47	147.49	412.63	197.37	224.88	492.75	350.00	1.685	

63	167.47	147.49	411.58	198.42	224.52	484.53	341.84	1.686
64	168.00	147.67	411.05	198.95	225.59	476.33	333.67	1.688
65	167.47	147.49	411.05	198.95	224.37	480.42	337.76	1.690
66	166.95	147.32	412.11	197.89	223.48	492.72	350.00	1.693
67	166.95	147.32	411.58	198.42	223.30	488.61	345.92	1.694
68	168.00	147.67	410.53	199.47	225.47	472.21	329.59	1.695
69	167.47	147.49	410.53	199.47	224.24	476.30	333.67	1.696
70	166.95	147.32	411.05	198.95	223.14	484.50	341.84	1.696
71	166.42	147.14	410.00	200.00	221.64	480.35	337.76	1.701
72	166.95	147.32	410.00	200.00	222.88	476.27	333.67	1.702
73	165.89	146.96	410.00	200.00	220.39	484.43	341.84	1.703
74	166.42	147.14	410.53	199.47	221.76	484.47	341.84	1.704
75	168.00	147.67	410.00	200.00	225.37	468.08	325.51	1.705
76	166.95	147.32	410.53	199.47	223.00	480.39	337.76	1.706
77	165.89	146.96	410.53	199.47	220.53	488.54	345.92	1.706
78	166.42	147.14	411.58	198.42	222.08	492.69	350.00	1.706
79	167.47	147.49	410.00	200.00	224.12	472.18	329.59	1.708
80	166.42	147.14	411.05	198.95	221.91	488.58	345.92	1.708
81	165.37	146.79	410.00	200.00	219.14	488.50	345.92	1.709
82	165.37	146.79	410.53	199.47	219.29	492.61	350.00	1.711
83	165.89	146.96	411.05	198.95	220.69	492.65	350.00	1.711
84	164.84	146.61	410.00	200.00	217.90	492.57	350.00	1.716
85	165.89	146.96	410.00	200.00	221.32	480.14	337.76	1.764
86	166.42	147.14	410.00	200.00	222.57	476.06	333.67	1.765
87	165.37	146.79	410.00	200.00	220.08	484.22	341.84	1.766
88	165.89	146.96	410.53	199.47	221.45	484.26	341.84	1.767
89	166.42	147.14	410.53	199.47	222.68	480.18	337.76	1.767
90	166.95	147.32	410.00	200.00	223.81	471.97	329.59	1.769
91	165.37	146.79	410.53	199.47	220.21	488.33	345.92	1.769
92	166.95	147.32	410.53	199.47	223.92	476.09	333.67	1.770
93	166.42	147.14	411.05	198.95	222.82	484.29	341.84	1.771
94	166.95	147.32	411.05	198.95	224.05	480.21	337.76	1.771
95	165.89	146.96	411.05	198.95	221.59	488.37	345.92	1.772
96	164.84	146.61	410.00	200.00	218.83	488.29	345.92	1.773
97	166.95	147.32	411.58	198.42	224.20	484.32	341.84	1.774
98	164.84	146.61	410.53	199.47	218.97	492.40	350.00	1.774
99	166.42	147.14	411.58	198.42	222.98	488.40	345.92	1.775

Critical Failure Surface (circle 1)

Intersects:	XL:	166.42	YL:	147.14	XR:	410.00	YR:	200.00	
Centre:	XC:	219.78	YC:	488.92		Radius:	R:	345.92	
Generated failure surface: (20 points)									
166.42	147.14	179.72	145.33	193.07	144.03	206.47	143.26		
219.89	143.00								
233.30	143.27	246.70	144.05	260.06	145.35	273.35	147.17		
286.57	149.51								
299.68	152.36	312.67	155.71	325.53	159.56	338.22	163.91		
350.74	168.75								
363.06	174.07	375.16	179.87	387.03	186.12	398.65	192.84		
410.00	200.00								

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

Slice		X-S	----- Base -----							PoreWater
Normal	Test									
Stress	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
1	166.42	4.11	-7.8	4.18	4.22	2	0.00	35.0	538.34	258.80
133.69	1.08									
2	170.60	12.33	-7.8	4.18	4.22	2	0.00	35.0	1615.00	776.39
401.06	1.08									
3	174.79	25.08	-7.8	4.93	4.98	3	100.00	18.0	3301.49	1579.20
691.60	1.04									
4	179.72	51.30	-5.5	6.68	6.71	3	100.00	18.0	6786.52	3216.00
1035.91	1.03									
5	186.40	70.49	-5.5	6.68	6.71	3	100.00	18.0	9343.89	4419.19
1423.60	1.03									
6	193.07	89.10	-3.3	6.70	6.71	3	100.00	18.0	11817.28	5569.36
1781.36	1.02									
7	199.77	106.66	-3.3	6.70	6.71	3	100.00	18.0	14143.05	6666.66
2131.11	1.02									
8	206.47	123.54	-1.1	6.71	6.71	3	100.00	18.0	16371.86	7710.21
2447.72	1.00									
9	213.18	139.40	-1.1	6.71	6.71	3	100.00	18.0	18458.04	8700.02
2759.43	1.00									
10	219.89	154.38	1.1	6.71	6.71	3	100.00	18.0	20421.09	9635.45
3035.26	1.00									
11	226.60	168.50	1.1	6.71	6.71	3	100.00	18.0	22261.04	10516.28
3308.88	1.00									
12	233.30	181.45	3.4	6.70	6.71	3	100.00	18.0	23939.84	11341.83
3544.31	0.99									
13	240.00	193.78	3.4	6.70	6.71	3	100.00	18.0	25528.32	12112.32

3779.80	0.99										
14	246.70	204.59	5.6	6.68	6.71	3	100.00	18.0	26909.62	12827.05	
3975.22	0.98										
15	253.38	215.10	5.6	6.68	6.71	3	100.00	18.0	28243.10	13486.08	
4172.63	0.98										
16	260.06	157.81	7.8	4.72	4.76	3	100.00	18.0	20688.77	9939.47	
4305.29	0.98										
17	264.77	147.32	7.8	4.29	4.33	2	0.00	35.0	19299.49	9278.86	
4346.28	0.94										
18	269.06	150.94	7.8	4.29	4.33	2	0.00	35.0	19772.83	9506.43	
4452.88	0.94										
19	273.35	238.70	10.0	6.61	6.71	2	0.00	35.0	31269.13	15125.37	
4528.79	0.93										
20	279.96	245.53	10.0	6.61	6.71	2	0.00	35.0	32165.02	15558.73	
4658.53	0.93										
21	286.57	92.04	12.2	2.43	2.49	2	0.00	35.0	12057.88	5877.30	
4697.29	0.92										
22	289.00	204.38	12.2	5.34	5.46	2	0.00	35.0	26773.65	13050.11	
4753.45	0.92										
23	294.34	207.70	12.2	5.34	5.46	2	0.00	35.0	27208.17	13261.91	
4830.60	0.92										
24	299.68	256.29	14.5	6.50	6.71	2	0.00	35.0	33574.41	16516.40	
4854.77	0.91										
25	306.18	259.47	14.5	6.50	6.71	2	0.00	35.0	33990.96	16721.30	
4915.00	0.91										
26	312.67	133.84	16.7	3.33	3.47	2	0.00	35.0	17532.50	8718.63	
4907.05	0.91										
27	316.00	181.66	16.7	4.50	4.70	2	0.00	35.0	23798.01	11614.52	
4916.87	0.91										
28	320.50	182.34	16.7	4.50	4.70	2	0.00	35.0	23886.92	11219.01	
4922.91	0.91										
29	325.00	261.06	18.7	6.61	6.98	2	0.00	35.0	34198.55	15894.72	
4747.74	0.90										
30	331.61	246.08	18.9	6.61	6.99	2	0.00	35.0	32236.82	14923.57	
4470.34	0.90										
31	338.22	180.34	21.1	5.14	5.51	2	0.00	35.0	23624.33	11033.37	
4172.25	0.90										
32	343.36	170.13	21.1	5.14	5.51	2	0.00	35.0	22287.28	10350.56	
3934.35	0.90										
33	348.50	70.95	21.1	2.24	2.40	5	0.00	45.0	7804.19	2787.31	
2976.83	0.84										
34	350.74	88.61	23.4	2.89	3.15	2	0.00	35.0	11608.39	122.89	
3298.24	0.89										
35	353.63	136.59	23.4	4.71	5.13	2	0.00	35.0	17893.91	0.00	
3114.72	0.89										
36	358.35	127.00	23.4	4.71	5.13	2	0.00	35.0	16637.22	0.00	
2895.97	0.89										
37	363.06	148.15	25.6	6.05	6.71	2	0.00	35.0	19408.21	0.00	
2580.64	0.89										
38	369.11	130.62	25.6	6.05	6.71	2	0.00	35.0	17111.37	0.00	
2275.24	0.89										
39	375.16	110.21	27.8	5.93	6.71	2	0.00	35.0	14437.86	0.00	
1919.52	0.89										
40	381.10	91.64	27.8	5.93	6.71	2	0.00	35.0	12004.69	0.00	
1596.02	0.89										
41	387.03	41.98	30.0	3.25	3.75	2	0.00	35.0	5499.99	0.00	
1310.77	0.89										
42	390.28	45.17	30.0	4.19	4.84	1	150.00	22.0	5917.84	0.00	
1155.39	0.99										
43	394.46	35.04	30.0	4.19	4.84	1	150.00	22.0	4590.72	0.00	
884.24	0.99										
44	398.65	30.47	32.2	5.67	6.71	1	150.00	22.0	3992.05	0.00	
536.05	1.00										
45	404.33	10.16	32.2	5.67	6.71	1	150.00	22.0	1330.68	0.00	
140.12	1.00										

X-S Area:	6122.06	Path Length:	254.97	X-S Weight:	802280.44

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:52:46

DATA: Analysis 1 - Case 5-1 Full Reservoir

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 174.00 348.50 174.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 161.00 348.50 161.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 158.00 348.50 158.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 174.00 450.00 174.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 161.00 450.00 161.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 158.00 450.00 158.00

Slope Surface (4 points)

100.00	161.00	208.00	161.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	197.00	208.00	197.00	316.00	197.00	348.50	197.00
351.50	185.00						
450.00	185.00						

Failure Surface

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

Intersects: XL:	208.00	YL:	161.00	XR:	385.00	YR:	200.00
Centre: XC:	246.36	YC:	408.04	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 5-1 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.977

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	210.37	161.79	380.00	200.00	250.92	377.40	219.39	1.920	
Critical Surface									
2	209.84	161.61	380.00	200.00	249.64	381.51	223.47	1.921	
3	206.68	161.00	380.00	200.00	244.44	397.80	239.80	1.922	
4	208.79	161.26	380.00	200.00	247.09	389.71	231.63	1.922	
5	209.32	161.44	380.00	200.00	248.37	385.61	227.55	1.923	
6	205.11	161.00	380.00	200.00	243.19	401.89	243.88	1.924	
7	210.89	161.96	380.00	200.00	252.20	373.27	215.31	1.924	
8	208.26	161.09	380.00	200.00	245.81	393.79	235.71	1.925	
9	203.53	161.00	380.00	200.00	241.94	405.97	247.96	1.926	
10	207.21	161.00	380.00	200.00	244.54	397.87	239.80	1.926	
11	208.79	161.26	380.53	200.00	247.52	389.64	231.63	1.926	
12	205.63	161.00	380.00	200.00	243.28	401.95	243.88	1.927	
13	208.26	161.09	380.53	200.00	246.24	393.72	235.71	1.927	
14	207.21	161.00	380.53	200.00	244.97	397.80	239.80	1.928	
15	204.05	161.00	380.00	200.00	242.04	406.03	247.96	1.929	
16	213.00	162.67	380.00	200.00	256.32	361.05	203.06	1.929	
17	207.74	161.00	380.00	200.00	244.64	397.94	239.80	1.929	
18	209.32	161.44	380.53	200.00	248.79	385.54	227.55	1.929	
19	205.63	161.00	380.53	200.00	243.71	401.89	243.88	1.930	
20	206.68	161.00	380.00	200.00	243.48	402.09	243.88	1.930	
21	206.16	161.00	380.00	200.00	243.38	402.02	243.88	1.931	
22	212.47	162.49	380.00	200.00	255.05	365.21	207.14	1.931	
23	210.37	161.79	380.00	200.00	249.95	381.73	223.47	1.931	
24	204.05	161.00	380.53	200.00	242.46	405.97	247.96	1.932	
25	207.74	161.00	380.53	200.00	245.07	397.87	239.80	1.932	
26	204.58	161.00	380.00	200.00	242.13	406.10	247.96	1.932	
27	209.84	161.61	380.00	200.00	248.67	385.83	227.55	1.933	
28	212.47	162.49	380.53	200.00	255.46	365.12	207.14	1.933	
29	211.95	162.32	380.00	200.00	253.77	369.36	211.22	1.933	
30	206.16	161.00	380.53	200.00	243.81	401.95	243.88	1.933	
31	211.95	162.32	380.53	200.00	254.19	369.27	211.22	1.933	
32	208.26	161.09	380.00	200.00	244.84	398.08	239.80	1.934	
33	209.32	161.44	380.00	200.00	247.39	389.92	231.63	1.934	
34	211.42	162.14	380.53	200.00	252.91	373.41	215.31	1.934	
35	203.00	161.00	380.00	200.00	240.89	410.18	252.04	1.934	
36	211.42	162.14	380.00	200.00	252.50	373.49	215.31	1.934	
37	207.21	161.00	380.00	200.00	243.58	402.15	243.88	1.934	
38	208.79	161.26	380.00	200.00	246.12	394.00	235.71	1.935	
39	204.58	161.00	380.53	200.00	242.56	406.03	247.96	1.935	
40	210.89	161.96	380.53	200.00	251.64	377.54	219.39	1.936	
41	205.11	161.00	380.00	200.00	242.23	406.16	247.96	1.936	
42	205.63	161.00	380.00	200.00	242.33	406.23	247.96	1.936	
43	206.16	161.00	381.05	200.00	244.24	401.89	243.88	1.936	
44	211.95	162.32	381.05	200.00	254.60	369.19	211.22	1.936	
45	207.21	161.00	380.53	200.00	244.01	402.09	243.88	1.936	
46	206.68	161.00	380.53	200.00	243.91	402.02	243.88	1.937	
47	211.42	162.14	381.05	200.00	253.33	373.33	215.31	1.937	
48	203.00	161.00	380.53	200.00	241.32	410.11	252.04	1.937	
49	210.89	161.96	381.05	200.00	252.06	377.46	219.39	1.937	
50	204.05	161.00	380.00	200.00	241.09	410.30	252.04	1.937	
51	210.37	161.79	381.05	200.00	250.79	381.57	223.47	1.937	
52	203.53	161.00	380.00	200.00	240.99	410.24	252.04	1.937	
53	208.79	161.26	380.53	200.00	246.55	393.93	235.71	1.937	
54	204.58	161.00	381.05	200.00	242.99	405.97	247.96	1.937	
55	205.11	161.00	380.53	200.00	242.66	406.10	247.96	1.938	
56	207.74	161.00	380.00	200.00	243.67	402.22	243.88	1.939	
57	210.89	161.96	380.00	200.00	251.22	377.61	219.39	1.939	
58	209.84	161.61	380.53	200.00	249.09	385.75	227.55	1.939	
59	210.37	161.79	380.53	200.00	250.37	381.65	223.47	1.939	
60	203.00	161.00	381.05	200.00	241.75	410.04	252.04	1.939	
61	206.68	161.00	381.05	200.00	244.34	401.95	243.88	1.939	
62	207.74	161.00	381.05	200.00	245.50	397.80	239.80	1.940	
63	209.84	161.61	381.05	200.00	249.51	385.68	227.55	1.940	
64	208.26	161.09	380.53	200.00	245.27	398.01	239.80	1.940	

65	206.16	161.00	380.00	200.00	242.42	406.29	247.96	1.940
66	203.53	161.00	380.53	200.00	241.42	410.18	252.04	1.940
67	210.89	161.96	381.58	200.00	252.47	377.38	219.39	1.940
68	210.37	161.79	381.58	200.00	251.20	381.50	223.47	1.940
69	209.32	161.44	381.05	200.00	248.24	389.78	231.63	1.941
70	207.74	161.00	380.53	200.00	244.10	402.15	243.88	1.941
71	209.84	161.61	381.58	200.00	249.93	385.61	227.55	1.941
72	205.11	161.00	381.05	200.00	243.09	406.03	247.96	1.941
73	204.58	161.00	380.00	200.00	241.18	410.37	252.04	1.942
74	209.32	161.44	380.53	200.00	247.82	389.85	231.63	1.942
75	205.63	161.00	380.53	200.00	242.76	406.16	247.96	1.942
76	206.16	161.00	380.53	200.00	242.85	406.23	247.96	1.942
77	213.00	162.67	380.00	200.00	255.34	365.44	207.14	1.942
78	209.32	161.44	381.58	200.00	248.67	389.70	231.63	1.942
79	208.79	161.26	381.58	200.00	247.40	393.79	235.71	1.942
80	207.74	161.00	381.05	200.00	244.53	402.09	243.88	1.942
81	203.53	161.00	381.05	200.00	241.85	410.11	252.04	1.943
82	207.21	161.00	381.05	200.00	244.44	402.02	243.88	1.943
83	209.32	161.44	380.00	200.00	246.42	394.21	235.71	1.943
84	203.00	161.00	380.00	200.00	239.95	414.44	256.12	1.943
85	204.58	161.00	380.53	200.00	241.61	410.30	252.04	1.943
86	204.05	161.00	380.53	200.00	241.52	410.24	252.04	1.943
87	208.79	161.26	381.05	200.00	246.97	393.86	235.71	1.943
88	205.11	161.00	381.58	200.00	243.51	405.97	247.96	1.943
89	212.47	162.49	380.00	200.00	254.07	369.58	211.22	1.944
90	209.32	161.44	382.11	200.00	249.09	389.63	231.63	1.944
91	206.68	161.00	380.00	200.00	242.52	406.36	247.96	1.944
92	210.89	161.96	380.00	200.00	250.25	381.94	223.47	1.944
93	205.63	161.00	381.05	200.00	243.19	406.10	247.96	1.944
94	213.00	162.67	380.53	200.00	255.76	365.35	207.14	1.945
95	208.79	161.26	380.00	200.00	245.15	398.29	239.80	1.945
96	203.00	161.00	380.53	200.00	240.38	414.38	256.12	1.945
97	211.95	162.32	380.00	200.00	252.80	373.71	215.31	1.945
98	210.37	161.79	380.00	200.00	248.97	386.04	227.55	1.945
99	212.47	162.49	380.53	200.00	254.48	369.50	211.22	1.945

3922.48	0.99										
15	271.26	110.77	5.3	4.68	4.70	3	100.00	18.0	14593.53	11090.16	
3966.94	0.99										
16	275.95	114.98	7.8	4.66	4.70	3	100.00	18.0	15120.12	10932.51	
3982.89	0.99										
17	280.61	119.25	7.8	4.66	4.70	3	100.00	18.0	15650.24	10745.50	
3998.41	0.99										
18	285.27	41.31	10.2	1.58	1.60	3	100.00	18.0	5414.26	3618.88	
3989.11	0.99										
19	286.85	102.06	10.2	3.84	3.90	2	0.00	35.0	13369.79	8681.69	
3935.29	0.95										
20	290.69	104.31	10.2	3.84	3.90	2	0.00	35.0	13664.97	8512.88	
3929.77	0.95										
21	294.53	127.15	12.7	4.59	4.70	2	0.00	35.0	16657.04	10009.47	
3883.88	0.95										
22	299.12	129.43	12.7	4.59	4.70	2	0.00	35.0	16955.17	9705.91	
3850.81	0.95										
23	303.71	129.83	15.2	4.54	4.70	2	0.00	35.0	17008.04	9373.79	
3777.53	0.94										
24	308.25	131.12	15.2	4.54	4.70	2	0.00	35.0	17176.98	9012.79	
3718.53	0.94										
25	312.79	93.16	17.6	3.21	3.37	2	0.00	35.0	12204.38	6211.47	
3631.24	0.94										
26	316.00	83.79	17.6	2.88	3.02	2	0.00	35.0	10976.06	5394.81	
3600.78	0.94										
27	318.88	83.92	17.6	2.88	3.02	2	0.00	35.0	10993.38	5222.44	
3600.25	0.94										
28	321.76	94.30	20.1	3.24	3.45	2	0.00	35.0	12353.07	5735.06	
3560.37	0.94										
29	325.00	156.94	20.1	5.60	5.96	2	0.00	35.0	20559.57	9310.45	
3424.35	0.94										
30	330.60	64.61	22.5	2.44	2.64	2	0.00	35.0	8464.38	3870.82	
3208.80	0.94										
31	333.04	79.27	22.5	3.13	3.39	1	150.00	22.0	10384.40	4721.28	
3136.68	1.00										
32	336.16	75.22	22.5	3.13	3.39	1	150.00	22.0	9853.24	4447.37	
2973.95	1.00										
33	339.29	95.58	25.0	4.26	4.70	1	150.00	22.0	12520.94	5699.07	
2748.99	1.00										
34	343.55	87.11	25.0	4.26	4.70	1	150.00	22.0	11410.96	5115.77	
2500.87	1.00										
35	347.82	13.12	27.4	0.68	0.77	1	150.00	22.0	1718.45	778.62	
2337.43	1.02										
36	348.50	54.90	27.4	3.00	3.38	5	0.00	45.0	6039.04	1961.68	
1708.09	0.89										
37	351.50	76.15	27.4	4.67	5.26	1	150.00	22.0	9976.00	429.77	
1897.57	1.02										
38	356.17	56.79	29.9	4.08	4.70	1	150.00	22.0	7439.64	0.00	
1587.18	1.03										
39	360.25	47.23	29.9	4.08	4.70	1	150.00	22.0	6186.75	0.00	
1313.14	1.03										
40	364.33	36.36	32.4	3.97	4.70	1	150.00	22.0	4762.67	0.00	
1013.79	1.04										
41	368.30	26.35	32.4	3.97	4.70	1	150.00	22.0	3451.87	0.00	
722.76	1.04										
42	372.27	15.56	34.8	3.86	4.70	1	150.00	22.0	2038.48	0.00	
413.02	1.06										
43	376.14	5.19	34.8	3.86	4.70	1	150.00	22.0	679.49	0.00	
106.08	1.06										

X-S Area:

3144.64

Path Length:

178.77

X-S Weight:

412213.31

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 5-1\West Farm Expansion Case 5-1 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:51:42

DATA: Analysis 1 - Case 5-1 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
100.00 200.00	348.50 200.00
Profile: 2 (2 points)	Material beneath: 2 - Sand and Gravel
100.00 174.00	348.50 174.00
Profile: 3 (2 points)	Material beneath: 3 - Weathered Bedrock
100.00 161.00	348.50 161.00
Profile: 4 (2 points)	Material beneath: 4 - Stable Bedrock
100.00 158.00	348.50 158.00
Profile: 5 (2 points)	Material beneath: 5 - Slurry Wall
348.50 200.00	351.50 200.00
Profile: 6 (2 points)	Material beneath: 1 - Overburden
351.50 200.00	450.00 200.00
Profile: 7 (2 points)	Material beneath: 2 - Sand and Gravel
351.50 174.00	450.00 174.00
Profile: 8 (2 points)	Material beneath: 3 - Weathered Bedrock
351.50 161.00	450.00 161.00
Profile: 9 (2 points)	Material beneath: 4 - Stable Bedrock
348.50 158.00	450.00 158.00

Slope Surface (4 points)

100.00	161.00	208.00	161.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	161.00	208.00	161.00	316.00	197.00	348.50	197.00
351.50	185.00						
450.00	185.00						

Failure Surface

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

Intersects: XL:	208.00	YL:	161.00	XR:	385.00	YR:	200.00
Centre: XC:	246.36	YC:	408.04	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 5-1 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.210

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.17

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	206.68	161.00	380.00	200.00	244.44	397.80	239.80	1.167	
Critical Surface									
2	209.84	161.61	380.00	200.00	249.64	381.51	223.47	1.167	
3	210.37	161.79	380.00	200.00	250.92	377.40	219.39	1.167	
4	208.79	161.26	380.00	200.00	247.09	389.71	231.63	1.167	
5	205.11	161.00	380.00	200.00	243.19	401.89	243.88	1.168	
6	209.32	161.44	380.00	200.00	248.37	385.61	227.55	1.168	
7	210.89	161.96	380.00	200.00	252.20	373.27	215.31	1.168	
8	203.53	161.00	380.00	200.00	241.94	405.97	247.96	1.169	
9	208.26	161.09	380.00	200.00	245.81	393.79	235.71	1.169	
10	207.21	161.00	380.00	200.00	244.54	397.87	239.80	1.169	
11	205.63	161.00	380.00	200.00	243.28	401.95	243.88	1.170	
12	208.79	161.26	380.53	200.00	247.52	389.64	231.63	1.170	
13	208.26	161.09	380.53	200.00	246.24	393.72	235.71	1.171	
14	204.05	161.00	380.00	200.00	242.04	406.03	247.96	1.171	
15	207.21	161.00	380.53	200.00	244.97	397.80	239.80	1.171	
16	209.32	161.44	380.53	200.00	248.79	385.54	227.55	1.171	
17	207.74	161.00	380.00	200.00	244.64	397.94	239.80	1.171	
18	205.63	161.00	380.53	200.00	243.71	401.89	243.88	1.172	
19	206.16	161.00	380.00	200.00	243.38	402.02	243.88	1.172	
20	206.68	161.00	380.00	200.00	243.48	402.09	243.88	1.172	
21	204.05	161.00	380.53	200.00	242.46	405.97	247.96	1.173	
22	204.58	161.00	380.00	200.00	242.13	406.10	247.96	1.173	
23	207.74	161.00	380.53	200.00	245.07	397.87	239.80	1.174	
24	210.37	161.79	380.00	200.00	249.95	381.73	223.47	1.174	
25	213.00	162.67	380.00	200.00	256.32	361.05	203.06	1.174	
26	203.00	161.00	380.00	200.00	240.89	410.18	252.04	1.174	
27	206.16	161.00	380.53	200.00	243.81	401.95	243.88	1.175	
28	209.84	161.61	380.00	200.00	248.67	385.83	227.55	1.175	
29	212.47	162.49	380.00	200.00	255.05	365.21	207.14	1.175	
30	208.26	161.09	380.00	200.00	244.84	398.08	239.80	1.175	
31	209.32	161.44	380.00	200.00	247.39	389.92	231.63	1.175	
32	207.21	161.00	380.00	200.00	243.58	402.15	243.88	1.175	
33	204.58	161.00	380.53	200.00	242.56	406.03	247.96	1.176	
34	211.95	162.32	380.00	200.00	253.77	369.36	211.22	1.176	
35	205.11	161.00	380.00	200.00	242.23	406.16	247.96	1.176	
36	208.79	161.26	380.00	200.00	246.12	394.00	235.71	1.176	
37	211.42	162.14	380.00	200.00	252.50	373.49	215.31	1.176	
38	205.63	161.00	380.00	200.00	242.33	406.23	247.96	1.176	
39	203.00	161.00	380.53	200.00	241.32	410.11	252.04	1.177	
40	203.53	161.00	380.00	200.00	240.99	410.24	252.04	1.177	
41	206.16	161.00	381.05	200.00	244.24	401.89	243.88	1.177	
42	206.68	161.00	380.53	200.00	243.91	402.02	243.88	1.177	
43	212.47	162.49	380.53	200.00	255.46	365.12	207.14	1.177	
44	204.05	161.00	380.00	200.00	241.09	410.30	252.04	1.177	
45	211.42	162.14	380.53	200.00	252.91	373.41	215.31	1.177	
46	207.21	161.00	380.53	200.00	244.01	402.09	243.88	1.177	
47	211.95	162.32	380.53	200.00	254.19	369.27	211.22	1.177	
48	210.89	161.96	380.53	200.00	251.64	377.54	219.39	1.177	
49	204.58	161.00	381.05	200.00	242.99	405.97	247.96	1.178	
50	205.11	161.00	380.53	200.00	242.66	406.10	247.96	1.178	
51	207.74	161.00	381.05	200.00	245.50	397.80	239.80	1.178	
52	208.79	161.26	380.53	200.00	246.55	393.93	235.71	1.178	
53	210.89	161.96	380.00	200.00	251.22	377.61	219.39	1.178	
54	207.74	161.00	380.00	200.00	243.67	402.22	243.88	1.178	
55	209.84	161.61	380.53	200.00	249.09	385.75	227.55	1.179	
56	203.00	161.00	381.05	200.00	241.75	410.04	252.04	1.179	
57	203.53	161.00	380.53	200.00	241.42	410.18	252.04	1.179	
58	206.16	161.00	380.00	200.00	242.42	406.29	247.96	1.179	
59	210.37	161.79	380.53	200.00	250.37	381.65	223.47	1.179	
60	206.68	161.00	381.05	200.00	244.34	401.95	243.88	1.179	
61	208.26	161.09	380.53	200.00	245.27	398.01	239.80	1.179	
62	210.37	161.79	381.05	200.00	250.79	381.57	223.47	1.179	
63	210.89	161.96	381.05	200.00	252.06	377.46	219.39	1.180	
64	211.95	162.32	381.05	200.00	254.60	369.19	211.22	1.180	

65	209.32	161.44	380.53	200.00	247.82	389.85	231.63	1.180
66	211.42	162.14	381.05	200.00	253.33	373.33	215.31	1.180
67	204.58	161.00	380.00	200.00	241.18	410.37	252.04	1.180
68	205.11	161.00	381.05	200.00	243.09	406.03	247.96	1.180
69	207.74	161.00	380.53	200.00	244.10	402.15	243.88	1.180
70	205.63	161.00	380.53	200.00	242.76	406.16	247.96	1.180
71	209.84	161.61	381.05	200.00	249.51	385.68	227.55	1.180
72	209.32	161.44	381.05	200.00	248.24	389.78	231.63	1.180
73	206.16	161.00	380.53	200.00	242.85	406.23	247.96	1.181
74	203.00	161.00	380.00	200.00	239.95	414.44	256.12	1.181
75	203.53	161.00	381.05	200.00	241.85	410.11	252.04	1.181
76	204.05	161.00	380.53	200.00	241.52	410.24	252.04	1.181
77	204.58	161.00	380.53	200.00	241.61	410.30	252.04	1.182
78	208.79	161.26	381.05	200.00	246.97	393.86	235.71	1.182
79	207.21	161.00	381.05	200.00	244.44	402.02	243.88	1.182
80	206.68	161.00	380.00	200.00	242.52	406.36	247.96	1.182
81	207.74	161.00	381.05	200.00	244.53	402.09	243.88	1.182
82	209.84	161.61	381.58	200.00	249.93	385.61	227.55	1.182
83	209.32	161.44	380.00	200.00	246.42	394.21	235.71	1.182
84	210.37	161.79	381.58	200.00	251.20	381.50	223.47	1.182
85	210.89	161.96	381.58	200.00	252.47	377.38	219.39	1.182
86	205.11	161.00	381.58	200.00	243.51	405.97	247.96	1.182
87	208.79	161.26	381.58	200.00	247.40	393.79	235.71	1.182
88	209.32	161.44	381.58	200.00	248.67	389.70	231.63	1.182
89	205.63	161.00	381.05	200.00	243.19	406.10	247.96	1.182
90	203.00	161.00	380.53	200.00	240.38	414.38	256.12	1.183
91	205.11	161.00	380.00	200.00	241.28	410.43	252.04	1.183
92	208.79	161.26	380.00	200.00	245.15	398.29	239.80	1.183
93	206.68	161.00	381.58	200.00	244.76	401.89	243.88	1.183
94	213.00	162.67	380.00	200.00	255.34	365.44	207.14	1.183
95	203.53	161.00	381.58	200.00	242.27	410.04	252.04	1.183
96	208.26	161.09	381.05	200.00	245.70	397.94	239.80	1.183
97	210.89	161.96	380.00	200.00	250.25	381.94	223.47	1.183
98	204.05	161.00	381.05	200.00	241.95	410.18	252.04	1.183
99	203.53	161.00	380.00	200.00	240.05	414.51	256.12	1.183

Critical Failure Surface (circle 1)

Intersects:	XL:	206.68	YL:	161.00	XR:	380.00	YR:	200.00	
Centre:	XC:	244.44	YC:	397.80		Radius:	R:	239.80	
Generated failure surface: (20 points)									
206.68	161.00		216.17	159.68		225.70	158.74	235.26	158.18
244.84	158.01								
254.41	158.22		263.97	158.81		273.50	159.78	282.98	161.13
292.40	162.85								
301.75	164.96		311.00	167.43		320.15	170.27	329.17	173.48
338.06	177.04								
346.80	180.95		355.38	185.21		363.78	189.81	371.99	194.74
380.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
	X-Left									
Stress	Factor									
1	206.68	0.12	-7.9	1.32	1.33	3	100.00	18.0	16.97	7.58
25.59	1.05									
2	208.00	4.69	-7.9	4.09	4.12	3	100.00	18.0	633.35	295.42
170.79	1.05									
3	212.09	12.57	-7.9	4.09	4.12	3	100.00	18.0	1689.32	792.09
434.83	1.05									
4	216.17	24.17	-5.6	4.77	4.79	3	100.00	18.0	3240.24	1515.47
698.85	1.03									
5	220.94	33.98	-5.6	4.77	4.79	3	100.00	18.0	4547.52	2130.48
977.27	1.03									
6	225.70	43.48	-3.3	4.78	4.79	3	100.00	18.0	5810.38	2717.71
1231.19	1.02									
7	230.48	52.43	-3.3	4.78	4.79	3	100.00	18.0	6996.30	3277.21
1481.43	1.02									
8	235.26	61.02	-1.0	4.79	4.79	3	100.00	18.0	8131.16	3808.58
1704.45	1.01									
9	240.05	69.09	-1.0	4.79	4.79	3	100.00	18.0	9191.44	4311.72
1926.49	1.01									
10	244.84	33.73	1.2	2.16	2.16	3	100.00	18.0	4482.15	2104.96
2065.86	0.99									
11	247.00	61.25	1.2	3.71	3.71	3	100.00	18.0	8131.74	3823.05
2184.66	0.99									
12	250.71	65.54	1.2	3.71	3.71	3	100.00	18.0	8689.98	4090.43
2334.77	0.99									
13	254.41	90.36	3.5	4.78	4.79	3	100.00	18.0	11963.26	5649.20
2475.39	0.98									
14	259.19	96.57	3.5	4.78	4.79	3	100.00	18.0	12762.30	6037.25

2641.11	0.98									
15	263.97	101.97	5.8	4.76	4.79	3	100.00	18.0	13451.44	6396.02
2773.95	0.98									
16	268.74	107.23	5.8	4.76	4.79	3	100.00	18.0	14116.65	6725.60
2911.60	0.98									
17	273.50	100.89	8.1	4.30	4.34	3	100.00	18.0	13256.64	6359.32
3010.09	0.97									
18	277.80	104.42	8.1	4.30	4.34	3	100.00	18.0	13692.51	6581.70
3109.59	0.97									
19	282.10	21.90	8.1	0.88	0.89	2	0.00	35.0	2869.16	1380.47
3112.89	0.93									
20	282.98	118.80	10.4	4.71	4.79	2	0.00	35.0	15562.87	7536.81
3132.48	0.92									
21	287.69	122.13	10.4	4.71	4.79	2	0.00	35.0	15998.70	7747.87
3220.19	0.92									
22	292.40	123.97	12.7	4.67	4.79	2	0.00	35.0	16239.66	7928.96
3259.38	0.90									
23	297.08	126.33	12.7	4.67	4.79	2	0.00	35.0	16549.36	8080.17
3321.54	0.90									
24	301.75	126.97	15.0	4.63	4.79	2	0.00	35.0	16633.20	8201.34
3335.01	0.89									
25	306.37	128.38	15.0	4.63	4.79	2	0.00	35.0	16818.20	8292.56
3372.08	0.89									
26	311.00	139.77	17.3	5.00	5.23	2	0.00	35.0	18310.21	9133.03
3361.30	0.88									
27	316.00	116.39	17.3	4.15	4.34	2	0.00	35.0	15246.88	7417.75
3366.97	0.88									
28	320.15	136.16	19.5	4.85	5.15	2	0.00	35.0	17836.48	8311.67
3313.43	0.87									
29	325.00	113.77	19.5	4.17	4.43	2	0.00	35.0	14903.71	6704.43
3210.19	0.87									
30	329.17	34.32	21.8	1.31	1.41	2	0.00	35.0	4496.07	2043.62
3054.72	0.87									
31	330.48	95.70	21.8	3.79	4.08	1	150.00	22.0	12537.35	5668.91
3027.41	0.95									
32	334.27	89.94	21.8	3.79	4.08	1	150.00	22.0	11782.75	5281.67
2841.08	0.95									
33	338.06	96.08	24.1	4.37	4.79	1	150.00	22.0	12585.88	5672.38
2602.25	0.95									
34	342.43	87.52	24.1	4.37	4.79	1	150.00	22.0	11465.35	5087.54
2363.87	0.95									
35	346.80	31.58	26.4	1.70	1.89	1	150.00	22.0	4137.53	1846.13
2170.45	0.95									
36	348.50	52.38	26.4	3.00	3.35	5	0.00	45.0	5761.62	1768.19
1504.65	0.78									
37	351.50	54.73	26.4	3.45	3.85	1	150.00	22.0	7170.18	206.15
1725.76	0.95									
38	354.95	60.99	28.5	4.42	5.02	1	150.00	22.0	7989.99	0.00
1464.54	0.96									
39	359.37	50.32	28.7	4.42	5.03	1	150.00	22.0	6591.52	0.00
1195.67	0.96									
40	363.78	36.76	31.0	4.11	4.79	1	150.00	22.0	4815.21	0.00
907.03	0.97									
41	367.89	26.63	31.0	4.11	4.79	1	150.00	22.0	3489.16	0.00
639.65	0.97									
42	371.99	15.78	33.3	4.00	4.79	1	150.00	22.0	2067.06	0.00
351.93	0.97									
43	376.00	5.26	33.3	4.00	4.79	1	150.00	22.0	689.03	0.00
71.47	0.97									

X-S Area: 3076.08

Path Length: 181.97

X-S Weight: 403350.50

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 5-2\West Farm Expansion Case 5-2 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:56:33

DATA: Analysis 1 - Case 5-2 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 192.00 348.50 192.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 183.00 348.50 183.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 180.00 348.50 180.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 192.00 450.00 192.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 183.00 450.00 183.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 180.00 450.00 180.00

Slope Surface (8 points)

100.00	183.00	274.00	183.00	325.00	200.00	400.00	200.00
405.00	195.00						
410.00	195.00	415.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	197.00	274.00	197.00	316.00	197.00	348.50	197.00
351.50	197.00						
450.00	197.00						

Failure Surface

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

Intersects:	XL:	274.00	YL:	183.00	XR:	405.00	YR:	195.00
	Centre:	XC:	317.50	YC:	429.19	Radius:	R:	250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

RESULTS: Analysis 1 - Case 5-2 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 6.381

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.72

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	274.26	183.09	400.00	200.00	310.27	391.22	211.22	2.720	<--
Critical Surface									
2	271.11	183.00	400.00	200.00	307.60	403.47	223.47	2.722	
3	274.79	183.26	400.00	200.00	311.26	387.17	207.14	2.725	
4	273.74	183.00	400.00	200.00	309.43	395.33	215.31	2.726	
5	270.05	183.00	400.00	200.00	306.76	407.57	227.55	2.726	
6	272.68	183.00	400.00	200.00	308.58	399.43	219.39	2.726	
7	271.63	183.00	400.00	200.00	307.74	403.53	223.47	2.730	
8	269.00	183.00	400.00	200.00	305.93	411.67	231.63	2.731	
9	275.32	183.44	400.00	200.00	312.24	383.12	203.06	2.731	
10	270.58	183.00	400.00	200.00	306.90	407.63	227.55	2.734	
11	274.79	183.26	400.53	199.47	311.89	391.20	211.22	2.736	
12	275.84	183.61	400.00	200.00	313.21	379.05	198.98	2.738	
13	272.16	183.00	400.00	200.00	307.88	403.60	223.47	2.739	
14	269.53	183.00	400.00	200.00	306.07	411.73	231.63	2.739	
15	271.63	183.00	400.53	199.47	308.43	407.56	227.55	2.740	
16	273.21	183.00	400.00	200.00	308.72	399.50	219.39	2.741	
17	274.26	183.09	400.00	200.00	309.70	395.46	215.31	2.741	
18	272.68	183.00	400.53	199.47	309.26	403.46	223.47	2.741	
19	271.11	183.00	400.00	200.00	307.04	407.70	227.55	2.743	
20	270.58	183.00	400.53	199.47	307.61	411.65	231.63	2.743	
21	275.32	183.44	400.53	199.47	312.86	387.15	207.14	2.743	
22	276.37	183.79	400.00	200.00	314.18	374.98	194.90	2.746	
23	274.79	183.26	400.00	200.00	310.69	391.41	211.22	2.746	
24	273.74	183.00	400.00	200.00	308.86	399.56	219.39	2.747	
25	272.68	183.00	400.00	200.00	308.01	403.66	223.47	2.747	
26	270.05	183.00	400.00	200.00	306.21	411.79	231.63	2.747	
27	269.53	183.00	400.53	199.47	306.79	415.75	235.71	2.748	
28	273.21	183.00	400.53	199.47	309.40	403.52	223.47	2.748	
29	272.16	183.00	400.53	199.47	308.57	407.62	227.55	2.748	
30	271.63	183.00	400.00	200.00	307.18	407.76	227.55	2.751	
31	274.26	183.09	400.53	199.47	310.38	399.48	219.39	2.751	
32	271.11	183.00	400.53	199.47	307.75	411.72	231.63	2.752	
33	269.00	183.00	400.00	200.00	305.38	415.89	235.71	2.752	
34	275.84	183.61	400.53	199.47	313.82	383.09	203.06	2.753	
35	275.32	183.44	400.00	200.00	311.67	387.37	207.14	2.753	
36	273.74	183.00	400.53	199.47	309.54	403.58	223.47	2.755	
37	273.21	183.00	400.00	200.00	308.15	403.72	223.47	2.755	
38	270.58	183.00	400.00	200.00	306.34	411.85	231.63	2.755	
39	270.05	183.00	400.53	199.47	306.93	415.81	235.71	2.756	
40	276.89	183.96	400.00	200.00	315.14	370.91	190.82	2.756	
41	274.79	183.26	400.53	199.47	311.35	395.44	215.31	2.757	
42	272.16	183.00	400.00	200.00	307.31	407.82	227.55	2.759	
43	273.21	183.00	401.05	198.95	310.12	407.54	227.55	2.759	
44	269.53	183.00	400.00	200.00	305.52	415.95	235.71	2.760	
45	271.63	183.00	400.53	199.47	307.89	411.78	231.63	2.761	
46	269.00	183.00	400.53	199.47	306.12	419.91	239.80	2.761	
47	275.84	183.61	400.00	200.00	312.65	383.31	203.06	2.761	
48	274.26	183.09	400.00	200.00	309.14	399.69	219.39	2.762	
49	272.68	183.00	400.53	199.47	308.71	407.68	227.55	2.763	
50	271.11	183.00	400.00	200.00	306.48	411.92	231.63	2.763	
51	270.58	183.00	400.53	199.47	307.08	415.87	235.71	2.765	
52	271.11	183.00	401.05	198.95	308.50	415.73	235.71	2.765	
53	275.32	183.44	400.53	199.47	312.32	391.40	211.22	2.765	
54	276.37	183.79	400.53	199.47	314.77	379.03	198.98	2.765	
55	274.26	183.09	401.05	198.95	311.08	403.50	223.47	2.765	
56	272.16	183.00	401.05	198.95	309.30	411.63	231.63	2.767	
57	273.74	183.00	400.00	200.00	308.29	403.78	223.47	2.767	
58	272.68	183.00	400.00	200.00	307.45	407.88	227.55	2.767	
59	274.79	183.26	400.00	200.00	310.12	395.65	215.31	2.767	
60	277.42	184.14	400.00	200.00	316.10	366.83	186.73	2.767	
61	273.74	183.00	401.05	198.95	310.26	407.60	227.55	2.768	
62	270.05	183.00	401.05	198.95	307.69	419.82	239.80	2.768	

63	270.05	183.00	400.00	200.00	305.66	416.01	235.71	2.768
64	276.37	183.79	400.00	200.00	313.62	379.25	198.98	2.769
65	273.21	183.00	400.53	199.47	308.85	407.74	227.55	2.769
66	269.53	183.00	400.53	199.47	306.26	419.97	239.80	2.769
67	272.16	183.00	400.53	199.47	308.03	411.84	231.63	2.769
68	271.63	183.00	400.00	200.00	306.62	411.98	231.63	2.771
69	274.26	183.09	400.53	199.47	309.83	403.71	223.47	2.772
70	269.00	183.00	401.05	198.95	306.90	423.92	243.88	2.772
71	274.79	183.26	401.05	198.95	312.04	399.47	219.39	2.772
72	275.84	183.61	400.53	199.47	313.28	387.35	207.14	2.772
73	271.11	183.00	400.53	199.47	307.21	415.93	235.71	2.773
74	272.68	183.00	401.05	198.95	309.45	411.70	231.63	2.773
75	271.63	183.00	401.05	198.95	308.64	415.79	235.71	2.773
76	269.00	183.00	400.00	200.00	304.83	420.10	239.80	2.773
77	275.32	183.44	400.00	200.00	311.11	391.61	211.22	2.775
78	273.74	183.00	400.53	199.47	308.99	407.80	227.55	2.775
79	273.21	183.00	400.00	200.00	307.58	407.94	227.55	2.775
80	270.58	183.00	400.00	200.00	305.79	416.07	235.71	2.776
81	270.58	183.00	401.05	198.95	307.84	419.88	239.80	2.777
82	270.05	183.00	400.53	199.47	306.40	420.02	239.80	2.777
83	272.68	183.00	400.53	199.47	308.17	411.90	231.63	2.777
84	276.89	183.96	400.00	200.00	314.58	375.18	194.90	2.777
85	274.79	183.26	400.53	199.47	310.80	399.67	219.39	2.779
86	272.16	183.00	400.00	200.00	306.75	412.03	231.63	2.779
87	273.21	183.00	401.05	198.95	309.59	411.76	231.63	2.780
88	269.53	183.00	401.05	198.95	307.04	423.98	243.88	2.780
89	271.63	183.00	400.53	199.47	307.35	415.99	235.71	2.781
90	276.37	183.79	400.53	199.47	314.24	383.29	203.06	2.781
91	269.53	183.00	400.00	200.00	304.97	420.16	239.80	2.781
92	269.00	183.00	400.53	199.47	305.60	424.12	243.88	2.781
93	274.26	183.09	400.00	200.00	308.57	403.91	223.47	2.782
94	275.84	183.61	400.00	200.00	312.09	387.56	207.14	2.783
95	276.89	183.96	400.53	199.47	315.72	374.96	194.90	2.783
96	271.11	183.00	400.00	200.00	305.93	416.13	235.71	2.784
97	270.58	183.00	400.53	199.47	306.54	420.08	239.80	2.785
98	271.11	183.00	401.05	198.95	307.98	419.94	239.80	2.785
99	275.32	183.44	401.05	198.95	312.99	395.42	215.31	2.785

Critical Failure Surface (circle 1)

Intersects:	XL:	274.26	YL:	183.09	XR:	400.00	YR:	200.00	
Centre:	XC:	310.27	YC:	391.22		Radius:	R:	211.22	
Generated failure surface: (20 points)									
	274.26	183.09	280.96	182.04	287.69	181.21	294.45	180.59	
301.22	180.19								
	308.00	180.01	314.78	180.04	321.56	180.30	328.32	180.77	
335.07	181.46								
	341.79	182.36	348.48	183.48	355.13	184.81	361.73	186.36	
368.28	188.12								
	374.77	190.08	381.19	192.26	387.54	194.64	393.82	197.22	
400.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 42 slices)

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left Factor									
1	274.26	0.08	-8.9	0.56	0.57	2	0.00	35.0	10.08	494.00
880.68	1.05									
2	274.82	3.15	-8.9	3.07	3.11	3	100.00	18.0	420.16	2761.07
968.66	1.03									
3	277.89	7.77	-8.9	3.07	3.11	3	100.00	18.0	1039.66	2854.23
1108.67	1.03									
4	280.96	13.63	-7.1	3.37	3.39	3	100.00	18.0	1825.33	3209.70
1245.14	1.02									
5	284.33	18.81	-7.1	3.37	3.39	3	100.00	18.0	2517.50	3297.84
1382.48	1.02									
6	287.69	23.89	-5.2	3.38	3.39	3	100.00	18.0	3195.80	3374.49
1509.01	1.02									
7	291.07	28.74	-5.2	3.38	3.39	3	100.00	18.0	3840.49	3439.70
1630.82	1.02									
8	294.45	32.34	-3.4	3.28	3.28	3	100.00	18.0	4318.10	3380.75
1739.35	1.01									
9	297.72	36.55	-3.4	3.28	3.28	3	100.00	18.0	4876.17	3420.35
1842.17	1.01									
10	301.00	43.50	-1.7	3.50	3.50	3	100.00	18.0	5798.09	3680.03
1937.16	1.00									
11	304.50	47.91	-1.5	3.50	3.50	3	100.00	18.0	6378.84	3700.36
2030.39	1.00									
12	308.00	50.46	0.3	3.39	3.39	3	100.00	18.0	6711.15	3593.53
2109.55	1.00									
13	311.39	54.23	0.3	3.39	3.39	3	100.00	18.0	7204.68	3589.75

2184.53	1.00										
14	314.78	20.44	2.1	1.22	1.22	3	100.00	18.0	2713.66	1291.97	
2227.08	1.00										
15	316.00	48.11	2.1	2.78	2.78	3	100.00	18.0	6382.07	2923.99	
2290.84	1.00										
16	318.78	50.40	2.1	2.78	2.78	3	100.00	18.0	6678.34	2906.01	
2396.98	1.00										
17	321.56	65.48	4.0	3.44	3.45	3	100.00	18.0	8667.49	3573.40	
2501.27	0.99										
18	325.00	64.24	4.0	3.32	3.33	3	100.00	18.0	8493.97	3395.45	
2542.83	0.99										
19	328.32	64.30	5.8	3.37	3.39	3	100.00	18.0	8492.44	3398.18	
2495.57	0.99										
20	331.69	63.14	5.8	3.37	3.39	3	100.00	18.0	8328.86	3325.41	
2447.41	0.99										
21	335.07	61.56	7.7	3.36	3.39	3	100.00	18.0	8108.79	3241.23	
2385.00	0.99										
22	338.43	60.04	7.7	3.36	3.39	3	100.00	18.0	7894.68	3145.61	
2321.82	0.99										
23	341.79	66.28	9.5	3.83	3.88	3	100.00	18.0	8695.30	3467.20	
2239.10	0.99										
24	345.62	47.96	9.5	2.86	2.90	2	0.00	35.0	6283.36	2491.44	
2140.41	0.97										
25	348.48	49.03	11.3	3.02	3.08	5	0.00	45.0	5392.82	2542.95	
1718.12	0.95										
26	351.50	56.40	11.3	3.63	3.70	2	0.00	35.0	7387.88	2896.79	
1975.65	0.97										
27	355.13	48.87	13.2	3.30	3.39	2	0.00	35.0	6401.42	2496.95	
1870.57	0.97										
28	358.43	46.31	13.2	3.30	3.39	2	0.00	35.0	6067.05	2333.37	
1772.30	0.97										
29	361.73	43.24	15.0	3.28	3.39	2	0.00	35.0	5664.08	2158.66	
1658.86	0.97										
30	365.00	40.36	15.0	3.28	3.39	2	0.00	35.0	5287.08	1972.73	
1547.64	0.97										
31	368.28	36.97	16.9	3.25	3.39	2	0.00	35.0	4842.95	1775.70	
1422.28	0.97										
32	371.52	33.78	16.9	3.25	3.39	2	0.00	35.0	4424.85	1567.61	
1298.34	0.97										
33	374.77	26.73	18.7	2.83	2.99	2	0.00	35.0	3501.55	1201.13	
1169.47	0.97										
34	377.60	24.01	18.7	2.83	2.99	2	0.00	35.0	3145.91	1022.29	
1049.17	0.97										
35	380.43	5.98	18.7	0.76	0.80	1	150.00	22.0	783.16	243.73	
978.59	1.01										
36	381.19	22.70	20.5	3.18	3.39	1	150.00	22.0	2973.37	877.69	
881.12	1.01										
37	384.37	18.92	20.5	3.18	3.39	1	150.00	22.0	2478.56	626.00	
729.58	1.01										
38	387.54	13.70	22.4	2.87	3.10	1	150.00	22.0	1794.79	343.41	
574.18	1.02										
39	390.41	10.31	22.4	2.87	3.10	1	150.00	22.0	1350.34	114.47	
424.03	1.02										
40	393.29	1.53	22.4	0.53	0.57	1	150.00	22.0	200.70	0.00	
335.49	1.02										
41	393.82	6.45	24.2	3.09	3.39	1	150.00	22.0	845.17	0.00	
232.95	1.03										
42	396.91	2.15	24.2	3.09	3.39	1	150.00	22.0	281.72	0.00	
62.15	1.03										

X-S Area:

1460.43

Path Length:

128.85

X-S Weight:

191698.42

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 5-2\West Farm Expansion Case 5-2 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:56:58

DATA: Analysis 1 - Case 5-2 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 192.00 348.50 192.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 183.00 348.50 183.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 180.00 348.50 180.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 192.00 450.00 192.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 183.00 450.00 183.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 180.00 450.00 180.00

Slope Surface (8 points)

100.00	183.00	274.00	183.00	325.00	200.00	400.00	200.00
405.00	195.00						
410.00	195.00	415.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	183.00	274.00	183.00	316.00	197.00	348.50	197.00
351.50	197.00						
450.00	197.00						

Failure Surface

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

Intersects: XL:	274.00	YL:	183.00	XR:	405.00	YR:	195.00
Centre: XC:	317.50	YC:	429.19	Radius: R:	250.00		

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

-- -- -- -- --
RESULTS: Analysis 1 - Case 5-2 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.738

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.00

Results Summary - Lowest 99 Factor of Safety circles

Circle X-Left Y-Left X-Right Y-Right X-Centre Y-Centre Radius FoS <--
1 271.11 183.00 400.00 200.00 307.60 403.47 223.47 2.001
Critical Surface
2 270.05 183.00 400.00 200.00 306.76 407.57 227.55 2.002
3 269.00 183.00 400.00 200.00 305.93 411.67 231.63 2.003
4 272.68 183.00 400.00 200.00 308.58 399.43 219.39 2.008
5 271.63 183.00 400.00 200.00 307.74 403.53 223.47 2.008
6 274.26 183.09 400.00 200.00 310.27 391.22 211.22 2.009
7 270.58 183.00 400.00 200.00 306.90 407.63 227.55 2.009
8 273.74 183.00 400.00 200.00 309.43 395.33 215.31 2.010
9 269.53 183.00 400.00 200.00 306.07 411.73 231.63 2.010
10 272.16 183.00 400.00 200.00 307.88 403.60 223.47 2.016
11 271.11 183.00 400.00 200.00 307.04 407.70 227.55 2.016
12 274.79 183.26 400.00 200.00 311.26 387.17 207.14 2.017
13 270.05 183.00 400.00 200.00 306.21 411.79 231.63 2.018
14 273.21 183.00 400.00 200.00 308.72 399.50 219.39 2.019
15 271.63 183.00 400.53 199.47 308.43 407.56 227.55 2.019
16 269.00 183.00 400.00 200.00 305.38 415.89 235.71 2.019
17 270.58 183.00 400.53 199.47 307.61 411.65 231.63 2.019
18 269.53 183.00 400.53 199.47 306.79 415.75 235.71 2.020
19 272.68 183.00 400.53 199.47 309.26 403.46 223.47 2.022
20 272.68 183.00 400.00 200.00 308.01 403.66 223.47 2.023
21 271.63 183.00 400.00 200.00 307.18 407.76 227.55 2.024
22 274.26 183.09 400.00 200.00 309.70 395.46 215.31 2.024
23 270.58 183.00 400.00 200.00 306.34 411.85 231.63 2.025
24 273.74 183.00 400.00 200.00 308.86 399.56 219.39 2.025
25 269.53 183.00 400.00 200.00 305.52 415.95 235.71 2.026
26 275.32 183.44 400.00 200.00 312.24 383.12 203.06 2.026
27 272.16 183.00 400.53 199.47 308.57 407.62 227.55 2.027
28 271.11 183.00 400.53 199.47 307.75 411.72 231.63 2.027
29 270.05 183.00 400.53 199.47 306.93 415.81 235.71 2.028
30 273.21 183.00 400.53 199.47 309.40 403.52 223.47 2.029
31 274.79 183.26 400.53 199.47 311.89 391.20 211.22 2.029
32 269.00 183.00 400.53 199.47 306.12 419.91 239.80 2.029
33 273.21 183.00 400.00 200.00 308.15 403.72 223.47 2.031
34 272.16 183.00 400.00 200.00 307.31 407.82 227.55 2.031
35 271.11 183.00 400.00 200.00 306.48 411.92 231.63 2.032
36 274.79 183.26 400.00 200.00 310.69 391.41 211.22 2.033
37 270.05 183.00 400.00 200.00 305.66 416.01 235.71 2.033
38 271.63 183.00 400.53 199.47 307.89 411.78 231.63 2.035
39 269.00 183.00 400.00 200.00 304.83 420.10 239.80 2.035
40 270.58 183.00 400.53 199.47 307.08 415.87 235.71 2.035
41 273.74 183.00 400.53 199.47 309.54 403.58 223.47 2.036
42 274.26 183.09 400.53 199.47 310.38 399.48 219.39 2.036
43 275.84 183.61 400.00 200.00 313.21 379.05 198.98 2.036
44 269.53 183.00 400.53 199.47 306.26 419.97 239.80 2.037
45 272.68 183.00 400.53 199.47 308.71 407.68 227.55 2.038
46 272.68 183.00 400.00 200.00 307.45 407.88 227.55 2.039
47 271.11 183.00 401.05 198.95 308.50 415.73 235.71 2.039
48 275.32 183.44 400.53 199.47 312.86 387.15 207.14 2.039
49 271.63 183.00 400.00 200.00 306.62 411.98 231.63 2.039
50 270.05 183.00 401.05 198.95 307.69 419.82 239.80 2.039
51 274.26 183.09 400.00 200.00 309.14 399.69 219.39 2.040
52 273.21 183.00 401.05 198.95 310.12 407.54 227.55 2.040
53 269.00 183.00 401.05 198.95 306.90 423.92 243.88 2.040
54 270.58 183.00 400.00 200.00 305.79 416.07 235.71 2.040
55 273.74 183.00 400.00 200.00 308.29 403.78 223.47 2.040
56 269.53 183.00 400.00 200.00 304.97 420.16 239.80 2.042
57 272.16 183.00 401.05 198.95 309.30 411.63 231.63 2.042
58 272.16 183.00 400.53 199.47 308.03 411.84 231.63 2.042
59 271.11 183.00 400.53 199.47 307.21 415.93 235.71 2.043
60 275.32 183.44 400.00 200.00 311.67 387.37 207.14 2.043
61 270.05 183.00 400.53 199.47 306.40 420.02 239.80 2.044
62 273.21 183.00 400.53 199.47 308.85 407.74 227.55 2.044

63	269.00	183.00	400.53	199.47	305.60	424.12	243.88	2.045
64	274.79	183.26	400.53	199.47	311.35	395.44	215.31	2.045
65	273.21	183.00	400.00	200.00	307.58	407.94	227.55	2.046
66	272.16	183.00	400.00	200.00	306.75	412.03	231.63	2.046
67	276.37	183.79	400.00	200.00	314.18	374.98	194.90	2.047
68	271.63	183.00	401.05	198.95	308.64	415.79	235.71	2.047
69	270.58	183.00	401.05	198.95	307.84	419.88	239.80	2.047
70	271.11	183.00	400.00	200.00	305.93	416.13	235.71	2.047
71	269.53	183.00	401.05	198.95	307.04	423.98	243.88	2.048
72	273.74	183.00	401.05	198.95	310.26	407.60	227.55	2.048
73	274.79	183.26	400.00	200.00	310.12	395.65	215.31	2.049
74	272.68	183.00	401.05	198.95	309.45	411.70	231.63	2.049
75	274.26	183.09	401.05	198.95	311.08	403.50	223.47	2.049
76	272.68	183.00	400.53	199.47	308.17	411.90	231.63	2.050
77	271.63	183.00	400.53	199.47	307.35	415.99	235.71	2.050
78	275.84	183.61	400.53	199.47	313.82	383.09	203.06	2.050
79	273.74	183.00	400.53	199.47	308.99	407.80	227.55	2.051
80	270.58	183.00	400.53	199.47	306.54	420.08	239.80	2.051
81	274.26	183.09	400.53	199.47	309.83	403.71	223.47	2.051
82	269.53	183.00	400.53	199.47	305.73	424.17	243.88	2.052
83	275.84	183.61	400.00	200.00	312.65	383.31	203.06	2.053
84	271.11	183.00	401.05	198.95	307.98	419.94	239.80	2.055
85	270.05	183.00	400.00	200.00	305.10	420.22	239.80	2.055
86	274.26	183.09	400.00	200.00	308.57	403.91	223.47	2.055
87	270.05	183.00	401.05	198.95	307.18	424.03	243.88	2.055
88	271.63	183.00	400.00	200.00	306.06	416.19	235.71	2.055
89	275.32	183.44	400.53	199.47	312.32	391.40	211.22	2.055
90	272.68	183.00	400.00	200.00	306.89	412.09	231.63	2.055
91	273.21	183.00	401.05	198.95	309.59	411.76	231.63	2.056
92	270.58	183.00	400.00	200.00	305.24	420.28	239.80	2.056
93	269.00	183.00	400.00	200.00	304.29	424.31	243.88	2.056
94	269.00	183.00	401.05	198.95	306.39	428.12	247.96	2.056
95	272.16	183.00	400.53	199.47	307.49	416.05	235.71	2.058
96	272.16	183.00	401.05	198.95	308.78	415.85	235.71	2.058
97	269.53	183.00	400.00	200.00	304.42	424.37	243.88	2.058
98	271.11	183.00	400.53	199.47	306.68	420.14	239.80	2.058
99	273.74	183.00	400.00	200.00	307.72	408.00	227.55	2.059

Critical Failure Surface (circle 1)

Intersects: XL:	271.11	YL:	183.00	XR:	400.00	YR:	200.00		
Centre: XC:	307.60	YC:	403.47			Radius: R:	223.47		
Generated failure surface: (20 points)									
271.11	183.00	277.97	181.97	284.87	181.16	291.78	180.56		
298.72	180.18								
305.66	180.01	312.60	180.06	319.54	180.32	326.46	180.80		
333.37	181.49								
340.25	182.40	347.11	183.52	353.92	184.85	360.69	186.40		
367.41	188.15								
374.07	190.12	380.66	192.28	387.19	194.65	393.63	197.23		
400.00	200.00								

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

Slice	X-S	Base								PoreWater
Normal	Test									
Stress	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
1	271.11	0.63	-8.5	2.89	2.93	3	100.00	18.0	88.37	39.54
38.61	1.04									
2	274.00	5.53	-8.5	3.97	4.02	3	100.00	18.0	753.26	348.83
199.88	1.04									
3	277.97	10.79	-6.7	3.45	3.47	3	100.00	18.0	1455.54	677.79
432.64	1.03									
4	281.42	16.15	-6.7	3.45	3.47	3	100.00	18.0	2172.24	1014.82
642.69	1.03									
5	284.87	21.40	-4.9	3.46	3.47	3	100.00	18.0	2872.75	1340.60
841.37	1.02									
6	288.33	26.43	-4.9	3.46	3.47	3	100.00	18.0	3541.01	1655.16
1036.07	1.02									
7	291.78	31.34	-3.2	3.47	3.47	3	100.00	18.0	4192.86	1958.34
1218.33	1.01									
8	295.25	36.01	-3.2	3.47	3.47	3	100.00	18.0	4811.19	2250.16
1397.58	1.01									
9	298.72	26.20	-1.4	2.28	2.28	3	100.00	18.0	3497.30	1635.35
1535.49	1.00									
10	301.00	28.62	-1.4	2.33	2.33	3	100.00	18.0	3817.48	1786.69
1644.30	1.00									
11	303.33	30.56	-1.4	2.33	2.33	3	100.00	18.0	4072.69	1907.67
1754.14	1.00									
12	305.66	48.98	0.4	3.47	3.47	3	100.00	18.0	6519.79	3056.42
1876.72	1.00									
13	309.13	52.91	0.4	3.47	3.47	3	100.00	18.0	7034.34	3301.92

2024.86	1.00										
14	312.60	55.47	2.2	3.40	3.40	3	100.00	18.0	7365.05	3464.09	
2156.76	0.99										
15	316.00	61.32	2.2	3.54	3.54	3	100.00	18.0	8130.00	3698.88	
2289.02	0.99										
16	319.54	49.77	4.0	2.73	2.74	3	100.00	18.0	6590.31	2833.75	
2393.97	0.99										
17	322.27	51.74	4.0	2.73	2.74	3	100.00	18.0	6843.35	2801.47	
2485.47	0.99										
18	325.00	28.17	4.0	1.46	1.47	3	100.00	18.0	3723.16	1487.41	
2524.14	0.99										
19	326.46	65.72	5.7	3.45	3.47	3	100.00	18.0	8679.80	3471.91	
2483.75	0.99										
20	329.92	64.53	5.7	3.45	3.47	3	100.00	18.0	8510.92	3396.79	
2435.30	0.99										
21	333.37	62.92	7.5	3.44	3.47	3	100.00	18.0	8286.11	3310.12	
2370.67	0.99										
22	336.81	61.35	7.5	3.44	3.47	3	100.00	18.0	8065.83	3211.79	
2307.41	0.99										
23	340.25	63.44	9.3	3.67	3.72	3	100.00	18.0	8321.95	3315.83	
2225.69	0.99										
24	343.92	53.31	9.3	3.18	3.23	2	0.00	35.0	6983.08	2766.47	
2120.52	0.96										
25	347.11	22.78	11.1	1.39	1.42	2	0.00	35.0	2984.20	1182.56	
2056.99	0.95										
26	348.50	47.74	11.1	3.00	3.06	5	0.00	45.0	5251.13	2463.08	
1666.20	0.93										
27	351.50	37.22	11.1	2.42	2.47	2	0.00	35.0	4875.56	1904.93	
1935.41	0.95										
28	353.92	49.95	12.9	3.38	3.47	2	0.00	35.0	6543.61	2547.23	
1844.74	0.95										
29	357.30	47.34	12.9	3.38	3.47	2	0.00	35.0	6201.17	2379.92	
1747.49	0.95										
30	360.69	44.21	14.6	3.36	3.47	2	0.00	35.0	5791.52	2201.35	
1632.98	0.95										
31	364.05	41.26	14.6	3.36	3.47	2	0.00	35.0	5405.62	2011.37	
1523.13	0.95										
32	367.41	37.82	16.4	3.33	3.47	2	0.00	35.0	4953.82	1810.10	
1397.37	0.95										
33	370.74	34.55	16.4	3.33	3.47	2	0.00	35.0	4525.92	1597.61	
1275.15	0.95										
34	374.07	26.99	18.2	2.87	3.02	2	0.00	35.0	3536.21	1208.02	
1147.26	0.94										
35	376.93	24.29	18.2	2.87	3.02	2	0.00	35.0	3182.14	1030.49	
1030.46	0.94										
36	379.80	6.76	18.2	0.86	0.91	1	150.00	22.0	885.99	274.65	
961.15	0.99										
37	380.66	23.24	20.0	3.26	3.47	1	150.00	22.0	3044.89	893.37	
861.66	0.99										
38	383.92	19.37	20.0	3.26	3.47	1	150.00	22.0	2538.07	636.50	
711.88	0.99										
39	387.19	13.99	21.8	2.94	3.16	1	150.00	22.0	1832.13	347.31	
557.44	1.00										
40	390.13	10.54	21.8	2.94	3.16	1	150.00	22.0	1380.67	115.77	
409.82	1.00										
41	393.06	1.65	21.8	0.57	0.61	1	150.00	22.0	215.80	0.00	
322.20	1.00										
42	393.63	6.62	23.5	3.18	3.47	1	150.00	22.0	866.84	0.00	
220.34	1.00										
43	396.82	2.21	23.5	3.18	3.47	1	150.00	22.0	288.94	0.00	
53.44	1.00										

X-S Area: 1451.81

Path Length: 131.91

X-S Weight: 190632.58

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Full Reservoir-EQ.gmf
 Processed: 01 Apr 2021 09:53:13

DATA: Analysis 1 - Case 5-3 Full Reservoir - Pseudostatic

Material Properties (5 materials)

```

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
  Cohesion  Phi  UnitWeight  Ru
    150.00  22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
  Cohesion  Phi  UnitWeight  Ru
     0.00  35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
  Cohesion  Phi  UnitWeight  Ru
    100.00  18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
  Cohesion  Phi  UnitWeight  Ru
    2000.00  20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
  Cohesion  Phi  UnitWeight  Ru
     0.00  45.0    110.00    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: 1 - Overburden
    100.00    200.00           348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
    100.00    190.00           348.50    190.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
    100.00    164.00           348.50    164.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
    100.00    161.00           348.50    161.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
    348.50    200.00           351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
    351.50    200.00           450.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
    351.50    190.00           450.00    190.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
    351.50    164.00           450.00    164.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
    348.50    161.00           450.00    161.00
  
```

Slope Surface (4 points)

100.00	164.00	217.00	164.00	325.00	200.00	450.00	200.00

Phreatic Surface (4 points)

100.00	197.00	348.50	197.00	351.50	178.00	450.00	178.00

Failure Surface

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

Intersects:	XL:	217.00	YL:	164.00	XR:	390.00	YR:	200.00
	Centre:	XC:	255.85	YC:	410.96	Radius:	R:	250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 5-3 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.422

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.20

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	219.37	164.79	385.00	200.00	260.10	380.36	219.39	2.201	
Critical Surface									
2	218.32	164.44	385.00	200.00	257.63	388.57	227.55	2.201	
3	217.79	164.26	385.00	200.00	256.40	392.66	231.63	2.201	
4	218.84	164.61	385.00	200.00	258.87	384.47	223.47	2.202	
5	216.21	164.00	385.00	200.00	253.94	400.81	239.80	2.202	
6	217.26	164.09	385.00	200.00	255.17	396.73	235.71	2.202	
7	216.74	164.00	385.00	200.00	254.04	400.88	239.80	2.206	
8	215.16	164.00	385.00	200.00	252.82	404.95	243.88	2.207	
9	212.00	164.00	385.00	200.00	250.41	413.10	252.04	2.210	
10	216.74	164.00	385.53	200.00	254.46	400.81	239.80	2.211	
11	215.68	164.00	385.00	200.00	252.92	405.02	243.88	2.212	
12	215.16	164.00	385.53	200.00	253.24	404.89	243.88	2.212	
13	213.05	164.00	385.00	200.00	251.51	408.96	247.96	2.213	
14	218.32	164.44	385.00	200.00	256.72	392.87	231.63	2.213	
15	213.58	164.00	385.53	200.00	252.04	408.96	247.96	2.214	
16	218.84	164.61	385.00	200.00	257.95	388.78	227.55	2.214	
17	222.00	165.67	385.00	200.00	265.33	364.05	203.06	2.214	
18	216.21	164.00	385.00	200.00	253.03	405.08	243.88	2.214	
19	219.37	164.79	385.00	200.00	259.18	384.68	223.47	2.214	
20	217.26	164.09	385.00	200.00	254.25	401.01	239.80	2.214	
21	221.47	165.49	385.00	200.00	264.10	368.20	207.14	2.215	
22	220.42	165.14	385.00	200.00	261.64	376.46	215.31	2.215	
23	220.95	165.32	385.00	200.00	262.87	372.34	211.22	2.215	
24	214.63	164.00	385.00	200.00	252.72	404.89	243.88	2.215	
25	217.79	164.26	385.00	200.00	255.48	396.94	235.71	2.216	
26	215.68	164.00	385.53	200.00	253.35	404.95	243.88	2.216	
27	219.89	164.96	385.00	200.00	260.41	380.58	219.39	2.216	
28	212.53	164.00	385.00	200.00	250.51	413.16	252.04	2.217	
29	214.11	164.00	385.53	200.00	252.14	409.02	247.96	2.217	
30	213.58	164.00	385.00	200.00	251.61	409.02	247.96	2.218	
31	217.79	164.26	385.53	200.00	255.91	396.88	235.71	2.219	
32	216.74	164.00	385.00	200.00	253.13	405.15	243.88	2.219	
33	218.32	164.44	385.53	200.00	257.14	392.79	231.63	2.219	
34	218.84	164.61	385.53	200.00	258.37	388.71	227.55	2.219	
35	219.37	164.79	385.53	200.00	259.60	384.61	223.47	2.220	
36	219.89	164.96	385.53	200.00	260.82	380.50	219.39	2.220	
37	220.95	165.32	385.53	200.00	263.28	372.25	211.22	2.220	
38	220.42	165.14	385.53	200.00	262.05	376.38	215.31	2.220	
39	216.21	164.00	385.53	200.00	253.45	405.02	243.88	2.221	
40	215.68	164.00	386.05	200.00	253.77	404.89	243.88	2.222	
41	214.11	164.00	386.05	200.00	252.56	408.96	247.96	2.223	
42	212.00	164.00	385.00	200.00	249.52	417.36	256.12	2.223	
43	214.63	164.00	385.53	200.00	252.24	409.09	247.96	2.223	
44	217.26	164.09	385.53	200.00	254.67	400.95	239.80	2.223	
45	216.74	164.00	385.53	200.00	253.55	405.08	243.88	2.223	
46	215.68	164.00	385.00	200.00	252.02	409.28	247.96	2.225	
47	215.16	164.00	385.53	200.00	252.34	409.16	247.96	2.225	
48	217.79	164.26	386.05	200.00	256.33	396.81	235.71	2.225	
49	214.11	164.00	385.00	200.00	251.71	409.09	247.96	2.225	
50	218.32	164.44	386.05	200.00	257.56	392.72	231.63	2.225	
51	213.05	164.00	385.00	200.00	250.62	413.23	252.04	2.225	
52	216.21	164.00	386.05	200.00	253.87	404.95	243.88	2.225	
53	218.84	164.61	386.05	200.00	258.78	388.63	227.55	2.225	
54	219.37	164.79	386.05	200.00	260.01	384.53	223.47	2.226	
55	217.26	164.09	386.05	200.00	255.10	400.88	239.80	2.226	
56	213.58	164.00	385.53	200.00	251.14	413.23	252.04	2.226	
57	219.89	164.96	386.05	200.00	261.24	380.42	219.39	2.226	
58	220.42	165.14	386.05	200.00	262.46	376.30	215.31	2.226	
59	214.63	164.00	386.05	200.00	252.66	409.02	247.96	2.226	
60	214.63	164.00	385.00	200.00	251.82	409.16	247.96	2.227	
61	218.84	164.61	385.00	200.00	257.03	393.08	231.63	2.227	
62	212.53	164.00	385.00	200.00	249.62	417.42	256.12	2.227	
63	218.32	164.44	385.00	200.00	255.80	397.15	235.71	2.228	
64	217.79	164.26	385.00	200.00	254.57	401.22	239.80	2.228	
65	213.05	164.00	386.05	200.00	251.46	413.10	252.04	2.228	
66	217.26	164.09	385.00	200.00	253.34	405.28	243.88	2.228	

67	219.89	164.96	385.00	200.00	259.50	384.90	223.47	2.228
68	219.37	164.79	385.00	200.00	258.27	388.99	227.55	2.229
69	216.21	164.00	385.00	200.00	252.12	409.35	247.96	2.229
70	215.68	164.00	385.53	200.00	252.44	409.22	247.96	2.229
71	220.42	165.14	385.00	200.00	260.72	380.79	219.39	2.229
72	212.53	164.00	385.53	200.00	250.94	413.10	252.04	2.230
73	214.11	164.00	385.53	200.00	251.24	413.29	252.04	2.230
74	217.79	164.26	386.58	200.00	256.75	396.74	235.71	2.230
75	213.58	164.00	385.00	200.00	250.72	413.29	252.04	2.231
76	218.32	164.44	386.58	200.00	257.97	392.65	231.63	2.231
77	216.74	164.00	386.05	200.00	253.98	405.02	243.88	2.231
78	218.84	164.61	386.58	200.00	259.20	388.56	227.55	2.231
79	221.47	165.49	385.00	200.00	263.18	372.56	211.22	2.231
80	216.21	164.00	386.58	200.00	254.30	404.89	243.88	2.231
81	222.00	165.67	385.00	200.00	264.41	368.42	207.14	2.231
82	219.37	164.79	386.58	200.00	260.42	384.46	223.47	2.231
83	217.26	164.09	386.58	200.00	255.52	400.81	239.80	2.231
84	218.32	164.44	385.53	200.00	256.22	397.08	235.71	2.232
85	214.63	164.00	386.58	200.00	253.09	408.96	247.96	2.232
86	217.79	164.26	385.53	200.00	254.99	401.16	239.80	2.232
87	220.95	165.32	385.00	200.00	261.95	376.68	215.31	2.233
88	215.16	164.00	386.05	200.00	252.77	409.09	247.96	2.233
89	215.16	164.00	385.00	200.00	251.92	409.22	247.96	2.233
90	216.74	164.00	385.00	200.00	252.21	409.41	247.96	2.233
91	219.37	164.79	385.53	200.00	258.68	388.92	227.55	2.233
92	216.21	164.00	385.53	200.00	252.54	409.28	247.96	2.234
93	215.68	164.00	386.05	200.00	252.87	409.16	247.96	2.234
94	218.84	164.61	385.53	200.00	257.45	393.01	231.63	2.234
95	217.26	164.09	385.53	200.00	253.76	405.22	243.88	2.234
96	219.89	164.96	385.53	200.00	259.91	384.82	223.47	2.234
97	216.74	164.00	386.58	200.00	254.40	404.95	243.88	2.234
98	214.11	164.00	386.05	200.00	251.67	413.23	252.04	2.235
99	214.63	164.00	385.53	200.00	251.34	413.35	252.04	2.235

Critical Failure Surface (circle 1)

Intersects:	XL:	219.37	YL:	164.79	XR:	385.00	YR:	200.00
Centre:	XC:	260.10	YC:	380.36		Radius:	R:	219.39
Generated failure surface: (20 points)								
219.37	164.79		228.39	163.28		237.47	162.15	246.59
255.73	161.02							161.39
264.88	161.03		274.02	161.42		283.14	162.19	292.21
301.23	164.87							163.34
310.18	166.77		319.05	169.04		327.80	171.68	336.45
344.96	178.05							174.69
353.32	181.76		361.52	185.82		369.54	190.22	377.37
385.00	200.00							194.95

Slice Geometry and Properties - Critical Failure Surface (circle 1, 42 slices)

Slice		X-S	----- Base -----						PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	219.37	5.57	-9.5	4.72	4.78	2	0.00	35.0	729.28	9727.17
2120.12	1.07									
2	224.08	14.82	-9.5	4.31	4.37	3	100.00	18.0	1957.00	9093.43
2335.17	1.04									
3	228.39	25.23	-7.1	4.54	4.57	3	100.00	18.0	3350.96	9706.62
2526.38	1.03									
4	232.93	34.67	-7.1	4.54	4.57	3	100.00	18.0	4613.38	9868.36
2712.85	1.03									
5	237.47	43.89	-4.7	4.56	4.57	3	100.00	18.0	5842.28	10003.10
2879.69	1.02									
6	242.03	52.53	-4.7	4.56	4.57	3	100.00	18.0	6992.17	10110.72
3038.74	1.02									
7	246.59	60.91	-2.3	4.57	4.57	3	100.00	18.0	8102.81	10191.12
3176.53	1.01									
8	251.16	68.73	-2.3	4.57	4.57	3	100.00	18.0	9135.26	10244.34
3308.06	1.01									
9	255.73	76.17	0.1	4.57	4.57	3	100.00	18.0	10115.06	10270.38
3416.98	1.00									
10	260.30	83.13	0.1	4.57	4.57	3	100.00	18.0	11026.03	10269.08
3520.96	1.00									
11	264.88	89.56	2.4	4.57	4.57	3	100.00	18.0	11864.20	10240.52
3601.17	0.99									
12	269.45	95.64	2.4	4.57	4.57	3	100.00	18.0	12650.72	10184.92
3677.62	0.99									
13	274.02	101.00	4.8	4.56	4.57	3	100.00	18.0	13339.35	10102.19
3729.32	0.99									
14	278.58	106.16	4.8	4.56	4.57	3	100.00	18.0	13998.96	9992.18
3778.30	0.99									
15	283.14	110.40	7.2	4.54	4.57	3	100.00	18.0	14531.42	9855.05

3801.75	0.99										
16	287.67	114.65	7.2	4.54	4.57	3	100.00	18.0	15062.75	9690.88	
3823.36	0.99										
17	292.21	72.35	9.6	2.79	2.83	3	100.00	18.0	9489.53	5895.37	
3819.89	0.99										
18	295.00	29.43	9.6	1.12	1.14	3	100.00	18.0	3856.43	2345.47	
3817.46	0.99										
19	296.12	137.02	9.6	5.11	5.19	2	0.00	35.0	17949.53	10540.69	
3776.17	0.96										
20	301.23	122.97	12.0	4.47	4.57	2	0.00	35.0	16109.03	9036.91	
3741.30	0.96										
21	305.71	125.39	12.0	4.47	4.57	2	0.00	35.0	16425.63	8765.32	
3716.66	0.96										
22	310.18	82.61	14.4	2.91	3.00	2	0.00	35.0	10822.48	5594.63	
3664.60	0.95										
23	313.09	83.26	14.4	2.91	3.00	2	0.00	35.0	10907.42	5454.73	
3632.19	0.95										
24	316.00	87.87	14.4	3.05	3.14	2	0.00	35.0	11510.46	5560.91	
3628.29	0.95										
25	319.05	86.41	16.8	2.98	3.11	2	0.00	35.0	11319.32	5338.33	
3619.06	0.95										
26	322.02	86.69	16.8	2.98	3.11	2	0.00	35.0	11356.12	5164.04	
3625.47	0.95										
27	325.00	80.60	16.8	2.80	2.93	2	0.00	35.0	10558.65	4704.80	
3575.81	0.95										
28	327.80	119.10	19.2	4.32	4.57	2	0.00	35.0	15602.63	7012.07	
3404.03	0.95										
29	332.13	112.61	19.2	4.32	4.57	2	0.00	35.0	14752.35	6583.28	
3217.51	0.95										
30	336.45	104.11	21.6	4.25	4.57	2	0.00	35.0	13638.88	6129.07	
2997.35	0.96										
31	340.70	96.96	21.6	4.25	4.57	2	0.00	35.0	12701.98	5649.21	
2790.02	0.96										
32	344.96	75.02	23.9	3.54	3.88	2	0.00	35.0	9827.06	4395.87	
2569.34	0.96										
33	348.50	50.78	23.9	2.56	2.81	5	0.00	45.0	5585.33	1520.72	
1903.80	0.91										
34	351.06	42.21	23.9	2.25	2.47	2	0.00	35.0	5530.00	0.00	
2150.51	0.96										
35	353.32	70.60	26.3	4.10	4.57	2	0.00	35.0	9248.68	0.00	
1948.94	0.96										
36	357.42	62.28	26.3	4.10	4.57	2	0.00	35.0	8158.59	0.00	
1719.24	0.96										
37	361.52	50.03	28.7	3.81	4.34	2	0.00	35.0	6554.25	0.00	
1464.86	0.97										
38	365.33	42.08	28.7	3.81	4.34	2	0.00	35.0	5511.97	0.00	
1231.92	0.97										
39	369.14	36.15	30.9	4.12	4.80	1	150.00	22.0	4736.06	0.00	
999.55	1.05										
40	373.25	25.92	31.1	4.12	4.81	1	150.00	22.0	3395.05	0.00	
705.16	1.05										
41	377.37	14.45	33.5	3.81	4.57	1	150.00	22.0	1892.74	0.00	
402.21	1.07										
42	381.19	4.82	33.5	3.81	4.57	1	150.00	22.0	630.92	0.00	
107.24	1.07										

X-S Area:	2984.78	Path Length:	173.83	X-S Weight:	391382.72

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 5-3\West Farm Expansion Case 5-3 Rapid Drawdown-EQ.gmf
 Processed: 01 Apr 2021 09:47:24

DATA: Analysis 1 - Case 5-3 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

 Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 190.00 348.50 190.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 164.00 348.50 164.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 161.00 348.50 161.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 190.00 450.00 190.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 164.00 450.00 164.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 161.00 450.00 161.00

Slope Surface (4 points)

 100.00 164.00 217.00 164.00 325.00 200.00 450.00 200.00

Phreatic Surface (6 points)

 100.00 164.00 217.00 164.00 316.00 197.00 348.50 197.00
 351.50 178.00
 450.00 178.00

Failure Surface

 Initial circular surface for critical search defined by: XL,XR,R
 Intersects: XL: 217.00 YL: 164.00 XR: 390.00 YR: 200.00
 Centre: XC: 255.85 YC: 410.96 Radius: R: 250.00

Earthquake Force

 Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

 Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 200.00
 Trial positions within range: 20 20 50

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 - - - - -

RESULTS: Analysis 1 - Case 5-3 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.511

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.36

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	216.21	164.00	385.00	200.00	253.94	400.81	239.80	1.358	
Critical Surface									
2	217.79	164.26	385.00	200.00	256.40	392.66	231.63	1.358	
3	218.32	164.44	385.00	200.00	257.63	388.57	227.55	1.358	
4	217.26	164.09	385.00	200.00	255.17	396.73	235.71	1.358	
5	219.37	164.79	385.00	200.00	260.10	380.36	219.39	1.359	
6	218.84	164.61	385.00	200.00	258.87	384.47	223.47	1.359	
7	216.74	164.00	385.00	200.00	254.04	400.88	239.80	1.360	
8	215.16	164.00	385.00	200.00	252.82	404.95	243.88	1.361	
9	212.00	164.00	385.00	200.00	250.41	413.10	252.04	1.363	
10	213.05	164.00	385.00	200.00	251.51	408.96	247.96	1.363	
11	214.63	164.00	385.00	200.00	252.72	404.89	243.88	1.364	
12	215.68	164.00	385.00	200.00	252.92	405.02	243.88	1.365	
13	216.74	164.00	385.53	200.00	254.46	400.81	239.80	1.365	
14	215.16	164.00	385.53	200.00	253.24	404.89	243.88	1.365	
15	213.58	164.00	385.53	200.00	252.04	408.96	247.96	1.366	
16	213.58	164.00	385.00	200.00	251.61	409.02	247.96	1.366	
17	216.21	164.00	385.00	200.00	253.03	405.08	243.88	1.366	
18	217.26	164.09	385.00	200.00	254.25	401.01	239.80	1.367	
19	218.32	164.44	385.00	200.00	256.72	392.87	231.63	1.367	
20	212.53	164.00	385.00	200.00	250.51	413.16	252.04	1.367	
21	218.84	164.61	385.00	200.00	257.95	388.78	227.55	1.368	
22	215.68	164.00	385.53	200.00	253.35	404.95	243.88	1.368	
23	217.79	164.26	385.00	200.00	255.48	396.94	235.71	1.368	
24	214.11	164.00	385.53	200.00	252.14	409.02	247.96	1.368	
25	219.37	164.79	385.00	200.00	259.18	384.68	223.47	1.368	
26	216.74	164.00	385.00	200.00	253.13	405.15	243.88	1.370	
27	220.42	165.14	385.00	200.00	261.64	376.46	215.31	1.370	
28	219.89	164.96	385.00	200.00	260.41	380.58	219.39	1.370	
29	220.95	165.32	385.00	200.00	262.87	372.34	211.22	1.370	
30	222.00	165.67	385.00	200.00	265.33	364.05	203.06	1.370	
31	214.11	164.00	385.00	200.00	251.71	409.09	247.96	1.370	
32	221.47	165.49	385.00	200.00	264.10	368.20	207.14	1.370	
33	217.79	164.26	385.53	200.00	255.91	396.88	235.71	1.371	
34	213.05	164.00	385.00	200.00	250.62	413.23	252.04	1.371	
35	218.32	164.44	385.53	200.00	257.14	392.79	231.63	1.371	
36	216.21	164.00	385.53	200.00	253.45	405.02	243.88	1.371	
37	212.00	164.00	385.00	200.00	249.52	417.36	256.12	1.372	
38	218.84	164.61	385.53	200.00	258.37	388.71	227.55	1.372	
39	215.68	164.00	386.05	200.00	253.77	404.89	243.88	1.372	
40	214.63	164.00	385.00	200.00	251.82	409.16	247.96	1.372	
41	214.63	164.00	385.53	200.00	252.24	409.09	247.96	1.372	
42	214.11	164.00	386.05	200.00	252.56	408.96	247.96	1.372	
43	219.37	164.79	385.53	200.00	259.60	384.61	223.47	1.373	
44	216.74	164.00	385.53	200.00	253.55	405.08	243.88	1.373	
45	217.26	164.09	385.53	200.00	254.67	400.95	239.80	1.373	
46	215.68	164.00	385.00	200.00	252.02	409.28	247.96	1.373	
47	219.89	164.96	385.53	200.00	260.82	380.50	219.39	1.373	
48	215.16	164.00	385.53	200.00	252.34	409.16	247.96	1.374	
49	220.42	165.14	385.53	200.00	262.05	376.38	215.31	1.374	
50	213.58	164.00	385.53	200.00	251.14	413.23	252.04	1.374	
51	212.53	164.00	385.53	200.00	250.94	413.10	252.04	1.374	
52	220.95	165.32	385.53	200.00	263.28	372.25	211.22	1.374	
53	216.21	164.00	386.05	200.00	253.87	404.95	243.88	1.374	
54	212.53	164.00	385.00	200.00	249.62	417.42	256.12	1.375	
55	213.58	164.00	385.00	200.00	250.72	413.29	252.04	1.375	
56	217.79	164.26	386.05	200.00	256.33	396.81	235.71	1.375	
57	214.63	164.00	386.05	200.00	252.66	409.02	247.96	1.375	
58	217.26	164.09	386.05	200.00	255.10	400.88	239.80	1.375	
59	218.32	164.44	386.05	200.00	257.56	392.72	231.63	1.376	
60	215.16	164.00	385.00	200.00	251.92	409.22	247.96	1.376	
61	213.05	164.00	386.05	200.00	251.46	413.10	252.04	1.376	
62	218.84	164.61	386.05	200.00	258.78	388.63	227.55	1.376	
63	217.26	164.09	385.00	200.00	253.34	405.28	243.88	1.376	
64	216.21	164.00	385.00	200.00	252.12	409.35	247.96	1.376	

65	217.79	164.26	385.00	200.00	254.57	401.22	239.80	1.376
66	218.32	164.44	385.00	200.00	255.80	397.15	235.71	1.377
67	219.37	164.79	386.05	200.00	260.01	384.53	223.47	1.377
68	215.68	164.00	385.53	200.00	252.44	409.22	247.96	1.377
69	218.84	164.61	385.00	200.00	257.03	393.08	231.63	1.377
70	214.11	164.00	385.53	200.00	251.24	413.29	252.04	1.377
71	219.89	164.96	386.05	200.00	261.24	380.42	219.39	1.377
72	220.42	165.14	386.05	200.00	262.46	376.30	215.31	1.378
73	216.74	164.00	386.05	200.00	253.98	405.02	243.88	1.378
74	219.37	164.79	385.00	200.00	258.27	388.99	227.55	1.378
75	214.11	164.00	385.00	200.00	250.82	413.35	252.04	1.378
76	219.89	164.96	385.00	200.00	259.50	384.90	223.47	1.379
77	216.21	164.00	386.58	200.00	254.30	404.89	243.88	1.379
78	215.16	164.00	386.05	200.00	252.77	409.09	247.96	1.379
79	213.05	164.00	385.53	200.00	251.04	413.16	252.04	1.379
80	214.63	164.00	386.58	200.00	253.09	408.96	247.96	1.379
81	217.79	164.26	386.58	200.00	256.75	396.74	235.71	1.379
82	212.00	164.00	385.53	200.00	249.95	417.30	256.12	1.379
83	216.74	164.00	385.00	200.00	252.21	409.41	247.96	1.379
84	217.26	164.09	386.58	200.00	255.52	400.81	239.80	1.380
85	220.42	165.14	385.00	200.00	260.72	380.79	219.39	1.380
86	218.32	164.44	386.58	200.00	257.97	392.65	231.63	1.380
87	217.79	164.26	385.53	200.00	254.99	401.16	239.80	1.380
88	216.21	164.00	385.53	200.00	252.54	409.28	247.96	1.380
89	218.32	164.44	385.53	200.00	256.22	397.08	235.71	1.380
90	215.68	164.00	386.05	200.00	252.87	409.16	247.96	1.380
91	218.84	164.61	386.58	200.00	259.20	388.56	227.55	1.380
92	213.58	164.00	386.05	200.00	251.57	413.16	252.04	1.380
93	214.63	164.00	385.53	200.00	251.34	413.35	252.04	1.381
94	217.26	164.09	385.53	200.00	253.76	405.22	243.88	1.381
95	214.11	164.00	386.05	200.00	251.67	413.23	252.04	1.381
96	219.37	164.79	386.58	200.00	260.42	384.46	223.47	1.381
97	213.05	164.00	385.00	200.00	249.72	417.48	256.12	1.381
98	216.74	164.00	386.58	200.00	254.40	404.95	243.88	1.381
99	212.53	164.00	386.05	200.00	250.47	417.30	256.12	1.381

Critical Failure Surface (circle 1)

Intersects:	XL:	216.21	YL:	164.00	XR:	385.00	YR:	200.00	
Centre:	XC:	253.94	YC:	400.81		Radius:	R:	239.80	
Generated failure surface: (20 points)									
	216.21	164.00	225.41	162.72		234.66	161.79	243.93	161.22
253.22	161.01								
	262.51	161.17	271.79	161.68		281.04	162.55	290.25	163.78
299.40	165.36								
	308.49	167.30	317.50	169.59		326.41	172.23	335.21	175.21
343.88	178.52								
	352.43	182.17	360.82	186.15		369.06	190.46	377.12	195.07
385.00	200.00								

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	216.21	0.04	-7.9	0.79	0.80	3	100.00	18.0	6.13	2.74
18.54	1.04									
2	217.00	4.65	-7.9	4.21	4.25	3	100.00	18.0	625.65	292.74
162.12	1.04									
3	221.21	13.01	-7.9	4.21	4.25	3	100.00	18.0	1746.30	819.85
433.46	1.04									
4	225.41	23.53	-5.7	4.62	4.65	3	100.00	18.0	3152.29	1475.53
698.45	1.03									
5	230.04	32.79	-5.7	4.62	4.65	3	100.00	18.0	4387.21	2056.47
969.10	1.03									
6	234.66	41.78	-3.5	4.64	4.65	3	100.00	18.0	5582.54	2612.09
1218.02	1.02									
7	239.29	50.26	-3.5	4.64	4.65	3	100.00	18.0	6706.92	3142.40
1462.42	1.02									
8	243.93	58.43	-1.3	4.64	4.65	3	100.00	18.0	7785.90	3647.02
1682.82	1.01									
9	248.58	66.10	-1.3	4.64	4.65	3	100.00	18.0	8795.88	4125.93
1900.89	1.01									
10	253.22	73.37	0.9	4.65	4.65	3	100.00	18.0	9748.21	4578.83
2093.05	1.00									
11	257.87	80.21	0.9	4.65	4.65	3	100.00	18.0	10640.58	5005.64
2284.76	1.00									
12	262.51	86.50	3.2	4.64	4.65	3	100.00	18.0	11457.30	5405.97
2448.94	0.99									
13	267.15	92.49	3.2	4.64	4.65	3	100.00	18.0	12229.32	5779.94
2614.27	0.99									
14	271.79	97.76	5.4	4.63	4.65	3	100.00	18.0	12904.07	6127.33

2750.74	0.98									
15	276.41	102.88	5.4	4.63	4.65	3	100.00	18.0	13554.09	6447.96
2889.72	0.98									
16	281.04	107.09	7.6	4.60	4.65	3	100.00	18.0	14081.67	6741.75
2998.76	0.98									
17	285.64	111.33	7.6	4.60	4.65	3	100.00	18.0	14608.69	7008.62
3111.45	0.98									
18	290.25	31.60	9.8	1.28	1.30	3	100.00	18.0	4140.52	2000.92
3162.19	0.97									
19	291.53	87.28	9.8	3.47	3.53	2	0.00	35.0	11433.87	5527.34
3149.53	0.93									
20	295.00	113.40	9.8	4.40	4.47	2	0.00	35.0	14854.95	7181.16
3228.68	0.93									
21	299.40	119.84	12.0	4.54	4.65	2	0.00	35.0	15699.40	7646.39
3276.08	0.92									
22	303.95	122.32	12.0	4.54	4.65	2	0.00	35.0	16024.04	7804.50
3343.82	0.92									
23	308.49	102.67	14.3	3.75	3.87	2	0.00	35.0	13449.81	6610.30
3364.67	0.91									
24	312.25	103.79	14.3	3.75	3.87	2	0.00	35.0	13596.05	6682.18
3401.25	0.91									
25	316.00	41.65	14.3	1.50	1.54	2	0.00	35.0	5455.74	2657.38
3425.03	0.91									
26	317.50	104.98	16.5	3.75	3.91	2	0.00	35.0	13752.84	6557.21
3401.84	0.90									
27	321.25	105.51	16.5	3.75	3.91	2	0.00	35.0	13821.89	6286.11
3408.66	0.90									
28	325.00	39.32	16.5	1.41	1.47	2	0.00	35.0	5150.51	2284.18
3386.73	0.90									
29	326.41	118.94	18.7	4.40	4.65	2	0.00	35.0	15580.99	6965.77
3237.42	0.90									
30	330.81	112.39	18.7	4.40	4.65	2	0.00	35.0	14722.48	6534.03
3057.49	0.90									
31	335.21	104.00	20.9	4.34	4.65	2	0.00	35.0	13623.42	6077.65
2837.91	0.89									
32	339.55	96.80	20.9	4.34	4.65	2	0.00	35.0	12680.53	5596.81
2639.35	0.89									
33	343.88	94.57	23.1	4.62	5.02	2	0.00	35.0	12388.94	5478.07
2396.65	0.89									
34	348.50	46.34	23.1	2.44	2.65	5	0.00	45.0	5097.74	1367.13
1711.50	0.83									
35	350.94	26.98	23.1	1.49	1.62	2	0.00	35.0	3534.76	0.00
1947.56	0.89									
36	352.43	70.66	25.4	4.20	4.65	2	0.00	35.0	9255.96	0.00
1771.75	0.89									
37	356.63	62.30	25.4	4.20	4.65	2	0.00	35.0	8161.66	0.00
1562.28	0.89									
38	360.82	47.43	27.6	3.68	4.15	2	0.00	35.0	6213.92	0.00
1329.68	0.89									
39	364.51	40.35	27.6	3.68	4.15	2	0.00	35.0	5286.48	0.00
1131.22	0.89									
40	368.19	8.53	27.6	0.87	0.98	1	150.00	22.0	1116.89	0.00
1057.98	0.98									
41	369.06	33.82	29.8	4.03	4.65	1	150.00	22.0	4430.64	0.00
884.97	0.98									
42	373.09	24.51	29.8	4.03	4.65	1	150.00	22.0	3211.37	0.00
626.55	0.98									
43	377.12	14.55	32.0	3.94	4.65	1	150.00	22.0	1906.48	0.00
349.83	0.99									
44	381.06	4.85	32.0	3.94	4.65	1	150.00	22.0	635.49	0.00
77.78	0.99									

X-S Area: 2921.62

Path Length: 176.54

X-S Weight: 383240.12

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 6-1\West Farm Expansion Case 6-1 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:54:45

DATA: Analysis 1 - Case 6-1 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 196.00 348.50 196.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 159.00 348.50 159.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 156.00 348.50 156.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 196.00 450.00 196.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 159.00 450.00 159.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 156.00 450.00 156.00

Slope Surface (4 points)

100.00 159.00 202.00 159.00 325.00 200.00 450.00 200.00

Phreatic Surface (6 points)

100.00 197.00 202.00 197.00 316.00 197.00 348.50 197.00
 351.50 181.00
 450.00 181.00

Failure Surface

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

Intersects: XL: 202.00 YL: 159.00 XR: 380.00 YR: 200.00
 Centre: XC: 238.76 YC: 406.28 Radius: R: 250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 200.00
 Trial positions within range: 20 20 50

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RESULTS: Analysis 1 - Case 6-1 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.074

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.97

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	204.37	159.79	375.00	200.00	244.58	371.31	215.31	1.972	
Critical Surface									
2	203.84	159.61	375.00	200.00	243.26	375.43	219.39	1.972	
3	203.32	159.44	375.00	200.00	241.95	379.54	223.47	1.976	
4	205.95	160.32	375.00	200.00	247.49	363.25	207.14	1.977	
5	205.42	160.14	375.00	200.00	246.18	367.40	211.22	1.979	
6	203.32	159.44	375.53	200.00	242.37	379.47	223.47	1.979	
7	202.79	159.26	375.00	200.00	240.63	383.64	227.55	1.979	
8	206.47	160.49	375.00	200.00	248.81	359.09	203.06	1.981	
9	205.95	160.32	375.53	200.00	247.91	363.16	207.14	1.981	
10	204.89	159.96	375.00	200.00	244.87	371.53	215.31	1.982	
11	202.79	159.26	375.53	200.00	241.06	383.57	227.55	1.982	
12	204.37	159.79	375.00	200.00	243.55	375.65	219.39	1.985	
13	202.26	159.09	375.53	200.00	239.75	387.67	231.63	1.987	
14	200.68	159.00	375.00	200.00	237.92	391.75	235.71	1.988	
15	205.42	160.14	376.05	200.00	247.02	367.23	211.22	1.988	
16	203.84	159.61	375.00	200.00	242.24	379.76	223.47	1.988	
17	202.26	159.09	375.00	200.00	239.32	387.74	231.63	1.989	
18	201.21	159.00	375.53	200.00	238.44	391.75	235.71	1.989	
19	203.32	159.44	375.00	200.00	240.93	383.86	227.55	1.991	
20	201.21	159.00	375.00	200.00	238.01	391.82	235.71	1.991	
21	203.84	159.61	375.53	200.00	242.67	379.69	223.47	1.991	
22	207.00	160.67	375.53	200.00	249.51	359.23	203.06	1.992	
23	204.89	159.96	375.53	200.00	245.29	371.45	215.31	1.992	
24	199.11	159.00	375.00	200.00	236.62	395.84	239.80	1.992	
25	204.37	159.79	376.05	200.00	244.40	375.49	219.39	1.992	
26	201.74	159.00	375.53	200.00	238.54	391.82	235.71	1.992	
27	204.89	159.96	376.05	200.00	245.71	371.37	215.31	1.992	
28	205.95	160.32	375.00	200.00	246.47	367.62	211.22	1.993	
29	207.00	160.67	375.00	200.00	249.10	359.32	203.06	1.994	
30	204.89	159.96	376.58	200.00	246.13	371.29	215.31	1.994	
31	203.32	159.44	375.53	200.00	241.36	383.79	227.55	1.994	
32	204.37	159.79	375.53	200.00	243.98	375.57	219.39	1.994	
33	201.74	159.00	375.00	200.00	238.11	391.89	235.71	1.994	
34	197.53	159.00	375.00	200.00	235.34	399.93	243.88	1.995	
35	206.47	160.49	375.00	200.00	247.78	363.47	207.14	1.995	
36	199.63	159.00	375.00	200.00	236.72	395.91	239.80	1.995	
37	205.42	160.14	375.53	200.00	246.60	367.31	211.22	1.996	
38	201.74	159.00	376.05	200.00	238.97	391.75	235.71	1.996	
39	207.00	160.67	376.05	200.00	249.92	359.14	203.06	1.996	
40	205.42	160.14	375.00	200.00	245.16	371.75	215.31	1.996	
41	206.47	160.49	375.53	200.00	248.20	363.39	207.14	1.996	
42	202.79	159.26	375.53	200.00	240.05	387.88	231.63	1.997	
43	204.37	159.79	376.58	200.00	244.82	375.42	219.39	1.997	
44	199.63	159.00	375.53	200.00	237.15	395.84	239.80	1.997	
45	206.47	160.49	376.05	200.00	248.61	363.30	207.14	1.998	
46	198.05	159.00	375.00	200.00	235.44	400.00	243.88	1.998	
47	200.16	159.00	375.00	200.00	236.82	395.98	239.80	1.998	
48	204.89	159.96	375.00	200.00	243.84	375.87	219.39	1.998	
49	203.84	159.61	376.58	200.00	243.51	379.53	223.47	1.998	
50	202.79	159.26	375.00	200.00	239.62	387.95	231.63	1.999	
51	200.68	159.00	375.53	200.00	237.34	395.98	239.80	1.999	
52	200.16	159.00	376.05	200.00	237.68	395.84	239.80	1.999	
53	205.95	160.32	376.05	200.00	247.31	367.45	211.22	2.000	
54	207.00	160.67	376.58	200.00	250.34	359.05	203.06	2.000	
55	202.26	159.09	375.53	200.00	238.74	391.96	235.71	2.000	
56	204.37	159.79	375.00	200.00	242.53	379.98	223.47	2.001	
57	200.16	159.00	375.53	200.00	237.25	395.91	239.80	2.001	
58	198.58	159.00	375.00	200.00	235.53	400.06	243.88	2.001	
59	200.68	159.00	375.00	200.00	236.91	396.04	239.80	2.001	
60	198.05	159.00	375.53	200.00	235.87	399.93	243.88	2.001	
61	203.32	159.44	376.58	200.00	242.21	383.64	227.55	2.002	
62	203.84	159.61	377.11	200.00	243.94	379.46	223.47	2.002	
63	206.47	160.49	376.58	200.00	249.03	363.22	207.14	2.002	
64	202.26	159.09	375.00	200.00	238.30	392.03	235.71	2.002	

65	198.58	159.00	376.05	200.00	236.39	399.93	243.88	2.002
66	200.68	159.00	376.05	200.00	237.77	395.91	239.80	2.003
67	205.42	160.14	376.05	200.00	246.00	371.59	215.31	2.003
68	203.84	159.61	376.05	200.00	243.09	379.61	223.47	2.003
69	202.26	159.09	376.05	200.00	239.17	391.90	235.71	2.004
70	205.95	160.32	375.53	200.00	246.89	367.53	211.22	2.004
71	204.37	159.79	375.53	200.00	242.96	379.90	223.47	2.004
72	201.21	159.00	375.00	200.00	237.00	396.11	239.80	2.004
73	202.79	159.26	376.58	200.00	240.90	387.74	231.63	2.004
74	198.58	159.00	375.53	200.00	235.96	400.00	243.88	2.005
75	203.32	159.44	376.05	200.00	241.78	383.71	227.55	2.005
76	203.32	159.44	377.11	200.00	242.63	383.57	227.55	2.005
77	197.00	159.00	375.00	200.00	234.26	404.14	247.96	2.005
78	199.11	159.00	375.00	200.00	235.63	400.13	243.88	2.006
79	204.89	159.96	376.05	200.00	244.69	375.71	219.39	2.006
80	205.42	160.14	376.58	200.00	246.42	371.51	215.31	2.006
81	199.11	159.00	376.05	200.00	236.49	400.00	243.88	2.006
82	201.21	159.00	376.05	200.00	237.87	395.98	239.80	2.006
83	203.84	159.61	375.53	200.00	241.65	384.00	227.55	2.006
84	205.42	160.14	375.53	200.00	245.58	371.67	215.31	2.006
85	202.79	159.26	376.05	200.00	240.48	387.81	231.63	2.007
86	206.47	160.49	377.11	200.00	249.44	363.13	207.14	2.007
87	201.74	159.00	375.00	200.00	237.10	396.17	239.80	2.007
88	201.21	159.00	375.53	200.00	237.44	396.04	239.80	2.008
89	203.84	159.61	375.00	200.00	241.22	384.07	227.55	2.008
90	199.11	159.00	375.53	200.00	236.06	400.06	243.88	2.008
91	207.00	160.67	375.53	200.00	248.49	363.61	207.14	2.008
92	206.47	160.49	375.00	200.00	246.76	367.84	211.22	2.008
93	202.79	159.26	377.11	200.00	241.33	387.67	231.63	2.008
94	203.32	159.44	375.53	200.00	240.34	388.09	231.63	2.008
95	197.53	159.00	375.00	200.00	234.35	404.21	247.96	2.008
96	204.89	159.96	375.53	200.00	244.27	375.79	219.39	2.008
97	205.95	160.32	377.11	200.00	248.14	367.28	211.22	2.008
98	199.63	159.00	375.00	200.00	235.72	400.19	243.88	2.008
99	204.89	159.96	376.58	200.00	245.11	375.63	219.39	2.009

Critical Failure Surface (circle 1)

Intersects:	XL:	204.37	YL:	159.79	XR:	375.00	YR:	200.00	
Centre:	XC:	244.58	YC:	371.31		Radius:	R:	215.31	
Generated failure surface: (20 points)									
	204.37	159.79	213.74	158.22		223.17	157.07	232.64	156.33
	242.14	156.02							
	251.64	156.12	261.13	156.64		270.59	157.58	279.99	158.93
	289.33	160.70							
	298.57	162.88	307.72	165.47		316.74	168.45	325.62	171.84
	334.34	175.61							
	342.89	179.76	351.24	184.28		359.39	189.17	367.31	194.41
	375.00	200.00							

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	204.37	5.57	-9.5	4.72	4.78	2	0.00	35.0	730.09	11226.14
2	209.09	16.41	-9.5	4.65	4.72	3	100.00	18.0	2168.05	11301.34
3	213.74	27.19	-7.0	4.72	4.75	3	100.00	18.0	3612.45	11581.70
4	218.46	37.32	-7.0	4.72	4.75	3	100.00	18.0	4966.90	11752.62
5	223.17	47.19	-4.4	4.74	4.75	3	100.00	18.0	6281.71	11892.49
6	227.91	56.41	-4.4	4.74	4.75	3	100.00	18.0	7507.07	12001.50
7	232.64	65.30	-1.9	4.75	4.75	3	100.00	18.0	8685.14	12079.71
8	237.39	73.57	-1.9	4.75	4.75	3	100.00	18.0	9775.78	12126.68
9	242.14	81.38	0.6	4.75	4.75	3	100.00	18.0	10801.77	12142.47
10	246.89	88.66	0.6	4.75	4.75	3	100.00	18.0	11753.07	12127.36
11	251.64	95.30	3.1	4.74	4.75	3	100.00	18.0	12615.25	12081.26
12	256.39	101.57	3.1	4.74	4.75	3	100.00	18.0	13423.50	12003.94
13	261.13	106.96	5.7	4.73	4.75	3	100.00	18.0	14112.02	11895.62
14	265.86	112.19	5.7	4.73	4.75	3	100.00	18.0	14774.78	11756.29

4087.56	0.99										
15	270.59	116.28	8.2	4.70	4.75	3	100.00	18.0	15283.44	11586.27	
4099.18	0.99										
16	275.29	120.46	8.2	4.70	4.75	3	100.00	18.0	15799.56	11385.32	
4109.87	0.99										
17	279.99	123.22	10.7	4.67	4.75	2	0.00	35.0	16142.14	11153.80	
4044.44	0.95										
18	284.66	126.36	10.7	4.67	4.75	2	0.00	35.0	16552.63	10891.52	
4032.38	0.95										
19	289.33	127.77	13.3	4.62	4.75	2	0.00	35.0	16738.01	10598.73	
3980.02	0.95										
20	293.95	129.86	13.3	4.62	4.75	2	0.00	35.0	17011.73	10275.73	
3940.61	0.95										
21	298.57	129.95	15.8	4.57	4.75	2	0.00	35.0	17022.88	9922.66	
3860.55	0.94										
22	303.15	131.00	15.8	4.57	4.75	2	0.00	35.0	17161.34	9539.43	
3794.29	0.94										
23	307.72	152.01	18.3	5.28	5.56	2	0.00	35.0	19913.30	10644.62	
3679.45	0.94										
24	313.00	86.36	18.3	3.00	3.16	2	0.00	35.0	11312.97	5775.00	
3594.48	0.94										
25	316.00	21.25	18.3	0.74	0.78	2	0.00	35.0	2783.20	1390.54	
3562.99	0.94										
26	316.74	118.53	20.8	4.13	4.42	2	0.00	35.0	15527.71	7656.75	
3517.43	0.94										
27	320.87	117.72	20.8	4.13	4.42	2	0.00	35.0	15421.73	7222.91	
3483.11	0.94										
28	325.00	128.06	23.0	4.67	5.07	2	0.00	35.0	16775.28	7733.69	
3320.81	0.94										
29	329.67	118.63	23.4	4.67	5.09	2	0.00	35.0	15540.59	7112.05	
3071.06	0.94										
30	334.34	99.81	25.9	4.27	4.75	2	0.00	35.0	13075.62	6034.71	
2796.48	0.95										
31	338.61	90.94	25.9	4.27	4.75	2	0.00	35.0	11913.76	5419.45	
2545.53	0.95										
32	342.89	105.10	28.4	5.61	6.38	2	0.00	35.0	13767.80	6262.75	
2215.47	0.95										
33	348.50	40.01	28.4	2.42	2.75	5	0.00	45.0	4401.40	1218.43	
1523.74	0.89										
34	350.92	62.03	30.8	4.24	4.93	2	0.00	35.0	8126.26	0.00	
1583.44	0.96										
35	355.15	51.27	31.0	4.24	4.94	2	0.00	35.0	6715.83	0.00	
1306.89	0.96										
36	359.39	37.72	33.5	3.96	4.75	2	0.00	35.0	4941.22	0.00	
1009.85	0.97										
37	363.35	27.33	33.5	3.96	4.75	2	0.00	35.0	3580.53	0.00	
731.76	0.97										
38	367.31	10.47	36.0	2.18	2.70	2	0.00	35.0	1371.18	0.00	
499.13	0.98										
39	369.50	11.00	36.0	5.50	6.80	1	150.00	22.0	1441.45	0.00	
179.90	1.08										

X-S Area:

3198.18

Path Length:

180.53

X-S Weight:

419529.16

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 6-1\West Farm Expansion Case 6-1 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:53:54

DATA: Analysis 1 - Case 6-1 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 196.00 348.50 196.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 159.00 348.50 159.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 156.00 348.50 156.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 196.00 450.00 196.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 159.00 450.00 159.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 156.00 450.00 156.00

Slope Surface (4 points)

100.00 159.00 202.00 159.00 325.00 200.00 450.00 200.00

Phreatic Surface (6 points)

100.00 159.00 202.00 159.00 316.00 197.00 348.50 197.00
 351.50 181.00
 450.00 181.00

Failure Surface

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

Intersects: XL: 202.00 YL: 159.00 XR: 380.00 YR: 200.00
 Centre: XC: 238.76 YC: 406.28 Radius: R: 250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 200.00
 Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case 6-1 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.240

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.17

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	203.84	159.61	375.00	200.00	243.26	375.43	219.39	1.169	
Critical Surface									
2	204.37	159.79	375.00	200.00	244.58	371.31	215.31	1.169	
3	203.32	159.44	375.00	200.00	241.95	379.54	223.47	1.172	
4	205.95	160.32	375.00	200.00	247.49	363.25	207.14	1.173	
5	202.79	159.26	375.00	200.00	240.63	383.64	227.55	1.174	
6	203.32	159.44	375.53	200.00	242.37	379.47	223.47	1.174	
7	205.42	160.14	375.00	200.00	246.18	367.40	211.22	1.174	
8	206.47	160.49	375.00	200.00	248.81	359.09	203.06	1.175	
9	202.79	159.26	375.53	200.00	241.06	383.57	227.55	1.176	
10	204.89	159.96	375.00	200.00	244.87	371.53	215.31	1.177	
11	205.95	160.32	375.53	200.00	247.91	363.16	207.14	1.177	
12	200.68	159.00	375.00	200.00	237.92	391.75	235.71	1.177	
13	202.26	159.09	375.00	200.00	239.32	387.74	231.63	1.178	
14	204.37	159.79	375.00	200.00	243.55	375.65	219.39	1.178	
15	202.26	159.09	375.53	200.00	239.75	387.67	231.63	1.179	
16	201.21	159.00	375.00	200.00	238.01	391.82	235.71	1.180	
17	199.11	159.00	375.00	200.00	236.62	395.84	239.80	1.180	
18	203.84	159.61	375.00	200.00	242.24	379.76	223.47	1.180	
19	201.21	159.00	375.53	200.00	238.44	391.75	235.71	1.180	
20	205.42	160.14	376.05	200.00	247.02	367.23	211.22	1.181	
21	203.32	159.44	375.00	200.00	240.93	383.86	227.55	1.182	
22	204.89	159.96	375.53	200.00	245.29	371.45	215.31	1.182	
23	197.53	159.00	375.00	200.00	235.34	399.93	243.88	1.182	
24	201.74	159.00	375.00	200.00	238.11	391.89	235.71	1.182	
25	199.63	159.00	375.00	200.00	236.72	395.91	239.80	1.182	
26	201.74	159.00	375.53	200.00	238.54	391.82	235.71	1.183	
27	203.84	159.61	375.53	200.00	242.67	379.69	223.47	1.183	
28	204.37	159.79	375.53	200.00	243.98	375.57	219.39	1.183	
29	207.00	160.67	375.00	200.00	249.10	359.32	203.06	1.184	
30	204.37	159.79	376.05	200.00	244.40	375.49	219.39	1.184	
31	198.05	159.00	375.00	200.00	235.44	400.00	243.88	1.184	
32	205.42	160.14	375.53	200.00	246.60	367.31	211.22	1.184	
33	204.89	159.96	376.05	200.00	245.71	371.37	215.31	1.184	
34	207.00	160.67	375.53	200.00	249.51	359.23	203.06	1.184	
35	200.16	159.00	375.00	200.00	236.82	395.98	239.80	1.184	
36	199.63	159.00	375.53	200.00	237.15	395.84	239.80	1.184	
37	203.32	159.44	375.53	200.00	241.36	383.79	227.55	1.184	
38	205.95	160.32	375.00	200.00	246.47	367.62	211.22	1.184	
39	206.47	160.49	375.00	200.00	247.78	363.47	207.14	1.184	
40	202.79	159.26	375.00	200.00	239.62	387.95	231.63	1.185	
41	201.74	159.00	376.05	200.00	238.97	391.75	235.71	1.185	
42	204.89	159.96	376.58	200.00	246.13	371.29	215.31	1.185	
43	202.79	159.26	375.53	200.00	240.05	387.88	231.63	1.186	
44	198.58	159.00	375.00	200.00	235.53	400.06	243.88	1.186	
45	205.42	160.14	375.00	200.00	245.16	371.75	215.31	1.186	
46	200.68	159.00	375.00	200.00	236.91	396.04	239.80	1.186	
47	200.16	159.00	375.53	200.00	237.25	395.91	239.80	1.187	
48	198.05	159.00	375.53	200.00	235.87	399.93	243.88	1.187	
49	200.68	159.00	375.53	200.00	237.34	395.98	239.80	1.187	
50	206.47	160.49	375.53	200.00	248.20	363.39	207.14	1.187	
51	204.37	159.79	376.58	200.00	244.82	375.42	219.39	1.187	
52	200.16	159.00	376.05	200.00	237.68	395.84	239.80	1.187	
53	202.26	159.09	375.00	200.00	238.30	392.03	235.71	1.187	
54	207.00	160.67	376.05	200.00	249.92	359.14	203.06	1.188	
55	204.89	159.96	375.00	200.00	243.84	375.87	219.39	1.188	
56	202.26	159.09	375.53	200.00	238.74	391.96	235.71	1.188	
57	203.84	159.61	376.58	200.00	243.51	379.53	223.47	1.188	
58	206.47	160.49	376.05	200.00	248.61	363.30	207.14	1.188	
59	197.00	159.00	375.00	200.00	234.26	404.14	247.96	1.189	
60	201.21	159.00	375.00	200.00	237.00	396.11	239.80	1.189	
61	203.84	159.61	376.05	200.00	243.09	379.61	223.47	1.189	
62	204.37	159.79	375.00	200.00	242.53	379.98	223.47	1.189	
63	198.58	159.00	375.53	200.00	235.96	400.00	243.88	1.189	
64	199.11	159.00	375.00	200.00	235.63	400.13	243.88	1.189	

65	198.58	159.00	376.05	200.00	236.39	399.93	243.88	1.189
66	205.95	160.32	376.05	200.00	247.31	367.45	211.22	1.190
67	200.68	159.00	376.05	200.00	237.77	395.91	239.80	1.190
68	203.32	159.44	376.58	200.00	242.21	383.64	227.55	1.190
69	203.32	159.44	376.05	200.00	241.78	383.71	227.55	1.190
70	205.95	160.32	375.53	200.00	246.89	367.53	211.22	1.190
71	201.74	159.00	375.00	200.00	237.10	396.17	239.80	1.191
72	203.84	159.61	377.11	200.00	243.94	379.46	223.47	1.191
73	207.00	160.67	376.58	200.00	250.34	359.05	203.06	1.191
74	197.53	159.00	375.00	200.00	234.35	404.21	247.96	1.191
75	202.26	159.09	376.05	200.00	239.17	391.90	235.71	1.191
76	199.63	159.00	375.00	200.00	235.72	400.19	243.88	1.191
77	202.79	159.26	376.05	200.00	240.48	387.81	231.63	1.191
78	199.11	159.00	375.53	200.00	236.06	400.06	243.88	1.191
79	201.21	159.00	375.53	200.00	237.44	396.04	239.80	1.191
80	205.42	160.14	376.05	200.00	246.00	371.59	215.31	1.191
81	205.42	160.14	375.53	200.00	245.58	371.67	215.31	1.192
82	204.37	159.79	375.53	200.00	242.96	379.90	223.47	1.192
83	202.79	159.26	376.58	200.00	240.90	387.74	231.63	1.192
84	197.00	159.00	375.53	200.00	234.69	404.08	247.96	1.192
85	199.11	159.00	376.05	200.00	236.49	400.00	243.88	1.192
86	206.47	160.49	376.58	200.00	249.03	363.22	207.14	1.192
87	203.84	159.61	375.00	200.00	241.22	384.07	227.55	1.192
88	201.21	159.00	376.05	200.00	237.87	395.98	239.80	1.192
89	203.32	159.44	377.11	200.00	242.63	383.57	227.55	1.193
90	203.84	159.61	375.53	200.00	241.65	384.00	227.55	1.193
91	198.05	159.00	375.00	200.00	234.44	404.27	247.96	1.193
92	204.89	159.96	375.53	200.00	244.27	375.79	219.39	1.193
93	203.32	159.44	375.00	200.00	239.91	388.16	231.63	1.193
94	200.16	159.00	375.00	200.00	235.81	400.26	243.88	1.193
95	204.89	159.96	376.05	200.00	244.69	375.71	219.39	1.193
96	199.63	159.00	375.53	200.00	236.15	400.13	243.88	1.193
97	201.74	159.00	375.53	200.00	237.53	396.11	239.80	1.193
98	205.42	160.14	376.58	200.00	246.42	371.51	215.31	1.194
99	203.32	159.44	375.53	200.00	240.34	388.09	231.63	1.194

Critical Failure Surface (circle 1)

Intersects:	XL:	203.84	YL:	159.61	XR:	375.00	YR:	200.00	
Centre:	XC:	243.26	YC:	375.43		Radius:	R:	219.39	
Generated failure surface: (20 points)									
	203.84	159.61		213.24	158.11		222.70	157.01	232.20
	241.72	156.05							
	251.24	156.19		260.75	156.74		270.22	157.71	279.64
	289.00	160.86							
	298.27	163.05		307.43	165.64		316.47	168.62	325.38
	334.13	175.75							
	342.71	179.88		351.10	184.38		359.29	189.24	367.26
	375.00	200.00							

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S		Base						PoreWater	
Normal	Test									
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	Factor									
1	203.84	3.62	-9.1	3.83	3.88	2	0.00	35.0	474.37	228.84
130.73	1.12									
2	207.67	18.20	-9.1	5.57	5.64	3	100.00	18.0	2409.11	1150.19
457.33	1.06									
3	213.24	26.98	-6.6	4.73	4.76	3	100.00	18.0	3589.39	1694.75
782.62	1.04									
4	217.97	37.03	-6.6	4.73	4.76	3	100.00	18.0	4932.21	2326.23
1071.59	1.04									
5	222.70	46.80	-4.1	4.75	4.76	3	100.00	18.0	6233.92	2928.13
1333.30	1.02									
6	227.45	55.95	-4.1	4.75	4.76	3	100.00	18.0	7448.51	3500.41
1591.84	1.02									
7	232.20	64.76	-1.6	4.76	4.76	3	100.00	18.0	8613.81	4042.49
1820.11	1.01									
8	236.96	72.96	-1.6	4.76	4.76	3	100.00	18.0	9694.69	4554.45
2048.18	1.01									
9	241.72	80.69	0.8	4.76	4.76	3	100.00	18.0	10709.78	5035.86
2243.48	1.00									
10	246.48	87.92	0.8	4.76	4.76	3	100.00	18.0	11652.60	5486.59
2441.10	1.00									
11	251.24	94.49	3.3	4.75	4.76	3	100.00	18.0	12505.38	5906.20
2603.92	0.99									
12	256.00	100.71	3.3	4.75	4.76	3	100.00	18.0	13306.71	6294.81
2771.12	0.99									
13	260.75	106.06	5.8	4.74	4.76	3	100.00	18.0	13988.80	6652.08
2901.92	0.98									
14	265.49	111.25	5.8	4.74	4.76	3	100.00	18.0	14646.37	6977.87

3038.80	0.98									
15	270.22	108.38	8.3	4.43	4.48	3	100.00	18.0	14240.99	6834.63
3134.89	0.97									
16	274.65	112.06	8.3	4.43	4.48	3	100.00	18.0	14694.73	7066.86
3235.28	0.97									
17	279.09	129.22	10.5	4.96	5.04	2	0.00	35.0	16927.43	8200.77
3236.90	0.92									
18	284.04	132.72	10.8	4.96	5.04	2	0.00	35.0	17386.63	8430.91
3320.27	0.91									
19	289.00	126.79	13.3	4.63	4.76	2	0.00	35.0	16609.82	8129.12
3351.97	0.90									
20	293.63	128.88	13.3	4.63	4.76	2	0.00	35.0	16883.75	8263.20
3407.25	0.90									
21	298.27	129.01	15.8	4.58	4.76	2	0.00	35.0	16900.81	8365.07
3409.06	0.89									
22	302.85	130.08	15.8	4.58	4.76	2	0.00	35.0	17041.10	8434.51
3437.38	0.89									
23	307.43	158.79	18.3	5.57	5.86	2	0.00	35.0	20802.01	10433.61
3413.02	0.88									
24	313.00	85.59	18.3	3.00	3.16	2	0.00	35.0	11212.78	5623.96
3414.85	0.88									
25	316.00	128.06	20.5	4.50	4.80	2	0.00	35.0	16775.92	8305.27
3362.65	0.87									
26	320.50	127.14	20.7	4.50	4.81	2	0.00	35.0	16655.78	7807.81
3317.12	0.87									
27	325.00	124.15	23.0	4.57	4.96	2	0.00	35.0	16263.60	7488.63
3145.81	0.87									
28	329.57	115.20	23.2	4.57	4.97	2	0.00	35.0	15091.76	6892.60
2913.35	0.87									
29	334.13	99.61	25.7	4.29	4.76	2	0.00	35.0	13049.00	6007.48
2643.44	0.86									
30	338.42	90.75	25.7	4.29	4.76	2	0.00	35.0	11888.23	5393.79
2404.55	0.86									
31	342.71	55.99	28.2	2.89	3.28	2	0.00	35.0	7335.28	3349.81
2166.24	0.86									
32	345.61	51.50	28.2	2.89	3.28	2	0.00	35.0	6746.76	3031.73
1988.82	0.86									
33	348.50	39.11	28.2	2.39	2.71	5	0.00	45.0	4302.40	1185.17
1372.66	0.78									
34	350.89	60.94	30.6	4.20	4.88	2	0.00	35.0	7983.52	0.00
1403.56	0.86									
35	355.09	50.46	30.7	4.20	4.89	2	0.00	35.0	6610.74	0.00
1160.71	0.86									
36	359.29	37.70	33.2	3.99	4.76	2	0.00	35.0	4938.42	0.00
890.57	0.86									
37	363.28	27.32	33.2	3.99	4.76	2	0.00	35.0	3578.28	0.00
645.29	0.86									
38	367.26	10.33	35.7	2.16	2.66	2	0.00	35.0	1352.71	0.00
437.60	0.86									
39	369.43	11.15	35.7	5.57	6.86	1	150.00	22.0	1460.58	0.00
136.20	0.99									

X-S Area:

3178.38

Path Length:

180.93

X-S Weight:

416938.66

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 6-2\West Farm Expansion Case 6-2 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:57:32

DATA: Analysis 1 - Case 6-2 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 196.00 348.50 196.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 175.00 348.50 175.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 172.00 348.50 172.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 196.00 450.00 196.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 175.00 450.00 175.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 172.00 450.00 172.00

Slope Surface (8 points)

100.00	175.00	250.00	175.00	325.00	200.00	400.00	200.00
405.00	195.00						
410.00	195.00	415.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	197.00	250.00	197.00	316.00	197.00	348.50	197.00
351.50	190.00						
450.00	190.00						

Failure Surface

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

Intersects:	XL:	250.00	YL:	175.00	XR:	405.00	YR:	195.00
	Centre:	XC:	297.11	YC:	420.52	Radius:	R:	250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

RESULTS: Analysis 1 - Case 6-2 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 5.374

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.68

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	250.79	175.26	400.00	200.00	289.59	403.62	231.63	2.683	<--
Critical Surface									
2	251.32	175.44	400.00	200.00	290.66	399.56	227.55	2.684	
3	251.84	175.61	400.00	200.00	291.74	395.49	223.47	2.685	
4	253.95	176.32	400.00	200.00	296.00	379.14	207.14	2.690	
5	254.47	176.49	400.00	200.00	297.06	375.04	203.06	2.690	
6	253.42	176.14	400.00	200.00	294.94	383.24	211.22	2.690	
7	252.89	175.96	400.00	200.00	293.88	387.33	215.31	2.691	
8	252.37	175.79	400.00	200.00	292.81	391.42	219.39	2.692	
9	249.74	175.00	400.00	200.00	287.55	411.80	239.80	2.692	
10	248.68	175.00	400.00	200.00	286.60	415.91	243.88	2.696	
11	247.11	175.00	400.00	200.00	285.54	419.96	247.96	2.697	
12	249.21	175.00	400.00	200.00	286.73	415.97	243.88	2.704	
13	251.32	175.44	400.53	199.47	291.10	403.63	231.63	2.704	
14	247.63	175.00	400.00	200.00	285.66	420.03	247.96	2.704	
15	250.26	175.09	400.00	200.00	287.80	411.93	239.80	2.704	
16	246.05	175.00	400.00	200.00	284.61	424.07	252.04	2.705	
17	251.32	175.44	400.00	200.00	289.96	403.83	231.63	2.707	
18	250.79	175.26	400.00	200.00	288.88	407.88	235.71	2.708	
19	251.84	175.61	400.00	200.00	291.03	399.76	227.55	2.709	
20	252.89	175.96	400.53	199.47	294.27	391.41	219.39	2.710	
21	252.37	175.79	400.53	199.47	293.22	395.49	223.47	2.710	
22	251.84	175.61	400.53	199.47	292.16	399.56	227.55	2.710	
23	253.42	176.14	400.53	199.47	295.33	387.33	215.31	2.710	
24	249.74	175.00	400.00	200.00	286.85	416.04	243.88	2.711	
25	248.16	175.00	400.00	200.00	285.78	420.09	247.96	2.711	
26	253.95	176.32	400.53	199.47	296.38	383.24	211.22	2.711	
27	252.37	175.79	400.00	200.00	292.11	395.70	223.47	2.711	
28	246.58	175.00	400.00	200.00	284.73	424.14	252.04	2.711	
29	254.47	176.49	400.53	199.47	297.42	379.13	207.14	2.712	
30	245.00	175.00	400.00	200.00	283.68	428.18	256.12	2.712	
31	253.42	176.14	400.00	200.00	294.24	387.54	215.31	2.717	
32	252.89	175.96	400.00	200.00	293.18	391.62	219.39	2.717	
33	253.95	176.32	400.00	200.00	295.30	383.45	211.22	2.717	
34	248.68	175.00	400.00	200.00	285.90	420.15	247.96	2.718	
35	247.11	175.00	400.00	200.00	284.85	424.20	252.04	2.718	
36	254.47	176.49	400.00	200.00	296.36	379.35	207.14	2.718	
37	245.53	175.00	400.00	200.00	283.80	428.25	256.12	2.719	
38	255.00	176.67	400.00	200.00	297.42	375.25	203.06	2.719	
39	248.68	175.00	400.53	199.47	287.09	419.97	247.96	2.719	
40	247.63	175.00	400.53	199.47	286.17	424.08	252.04	2.722	
41	246.05	175.00	400.53	199.47	285.13	428.12	256.12	2.723	
42	249.21	175.00	400.53	199.47	287.22	420.03	247.96	2.723	
43	250.79	175.26	400.53	199.47	289.35	411.94	239.80	2.725	
44	246.05	175.00	400.00	200.00	283.92	428.31	256.12	2.725	
45	251.32	175.44	400.53	199.47	290.41	407.89	235.71	2.727	
46	249.21	175.00	400.00	200.00	286.02	420.21	247.96	2.728	
47	250.26	175.09	400.00	200.00	287.09	416.17	243.88	2.729	
48	248.16	175.00	400.53	199.47	286.29	424.14	252.04	2.729	
49	249.74	175.00	400.53	199.47	287.34	420.09	247.96	2.729	
50	246.58	175.00	400.53	199.47	285.25	428.19	256.12	2.730	
51	251.32	175.44	400.00	200.00	289.26	408.08	235.71	2.730	
52	245.00	175.00	400.53	199.47	284.21	432.23	260.20	2.730	
53	251.84	175.61	401.05	198.95	292.61	403.63	231.63	2.731	
54	252.37	175.79	401.05	198.95	293.66	399.56	227.55	2.731	
55	250.26	175.09	400.53	199.47	288.28	415.98	243.88	2.732	
56	249.74	175.00	400.00	200.00	286.14	420.27	247.96	2.732	
57	248.16	175.00	400.00	200.00	285.09	424.32	252.04	2.732	
58	252.89	175.96	401.05	198.95	294.70	395.49	223.47	2.732	
59	247.63	175.00	400.00	200.00	284.97	424.26	252.04	2.733	
60	245.00	175.00	400.00	200.00	283.00	432.41	260.20	2.733	
61	251.84	175.61	400.00	200.00	290.33	404.03	231.63	2.733	
62	253.42	176.14	401.05	198.95	295.74	391.41	219.39	2.734	

63	250.79	175.26	400.00	200.00	288.18	412.13	239.80	2.734
64	251.84	175.61	400.53	199.47	291.48	403.83	231.63	2.734
65	252.37	175.79	400.53	199.47	292.54	399.77	227.55	2.735
66	253.95	176.32	401.05	198.95	296.78	387.32	215.31	2.736
67	252.89	175.96	400.53	199.47	293.59	395.70	223.47	2.736
68	248.68	175.00	400.53	199.47	286.41	424.20	252.04	2.736
69	247.11	175.00	400.53	199.47	285.37	428.25	256.12	2.736
70	246.58	175.00	400.00	200.00	284.04	428.37	256.12	2.737
71	254.47	176.49	401.05	198.95	297.81	383.22	211.22	2.737
72	253.42	176.14	400.53	199.47	294.65	391.62	219.39	2.737
73	245.53	175.00	400.53	199.47	284.33	432.29	260.20	2.737
74	247.11	175.00	400.00	200.00	284.16	428.43	256.12	2.739
75	253.95	176.32	400.53	199.47	295.70	387.54	215.31	2.739
76	248.68	175.00	400.00	200.00	285.21	424.38	252.04	2.739
77	255.00	176.67	401.05	198.95	298.84	379.12	207.14	2.740
78	254.47	176.49	400.53	199.47	296.74	383.44	211.22	2.740
79	245.53	175.00	400.00	200.00	283.12	432.47	260.20	2.741
80	255.00	176.67	400.53	199.47	297.79	379.34	207.14	2.742
81	252.89	175.96	400.00	200.00	292.48	395.90	223.47	2.742
82	249.21	175.00	401.05	198.95	287.74	424.08	252.04	2.743
83	249.21	175.00	400.53	199.47	286.53	424.26	252.04	2.743
84	247.63	175.00	400.53	199.47	285.49	428.31	256.12	2.743
85	253.42	176.14	400.00	200.00	293.54	391.83	219.39	2.743
86	252.37	175.79	400.00	200.00	291.41	399.97	227.55	2.743
87	246.05	175.00	400.53	199.47	284.45	432.35	260.20	2.744
88	253.95	176.32	400.00	200.00	294.61	387.75	215.31	2.744
89	250.26	175.09	401.05	198.95	288.79	420.04	247.96	2.744
90	250.26	175.09	400.53	199.47	287.59	420.22	247.96	2.744
91	254.47	176.49	400.00	200.00	295.67	383.66	211.22	2.746
92	246.05	175.00	400.00	200.00	283.23	432.53	260.20	2.746
93	250.79	175.26	401.05	198.95	289.84	415.99	243.88	2.747
94	247.63	175.00	400.00	200.00	284.28	428.49	256.12	2.747
95	250.79	175.26	400.53	199.47	288.66	416.18	243.88	2.747
96	249.21	175.00	400.00	200.00	285.32	424.44	252.04	2.748
97	255.00	176.67	400.00	200.00	296.73	379.56	207.14	2.748
98	250.26	175.09	400.00	200.00	286.39	420.40	247.96	2.749
99	246.58	175.00	401.05	198.95	285.79	432.23	260.20	2.750

Critical Failure Surface (circle 1)

Intersects:	XL:	250.79	YL:	175.26	XR:	400.00	YR:	200.00	
Centre:	XC:	289.59	YC:	403.62		Radius:	R:	231.63	
Generated failure surface: (20 points)									
250.79	175.26	258.81	174.05	266.86	173.11	274.94	172.45		
283.04	172.08								
291.15	172.00	299.26	172.19	307.35	172.67	315.42	173.44		
323.47	174.48								
331.46	175.81	339.41	177.41	347.30	179.30	355.12	181.45		
362.85	183.88								
370.50	186.58	378.05	189.55	385.48	192.77	392.81	196.26		
400.00	200.00								

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

Slice	X-S	Base								PoreWater
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	250.79	0.73	-8.6	1.73	1.75	2	0.00	35.0	95.35	2390.63
1394.61	1.05									
2	252.52	5.04	-8.6	3.14	3.18	3	100.00	18.0	667.35	4410.71
1507.92	1.03									
3	255.66	9.83	-8.6	3.14	3.18	3	100.00	18.0	1310.07	4505.38
1649.14	1.03									
4	258.81	19.31	-6.6	4.03	4.05	3	100.00	18.0	2577.85	5866.52
1797.14	1.02									
5	262.83	26.60	-6.6	4.03	4.05	3	100.00	18.0	3551.98	5985.04
1957.10	1.02									
6	266.86	33.74	-4.6	4.04	4.05	3	100.00	18.0	4502.80	6085.74
2103.24	1.01									
7	270.90	40.50	-4.6	4.04	4.05	3	100.00	18.0	5402.26	6168.44
2242.93	1.01									
8	274.94	47.09	-2.6	4.05	4.05	3	100.00	18.0	6276.03	6233.23
2367.80	1.01									
9	278.99	53.31	-2.6	4.05	4.05	3	100.00	18.0	7098.18	6280.15
2487.15	1.01									
10	283.04	56.60	-0.6	3.88	3.88	3	100.00	18.0	7528.81	6033.98
2588.64	1.00									
11	286.92	61.78	-0.6	3.88	3.88	3	100.00	18.0	8208.11	6044.07
2683.30	1.00									
12	290.80	73.03	1.2	4.23	4.23	3	100.00	18.0	9691.92	6589.66
2767.65	1.00									
13	295.03	78.56	1.4	4.23	4.23	3	100.00	18.0	10412.02	6563.05

2849.11	1.00										
14	299.26	80.06	3.4	4.05	4.05	3	100.00	18.0	10596.24	6245.63	
2912.23	0.99										
15	303.30	84.54	3.4	4.05	4.05	3	100.00	18.0	11174.37	6184.82	
2970.39	0.99										
16	307.35	61.51	5.4	2.82	2.84	3	100.00	18.0	8120.14	4282.49	
3005.14	0.99										
17	310.18	63.42	5.4	2.82	2.84	3	100.00	18.0	8362.17	4235.27	
3031.57	0.99										
18	313.00	55.96	5.4	2.42	2.44	3	100.00	18.0	7371.16	3597.89	
3056.13	0.99										
19	315.42	95.61	7.4	4.02	4.05	3	100.00	18.0	12577.04	5895.19	
3097.52	0.99										
20	319.44	98.90	7.4	4.02	4.05	3	100.00	18.0	12986.68	5763.01	
3197.30	0.99										
21	323.47	38.58	9.4	1.53	1.56	3	100.00	18.0	5059.41	2173.58	
3253.17	0.99										
22	325.00	39.97	9.4	1.59	1.61	3	100.00	18.0	5238.60	2226.57	
3249.89	0.99										
23	326.59	119.88	9.4	4.87	4.94	2	0.00	35.0	15704.75	6657.96	
3144.33	0.97										
24	331.46	94.55	11.4	3.97	4.05	2	0.00	35.0	12385.52	5259.83	
3025.47	0.97										
25	335.44	91.36	11.4	3.97	4.05	2	0.00	35.0	11967.64	5056.76	
2923.07	0.97										
26	339.41	87.21	13.4	3.94	4.05	2	0.00	35.0	11425.09	4836.09	
2797.24	0.97										
27	343.36	83.50	13.4	3.94	4.05	2	0.00	35.0	10938.83	4597.97	
2677.72	0.97										
28	347.30	24.65	15.4	1.20	1.25	2	0.00	35.0	3228.99	1362.54	
2583.27	0.97										
29	348.50	59.88	15.4	3.00	3.11	5	0.00	45.0	6586.37	2613.69	
2068.99	0.94										
30	351.50	68.87	15.4	3.62	3.75	2	0.00	35.0	9022.43	2117.50	
2365.24	0.97										
31	355.12	69.39	17.4	3.87	4.05	2	0.00	35.0	9089.91	2008.50	
2209.51	0.97										
32	358.98	64.69	17.4	3.87	4.05	2	0.00	35.0	8474.27	1701.14	
2056.68	0.97										
33	362.85	59.04	19.4	3.82	4.05	2	0.00	35.0	7733.89	1376.79	
1880.91	0.97										
34	366.68	53.88	19.4	3.82	4.05	2	0.00	35.0	7058.00	1035.37	
1711.93	0.97										
35	370.50	47.83	21.4	3.77	4.05	2	0.00	35.0	6266.37	677.12	
1521.72	0.97										
36	374.27	42.24	21.4	3.77	4.05	2	0.00	35.0	5533.58	302.08	
1336.97	0.97										
37	378.05	10.67	23.5	1.04	1.14	2	0.00	35.0	1398.16	16.07	
1204.83	0.98										
38	379.09	29.76	23.5	3.20	3.49	2	0.00	35.0	3898.23	0.00	
1095.13	0.98										
39	382.29	25.32	23.5	3.20	3.49	2	0.00	35.0	3317.13	0.00	
931.88	0.98										
40	385.48	21.74	25.5	3.39	3.75	2	0.00	35.0	2848.35	0.00	
747.95	0.99										
41	388.87	16.28	25.5	3.39	3.75	2	0.00	35.0	2132.72	0.00	
560.04	0.99										
42	392.26	11.68	27.2	3.87	4.35	1	150.00	22.0	1530.23	0.00	
340.31	1.04										
43	396.13	3.89	27.5	3.87	4.36	1	150.00	22.0	510.08	0.00	
95.26	1.05										

X-S Area:

2210.99

Path Length:

154.06

X-S Weight:

289859.09

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 6-2\West Farm Expansion Case 6-2 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 12:59:03

DATA: Analysis 1 - Case 6-2 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 196.00 348.50 196.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 175.00 348.50 175.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 172.00 348.50 172.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 196.00 450.00 196.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 175.00 450.00 175.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 172.00 450.00 172.00

Slope Surface (8 points)

100.00	175.00	250.00	175.00	325.00	200.00	400.00	200.00
405.00	195.00						
410.00	195.00	415.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	175.00	250.00	175.00	316.00	197.00	348.50	197.00
351.50	190.00						
450.00	190.00						

Failure Surface

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

Intersects:	XL:	250.00	YL:	175.00	XR:	405.00	YR:	195.00
	Centre:	XC:	297.11	YC:	420.52	Radius:	R:	250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

RESULTS: Analysis 1 - Case 6-2 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.689

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.82

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	250.79	175.26	400.00	200.00	289.59	403.62	231.63	1.816	<--
Critical Surface									
2	251.32	175.44	400.00	200.00	290.66	399.56	227.55	1.818	
3	249.74	175.00	400.00	200.00	287.55	411.80	239.80	1.819	
4	247.11	175.00	400.00	200.00	285.54	419.96	247.96	1.819	
5	248.68	175.00	400.00	200.00	286.60	415.91	243.88	1.821	
6	251.84	175.61	400.00	200.00	291.74	395.49	223.47	1.822	
7	246.05	175.00	400.00	200.00	284.61	424.07	252.04	1.824	
8	247.63	175.00	400.00	200.00	285.66	420.03	247.96	1.825	
9	249.21	175.00	400.00	200.00	286.73	415.97	243.88	1.826	
10	252.37	175.79	400.00	200.00	292.81	391.42	219.39	1.827	
11	245.00	175.00	400.00	200.00	283.68	428.18	256.12	1.828	
12	250.26	175.09	400.00	200.00	287.80	411.93	239.80	1.829	
13	246.58	175.00	400.00	200.00	284.73	424.14	252.04	1.829	
14	252.89	175.96	400.00	200.00	293.88	387.33	215.31	1.829	
15	248.16	175.00	400.00	200.00	285.78	420.09	247.96	1.830	
16	253.42	176.14	400.00	200.00	294.94	383.24	211.22	1.831	
17	249.74	175.00	400.00	200.00	286.85	416.04	243.88	1.832	
18	245.53	175.00	400.00	200.00	283.80	428.25	256.12	1.833	
19	253.95	176.32	400.00	200.00	296.00	379.14	207.14	1.834	
20	250.79	175.26	400.00	200.00	288.88	407.88	235.71	1.834	
21	247.11	175.00	400.00	200.00	284.85	424.20	252.04	1.834	
22	251.32	175.44	400.00	200.00	289.96	403.83	231.63	1.835	
23	251.32	175.44	400.53	199.47	291.10	403.63	231.63	1.835	
24	248.68	175.00	400.00	200.00	285.90	420.15	247.96	1.836	
25	254.47	176.49	400.00	200.00	297.06	375.04	203.06	1.836	
26	251.84	175.61	400.00	200.00	291.03	399.76	227.55	1.839	
27	246.05	175.00	400.00	200.00	283.92	428.31	256.12	1.839	
28	246.05	175.00	400.53	199.47	285.13	428.12	256.12	1.839	
29	248.68	175.00	400.53	199.47	287.09	419.97	247.96	1.840	
30	247.63	175.00	400.53	199.47	286.17	424.08	252.04	1.841	
31	251.84	175.61	400.53	199.47	292.16	399.56	227.55	1.841	
32	252.37	175.79	400.00	200.00	292.11	395.70	223.47	1.842	
33	249.21	175.00	400.53	199.47	287.22	420.03	247.96	1.843	
34	245.00	175.00	400.00	200.00	283.00	432.41	260.20	1.843	
35	252.37	175.79	400.53	199.47	293.22	395.49	223.47	1.844	
36	249.21	175.00	400.00	200.00	286.02	420.21	247.96	1.844	
37	245.00	175.00	400.53	199.47	284.21	432.23	260.20	1.844	
38	246.58	175.00	400.53	199.47	285.25	428.19	256.12	1.845	
39	247.63	175.00	400.00	200.00	284.97	424.26	252.04	1.845	
40	248.16	175.00	400.00	200.00	285.09	424.32	252.04	1.845	
41	250.26	175.09	400.00	200.00	287.09	416.17	243.88	1.846	
42	252.89	175.96	400.53	199.47	294.27	391.41	219.39	1.846	
43	248.16	175.00	400.53	199.47	286.29	424.14	252.04	1.846	
44	249.74	175.00	400.00	200.00	286.14	420.27	247.96	1.847	
45	246.58	175.00	400.00	200.00	284.04	428.37	256.12	1.847	
46	252.89	175.96	400.00	200.00	293.18	391.62	219.39	1.848	
47	249.74	175.00	400.53	199.47	287.34	420.09	247.96	1.848	
48	250.79	175.26	400.53	199.47	289.35	411.94	239.80	1.848	
49	253.42	176.14	400.53	199.47	295.33	387.33	215.31	1.849	
50	245.53	175.00	400.00	200.00	283.12	432.47	260.20	1.849	
51	247.11	175.00	400.00	200.00	284.16	428.43	256.12	1.849	
52	245.53	175.00	400.53	199.47	284.33	432.29	260.20	1.849	
53	253.42	176.14	400.00	200.00	294.24	387.54	215.31	1.850	
54	247.11	175.00	400.53	199.47	285.37	428.25	256.12	1.850	
55	250.26	175.09	400.53	199.47	288.28	415.98	243.88	1.851	
56	248.68	175.00	400.00	200.00	285.21	424.38	252.04	1.851	
57	251.32	175.44	400.00	200.00	289.26	408.08	235.71	1.851	
58	250.79	175.26	400.00	200.00	288.18	412.13	239.80	1.852	
59	253.95	176.32	400.53	199.47	296.38	383.24	211.22	1.852	
60	248.68	175.00	400.53	199.47	286.41	424.20	252.04	1.852	
61	251.32	175.44	400.53	199.47	290.41	407.89	235.71	1.852	
62	253.95	176.32	400.00	200.00	295.30	383.45	211.22	1.853	

63	246.05	175.00	400.00	200.00	283.23	432.53	260.20	1.854
64	246.05	175.00	400.53	199.47	284.45	432.35	260.20	1.855
65	254.47	176.49	400.53	199.47	297.42	379.13	207.14	1.855
66	251.84	175.61	400.00	200.00	290.33	404.03	231.63	1.855
67	247.63	175.00	400.00	200.00	284.28	428.49	256.12	1.855
68	247.63	175.00	400.53	199.47	285.49	428.31	256.12	1.856
69	254.47	176.49	400.00	200.00	296.36	379.35	207.14	1.856
70	249.21	175.00	400.53	199.47	286.53	424.26	252.04	1.857
71	249.21	175.00	400.00	200.00	285.32	424.44	252.04	1.857
72	251.84	175.61	401.05	198.95	292.61	403.63	231.63	1.858
73	245.00	175.00	400.00	200.00	282.32	436.64	264.29	1.858
74	251.84	175.61	400.53	199.47	291.48	403.83	231.63	1.858
75	245.00	175.00	400.53	199.47	283.55	436.46	264.29	1.859
76	249.21	175.00	401.05	198.95	287.74	424.08	252.04	1.859
77	255.00	176.67	400.00	200.00	297.42	375.25	203.06	1.860
78	246.58	175.00	400.00	200.00	283.35	432.59	260.20	1.860
79	246.58	175.00	400.53	199.47	284.58	432.41	260.20	1.860
80	245.00	175.00	401.05	198.95	284.77	436.28	264.29	1.860
81	250.26	175.09	400.53	199.47	287.59	420.22	247.96	1.860
82	250.26	175.09	400.00	200.00	286.39	420.40	247.96	1.861
83	252.37	175.79	401.05	198.95	293.66	399.56	227.55	1.861
84	248.16	175.00	400.53	199.47	285.61	428.37	256.12	1.861
85	246.58	175.00	401.05	198.95	285.79	432.23	260.20	1.861
86	252.37	175.79	400.53	199.47	292.54	399.77	227.55	1.861
87	248.16	175.00	400.00	200.00	284.39	428.55	256.12	1.862
88	250.26	175.09	401.05	198.95	288.79	420.04	247.96	1.862
89	247.63	175.00	401.05	198.95	286.70	428.13	256.12	1.863
90	249.74	175.00	400.00	200.00	285.44	424.50	252.04	1.864
91	245.53	175.00	400.53	199.47	283.67	436.52	264.29	1.864
92	245.53	175.00	400.00	200.00	282.43	436.70	264.29	1.864
93	250.79	175.26	400.53	199.47	288.66	416.18	243.88	1.864
94	252.89	175.96	401.05	198.95	294.70	395.49	223.47	1.864
95	250.79	175.26	400.00	200.00	287.47	416.37	243.88	1.864
96	252.89	175.96	400.53	199.47	293.59	395.70	223.47	1.864
97	252.37	175.79	400.00	200.00	291.41	399.97	227.55	1.865
98	249.74	175.00	401.05	198.95	287.86	424.14	252.04	1.865
99	247.11	175.00	400.53	199.47	284.70	432.47	260.20	1.865

Critical Failure Surface (circle 1)

Intersects: XL:	250.79	YL:	175.26	XR:	400.00	YR:	200.00		
Centre: XC:	289.59	YC:	403.62			Radius: R:	231.63		
Generated failure surface: (20 points)									
250.79	175.26	258.81	174.05	266.86	173.11	274.94	172.45		
283.04	172.08								
291.15	172.00	299.26	172.19	307.35	172.67	315.42	173.44		
323.47	174.48								
331.46	175.81	339.41	177.41	347.30	179.30	355.12	181.45		
362.85	183.88								
370.50	186.58	378.05	189.55	385.48	192.77	392.81	196.26		
400.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	250.79	0.73	-8.6	1.73	1.75	2	0.00	35.0	95.36	45.94
56.85	1.07									
2	252.52	5.04	-8.6	3.14	3.18	3	100.00	18.0	667.35	317.92
224.11	1.04									
3	255.66	9.83	-8.6	3.14	3.18	3	100.00	18.0	1310.07	620.35
431.71	1.04									
4	258.81	19.31	-6.6	4.03	4.05	3	100.00	18.0	2577.85	1213.24
653.91	1.03									
5	262.83	26.60	-6.6	4.03	4.05	3	100.00	18.0	3551.98	1671.33
898.53	1.03									
6	266.86	33.74	-4.6	4.04	4.05	3	100.00	18.0	4502.80	2112.17
1127.49	1.02									
7	270.90	40.50	-4.6	4.04	4.05	3	100.00	18.0	5402.26	2535.70
1351.81	1.02									
8	274.94	47.09	-2.6	4.05	4.05	3	100.00	18.0	6276.03	2941.67
1558.97	1.01									
9	278.99	53.31	-2.6	4.05	4.05	3	100.00	18.0	7098.18	3330.12
1762.85	1.01									
10	283.04	56.60	-0.6	3.88	3.88	3	100.00	18.0	7528.81	3532.19
1944.29	1.00									
11	286.92	61.78	-0.6	3.88	3.88	3	100.00	18.0	8208.11	3855.02
2119.66	1.00									
12	290.80	73.03	1.2	4.23	4.23	3	100.00	18.0	9691.92	4557.99
2285.57	1.00									
13	295.03	78.56	1.4	4.23	4.23	3	100.00	18.0	10412.02	4903.47

2454.63	1.00										
14	299.26	80.06	3.4	4.05	4.05	3	100.00	18.0	10596.24	5004.35	
2600.36	0.99										
15	303.30	84.54	3.4	4.05	4.05	3	100.00	18.0	11174.37	5284.86	
2742.46	0.99										
16	307.35	61.51	5.4	2.82	2.84	3	100.00	18.0	8120.14	3855.53	
2844.93	0.99										
17	310.18	63.42	5.4	2.82	2.84	3	100.00	18.0	8362.17	3974.94	
2929.87	0.99										
18	313.00	55.96	5.4	2.42	2.44	3	100.00	18.0	7371.16	3507.34	
3008.80	0.99										
19	315.42	95.61	7.4	4.02	4.05	3	100.00	18.0	12577.04	5895.19	
3083.18	0.99										
20	319.44	98.90	7.4	4.02	4.05	3	100.00	18.0	12986.68	5763.01	
3181.99	0.99										
21	323.47	38.58	9.4	1.53	1.56	3	100.00	18.0	5059.41	2173.58	
3233.01	0.98										
22	325.00	39.97	9.4	1.59	1.61	3	100.00	18.0	5238.60	2226.57	
3229.61	0.98										
23	326.59	119.88	9.4	4.87	4.94	2	0.00	35.0	15704.75	6657.96	
3109.42	0.95										
24	331.46	94.55	11.4	3.97	4.05	2	0.00	35.0	12385.52	5259.83	
2985.10	0.95										
25	335.44	91.36	11.4	3.97	4.05	2	0.00	35.0	11967.64	5056.76	
2883.92	0.95										
26	339.41	87.21	13.4	3.94	4.05	2	0.00	35.0	11425.09	4836.09	
2753.52	0.94										
27	343.36	83.50	13.4	3.94	4.05	2	0.00	35.0	10938.83	4597.97	
2635.65	0.94										
28	347.30	24.65	15.4	1.20	1.25	2	0.00	35.0	3228.99	1362.54	
2536.96	0.94										
29	348.50	59.88	15.4	3.00	3.11	5	0.00	45.0	6586.37	2613.69	
2016.56	0.90										
30	351.50	68.87	15.4	3.62	3.75	2	0.00	35.0	9022.43	2117.50	
2309.24	0.94										
31	355.12	69.39	17.4	3.87	4.05	2	0.00	35.0	9089.91	2008.50	
2149.65	0.93										
32	358.98	64.69	17.4	3.87	4.05	2	0.00	35.0	8474.27	1701.14	
1999.50	0.93										
33	362.85	59.04	19.4	3.82	4.05	2	0.00	35.0	7733.89	1376.79	
1821.21	0.93										
34	366.68	53.88	19.4	3.82	4.05	2	0.00	35.0	7058.00	1035.37	
1655.51	0.93										
35	370.50	47.83	21.4	3.77	4.05	2	0.00	35.0	6266.37	677.12	
1464.10	0.93										
36	374.27	42.24	21.4	3.77	4.05	2	0.00	35.0	5533.58	302.08	
1283.27	0.93										
37	378.05	10.67	23.5	1.04	1.14	2	0.00	35.0	1398.16	16.07	
1149.66	0.93										
38	379.09	29.76	23.5	3.20	3.49	2	0.00	35.0	3898.23	0.00	
1044.38	0.93										
39	382.29	25.32	23.5	3.20	3.49	2	0.00	35.0	3317.13	0.00	
888.70	0.93										
40	385.48	21.74	25.5	3.39	3.75	2	0.00	35.0	2848.35	0.00	
710.45	0.94										
41	388.87	16.28	25.5	3.39	3.75	2	0.00	35.0	2132.72	0.00	
531.96	0.94										
42	392.26	11.68	27.2	3.87	4.35	1	150.00	22.0	1530.23	0.00	
316.71	1.01										
43	396.13	3.89	27.5	3.87	4.36	1	150.00	22.0	510.08	0.00	
79.63	1.01										

X-S Area:

2210.99

Path Length:

154.06

X-S Weight:

289859.09

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 7-1\West Farm Expansion Case 7-1 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 12:59:37

DATA: Analysis 1 - Case 7-1 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 188.00 348.50 188.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 144.00 348.50 144.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 141.00 348.50 141.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 500.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 188.00 500.00 188.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 144.00 500.00 144.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 141.00 500.00 141.00

Slope Surface (4 points)

100.00 144.00 157.00 144.00 325.00 200.00 500.00 200.00

Phreatic Surface (6 points)

100.00 197.00 157.00 197.00 316.00 197.00 348.50 197.00
 351.50 170.00
 500.00 170.00

Failure Surface

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

Intersects: XL: 157.00 YL: 144.00 XR: 480.00 YR: 200.00
 Centre: XC: 237.81 YC: 637.43 Radius: R: 500.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 200.00
 Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case 7-1 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.199

Analysis Summary

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

Critical (minimum) Factor of Safety: 3.05

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	158.32	144.44	475.00	200.00	221.16	716.51	575.51	3.048	
Critical Surface									
2	159.89	144.96	475.00	200.00	225.99	696.12	555.10	3.049	
3	156.21	144.00	475.00	200.00	216.38	736.87	595.92	3.050	
4	155.16	144.00	475.00	200.00	215.46	740.96	600.00	3.052	
5	160.95	145.32	475.00	200.00	228.95	683.90	542.86	3.052	
6	159.37	144.79	475.00	200.00	224.14	704.32	563.27	3.052	
7	157.79	144.26	475.00	200.00	219.31	724.69	583.67	3.053	
8	159.37	144.79	475.53	200.00	224.57	704.27	563.27	3.054	
9	156.74	144.00	475.00	200.00	216.47	736.92	595.92	3.054	
10	158.84	144.61	475.00	200.00	222.29	712.51	571.43	3.054	
11	157.26	144.09	475.00	200.00	217.45	732.86	591.84	3.054	
12	156.74	144.00	475.53	200.00	216.90	736.87	595.92	3.055	
13	157.26	144.09	475.53	200.00	217.88	732.81	591.84	3.055	
14	160.42	145.14	475.00	200.00	227.11	692.11	551.02	3.055	
15	155.68	144.00	475.00	200.00	215.55	741.01	600.00	3.056	
16	158.84	144.61	475.53	200.00	222.71	712.46	571.43	3.056	
17	155.68	144.00	475.53	200.00	215.99	740.96	600.00	3.057	
18	160.42	145.14	475.53	200.00	227.53	692.06	551.02	3.057	
19	162.00	145.67	475.00	200.00	231.91	671.65	530.61	3.057	
20	162.00	145.67	475.53	200.00	232.33	671.60	530.61	3.057	
21	158.32	144.44	475.00	200.00	220.43	720.69	579.59	3.058	
22	158.84	144.61	476.05	200.00	223.14	712.41	571.43	3.058	
23	159.89	144.96	475.00	200.00	225.26	700.32	559.18	3.058	
24	157.79	144.26	475.53	200.00	219.74	724.64	583.67	3.059	
25	156.21	144.00	475.00	200.00	215.64	741.05	600.00	3.060	
26	159.89	144.96	475.53	200.00	225.68	700.27	559.18	3.060	
27	157.79	144.26	475.00	200.00	218.57	728.87	587.76	3.060	
28	158.32	144.44	476.05	200.00	221.29	720.60	579.59	3.060	
29	156.21	144.00	475.53	200.00	216.08	741.01	600.00	3.061	
30	157.79	144.26	475.53	200.00	219.00	728.82	587.76	3.061	
31	159.89	144.96	476.05	200.00	226.11	700.21	559.18	3.062	
32	156.21	144.00	476.05	200.00	216.51	740.96	600.00	3.062	
33	161.47	145.49	475.00	200.00	230.07	679.88	538.78	3.062	
34	160.95	145.32	475.00	200.00	228.22	688.10	546.94	3.062	
35	161.47	145.49	475.53	200.00	230.49	679.83	538.78	3.063	
36	159.37	144.79	475.53	200.00	223.83	708.46	567.35	3.063	
37	161.47	145.49	476.05	200.00	230.91	679.77	538.78	3.063	
38	158.84	144.61	475.00	200.00	221.55	716.70	575.51	3.063	
39	158.32	144.44	475.53	200.00	220.86	720.65	579.59	3.063	
40	156.74	144.00	475.00	200.00	215.73	741.09	600.00	3.064	
41	159.37	144.79	476.05	200.00	224.26	708.41	567.35	3.064	
42	157.26	144.09	475.00	200.00	216.71	737.03	595.92	3.064	
43	157.79	144.26	476.05	200.00	219.44	728.78	587.76	3.064	
44	156.74	144.00	475.53	200.00	216.17	741.05	600.00	3.065	
45	160.42	145.14	475.00	200.00	226.38	696.31	555.10	3.065	
46	157.26	144.09	475.53	200.00	217.15	736.99	595.92	3.066	
47	156.74	144.00	476.05	200.00	216.61	741.01	600.00	3.066	
48	158.84	144.61	475.00	200.00	223.02	708.32	567.35	3.066	
49	160.42	145.14	475.53	200.00	226.80	696.26	555.10	3.067	
50	157.26	144.09	476.05	200.00	217.58	736.95	595.92	3.067	
51	156.74	144.00	476.58	200.00	217.04	740.96	600.00	3.067	
52	160.95	145.32	475.53	200.00	228.64	688.05	546.94	3.067	
53	158.32	144.44	475.00	200.00	219.70	724.88	583.67	3.067	
54	159.37	144.79	475.00	200.00	223.41	708.51	567.35	3.067	
55	157.26	144.09	476.58	200.00	218.01	736.90	595.92	3.067	
56	160.95	145.32	476.05	200.00	229.07	688.00	546.94	3.068	
57	158.32	144.44	475.53	200.00	220.13	724.83	583.67	3.068	
58	160.95	145.32	476.58	200.00	229.49	687.94	546.94	3.068	
59	162.00	145.67	476.58	200.00	232.44	675.70	534.69	3.068	
60	162.00	145.67	475.00	200.00	231.18	675.87	534.69	3.068	
61	158.84	144.61	475.53	200.00	221.98	716.65	575.51	3.068	
62	162.00	145.67	476.05	200.00	232.02	675.76	534.69	3.068	
63	162.00	145.67	475.53	200.00	231.60	675.81	534.69	3.068	
64	158.84	144.61	476.58	200.00	222.84	716.55	575.51	3.068	

65	158.32	144.44	476.05	200.00	220.56	724.78	583.67	3.069
66	159.89	144.96	475.53	200.00	224.95	704.46	563.27	3.069
67	159.37	144.79	476.58	200.00	224.69	708.36	567.35	3.070
68	159.37	144.79	475.00	200.00	222.67	712.70	571.43	3.070
69	157.79	144.26	476.58	200.00	219.87	728.73	587.76	3.070
70	157.79	144.26	475.00	200.00	217.84	733.05	591.84	3.070
71	159.89	144.96	476.05	200.00	225.38	704.41	563.27	3.071
72	160.42	145.14	476.05	200.00	227.22	696.21	555.10	3.071
73	157.79	144.26	475.53	200.00	218.27	733.00	591.84	3.071
74	160.95	145.32	475.00	200.00	227.49	692.30	551.02	3.072
75	161.47	145.49	475.00	200.00	229.34	684.09	542.86	3.072
76	160.42	145.14	476.58	200.00	227.65	696.16	555.10	3.072
77	157.79	144.26	476.05	200.00	218.70	732.96	591.84	3.072
78	158.32	144.44	477.11	200.00	221.42	724.69	583.67	3.073
79	159.89	144.96	475.00	200.00	224.53	704.51	563.27	3.073
80	160.42	145.14	477.11	200.00	228.07	696.10	555.10	3.073
81	161.47	145.49	475.53	200.00	229.76	684.04	542.86	3.073
82	159.37	144.79	475.53	200.00	223.10	712.65	571.43	3.073
83	157.79	144.26	476.58	200.00	219.14	732.91	591.84	3.073
84	161.47	145.49	477.11	200.00	231.02	683.88	542.86	3.073
85	161.47	145.49	476.05	200.00	230.18	683.98	542.86	3.073
86	161.47	145.49	476.58	200.00	230.60	683.93	542.86	3.073
87	158.84	144.61	476.05	200.00	222.41	716.60	575.51	3.074
88	158.84	144.61	477.11	200.00	223.27	716.51	575.51	3.074
89	158.84	144.61	475.00	200.00	220.82	720.88	579.59	3.074
90	157.26	144.09	475.00	200.00	215.98	741.21	600.00	3.074
91	158.32	144.44	476.58	200.00	220.99	724.74	583.67	3.075
92	158.84	144.61	475.53	200.00	221.25	720.84	579.59	3.075
93	159.37	144.79	476.58	200.00	223.96	712.56	571.43	3.075
94	157.26	144.09	475.53	200.00	216.41	741.17	600.00	3.075
95	158.84	144.61	476.05	200.00	221.68	720.79	579.59	3.075
96	159.89	144.96	476.58	200.00	225.80	704.36	563.27	3.076
97	157.79	144.26	477.11	200.00	219.57	732.87	591.84	3.076
98	160.42	145.14	475.53	200.00	226.07	700.46	559.18	3.076
99	157.26	144.09	476.05	200.00	216.85	741.12	600.00	3.077

Critical Failure Surface (circle 1)

Intersects:	XL:	158.32	YL:	144.44	XR:	475.00	YR:	200.00	
Centre:	XC:	221.16	YC:	716.51		Radius:	R:	575.51	
Generated failure surface: (20 points)									
158.32	144.44		175.39	142.82		192.50	141.71	209.64	141.11
226.79	141.02								
243.94	141.45		261.06	142.38		278.15	143.82	295.19	145.78
312.16	148.24								
329.05	151.20		345.85	154.67		362.53	158.63	379.09	163.09
395.51	168.04								
411.78	173.48		427.87	179.40		443.78	185.80	459.50	192.67
475.00	200.00								

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

Slice	X-S	Base							PoreWater
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Force
Stress	X-Left								
1	158.32	4.58	-5.4	4.63	4.65	2	0.00	35.0	15305.20
3362.97	1.03								
2	162.94	20.62	-5.4	6.22	6.25	3	100.00	18.0	20790.02
3561.32	1.01								
3	169.17	37.20	-5.4	6.22	6.25	3	100.00	18.0	4928.51
3788.75	1.01								
4	175.39	77.12	-3.7	8.56	8.57	3	100.00	18.0	10228.03
4037.56	1.01								
5	183.95	106.28	-3.7	8.56	8.57	3	100.00	18.0	14094.34
4313.09	1.01								
6	192.50	134.56	-2.0	8.57	8.57	3	100.00	18.0	17835.92
4566.16	1.00								
7	201.07	161.60	-2.0	8.57	8.57	3	100.00	18.0	21404.47
4805.15	1.00								
8	209.64	187.67	-0.3	8.57	8.57	3	100.00	18.0	24834.56
5020.29	1.00								
9	218.22	212.56	-0.3	8.57	8.57	3	100.00	18.0	28098.33
5222.68	1.00								
10	226.79	236.27	1.4	8.57	8.57	3	100.00	18.0	31197.60
5399.94	1.00								
11	235.36	258.95	1.4	8.57	8.57	3	100.00	18.0	34150.49
5565.65	1.00								
12	243.94	280.20	3.1	8.56	8.57	3	100.00	18.0	36904.30
5705.15	1.00								
13	252.50	300.64	3.1	8.56	8.57	3	100.00	18.0	39541.86
5834.18	1.00								
14	261.06	319.30	4.8	8.54	8.57	3	100.00	18.0	41935.27

5936.03	0.99										
15	269.60	337.47	4.8	8.54	8.57	3	100.00	18.0	44253.81	28645.82	
6028.40	0.99										
16	278.15	62.24	6.5	1.53	1.54	3	100.00	18.0	8154.98	5095.93	
6069.87	0.99										
17	279.68	390.71	6.5	9.32	9.38	2	0.00	35.0	51183.62	30719.41	
6075.33	0.98										
18	289.00	269.83	6.5	6.19	6.23	2	0.00	35.0	35347.75	20044.43	
6133.27	0.98										
19	295.19	382.61	8.2	8.49	8.57	2	0.00	35.0	50121.31	27079.13	
6151.17	0.98										
20	303.67	396.18	8.2	8.49	8.57	2	0.00	35.0	51899.21	26421.25	
6180.63	0.98										
21	312.16	183.50	10.0	3.84	3.90	2	0.00	35.0	24038.03	11780.75	
6173.05	0.98										
22	316.00	439.21	10.0	9.00	9.14	2	0.00	35.0	57536.03	26969.83	
6259.57	0.98										
23	325.00	199.17	10.0	4.05	4.11	2	0.00	35.0	26091.88	11848.23	
6301.52	0.98										
24	329.05	402.55	11.7	8.40	8.57	2	0.00	35.0	52733.76	24042.91	
6122.07	0.97										
25	337.45	388.00	11.7	8.40	8.57	2	0.00	35.0	50827.61	23115.81	
5900.45	0.97										
26	345.85	119.40	13.4	2.65	2.73	2	0.00	35.0	15640.93	7147.46	
5728.04	0.97										
27	348.50	133.04	13.4	3.00	3.08	5	0.00	45.0	14634.87	5358.30	
4651.19	0.95										
28	351.50	239.06	13.4	5.52	5.67	2	0.00	35.0	31317.21	4718.53	
5426.32	0.97										
29	357.02	231.83	13.4	5.52	5.67	2	0.00	35.0	30370.00	4254.78	
5259.27	0.97										
30	362.53	333.31	15.1	8.28	8.57	2	0.00	35.0	43663.41	5487.32	
5003.49	0.98										
31	370.81	314.84	15.1	8.28	8.57	2	0.00	35.0	41244.63	4294.12	
4720.27	0.98										
32	379.09	292.86	16.8	8.21	8.57	2	0.00	35.0	38364.88	3035.17	
4393.29	0.98										
33	387.30	272.54	16.8	8.21	8.57	2	0.00	35.0	35702.35	1710.50	
4079.98	0.98										
34	395.51	181.50	18.5	5.86	6.18	2	0.00	35.0	23776.06	377.56	
3773.20	0.98										
35	401.37	294.07	18.5	10.41	10.97	2	0.00	35.0	38523.41	0.00	
3438.04	0.98										
36	411.78	201.52	20.2	8.05	8.57	2	0.00	35.0	26398.91	0.00	
3024.73	0.98										
37	419.82	177.70	20.2	8.05	8.57	2	0.00	35.0	23278.09	0.00	
2667.14	0.98										
38	427.87	151.17	21.9	7.96	8.57	2	0.00	35.0	19803.00	0.00	
2278.64	0.99										
39	435.83	125.72	21.9	7.96	8.57	2	0.00	35.0	16469.16	0.00	
1895.03	0.99										
40	443.78	66.01	23.6	5.04	5.50	2	0.00	35.0	8647.89	0.00	
1559.66	0.99										
41	448.82	57.82	23.6	5.34	5.83	1	150.00	22.0	7574.96	0.00	
1321.13	1.03										
42	454.16	45.37	23.6	5.34	5.83	1	150.00	22.0	5943.62	0.00	
1032.24	1.03										
43	459.50	42.63	25.3	7.75	8.57	1	150.00	22.0	5585.03	0.00	
656.12	1.04										
44	467.25	14.21	25.3	7.75	8.57	1	150.00	22.0	1861.67	0.00	
204.10	1.04										

X-S Area: 9083.61

Path Length: 325.84

X-S Weight: 1189461.25

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 7-1\West Farm Expansion Case 7-1 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 13:00:01

DATA: Analysis 1 - Case 7-1 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 188.00 348.50 188.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 144.00 348.50 144.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 141.00 348.50 141.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 500.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 188.00 500.00 188.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 144.00 500.00 144.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 141.00 500.00 141.00

Slope Surface (4 points)

100.00	144.00	157.00	144.00	325.00	200.00	500.00	200.00

Phreatic Surface (6 points)

100.00	144.00	157.00	144.00	316.00	197.00	348.50	197.00
351.50	170.00						
500.00	170.00						

Failure Surface

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

Intersects: XL:	157.00	YL:	144.00	XR:	480.00	YR:	200.00
Centre: XC:	237.81	YC:	637.43	Radius: R:			500.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 7-1 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.684

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	156.21	144.00	475.00	200.00	216.38	736.87	595.92	1.920	
Critical Surface									
2	158.32	144.44	475.00	200.00	221.16	716.51	575.51	1.921	
3	155.16	144.00	475.00	200.00	215.46	740.96	600.00	1.922	
4	159.89	144.96	475.00	200.00	225.99	696.12	555.10	1.923	
5	156.74	144.00	475.00	200.00	216.47	736.92	595.92	1.923	
6	157.79	144.26	475.00	200.00	219.31	724.69	583.67	1.924	
7	157.26	144.09	475.00	200.00	217.45	732.86	591.84	1.924	
8	155.68	144.00	475.00	200.00	215.55	741.01	600.00	1.924	
9	156.74	144.00	475.53	200.00	216.90	736.87	595.92	1.924	
10	159.37	144.79	475.00	200.00	224.14	704.32	563.27	1.925	
11	157.26	144.09	475.53	200.00	217.88	732.81	591.84	1.925	
12	155.68	144.00	475.53	200.00	215.99	740.96	600.00	1.925	
13	158.84	144.61	475.00	200.00	222.29	712.51	571.43	1.926	
14	159.37	144.79	475.53	200.00	224.57	704.27	563.27	1.926	
15	160.95	145.32	475.00	200.00	228.95	683.90	542.86	1.926	
16	156.21	144.00	475.00	200.00	215.64	741.05	600.00	1.927	
17	158.32	144.44	475.00	200.00	220.43	720.69	579.59	1.927	
18	158.84	144.61	475.53	200.00	222.71	712.46	571.43	1.927	
19	157.79	144.26	475.53	200.00	219.74	724.64	583.67	1.928	
20	160.42	145.14	475.00	200.00	227.11	692.11	551.02	1.928	
21	156.21	144.00	475.53	200.00	216.08	741.01	600.00	1.928	
22	157.79	144.26	475.00	200.00	218.57	728.87	587.76	1.928	
23	158.84	144.61	476.05	200.00	223.14	712.41	571.43	1.929	
24	159.89	144.96	475.00	200.00	225.26	700.32	559.18	1.929	
25	156.21	144.00	476.05	200.00	216.51	740.96	600.00	1.929	
26	160.42	145.14	475.53	200.00	227.53	692.06	551.02	1.930	
27	157.79	144.26	475.53	200.00	219.00	728.82	587.76	1.930	
28	162.00	145.67	475.00	200.00	231.91	671.65	530.61	1.930	
29	156.74	144.00	475.00	200.00	215.73	741.09	600.00	1.930	
30	158.32	144.44	476.05	200.00	221.29	720.60	579.59	1.930	
31	157.26	144.09	475.00	200.00	216.71	737.03	595.92	1.931	
32	162.00	145.67	475.53	200.00	232.33	671.60	530.61	1.931	
33	159.89	144.96	475.53	200.00	225.68	700.27	559.18	1.931	
34	156.74	144.00	475.53	200.00	216.17	741.05	600.00	1.931	
35	158.32	144.44	475.53	200.00	220.86	720.65	579.59	1.931	
36	158.84	144.61	475.00	200.00	221.55	716.70	575.51	1.931	
37	157.26	144.09	475.53	200.00	217.15	736.99	595.92	1.932	
38	161.47	145.49	475.00	200.00	230.07	679.88	538.78	1.932	
39	159.37	144.79	475.53	200.00	223.83	708.46	567.35	1.932	
40	157.79	144.26	476.05	200.00	219.44	728.78	587.76	1.932	
41	156.74	144.00	476.05	200.00	216.61	741.01	600.00	1.932	
42	159.89	144.96	476.05	200.00	226.11	700.21	559.18	1.933	
43	160.95	145.32	475.00	200.00	228.22	688.10	546.94	1.933	
44	157.26	144.09	476.05	200.00	217.58	736.95	595.92	1.933	
45	158.84	144.61	475.00	200.00	223.02	708.32	567.35	1.933	
46	161.47	145.49	475.53	200.00	230.49	679.83	538.78	1.933	
47	156.74	144.00	476.58	200.00	217.04	740.96	600.00	1.933	
48	158.32	144.44	475.00	200.00	219.70	724.88	583.67	1.933	
49	159.37	144.79	476.05	200.00	224.26	708.41	567.35	1.934	
50	157.26	144.09	476.58	200.00	218.01	736.90	595.92	1.934	
51	160.42	145.14	475.00	200.00	226.38	696.31	555.10	1.934	
52	161.47	145.49	476.05	200.00	230.91	679.77	538.78	1.934	
53	158.32	144.44	475.53	200.00	220.13	724.83	583.67	1.935	
54	159.37	144.79	475.00	200.00	223.41	708.51	567.35	1.935	
55	158.84	144.61	475.53	200.00	221.98	716.65	575.51	1.935	
56	157.79	144.26	475.00	200.00	217.84	733.05	591.84	1.935	
57	160.95	145.32	475.53	200.00	228.64	688.05	546.94	1.935	
58	158.32	144.44	476.05	200.00	220.56	724.78	583.67	1.936	
59	160.42	145.14	475.53	200.00	226.80	696.26	555.10	1.936	
60	159.37	144.79	476.58	200.00	224.69	708.36	567.35	1.936	
61	157.79	144.26	476.58	200.00	219.87	728.73	587.76	1.936	
62	157.79	144.26	475.53	200.00	218.27	733.00	591.84	1.936	
63	158.84	144.61	476.58	200.00	222.84	716.55	575.51	1.937	
64	159.37	144.79	475.00	200.00	222.67	712.70	571.43	1.937	

65	160.95	145.32	476.05	200.00	229.07	688.00	546.94	1.937
66	162.00	145.67	475.00	200.00	231.18	675.87	534.69	1.937
67	159.89	144.96	475.53	200.00	224.95	704.46	563.27	1.937
68	157.26	144.09	475.00	200.00	215.98	741.21	600.00	1.937
69	157.79	144.26	476.05	200.00	218.70	732.96	591.84	1.938
70	160.95	145.32	476.58	200.00	229.49	687.94	546.94	1.938
71	162.00	145.67	475.53	200.00	231.60	675.81	534.69	1.938
72	160.42	145.14	476.05	200.00	227.22	696.21	555.10	1.938
73	157.26	144.09	475.53	200.00	216.41	741.17	600.00	1.938
74	157.79	144.26	476.58	200.00	219.14	732.91	591.84	1.939
75	158.84	144.61	475.00	200.00	220.82	720.88	579.59	1.939
76	159.89	144.96	476.05	200.00	225.38	704.41	563.27	1.939
77	161.47	145.49	475.00	200.00	229.34	684.09	542.86	1.939
78	159.89	144.96	475.00	200.00	224.53	704.51	563.27	1.939
79	158.84	144.61	477.11	200.00	223.27	716.51	575.51	1.939
80	162.00	145.67	476.05	200.00	232.02	675.76	534.69	1.939
81	158.32	144.44	477.11	200.00	221.42	724.69	583.67	1.939
82	159.37	144.79	475.53	200.00	223.10	712.65	571.43	1.939
83	158.84	144.61	476.05	200.00	222.41	716.60	575.51	1.939
84	160.95	145.32	475.00	200.00	227.49	692.30	551.02	1.940
85	157.26	144.09	476.05	200.00	216.85	741.12	600.00	1.940
86	162.00	145.67	476.58	200.00	232.44	675.70	534.69	1.940
87	158.84	144.61	475.53	200.00	221.25	720.84	579.59	1.940
88	160.42	145.14	476.58	200.00	227.65	696.16	555.10	1.940
89	158.32	144.44	476.58	200.00	220.99	724.74	583.67	1.940
90	161.47	145.49	475.53	200.00	229.76	684.04	542.86	1.940
91	158.32	144.44	475.00	200.00	218.96	729.06	587.76	1.940
92	158.84	144.61	476.05	200.00	221.68	720.79	579.59	1.941
93	157.79	144.26	477.11	200.00	219.57	732.87	591.84	1.941
94	157.26	144.09	476.58	200.00	217.28	741.08	600.00	1.941
95	160.42	145.14	477.11	200.00	228.07	696.10	555.10	1.941
96	159.89	144.96	476.58	200.00	225.80	704.36	563.27	1.941
97	159.37	144.79	476.58	200.00	223.96	712.56	571.43	1.941
98	158.32	144.44	475.53	200.00	219.40	729.01	587.76	1.942
99	161.47	145.49	476.05	200.00	230.18	683.98	542.86	1.942

Critical Failure Surface (circle 1)

Intersects:	XL:	156.21	YL:	144.00	XR:	475.00	YR:	200.00	
Centre:	XC:	216.38	YC:	736.87		Radius:	R:	595.92	
Generated failure surface: (20 points)									
156.21	144.00		173.40	142.51		190.62	141.51	207.86	141.02
225.12	141.02								
242.36	141.52		259.58	142.52		276.77	144.02	293.90	146.02
310.97	148.51								
327.97	151.50		344.86	154.97		361.65	158.93	378.32	163.38
394.85	168.31								
411.24	173.71		427.46	179.59		443.50	185.93	459.35	192.74
475.00	200.00								

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	156.21	13.25	-5.0	8.59	8.63	3	100.00	18.0	1768.38	830.18
212.01	1.02									
2	164.80	44.29	-5.0	8.59	8.63	3	100.00	18.0	5897.66	2773.84
696.33	1.02									
3	173.40	74.43	-3.3	8.61	8.63	3	100.00	18.0	9899.93	4651.99
1158.71	1.01									
4	182.01	103.43	-3.3	8.61	8.63	3	100.00	18.0	13742.18	6464.80
1607.22	1.01									
5	190.62	131.54	-1.6	8.62	8.63	3	100.00	18.0	17456.78	8211.40
2031.40	1.01									
6	199.24	158.46	-1.6	8.62	8.63	3	100.00	18.0	21004.52	9891.83
2443.93	1.01									
7	207.86	184.38	0.0	8.63	8.63	3	100.00	18.0	24411.25	11505.37
2830.01	1.00									
8	216.49	209.17	0.0	8.63	8.63	3	100.00	18.0	27658.23	13052.09
3206.43	1.00									
9	225.12	232.77	1.7	8.62	8.63	3	100.00	18.0	30739.59	14531.27
3554.50	1.00									
10	233.74	255.39	1.7	8.62	8.63	3	100.00	18.0	33680.15	15942.88
3894.69	1.00									
11	242.36	276.56	3.3	8.61	8.63	3	100.00	18.0	36421.06	17286.43
4204.85	0.99									
12	250.97	296.96	3.3	8.61	8.63	3	100.00	18.0	39050.95	18561.84
4508.72	0.99									
13	259.58	310.67	5.0	8.46	8.49	3	100.00	18.0	40790.96	19459.21
4779.06	0.99									
14	268.04	328.29	5.0	8.46	8.49	3	100.00	18.0	43036.71	20562.89

5042.50	0.99									
15	276.51	253.12	6.6	6.25	6.29	2	0.00	35.0	33158.87	15899.38
5196.03	0.97									
16	282.75	261.58	6.6	6.25	6.29	2	0.00	35.0	34267.22	16433.13
5368.53	0.97									
17	289.00	211.26	6.6	4.90	4.94	2	0.00	35.0	27675.11	13271.83
5523.50	0.97									
18	293.90	379.09	8.3	8.54	8.63	2	0.00	35.0	49660.75	23905.87
5664.37	0.96									
19	302.44	392.74	8.3	8.54	8.63	2	0.00	35.0	51449.06	24766.72
5868.32	0.96									
20	310.97	237.28	10.0	5.03	5.10	2	0.00	35.0	31083.43	15032.86
5989.54	0.95									
21	316.00	434.84	10.0	9.00	9.14	2	0.00	35.0	56964.05	26694.20
6124.19	0.95									
22	325.00	144.59	10.0	2.97	3.01	2	0.00	35.0	18941.87	8597.27
6175.53	0.95									
23	327.97	402.47	11.6	8.45	8.63	2	0.00	35.0	52723.57	24025.04
5999.21	0.95									
24	336.41	387.79	11.6	8.45	8.63	2	0.00	35.0	50800.43	23089.80
5779.89	0.95									
25	344.86	162.20	13.3	3.64	3.74	2	0.00	35.0	21248.59	9700.06
5585.26	0.95									
26	348.50	131.45	13.3	3.00	3.08	5	0.00	45.0	14459.39	5254.13
4478.81	0.92									
27	351.50	429.11	13.3	10.15	10.43	2	0.00	35.0	56213.75	7983.46
5158.50	0.95									
28	361.65	332.98	14.9	8.33	8.63	2	0.00	35.0	43620.46	5357.63
4824.99	0.94									
29	369.99	314.45	14.9	8.33	8.63	2	0.00	35.0	41192.73	4160.77
4547.22	0.94									
30	378.32	292.51	16.6	8.27	8.63	2	0.00	35.0	38319.34	2899.23
4214.14	0.94									
31	386.59	272.15	16.6	8.27	8.63	2	0.00	35.0	35651.13	1573.01
3907.93	0.94									
32	394.85	158.07	18.3	5.12	5.40	2	0.00	35.0	20706.75	284.61
3612.54	0.94									
33	399.98	163.65	18.3	5.63	5.93	2	0.00	35.0	21438.10	0.00
3399.47	0.94									
34	405.61	153.20	18.3	5.63	5.93	2	0.00	35.0	20068.81	0.00
3182.32	0.94									
35	411.24	201.26	19.9	8.11	8.63	2	0.00	35.0	26365.19	0.00
2871.66	0.94									
36	419.35	177.43	19.9	8.11	8.63	2	0.00	35.0	23243.59	0.00
2531.67	0.94									
37	427.46	150.99	21.6	8.02	8.63	2	0.00	35.0	19780.02	0.00
2155.18	0.94									
38	435.48	125.55	21.6	8.02	8.63	2	0.00	35.0	16447.14	0.00
1792.04	0.94									
39	443.50	62.73	23.2	4.81	5.24	2	0.00	35.0	8217.30	0.00
1476.26	0.94									
40	448.31	59.70	23.2	5.52	6.01	1	150.00	22.0	7820.36	0.00
1268.68	1.00									
41	453.83	46.62	23.2	5.52	6.01	1	150.00	22.0	6106.97	0.00
983.99	1.00									
42	459.35	42.61	24.9	7.82	8.63	1	150.00	22.0	5581.69	0.00
616.92	1.00									
43	467.18	14.20	24.9	7.82	8.63	1	150.00	22.0	1860.56	0.00
183.63	1.00									

X-S Area: 9015.20

Path Length: 327.78

X-S Weight: 1180624.75

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 13:05:39

DATA: Analysis 1 - Case 7-2 Full Reservoir

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 198.00 348.50 198.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 144.00 348.50 144.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 141.00 348.50 141.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 198.00 450.00 198.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 144.00 450.00 144.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 141.00 450.00 141.00

Slope Surface (8 points)

100.00	144.00	157.00	144.00	325.00	200.00	405.00	200.00
410.00	195.00						
415.00	195.00	420.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	197.00	157.00	197.00	316.00	197.00	348.50	197.00
351.50	172.00						
450.00	172.00						

Failure Surface

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

Intersects: XL:	157.00	YL:	144.00	XR:	410.00	YR:	195.00
Centre: XC:	241.19	YC:	379.40	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

RESULTS: Analysis 1 - Case 7-2 Full Reservoir

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.807

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.23

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	159.37	144.79	405.00	200.00	210.57	491.02	350.00	2.229	<--
Critical Surface									
2	159.89	144.96	405.00	200.00	211.84	486.96	345.92	2.230	
3	160.42	145.14	405.00	200.00	213.10	482.89	341.84	2.232	
4	160.95	145.32	405.00	200.00	214.37	478.82	337.76	2.233	
5	161.47	145.49	405.00	200.00	215.64	474.74	333.67	2.234	
6	162.00	145.67	405.00	200.00	216.91	470.65	329.59	2.234	
7	159.89	144.96	405.00	200.00	210.88	491.23	350.00	2.242	
8	160.95	145.32	405.00	200.00	213.41	483.10	341.84	2.243	
9	161.47	145.49	405.00	200.00	214.68	479.03	337.76	2.244	
10	162.00	145.67	405.00	200.00	215.95	474.95	333.67	2.245	
11	160.42	145.14	405.00	200.00	212.15	487.17	345.92	2.247	
12	159.89	144.96	405.53	199.47	211.95	491.07	350.00	2.248	
13	160.42	145.14	405.53	199.47	213.21	487.01	345.92	2.249	
14	160.95	145.32	405.53	199.47	214.47	482.94	341.84	2.250	
15	161.47	145.49	405.53	199.47	215.73	478.86	337.76	2.251	
16	162.00	145.67	405.53	199.47	216.99	474.78	333.67	2.252	
17	160.42	145.14	405.00	200.00	211.19	491.44	350.00	2.252	
18	160.95	145.32	405.00	200.00	212.46	487.38	345.92	2.253	
19	161.47	145.49	405.00	200.00	213.72	483.31	341.84	2.254	
20	162.00	145.67	405.00	200.00	214.99	479.24	337.76	2.258	
21	160.95	145.32	405.53	199.47	213.53	487.22	345.92	2.261	
22	161.47	145.49	405.53	199.47	214.78	483.15	341.84	2.262	
23	162.00	145.67	405.53	199.47	216.04	479.07	337.76	2.263	
24	160.42	145.14	405.53	199.47	212.27	491.28	350.00	2.265	
25	160.95	145.32	405.00	200.00	211.50	491.65	350.00	2.266	
26	160.42	145.14	406.05	198.95	213.34	491.12	350.00	2.268	
27	161.47	145.49	405.00	200.00	212.77	487.59	345.92	2.268	
28	160.95	145.32	406.05	198.95	214.59	487.05	345.92	2.269	
29	162.00	145.67	405.00	200.00	214.03	483.52	341.84	2.269	
30	161.47	145.49	406.05	198.95	215.84	482.98	341.84	2.270	
31	162.00	145.67	406.05	198.95	217.09	478.90	337.76	2.271	
32	160.95	145.32	405.53	199.47	212.58	491.49	350.00	2.271	
33	161.47	145.49	405.53	199.47	213.84	487.42	345.92	2.272	
34	162.00	145.67	405.53	199.47	215.10	483.35	341.84	2.276	
35	160.95	145.32	406.05	198.95	213.66	491.32	350.00	2.279	
36	161.47	145.49	405.00	200.00	211.81	491.85	350.00	2.280	
37	161.47	145.49	406.05	198.95	214.91	487.26	345.92	2.281	
38	162.00	145.67	406.05	198.95	216.16	483.19	341.84	2.282	
39	162.00	145.67	405.00	200.00	213.08	487.79	345.92	2.282	
40	161.47	145.49	405.53	199.47	212.89	491.69	350.00	2.286	
41	160.95	145.32	406.58	198.42	214.73	491.16	350.00	2.287	
42	162.00	145.67	405.53	199.47	214.15	487.63	345.92	2.287	
43	161.47	145.49	406.58	198.42	215.97	487.09	345.92	2.288	
44	162.00	145.67	406.58	198.42	217.21	483.01	341.84	2.290	
45	161.47	145.49	406.05	198.95	213.97	491.53	350.00	2.291	
46	162.00	145.67	405.00	200.00	212.12	492.06	350.00	2.295	
47	162.00	145.67	406.05	198.95	215.22	487.47	345.92	2.295	
48	160.95	145.32	407.11	197.89	215.81	490.99	350.00	2.297	
49	161.47	145.49	407.11	197.89	217.04	486.92	345.92	2.297	
50	162.00	145.67	407.11	197.89	218.27	482.84	341.84	2.298	
51	161.47	145.49	406.58	198.42	215.05	491.37	350.00	2.299	
52	162.00	145.67	405.53	199.47	213.21	491.90	350.00	2.301	
53	162.00	145.67	406.58	198.42	216.29	487.30	345.92	2.301	
54	162.00	145.67	406.05	198.95	214.29	491.74	350.00	2.306	
55	161.47	145.49	407.11	197.89	216.13	491.20	350.00	2.309	
56	162.00	145.67	407.11	197.89	217.36	487.13	345.92	2.310	
57	162.00	145.67	406.58	198.42	215.37	491.57	350.00	2.314	
58	162.00	145.67	406.58	198.42	218.14	478.72	337.76	2.320	
59	161.47	145.49	407.63	197.37	217.20	491.03	350.00	2.321	
60	162.00	145.67	407.11	197.89	216.45	491.41	350.00	2.321	
61	162.00	145.67	407.63	197.37	218.42	486.95	345.92	2.322	
62	161.47	145.49	406.58	198.42	216.90	482.80	341.84	2.325	

63	162.00	145.67	407.63	197.37	217.52	491.24	350.00	2.334
64	160.95	145.32	406.58	198.42	215.66	486.88	345.92	2.338
65	162.00	145.67	408.16	196.84	218.59	491.06	350.00	2.342
66	160.42	145.14	406.58	198.42	214.42	490.95	350.00	2.357
67	161.47	145.49	406.05	198.95	216.78	478.69	337.76	2.367
68	160.95	145.32	406.05	198.95	215.53	482.77	341.84	2.371
69	162.00	145.67	406.05	198.95	218.03	474.60	333.67	2.372
70	160.42	145.14	406.05	198.95	214.28	486.84	345.92	2.385
71	159.89	144.96	406.05	198.95	213.03	490.91	350.00	2.408
72	160.95	145.32	405.53	199.47	215.42	478.65	337.76	2.410
73	161.47	145.49	405.53	199.47	216.68	474.57	333.67	2.414
74	160.42	145.14	405.53	199.47	214.16	482.73	341.84	2.417
75	162.00	145.67	405.53	199.47	217.94	470.48	329.59	2.431
76	159.89	144.96	405.53	199.47	212.90	486.80	345.92	2.437
77	160.95	145.32	405.00	200.00	215.33	474.53	333.67	2.455
78	160.42	145.14	405.00	200.00	214.07	478.61	337.76	2.457
79	161.47	145.49	405.00	200.00	216.60	470.44	329.59	2.468
80	159.37	144.79	405.53	199.47	211.64	490.86	350.00	2.470
81	159.89	144.96	405.00	200.00	212.80	482.68	341.84	2.472
82	162.00	145.67	405.00	200.00	217.87	466.35	325.51	2.498
83	159.37	144.79	405.00	200.00	211.53	486.75	345.92	2.504
84	158.84	144.61	405.00	200.00	210.26	490.82	350.00	2.542
85	162.00	145.67	408.68	196.32	219.66	490.88	350.00	2.569
86	161.47	145.49	408.16	196.84	218.27	490.85	350.00	2.593
87	162.00	145.67	407.63	197.37	219.32	482.66	341.84	2.602
88	162.00	145.67	408.16	196.84	219.48	486.78	345.92	2.604
89	161.47	145.49	407.11	197.89	217.95	482.63	341.84	2.610
90	160.95	145.32	407.63	197.37	216.88	490.82	350.00	2.614
91	161.47	145.49	407.63	197.37	218.10	486.74	345.92	2.615
92	162.00	145.67	407.11	197.89	219.19	478.55	337.76	2.619
93	160.95	145.32	407.11	197.89	216.72	486.71	345.92	2.627
94	162.00	145.67	406.58	198.42	219.07	474.42	333.67	2.627
95	160.95	145.32	406.58	198.42	216.58	482.59	341.84	2.628
96	161.47	145.49	406.58	198.42	217.83	478.51	337.76	2.630
97	160.42	145.14	407.11	197.89	215.49	490.78	350.00	2.642
98	162.00	145.67	406.05	198.95	218.97	470.30	329.59	2.644
99	161.47	145.49	406.05	198.95	217.72	474.39	333.67	2.645

Critical Failure Surface (circle 1)

Intersects:	XL:	159.37	YL:	144.79	XR:	405.00	YR:	200.00	
Centre:	XC:	210.57	YC:	491.02			Radius:	R:	350.00
Generated failure surface: (20 points)									
	159.37	144.79	172.81	143.07	186.31	141.87	199.85	141.19	
213.40	141.04								
	226.95	141.41	240.47	142.30	253.95	143.72	267.37	145.66	
280.69	148.12								
	293.92	151.09	307.02	154.58	319.97	158.56	332.76	163.05	
345.37	168.02								
	357.77	173.49	369.95	179.42	381.90	185.83	393.59	192.69	
405.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left Factor									
1	159.37	8.76	-7.3	6.16	6.21	2	0.00	35.0	1147.37	20389.60
3384.18	1.05									
2	165.53	32.94	-7.3	7.28	7.34	3	100.00	18.0	4349.41	24495.27
3663.15	1.03									
3	172.81	51.50	-5.1	6.75	6.78	3	100.00	18.0	6829.25	22933.39
3930.93	1.02									
4	179.56	70.74	-5.1	6.75	6.78	3	100.00	18.0	9390.27	23187.28
4172.58	1.02									
5	186.31	89.35	-2.9	6.77	6.78	3	100.00	18.0	11861.27	23385.83
4388.70	1.01									
6	193.08	106.92	-2.9	6.77	6.78	3	100.00	18.0	14184.71	23529.01
4592.54	1.01									
7	199.85	123.75	-0.6	6.78	6.78	3	100.00	18.0	16403.68	23616.76
4768.85	1.00									
8	206.62	139.57	-0.6	6.78	6.78	3	100.00	18.0	18481.68	23649.04
4934.83	1.00									
9	213.40	154.45	1.6	6.77	6.78	3	100.00	18.0	20427.79	23626.06
5071.56	1.00									
10	220.18	168.49	1.6	6.77	6.78	3	100.00	18.0	22253.95	23547.42
5199.66	1.00									
11	226.95	181.29	3.8	6.76	6.78	3	100.00	18.0	23909.35	23413.04
5297.07	0.99									
12	233.71	193.50	3.8	6.76	6.78	3	100.00	18.0	25478.51	23223.45
5387.35	0.99									
13	240.47	204.12	6.0	6.74	6.78	3	100.00	18.0	26830.46	22978.62

5445.73	0.99									
14	247.21	214.48	6.0	6.74	6.78	3	100.00	18.0	28139.44	22678.56
5498.28	0.99									
15	253.95	62.50	8.2	1.91	1.93	3	100.00	18.0	8189.62	6388.83
5512.61	0.99									
16	255.86	192.72	8.2	5.75	5.81	2	0.00	35.0	25245.70	19074.78
5479.19	0.97									
17	261.61	198.96	8.2	5.75	5.81	2	0.00	35.0	26063.94	18772.91
5498.50	0.97									
18	267.37	237.39	10.4	6.66	6.78	2	0.00	35.0	31097.52	21448.21
5474.76	0.96									
19	274.03	244.00	10.4	6.66	6.78	2	0.00	35.0	31963.93	20928.50
5462.43	0.96									
20	280.69	247.73	12.7	6.61	6.78	2	0.00	35.0	32452.37	20354.44
5404.40	0.96									
21	287.31	252.47	12.7	6.61	6.78	2	0.00	35.0	33074.09	19726.01
5357.66	0.96									
22	293.92	253.89	14.9	6.55	6.78	2	0.00	35.0	33258.99	19043.69
5264.56	0.95									
23	300.47	256.78	14.9	6.55	6.78	2	0.00	35.0	33638.28	18307.49
5183.92	0.95									
24	307.02	177.37	17.1	4.49	4.70	2	0.00	35.0	23235.19	12238.67
5074.08	0.95									
25	311.51	177.88	17.1	4.49	4.70	2	0.00	35.0	23302.82	11833.27
4995.01	0.95									
26	316.00	119.09	17.1	3.00	3.14	2	0.00	35.0	15600.95	7677.30
4957.53	0.95									
27	319.00	238.35	19.0	6.00	6.34	2	0.00	35.0	31223.91	14935.39
4926.26	0.95									
28	325.00	297.30	19.3	7.76	8.22	2	0.00	35.0	38946.07	18119.63
4739.58	0.95									
29	332.76	225.08	21.5	6.30	6.78	2	0.00	35.0	29484.93	13830.97
4386.81	0.96									
30	339.06	209.39	21.5	6.30	6.78	2	0.00	35.0	27430.15	12778.70
4079.66	0.96									
31	345.37	98.04	23.8	3.13	3.42	2	0.00	35.0	12842.67	6043.11
3814.89	0.96									
32	348.50	89.81	23.8	3.00	3.28	5	0.00	45.0	9878.57	2952.55
2898.33	0.91									
33	351.50	82.91	23.8	2.90	3.16	2	0.00	35.0	10861.32	125.81
3300.54	0.96									
34	354.40	92.01	23.8	3.38	3.69	2	0.00	35.0	12053.04	0.00
3136.85	0.96									
35	357.77	152.48	26.0	6.09	6.78	2	0.00	35.0	19974.48	0.00
2843.58	0.96									
36	363.86	134.39	26.0	6.09	6.78	2	0.00	35.0	17605.41	0.00
2506.31	0.96									
37	369.95	113.33	28.2	5.97	6.78	2	0.00	35.0	14845.75	0.00
2127.44	0.97									
38	375.93	94.20	28.2	5.97	6.78	2	0.00	35.0	12340.33	0.00
1768.41	0.97									
39	381.90	72.79	30.4	5.84	6.78	2	0.00	35.0	9535.82	0.00
1377.68	0.98									
40	387.74	52.74	30.4	5.84	6.78	2	0.00	35.0	6909.08	0.00
998.19	0.98									
41	393.59	24.80	32.6	4.15	4.92	2	0.00	35.0	3248.36	0.00
652.41	0.99									
42	397.73	13.79	32.6	4.15	4.92	2	0.00	35.0	1806.82	0.00
362.88	0.99									
43	401.88	3.12	32.6	3.12	3.71	1	150.00	22.0	409.09	0.00
78.76	1.06									

X-S Area:

6155.14

Path Length:

257.51

X-S Weight:

806206.38

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 7-2\West Farm Expansion Case 7-2 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 13:05:12

DATA: Analysis 1 - Case 7-2 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 198.00 348.50 198.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 144.00 348.50 144.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 141.00 348.50 141.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 198.00 450.00 198.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 144.00 450.00 144.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 141.00 450.00 141.00

Slope Surface (8 points)

100.00	144.00	157.00	144.00	325.00	200.00	405.00	200.00
410.00	195.00						
415.00	195.00	420.00	200.00	450.00	200.00		

Phreatic Surface (6 points)

100.00	144.00	157.00	144.00	316.00	197.00	348.50	197.00
351.50	172.00						
450.00	172.00						

Failure Surface

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

Intersects: XL:	157.00	YL:	144.00	XR:	410.00	YR:	195.00
Centre: XC:	241.19	YC:	379.40	Radius: R:	250.00		

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

- - - - -

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RESULTS: Analysis 1 - Case 7-2 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.324

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 <--
1 159.37 144.79 405.00 200.00 210.57 491.02 350.00 1.316
Critical Surface
2 159.89 144.96 405.00 200.00 211.84 486.96 345.92 1.317
3 160.42 145.14 405.00 200.00 213.10 482.89 341.84 1.318
4 160.95 145.32 405.00 200.00 214.37 478.82 337.76 1.319
5 161.47 145.49 405.00 200.00 215.64 474.74 333.67 1.320
6 162.00 145.67 405.00 200.00 216.91 470.65 329.59 1.320
7 159.89 144.96 405.00 200.00 210.88 491.23 350.00 1.325
8 160.95 145.32 405.00 200.00 213.41 483.10 341.84 1.326
9 161.47 145.49 405.00 200.00 214.68 479.03 337.76 1.327
10 162.00 145.67 405.00 200.00 215.95 474.95 333.67 1.328
11 160.42 145.14 405.00 200.00 212.15 487.17 345.92 1.328
12 159.89 144.96 405.53 199.47 211.95 491.07 350.00 1.330
13 160.42 145.14 405.53 199.47 213.21 487.01 345.92 1.331
14 160.95 145.32 405.53 199.47 214.47 482.94 341.84 1.332
15 160.42 145.14 405.00 200.00 211.19 491.44 350.00 1.332
16 161.47 145.49 405.53 199.47 215.73 478.86 337.76 1.332
17 160.95 145.32 405.00 200.00 212.46 487.38 345.92 1.333
18 162.00 145.67 405.53 199.47 216.99 474.78 333.67 1.333
19 161.47 145.49 405.00 200.00 213.72 483.31 341.84 1.333
20 162.00 145.67 405.00 200.00 214.99 479.24 337.76 1.336
21 160.95 145.32 405.53 199.47 213.53 487.22 345.92 1.338
22 161.47 145.49 405.53 199.47 214.78 483.15 341.84 1.339
23 162.00 145.67 405.53 199.47 216.04 479.07 337.76 1.341
24 160.42 145.14 405.53 199.47 212.27 491.28 350.00 1.342
25 160.95 145.32 405.00 200.00 211.50 491.65 350.00 1.341
26 161.47 145.49 405.00 200.00 212.77 487.59 345.92 1.342
27 160.42 145.14 406.05 198.95 213.34 491.12 350.00 1.343
28 162.00 145.67 405.00 200.00 214.03 483.52 341.84 1.344
29 160.95 145.32 406.05 198.95 214.59 487.05 345.92 1.344
30 161.47 145.49 406.05 198.95 215.84 482.98 341.84 1.345
31 160.95 145.32 405.53 199.47 212.58 491.49 350.00 1.345
32 162.00 145.67 406.05 198.95 217.09 478.90 337.76 1.346
33 161.47 145.49 405.53 199.47 213.84 487.42 345.92 1.346
34 162.00 145.67 405.53 199.47 215.10 483.35 341.84 1.349
35 161.47 145.49 405.00 200.00 211.81 491.85 350.00 1.351
36 160.95 145.32 406.05 198.95 213.66 491.32 350.00 1.351
37 162.00 145.67 405.00 200.00 213.08 487.79 345.92 1.352
38 161.47 145.49 406.05 198.95 214.91 487.26 345.92 1.352
39 162.00 145.67 406.05 198.95 216.16 483.19 341.84 1.354
40 161.47 145.49 405.53 199.47 212.89 491.69 350.00 1.355
41 162.00 145.67 405.53 199.47 214.15 487.63 345.92 1.356
42 160.95 145.32 406.58 198.42 214.73 491.16 350.00 1.357
43 161.47 145.49 406.58 198.42 215.97 487.09 345.92 1.358
44 162.00 145.67 406.58 198.42 217.21 483.01 341.84 1.359
45 161.47 145.49 406.05 198.95 213.97 491.53 350.00 1.359
46 162.00 145.67 405.00 200.00 212.12 492.06 350.00 1.360
47 162.00 145.67 406.05 198.95 215.22 487.47 345.92 1.362
48 160.95 145.32 407.11 197.89 215.81 490.99 350.00 1.363
49 161.47 145.49 407.11 197.89 217.04 486.92 345.92 1.364
50 162.00 145.67 407.11 197.89 218.27 482.84 341.84 1.365
51 161.47 145.49 406.58 198.42 215.05 491.37 350.00 1.365
52 162.00 145.67 405.53 199.47 213.21 491.90 350.00 1.365
53 162.00 145.67 406.58 198.42 216.29 487.30 345.92 1.366
54 162.00 145.67 406.05 198.95 214.29 491.74 350.00 1.370
55 161.47 145.49 407.11 197.89 216.13 491.20 350.00 1.372
56 162.00 145.67 407.11 197.89 217.36 487.13 345.92 1.373
57 162.00 145.67 406.58 198.42 215.37 491.57 350.00 1.375
58 161.47 145.49 407.63 197.37 217.20 491.03 350.00 1.378
59 162.00 145.67 406.58 198.42 218.14 478.72 337.76 1.378
60 162.00 145.67 407.63 197.37 218.42 486.95 345.92 1.379
61 162.00 145.67 407.11 197.89 216.45 491.41 350.00 1.380
62 161.47 145.49 406.58 198.42 216.90 482.80 341.84 1.382

63	162.00	145.67	407.63	197.37	217.52	491.24	350.00	1.387
64	160.95	145.32	406.58	198.42	215.66	486.88	345.92	1.390
65	162.00	145.67	408.16	196.84	218.59	491.06	350.00	1.393
66	160.42	145.14	406.58	198.42	214.42	490.95	350.00	1.402
67	161.47	145.49	406.05	198.95	216.78	478.69	337.76	1.409
68	160.95	145.32	406.05	198.95	215.53	482.77	341.84	1.411
69	162.00	145.67	406.05	198.95	218.03	474.60	333.67	1.412
70	160.42	145.14	406.05	198.95	214.28	486.84	345.92	1.420
71	159.89	144.96	406.05	198.95	213.03	490.91	350.00	1.435
72	160.95	145.32	405.53	199.47	215.42	478.65	337.76	1.436
73	161.47	145.49	405.53	199.47	216.68	474.57	333.67	1.439
74	160.42	145.14	405.53	199.47	214.16	482.73	341.84	1.441
75	162.00	145.67	405.53	199.47	217.94	470.48	329.59	1.450
76	159.89	144.96	405.53	199.47	212.90	486.80	345.92	1.453
77	160.95	145.32	405.00	200.00	215.33	474.53	333.67	1.464
78	160.42	145.14	405.00	200.00	214.07	478.61	337.76	1.465
79	161.47	145.49	405.00	200.00	216.60	470.44	329.59	1.473
80	159.37	144.79	405.53	199.47	211.64	490.86	350.00	1.475
81	159.89	144.96	405.00	200.00	212.80	482.68	341.84	1.475
82	162.00	145.67	405.00	200.00	217.87	466.35	325.51	1.492
83	159.37	144.79	405.00	200.00	211.53	486.75	345.92	1.495
84	158.84	144.61	405.00	200.00	210.26	490.82	350.00	1.520
85	162.00	145.67	408.68	196.32	219.66	490.88	350.00	1.541
86	161.47	145.49	408.16	196.84	218.27	490.85	350.00	1.556
87	162.00	145.67	407.63	197.37	219.32	482.66	341.84	1.562
88	162.00	145.67	408.16	196.84	219.48	486.78	345.92	1.564
89	161.47	145.49	407.11	197.89	217.95	482.63	341.84	1.568
90	161.47	145.49	407.63	197.37	218.10	486.74	345.92	1.570
91	160.95	145.32	407.63	197.37	216.88	490.82	350.00	1.570
92	162.00	145.67	407.11	197.89	219.19	478.55	337.76	1.572
93	160.95	145.32	407.11	197.89	216.72	486.71	345.92	1.579
94	162.00	145.67	406.58	198.42	219.07	474.42	333.67	1.579
95	160.95	145.32	406.58	198.42	216.58	482.59	341.84	1.579
96	161.47	145.49	406.58	198.42	217.83	478.51	337.76	1.580
97	160.42	145.14	407.11	197.89	215.49	490.78	350.00	1.588
98	162.00	145.67	406.05	198.95	218.97	470.30	329.59	1.589
99	161.47	145.49	406.05	198.95	217.72	474.39	333.67	1.589

Critical Failure Surface (circle 1)

Intersects:	XL:	159.37	YL:	144.79	XR:	405.00	YR:	200.00	
Centre:	XC:	210.57	YC:	491.02			Radius:	R:	350.00
Generated failure surface: (20 points)									
	159.37	144.79	172.81	143.07	186.31	141.87	199.85	141.19	
213.40	141.04								
	226.95	141.41	240.47	142.30	253.95	143.72	267.37	145.66	
280.69	148.12								
	293.92	151.09	307.02	154.58	319.97	158.56	332.76	163.05	
345.37	168.02								
	357.77	173.49	369.95	179.42	381.90	185.83	393.59	192.69	
405.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left Factor									
1	159.37	8.76	-7.3	6.16	6.21	2	0.00	35.0	1147.37	551.00
193.36	1.08									
2	165.53	32.94	-7.3	7.28	7.34	3	100.00	18.0	4349.41	2072.40
617.59	1.04									
3	172.81	51.50	-5.1	6.75	6.78	3	100.00	18.0	6829.25	3226.05
1030.67	1.03									
4	179.56	70.74	-5.1	6.75	6.78	3	100.00	18.0	9390.27	4431.39
1414.61	1.03									
5	186.31	89.35	-2.9	6.77	6.78	3	100.00	18.0	11861.27	5582.66
1767.96	1.01									
6	193.08	106.92	-2.9	6.77	6.78	3	100.00	18.0	14184.71	6679.86
2113.51	1.01									
7	199.85	123.75	-0.6	6.78	6.78	3	100.00	18.0	16403.68	7722.18
2425.19	1.00									
8	206.62	139.57	-0.6	6.78	6.78	3	100.00	18.0	18481.68	8709.61
2732.29	1.00									
9	213.40	154.45	1.6	6.77	6.78	3	100.00	18.0	20427.79	9641.49
3002.73	0.99									
10	220.18	168.49	1.6	6.77	6.78	3	100.00	18.0	22253.95	10517.69
3271.35	0.99									
11	226.95	181.29	3.8	6.76	6.78	3	100.00	18.0	23909.35	11337.45
3500.97	0.99									
12	233.71	193.50	3.8	6.76	6.78	3	100.00	18.0	25478.51	12101.01
3731.12	0.99									
13	240.47	204.12	6.0	6.74	6.78	3	100.00	18.0	26830.46	12807.71

3920.35	0.98									
14	247.21	214.48	6.0	6.74	6.78	3	100.00	18.0	28139.44	13457.58
4112.07	0.98									
15	253.95	62.50	8.2	1.91	1.93	3	100.00	18.0	8189.62	3940.34
4206.49	0.98									
16	255.86	192.72	8.2	5.75	5.81	2	0.00	35.0	25245.70	12150.57
4223.78	0.94									
17	261.61	198.96	8.2	5.75	5.81	2	0.00	35.0	26063.94	12544.39
4360.67	0.94									
18	267.37	237.39	10.4	6.66	6.78	2	0.00	35.0	31097.52	15062.64
4447.97	0.93									
19	274.03	244.00	10.4	6.66	6.78	2	0.00	35.0	31963.93	15482.31
4571.90	0.93									
20	280.69	247.73	12.7	6.61	6.78	2	0.00	35.0	32452.37	15843.90
4633.79	0.92									
21	287.31	252.47	12.7	6.61	6.78	2	0.00	35.0	33074.09	16147.44
4722.57	0.92									
22	293.92	253.89	14.9	6.55	6.78	2	0.00	35.0	33258.99	16392.66
4748.83	0.91									
23	300.47	256.78	14.9	6.55	6.78	2	0.00	35.0	33638.28	16579.61
4802.99	0.91									
24	307.02	177.37	17.1	4.49	4.70	2	0.00	35.0	23235.19	11580.01
4791.63	0.90									
25	311.51	177.88	17.1	4.49	4.70	2	0.00	35.0	23302.82	11613.71
4805.58	0.90									
26	316.00	119.09	17.1	3.00	3.14	2	0.00	35.0	15600.95	7677.30
4812.82	0.90									
27	319.00	238.35	19.0	6.00	6.34	2	0.00	35.0	31223.91	14935.39
4763.41	0.89									
28	325.00	297.30	19.3	7.76	8.22	2	0.00	35.0	38946.07	18119.63
4576.29	0.89									
29	332.76	225.08	21.5	6.30	6.78	2	0.00	35.0	29484.93	13830.97
4220.06	0.89									
30	339.06	209.39	21.5	6.30	6.78	2	0.00	35.0	27430.15	12778.70
3923.71	0.89									
31	345.37	98.04	23.8	3.13	3.42	2	0.00	35.0	12842.67	6043.11
3655.58	0.89									
32	348.50	89.81	23.8	3.00	3.28	5	0.00	45.0	9878.57	2952.55
2693.27	0.82									
33	351.50	82.91	23.8	2.90	3.16	2	0.00	35.0	10861.32	125.81
3047.13	0.89									
34	354.40	92.01	23.8	3.38	3.69	2	0.00	35.0	12053.04	0.00
2893.07	0.89									
35	357.77	152.48	26.0	6.09	6.78	2	0.00	35.0	19974.48	0.00
2603.83	0.88									
36	363.86	134.39	26.0	6.09	6.78	2	0.00	35.0	17605.41	0.00
2295.00	0.88									
37	369.95	113.33	28.2	5.97	6.78	2	0.00	35.0	14845.75	0.00
1934.08	0.88									
38	375.93	94.20	28.2	5.97	6.78	2	0.00	35.0	12340.33	0.00
1607.68	0.88									
39	381.90	72.79	30.4	5.84	6.78	2	0.00	35.0	9535.82	0.00
1243.40	0.88									
40	387.74	52.74	30.4	5.84	6.78	2	0.00	35.0	6909.08	0.00
900.90	0.88									
41	393.59	24.80	32.6	4.15	4.92	2	0.00	35.0	3248.36	0.00
584.51	0.89									
42	397.73	13.79	32.6	4.15	4.92	2	0.00	35.0	1806.82	0.00
325.12	0.89									
43	401.88	3.12	32.6	3.12	3.71	1	150.00	22.0	409.09	0.00
48.48	0.99									

X-S Area:

6155.14

Path Length:

257.51

X-S Weight:

806206.38

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-1\West Farm Expansion Case 8-1 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 13:06:53

DATA: Analysis 1 - Case 8-1 Full Reservoir - Pseudostatic

Material Properties (5 materials)

```

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
Cohesion  Phi  UnitWeight  Ru
150.00    22.0    131.00    Auto
Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
Cohesion  Phi  UnitWeight  Ru
0.00      35.0    131.00    Auto
Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
Cohesion  Phi  UnitWeight  Ru
100.00    18.0    141.00    Auto
Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
Cohesion  Phi  UnitWeight  Ru
2000.00   20.0    141.00    Auto
Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
Cohesion  Phi  UnitWeight  Ru
0.00      45.0    110.00    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: 1 - Overburden
100.00    200.00        348.50    200.00
Profile: 2 (2 points)   Material beneath: 2 - Sand and Gravel
100.00    182.00        348.50    182.00
Profile: 3 (2 points)   Material beneath: 3 - Weathered Bedrock
100.00    163.00        348.50    163.00
Profile: 4 (2 points)   Material beneath: 4 - Stable Bedrock
100.00    160.00        348.50    160.00
Profile: 5 (2 points)   Material beneath: 5 - Slurry Wall
348.50    200.00        351.50    200.00
Profile: 6 (2 points)   Material beneath: 1 - Overburden
351.50    200.00        500.00    200.00
Profile: 7 (2 points)   Material beneath: 2 - Sand and Gravel
351.50    182.00        500.00    182.00
Profile: 8 (2 points)   Material beneath: 3 - Weathered Bedrock
351.50    163.00        500.00    163.00
Profile: 9 (2 points)   Material beneath: 4 - Stable Bedrock
348.50    160.00        500.00    160.00
  
```

Slope Surface (4 points)

100.00	163.00	214.00	163.00	325.00	200.00	500.00	200.00

Phreatic Surface (6 points)

100.00	197.00	214.00	197.00	316.00	197.00	348.50	197.00
351.50	172.00						
500.00	172.00						

Failure Surface

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

Intersects: XL:	214.00	YL:	163.00	XR:	475.00	YR:	200.00
Centre: XC:	276.80	YC:	659.04	Radius: R:			500.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 8-1 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.870

Analysis Summary

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

Critical (minimum) Factor of Safety: 3.55

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	213.21	163.00	470.00	200.00	268.83	686.58	526.53	3.548	
Critical Surface									
2	212.68	163.00	470.00	200.00	268.72	686.54	526.53	3.549	
3	213.74	163.00	470.00	200.00	269.54	682.46	522.45	3.554	
4	212.68	163.00	470.53	200.00	268.54	690.66	530.61	3.555	
5	212.16	163.00	470.53	200.00	268.43	690.62	530.61	3.556	
6	211.63	163.00	470.00	200.00	267.91	690.62	530.61	3.558	
7	210.58	163.00	470.00	200.00	267.09	694.70	534.69	3.558	
8	209.53	163.00	470.00	200.00	266.28	698.78	538.78	3.558	
9	214.26	163.09	470.00	200.00	270.42	678.40	518.37	3.559	
10	213.21	163.00	470.00	200.00	268.23	690.75	530.61	3.559	
11	213.21	163.00	470.53	200.00	269.25	686.54	526.53	3.561	
12	214.79	163.26	470.00	200.00	272.06	670.24	510.20	3.561	
13	212.16	163.00	471.05	200.00	268.26	694.74	534.69	3.562	
14	215.32	163.44	470.00	200.00	273.70	662.07	502.04	3.563	
15	212.68	163.00	470.00	200.00	268.12	690.71	530.61	3.563	
16	210.05	163.00	470.00	200.00	266.39	698.82	538.78	3.563	
17	214.26	163.09	470.53	200.00	270.83	678.36	518.37	3.563	
18	209.00	163.00	470.00	200.00	265.59	702.90	542.86	3.564	
19	214.79	163.26	470.53	200.00	272.48	670.20	510.20	3.564	
20	211.63	163.00	471.05	200.00	268.15	694.70	534.69	3.564	
21	215.84	163.61	470.00	200.00	275.34	653.90	493.88	3.564	
22	216.37	163.79	470.00	200.00	276.97	645.71	485.71	3.565	
23	215.32	163.44	470.53	200.00	274.11	662.02	502.04	3.565	
24	211.11	163.00	470.53	200.00	267.62	694.70	534.69	3.565	
25	213.74	163.00	470.53	200.00	269.36	686.58	526.53	3.565	
26	216.89	163.96	470.00	200.00	278.59	637.51	477.55	3.565	
27	210.05	163.00	470.53	200.00	266.81	698.78	538.78	3.565	
28	209.00	163.00	470.53	200.00	266.00	702.86	542.86	3.566	
29	213.74	163.00	470.00	200.00	268.94	686.63	526.53	3.566	
30	212.16	163.00	470.00	200.00	267.42	694.83	534.69	3.566	
31	211.11	163.00	470.00	200.00	266.61	698.91	538.78	3.566	
32	212.68	163.00	470.53	200.00	267.94	694.83	534.69	3.567	
33	210.05	163.00	470.00	200.00	265.80	702.99	542.86	3.567	
34	209.00	163.00	470.00	200.00	264.99	707.06	546.94	3.568	
35	212.68	163.00	471.05	200.00	268.96	690.62	530.61	3.568	
36	213.74	163.00	470.00	200.00	268.33	690.80	530.61	3.568	
37	210.58	163.00	470.53	200.00	266.92	698.82	538.78	3.570	
38	209.53	163.00	470.53	200.00	266.11	702.90	542.86	3.571	
39	213.74	163.00	470.53	200.00	268.75	690.75	530.61	3.571	
40	212.16	163.00	470.53	200.00	267.84	694.79	534.69	3.571	
41	211.11	163.00	471.58	200.00	267.86	698.78	538.78	3.571	
42	213.74	163.00	471.05	200.00	269.77	686.54	526.53	3.572	
43	212.16	163.00	470.53	200.00	267.24	698.95	538.78	3.572	
44	214.79	163.26	470.00	200.00	271.46	674.42	514.29	3.572	
45	213.21	163.00	471.05	200.00	269.07	690.66	530.61	3.572	
46	211.63	163.00	470.00	200.00	267.31	694.79	534.69	3.573	
47	210.58	163.00	471.05	200.00	267.34	698.78	538.78	3.573	
48	212.16	163.00	470.00	200.00	268.01	690.66	530.61	3.573	
49	209.53	163.00	471.05	200.00	266.53	702.86	542.86	3.573	
50	213.21	163.00	470.00	200.00	267.63	694.92	534.69	3.573	
51	210.58	163.00	470.00	200.00	266.50	698.87	538.78	3.573	
52	211.11	163.00	470.00	200.00	267.20	694.74	534.69	3.574	
53	210.58	163.00	470.00	200.00	265.91	703.03	542.86	3.574	
54	211.63	163.00	470.00	200.00	266.71	698.95	538.78	3.574	
55	209.53	163.00	470.00	200.00	265.10	707.11	546.94	3.574	
56	212.68	163.00	470.00	200.00	267.52	694.87	534.69	3.574	
57	211.63	163.00	470.53	200.00	267.13	698.91	538.78	3.574	
58	214.26	163.09	470.53	200.00	270.23	682.53	522.45	3.574	
59	214.26	163.09	470.00	200.00	269.81	682.57	522.45	3.574	
60	215.32	163.44	470.00	200.00	273.10	666.25	506.12	3.574	
61	212.16	163.00	471.05	200.00	267.66	698.91	538.78	3.574	
62	210.58	163.00	470.53	200.00	266.33	702.99	542.86	3.574	
63	209.53	163.00	470.00	200.00	265.69	702.94	542.86	3.574	
64	213.21	163.00	470.53	200.00	268.65	690.71	530.61	3.574	

65	214.79	163.26	470.53	200.00	271.88	674.37	514.29	3.574
66	214.26	163.09	470.00	200.00	269.21	686.74	526.53	3.575
67	209.53	163.00	470.53	200.00	265.52	707.06	546.94	3.575
68	212.16	163.00	471.58	200.00	268.67	694.70	534.69	3.575
69	215.84	163.61	470.00	200.00	274.74	658.08	497.96	3.576
70	213.21	163.00	470.53	200.00	268.05	694.87	534.69	3.576
71	215.32	163.44	470.53	200.00	273.51	666.20	506.12	3.576
72	214.26	163.09	471.05	200.00	270.65	682.48	522.45	3.576
73	214.79	163.26	471.05	200.00	272.29	674.32	514.29	3.577
74	216.37	163.79	470.00	200.00	276.37	649.90	489.80	3.577
75	211.11	163.00	471.05	200.00	267.45	698.82	538.78	3.578
76	215.84	163.61	470.53	200.00	275.15	658.03	497.96	3.578
77	214.26	163.09	470.53	200.00	269.63	686.70	526.53	3.578
78	210.05	163.00	471.05	200.00	266.64	702.90	542.86	3.578
79	211.63	163.00	471.58	200.00	267.97	698.82	538.78	3.578
80	216.89	163.96	470.00	200.00	278.00	641.71	481.63	3.578
81	209.00	163.00	471.05	200.00	265.83	706.98	546.94	3.578
82	215.32	163.44	471.05	200.00	273.93	666.16	506.12	3.578
83	213.21	163.00	471.05	200.00	268.47	694.83	534.69	3.578
84	217.95	164.32	470.00	200.00	281.24	625.30	465.31	3.579
85	217.42	164.14	470.00	200.00	279.62	633.51	473.47	3.579
86	210.58	163.00	472.11	200.00	267.58	702.86	542.86	3.579
87	214.79	163.26	471.58	200.00	272.71	674.28	514.29	3.579
88	216.37	163.79	470.53	200.00	276.78	649.85	489.80	3.579
89	213.21	163.00	471.58	200.00	269.49	690.62	530.61	3.579
90	211.63	163.00	471.05	200.00	267.55	698.87	538.78	3.579
91	211.63	163.00	471.05	200.00	266.96	703.03	542.86	3.579
92	212.68	163.00	471.58	200.00	268.78	694.74	534.69	3.580
93	215.84	163.61	471.05	200.00	275.56	657.98	497.96	3.580
94	216.89	163.96	470.53	200.00	278.40	641.65	481.63	3.580
95	210.05	163.00	471.58	200.00	267.06	702.86	542.86	3.580
96	217.42	164.14	470.53	200.00	280.02	633.45	473.47	3.580
97	210.05	163.00	470.00	200.00	265.21	707.15	546.94	3.580
98	209.00	163.00	470.00	200.00	264.40	711.23	551.02	3.580
99	211.11	163.00	470.00	200.00	266.01	703.07	542.86	3.581

Critical Failure Surface (circle 1)

Intersects:	XL:	213.21	YL:	163.00	XR:	470.00	YR:	200.00	
Centre:	XC:	268.83	YC:	686.58			Radius:	R:	526.53
Generated failure surface: (20 points)									
213.21	163.00		226.95	161.72		240.71	160.81	254.50	160.25
268.29	160.05								
282.09	160.22		295.88	160.75		309.64	161.64	323.38	162.89
337.09	164.50								
350.74	166.46		364.34	168.79		377.87	171.47	391.33	174.50
404.71	177.89								
417.99	181.62		431.17	185.71		444.24	190.13	457.18	194.90
470.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	213.21	8.25	-5.3	6.87	6.90	3	100.00	18.0	1102.58	14772.91
2230.49	1.01									
2	220.08	28.36	-5.3	6.87	6.90	3	100.00	18.0	3781.31	15047.86
2479.39	1.01									
3	226.95	47.97	-3.8	6.88	6.90	3	100.00	18.0	6388.29	15284.02
2713.74	1.01									
4	233.83	66.92	-3.8	6.88	6.90	3	100.00	18.0	8902.11	15481.44
2936.97	1.01									
5	240.71	85.38	-2.3	6.89	6.90	3	100.00	18.0	11345.45	15639.69
3144.68	1.00									
6	247.61	103.13	-2.3	6.89	6.90	3	100.00	18.0	13690.19	15759.39
3342.17	1.00									
7	254.50	120.35	-0.8	6.90	6.90	3	100.00	18.0	15959.55	15840.46
3523.25	1.00									
8	261.40	136.89	-0.8	6.90	6.90	3	100.00	18.0	18131.87	15882.45
3694.92	1.00									
9	268.29	58.11	0.7	2.71	2.71	3	100.00	18.0	7691.92	6235.24
3805.07	1.00									
10	271.00	126.44	0.7	5.54	5.55	3	100.00	18.0	16723.54	12761.14
3892.27	1.00									
11	276.54	136.32	0.7	5.54	5.55	3	100.00	18.0	18013.68	12737.95
4009.48	1.00									
12	282.09	182.62	2.2	6.89	6.90	3	100.00	18.0	24105.28	15774.74
4123.06	1.00									
13	288.98	196.64	2.2	6.89	6.90	3	100.00	18.0	25923.53	15661.07
4242.98	1.00									
14	295.88	209.74	3.7	6.88	6.90	3	100.00	18.0	27614.92	15508.29

4344.32	1.00										
15	302.76	222.47	3.7	6.88	6.90	3	100.00	18.0	29252.65	15316.92	
4438.32	1.00										
16	309.64	216.19	5.2	6.36	6.38	3	100.00	18.0	28389.04	13967.81	
4510.64	1.00										
17	316.00	263.43	5.2	7.38	7.41	3	100.00	18.0	34542.80	15936.75	
4654.90	1.00										
18	323.38	59.40	6.7	1.62	1.63	3	100.00	18.0	7781.64	3454.70	
4782.20	1.00										
19	325.00	220.98	6.7	6.04	6.08	2	0.00	35.0	28948.02	12744.71	
4729.25	0.98										
20	331.04	216.69	6.7	6.04	6.08	2	0.00	35.0	28386.23	12475.27	
4637.39	0.98										
21	337.09	200.27	8.2	5.71	5.77	2	0.00	35.0	26234.97	11546.34	
4525.27	0.98										
22	342.79	195.57	8.2	5.71	5.77	2	0.00	35.0	25620.20	11250.48	
4419.10	0.98										
23	348.50	75.53	8.2	2.24	2.26	5	0.00	45.0	8308.03	3017.98	
3613.99	0.97										
24	350.74	224.08	9.7	6.80	6.90	2	0.00	35.0	29354.09	2132.49	
4186.18	0.98										
25	357.54	216.17	9.7	6.80	6.90	2	0.00	35.0	28318.71	1632.15	
4036.51	0.98										
26	364.34	206.66	11.2	6.77	6.90	2	0.00	35.0	27072.44	1093.53	
3856.27	0.98										
27	371.11	197.59	11.2	6.77	6.90	2	0.00	35.0	25884.52	516.70	
3684.18	0.98										
28	377.87	66.50	12.7	2.35	2.41	2	0.00	35.0	8711.40	39.91	
3545.73	0.98										
29	380.23	152.01	12.7	5.55	5.69	2	0.00	35.0	19913.58	0.00	
3433.27	0.98										
30	385.78	145.06	12.7	5.55	5.69	2	0.00	35.0	19002.86	0.00	
3276.27	0.98										
31	391.33	164.84	14.2	6.69	6.90	2	0.00	35.0	21594.25	0.00	
3075.52	0.98										
32	398.02	153.52	14.2	6.69	6.90	2	0.00	35.0	20111.49	0.00	
2864.33	0.98										
33	404.71	140.63	15.7	6.64	6.90	2	0.00	35.0	18422.75	0.00	
2628.37	0.98										
34	411.35	128.23	15.7	6.64	6.90	2	0.00	35.0	16798.24	0.00	
2396.61	0.98										
35	417.99	22.11	17.2	1.22	1.27	2	0.00	35.0	2895.93	0.00	
2245.41	0.99										
36	419.20	102.13	17.2	5.98	6.26	1	150.00	22.0	13379.34	0.00	
2147.82	1.01										
37	425.19	91.05	17.2	5.98	6.26	1	150.00	22.0	11927.60	0.00	
1913.40	1.01										
38	431.17	86.17	18.7	6.53	6.90	1	150.00	22.0	11288.34	0.00	
1649.77	1.02										
39	437.70	71.71	18.7	6.53	6.90	1	150.00	22.0	9394.56	0.00	
1370.68	1.02										
40	444.24	56.18	20.2	6.47	6.90	1	150.00	22.0	7359.43	0.00	
1076.16	1.02										
41	450.71	40.75	20.2	6.47	6.90	1	150.00	22.0	5338.47	0.00	
776.54	1.02										
42	457.18	24.53	21.7	6.41	6.90	1	150.00	22.0	3213.43	0.00	
463.57	1.03										
43	463.59	8.18	21.7	6.41	6.90	1	150.00	22.0	1071.14	0.00	
143.79	1.03										

X-S Area:

5475.76

Path Length:

262.13

X-S Weight:

717890.38

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-1\West Farm Expansion Case 8-1 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 13:06:28

DATA: Analysis 1 - Case 8-1 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 182.00 348.50 182.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 163.00 348.50 163.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 160.00 348.50 160.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 500.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 182.00 500.00 182.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 163.00 500.00 163.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 160.00 500.00 160.00

Slope Surface (4 points)

100.00	163.00	214.00	163.00	325.00	200.00	500.00	200.00

Phreatic Surface (6 points)

100.00	163.00	214.00	163.00	316.00	197.00	348.50	197.00
351.50	172.00						
500.00	172.00						

Failure Surface

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

Intersects: XL:	214.00	YL:	163.00	XR:	475.00	YR:	200.00
Centre: XC:	276.80	YC:	659.04	Radius: R:			500.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 8-1 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.318

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.39

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	213.21	163.00	470.00	200.00	268.83	686.58	526.53	2.393	
Critical Surface									
2	212.68	163.00	470.00	200.00	268.72	686.54	526.53	2.393	
3	209.53	163.00	470.00	200.00	266.28	698.78	538.78	2.396	
4	210.58	163.00	470.00	200.00	267.09	694.70	534.69	2.397	
5	213.74	163.00	470.00	200.00	269.54	682.46	522.45	2.397	
6	211.63	163.00	470.00	200.00	267.91	690.62	530.61	2.397	
7	212.68	163.00	470.53	200.00	268.54	690.66	530.61	2.398	
8	212.16	163.00	470.53	200.00	268.43	690.62	530.61	2.399	
9	209.00	163.00	470.00	200.00	265.59	702.90	542.86	2.400	
10	210.05	163.00	470.00	200.00	266.39	698.82	538.78	2.400	
11	213.21	163.00	470.00	200.00	268.23	690.75	530.61	2.401	
12	214.26	163.09	470.00	200.00	270.42	678.40	518.37	2.401	
13	209.00	163.00	470.53	200.00	266.00	702.86	542.86	2.402	
14	213.21	163.00	470.53	200.00	269.25	686.54	526.53	2.402	
15	210.05	163.00	470.53	200.00	266.81	698.78	538.78	2.402	
16	209.00	163.00	470.00	200.00	264.99	707.06	546.94	2.403	
17	210.05	163.00	470.00	200.00	265.80	702.99	542.86	2.403	
18	211.11	163.00	470.53	200.00	267.62	694.70	534.69	2.403	
19	211.11	163.00	470.00	200.00	266.61	698.91	538.78	2.403	
20	212.68	163.00	470.00	200.00	268.12	690.71	530.61	2.404	
21	212.16	163.00	471.05	200.00	268.26	694.74	534.69	2.404	
22	212.16	163.00	470.00	200.00	267.42	694.83	534.69	2.404	
23	214.79	163.26	470.00	200.00	272.06	670.24	510.20	2.404	
24	211.63	163.00	471.05	200.00	268.15	694.70	534.69	2.405	
25	214.26	163.09	470.53	200.00	270.83	678.36	518.37	2.405	
26	209.53	163.00	470.53	200.00	266.11	702.90	542.86	2.406	
27	213.74	163.00	470.53	200.00	269.36	686.58	526.53	2.406	
28	213.74	163.00	470.00	200.00	268.94	686.63	526.53	2.406	
29	210.58	163.00	470.53	200.00	266.92	698.82	538.78	2.406	
30	212.68	163.00	470.53	200.00	267.94	694.83	534.69	2.407	
31	214.79	163.26	470.53	200.00	272.48	670.20	510.20	2.407	
32	209.53	163.00	470.00	200.00	265.10	707.11	546.94	2.407	
33	209.53	163.00	470.00	200.00	265.69	702.94	542.86	2.407	
34	215.32	163.44	470.00	200.00	273.70	662.07	502.04	2.407	
35	210.58	163.00	470.00	200.00	266.50	698.87	538.78	2.407	
36	213.74	163.00	470.00	200.00	268.33	690.80	530.61	2.407	
37	211.63	163.00	470.00	200.00	267.31	694.79	534.69	2.408	
38	212.68	163.00	471.05	200.00	268.96	690.62	530.61	2.408	
39	211.11	163.00	470.00	200.00	267.20	694.74	534.69	2.408	
40	210.58	163.00	470.00	200.00	265.91	703.03	542.86	2.408	
41	209.53	163.00	471.05	200.00	266.53	702.86	542.86	2.408	
42	212.16	163.00	470.00	200.00	268.01	690.66	530.61	2.408	
43	210.58	163.00	471.05	200.00	267.34	698.78	538.78	2.409	
44	211.63	163.00	470.00	200.00	266.71	698.95	538.78	2.409	
45	209.53	163.00	470.53	200.00	265.52	707.06	546.94	2.409	
46	210.58	163.00	470.53	200.00	266.33	702.99	542.86	2.409	
47	212.68	163.00	470.00	200.00	267.52	694.87	534.69	2.410	
48	212.16	163.00	470.53	200.00	267.84	694.79	534.69	2.410	
49	215.32	163.44	470.53	200.00	274.11	662.02	502.04	2.410	
50	211.63	163.00	470.53	200.00	267.13	698.91	538.78	2.410	
51	215.84	163.61	470.00	200.00	275.34	653.90	493.88	2.410	
52	213.74	163.00	470.53	200.00	268.75	690.75	530.61	2.410	
53	212.16	163.00	470.53	200.00	267.24	698.95	538.78	2.410	
54	211.11	163.00	471.58	200.00	267.86	698.78	538.78	2.411	
55	213.74	163.00	471.05	200.00	269.77	686.54	526.53	2.411	
56	213.21	163.00	470.00	200.00	267.63	694.92	534.69	2.411	
57	213.21	163.00	471.05	200.00	269.07	690.66	530.61	2.411	
58	209.00	163.00	471.05	200.00	265.83	706.98	546.94	2.411	
59	209.00	163.00	470.00	200.00	264.40	711.23	551.02	2.412	
60	213.21	163.00	470.53	200.00	268.65	690.71	530.61	2.412	
61	214.26	163.09	470.00	200.00	269.81	682.57	522.45	2.412	
62	210.05	163.00	471.05	200.00	266.64	702.90	542.86	2.412	
63	214.79	163.26	470.00	200.00	271.46	674.42	514.29	2.412	
64	216.37	163.79	470.00	200.00	276.97	645.71	485.71	2.412	

65	212.16	163.00	471.05	200.00	267.66	698.91	538.78	2.412
66	214.26	163.09	470.53	200.00	270.23	682.53	522.45	2.412
67	210.05	163.00	470.00	200.00	265.21	707.15	546.94	2.412
68	211.11	163.00	471.05	200.00	267.45	698.82	538.78	2.412
69	209.00	163.00	470.53	200.00	264.82	711.19	551.02	2.413
70	214.26	163.09	470.00	200.00	269.21	686.74	526.53	2.413
71	213.21	163.00	470.53	200.00	268.05	694.87	534.69	2.413
72	211.11	163.00	470.00	200.00	266.01	703.07	542.86	2.413
73	212.16	163.00	471.58	200.00	268.67	694.70	534.69	2.413
74	209.00	163.00	470.53	200.00	265.41	707.02	546.94	2.413
75	210.05	163.00	470.53	200.00	265.63	707.11	546.94	2.413
76	210.05	163.00	470.53	200.00	266.22	702.94	542.86	2.413
77	211.11	163.00	470.53	200.00	267.03	698.87	538.78	2.414
78	209.00	163.00	471.58	200.00	266.25	706.93	546.94	2.414
79	212.16	163.00	470.00	200.00	266.82	699.00	538.78	2.414
80	211.63	163.00	470.53	200.00	267.73	694.74	534.69	2.414
81	211.11	163.00	470.53	200.00	266.43	703.03	542.86	2.414
82	210.05	163.00	471.58	200.00	267.06	702.86	542.86	2.414
83	214.79	163.26	470.53	200.00	271.88	674.37	514.29	2.414
84	216.89	163.96	470.00	200.00	278.59	637.51	477.55	2.414
85	214.26	163.09	471.05	200.00	270.65	682.48	522.45	2.415
86	209.00	163.00	471.05	200.00	265.24	711.14	551.02	2.415
87	215.32	163.44	470.00	200.00	273.10	666.25	506.12	2.415
88	210.05	163.00	471.05	200.00	266.05	707.06	546.94	2.415
89	211.63	163.00	471.58	200.00	267.97	698.82	538.78	2.415
90	214.26	163.09	470.53	200.00	269.63	686.70	526.53	2.415
91	211.11	163.00	471.05	200.00	266.85	702.99	542.86	2.415
92	213.21	163.00	471.05	200.00	268.47	694.83	534.69	2.415
93	211.63	163.00	471.05	200.00	267.55	698.87	538.78	2.416
94	211.63	163.00	471.05	200.00	266.96	703.03	542.86	2.416
95	213.21	163.00	471.58	200.00	269.49	690.62	530.61	2.416
96	210.58	163.00	472.11	200.00	267.58	702.86	542.86	2.416
97	212.68	163.00	471.58	200.00	268.78	694.74	534.69	2.416
98	212.68	163.00	470.53	200.00	267.35	699.00	538.78	2.416
99	209.53	163.00	470.00	200.00	264.51	711.27	551.02	2.417

Critical Failure Surface (circle 1)

Intersects:	XL:	213.21	YL:	163.00	XR:	470.00	YR:	200.00	
Centre:	XC:	268.83	YC:	686.58	Radius:	R:		526.53	
Generated failure surface: (20 points)									
213.21	163.00		226.95	161.72		240.71	160.81	254.50	160.25
268.29	160.05								
282.09	160.22		295.88	160.75		309.64	161.64	323.38	162.89
337.09	164.50								
350.74	166.46		364.34	168.79		377.87	171.47	391.33	174.50
404.71	177.89								
417.99	181.62		431.17	185.71		444.24	190.13	457.18	194.90
470.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	213.21	8.25	-5.3	6.87	6.90	3	100.00	18.0	1102.58	516.97
165.55	1.02									
2	220.08	28.36	-5.3	6.87	6.90	3	100.00	18.0	3781.31	1777.46
558.20	1.02									
3	226.95	47.97	-3.8	6.88	6.90	3	100.00	18.0	6388.29	3000.21
935.43	1.01									
4	233.83	66.92	-3.8	6.88	6.90	3	100.00	18.0	8902.11	4185.22
1302.41	1.01									
5	240.71	85.38	-2.3	6.89	6.90	3	100.00	18.0	11345.45	5331.96
1652.54	1.01									
6	247.61	103.13	-2.3	6.89	6.90	3	100.00	18.0	13690.19	6440.62
1993.71	1.01									
7	254.50	120.35	-0.8	6.90	6.90	3	100.00	18.0	15959.55	7510.88
2316.72	1.00									
8	261.40	136.89	-0.8	6.90	6.90	3	100.00	18.0	18131.87	8542.54
2631.97	1.00									
9	268.29	58.11	0.7	2.71	2.71	3	100.00	18.0	7691.92	3626.45
2839.97	1.00									
10	271.00	126.44	0.7	5.54	5.55	3	100.00	18.0	16723.54	7890.55
3012.93	1.00									
11	276.54	136.32	0.7	5.54	5.55	3	100.00	18.0	18013.68	8506.91
3245.40	1.00									
12	282.09	182.62	2.2	6.89	6.90	3	100.00	18.0	24105.28	11403.66
3485.81	1.00									
13	288.98	196.64	2.2	6.89	6.90	3	100.00	18.0	25923.53	12279.07
3748.87	1.00									
14	295.88	209.74	3.7	6.88	6.90	3	100.00	18.0	27614.92	13114.73

3990.53	0.99										
15	302.76	222.47	3.7	6.88	6.90	3	100.00	18.0	29252.65	13911.08	
4227.38	0.99										
16	309.64	216.19	5.2	6.36	6.38	3	100.00	18.0	28389.04	13545.92	
4434.10	0.99										
17	316.00	263.43	5.2	7.38	7.41	3	100.00	18.0	34542.80	15936.75	
4643.73	0.99										
18	323.38	59.40	6.7	1.62	1.63	3	100.00	18.0	7781.64	3454.70	
4767.04	0.99										
19	325.00	220.98	6.7	6.04	6.08	2	0.00	35.0	28948.02	12744.71	
4700.77	0.97										
20	331.04	216.69	6.7	6.04	6.08	2	0.00	35.0	28386.23	12475.27	
4609.42	0.97										
21	337.09	200.27	8.2	5.71	5.77	2	0.00	35.0	26234.97	11546.34	
4492.05	0.97										
22	342.79	195.57	8.2	5.71	5.77	2	0.00	35.0	25620.20	11250.48	
4386.61	0.97										
23	348.50	75.53	8.2	2.24	2.26	5	0.00	45.0	8308.03	3017.98	
3571.82	0.95										
24	350.74	224.08	9.7	6.80	6.90	2	0.00	35.0	29354.09	2132.49	
4126.07	0.97										
25	357.54	216.17	9.7	6.80	6.90	2	0.00	35.0	28318.71	1632.15	
3977.60	0.97										
26	364.34	206.66	11.2	6.77	6.90	2	0.00	35.0	27072.44	1093.53	
3790.36	0.96										
27	371.11	197.59	11.2	6.77	6.90	2	0.00	35.0	25884.52	516.70	
3619.84	0.96										
28	377.87	66.50	12.7	2.35	2.41	2	0.00	35.0	8711.40	39.91	
3474.66	0.96										
29	380.23	152.01	12.7	5.55	5.69	2	0.00	35.0	19913.58	0.00	
3364.13	0.96										
30	385.78	145.06	12.7	5.55	5.69	2	0.00	35.0	19002.86	0.00	
3210.29	0.96										
31	391.33	164.84	14.2	6.69	6.90	2	0.00	35.0	21594.25	0.00	
3006.50	0.96										
32	398.02	153.52	14.2	6.69	6.90	2	0.00	35.0	20111.49	0.00	
2800.05	0.96										
33	404.71	140.63	15.7	6.64	6.90	2	0.00	35.0	18422.75	0.00	
2563.34	0.96										
34	411.35	128.23	15.7	6.64	6.90	2	0.00	35.0	16798.24	0.00	
2337.31	0.96										
35	417.99	22.11	17.2	1.22	1.27	2	0.00	35.0	2895.93	0.00	
2184.69	0.96										
36	419.20	102.13	17.2	5.98	6.26	1	150.00	22.0	13379.34	0.00	
2107.08	0.99										
37	425.19	91.05	17.2	5.98	6.26	1	150.00	22.0	11927.60	0.00	
1876.46	0.99										
38	431.17	86.17	18.7	6.53	6.90	1	150.00	22.0	11288.34	0.00	
1614.20	1.00										
39	437.70	71.71	18.7	6.53	6.90	1	150.00	22.0	9394.56	0.00	
1340.02	1.00										
40	444.24	56.18	20.2	6.47	6.90	1	150.00	22.0	7359.43	0.00	
1048.59	1.00										
41	450.71	40.75	20.2	6.47	6.90	1	150.00	22.0	5338.47	0.00	
754.68	1.00										
42	457.18	24.53	21.7	6.41	6.90	1	150.00	22.0	3213.43	0.00	
446.45	1.01										
43	463.59	8.18	21.7	6.41	6.90	1	150.00	22.0	1071.14	0.00	
133.23	1.01										

X-S Area:

5475.76

Path Length:

262.13

X-S Weight:

717890.38

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-2\West Farm Expansion Case 8-2 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 13:07:49

DATA: Analysis 1 - Case 8-2 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 198.00 348.50 198.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 162.00 348.50 162.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 159.00 348.50 159.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 198.00 450.00 198.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 162.00 450.00 162.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 159.00 450.00 159.00

Slope Surface (4 points)

100.00	162.00	211.00	162.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	197.00	211.00	197.00	316.00	197.00	348.50	197.00
351.50	172.00						
450.00	172.00						

Failure Surface

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

Intersects: XL:	211.00	YL:	162.00	XR:	390.00	YR:	200.00
Centre: XC:	252.19	YC:	408.58	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 8-2 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 3.064

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.19

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	213.89	162.96	385.00	200.00	255.95	382.44	223.47	2.186	
Critical Surface									
2	213.37	162.79	385.00	200.00	254.70	386.55	227.55	2.186	
3	212.84	162.61	385.00	200.00	253.46	390.66	231.63	2.186	
4	212.32	162.44	385.00	200.00	252.21	394.75	235.71	2.187	
5	210.21	162.00	385.00	200.00	248.47	406.99	247.96	2.188	
6	211.26	162.09	385.00	200.00	249.72	402.91	243.88	2.189	
7	208.63	162.00	385.00	200.00	247.25	411.07	252.04	2.191	
8	211.79	162.26	385.00	200.00	250.96	398.84	239.80	2.192	
9	210.74	162.00	385.00	200.00	248.57	407.06	247.96	2.193	
10	207.05	162.00	385.00	200.00	246.03	415.14	256.12	2.193	
11	209.16	162.00	385.00	200.00	247.35	411.13	252.04	2.196	
12	209.68	162.00	385.00	200.00	247.45	411.20	252.04	2.197	
13	207.58	162.00	385.00	200.00	246.13	415.20	256.12	2.198	
14	207.58	162.00	385.53	200.00	246.55	415.14	256.12	2.198	
15	210.74	162.00	385.53	200.00	249.00	406.99	247.96	2.198	
16	216.00	163.67	385.00	200.00	259.99	370.26	211.22	2.198	
17	215.47	163.49	385.00	200.00	258.75	374.40	215.31	2.199	
18	212.84	162.61	385.00	200.00	252.52	394.96	235.71	2.199	
19	214.95	163.32	385.00	200.00	257.50	378.54	219.39	2.199	
20	209.16	162.00	385.53	200.00	247.77	411.07	252.04	2.199	
21	213.89	162.96	385.00	200.00	255.01	386.77	227.55	2.199	
22	214.42	163.14	385.00	200.00	256.26	382.66	223.47	2.200	
23	206.00	162.00	385.00	200.00	244.92	419.28	260.20	2.200	
24	212.32	162.44	385.00	200.00	251.28	399.05	239.80	2.200	
25	211.79	162.26	385.00	200.00	250.03	403.12	243.88	2.202	
26	210.21	162.00	385.00	200.00	247.55	411.26	252.04	2.202	
27	208.11	162.00	385.00	200.00	246.23	415.27	256.12	2.202	
28	208.11	162.00	385.53	200.00	246.65	415.20	256.12	2.203	
29	213.37	162.79	385.00	200.00	253.77	390.87	231.63	2.203	
30	215.47	163.49	385.53	200.00	259.16	374.32	215.31	2.203	
31	206.00	162.00	385.53	200.00	245.34	419.21	260.20	2.204	
32	211.26	162.09	385.00	200.00	248.78	407.19	247.96	2.204	
33	209.68	162.00	385.53	200.00	247.87	411.13	252.04	2.204	
34	214.95	163.32	385.53	200.00	257.91	378.45	219.39	2.204	
35	206.53	162.00	385.00	200.00	245.02	419.34	260.20	2.204	
36	212.32	162.44	385.53	200.00	251.70	398.98	239.80	2.204	
37	214.42	163.14	385.53	200.00	256.67	382.58	223.47	2.205	
38	213.37	162.79	385.53	200.00	254.19	390.80	231.63	2.205	
39	213.89	162.96	385.53	200.00	255.43	386.69	227.55	2.205	
40	211.79	162.26	385.53	200.00	250.45	403.06	243.88	2.206	
41	208.63	162.00	385.00	200.00	246.33	415.33	256.12	2.206	
42	210.74	162.00	385.00	200.00	247.64	411.32	252.04	2.207	
43	209.68	162.00	386.05	200.00	248.30	411.07	252.04	2.208	
44	206.53	162.00	385.53	200.00	245.44	419.28	260.20	2.208	
45	211.26	162.09	385.53	200.00	249.21	407.13	247.96	2.208	
46	207.05	162.00	385.00	200.00	245.12	419.41	260.20	2.208	
47	210.21	162.00	385.53	200.00	247.97	411.20	252.04	2.208	
48	208.63	162.00	385.53	200.00	246.75	415.27	256.12	2.209	
49	212.84	162.61	385.53	200.00	252.94	394.89	235.71	2.209	
50	214.95	163.32	386.05	200.00	258.33	378.37	219.39	2.209	
51	214.42	163.14	386.05	200.00	257.09	382.50	223.47	2.209	
52	211.79	162.26	386.05	200.00	250.88	402.99	243.88	2.210	
53	208.11	162.00	386.05	200.00	247.08	415.14	256.12	2.210	
54	213.89	162.96	386.05	200.00	255.84	386.62	227.55	2.210	
55	212.84	162.61	386.05	200.00	253.36	394.82	235.71	2.210	
56	213.37	162.79	386.05	200.00	254.60	390.72	231.63	2.210	
57	206.53	162.00	386.05	200.00	245.87	419.21	260.20	2.210	
58	209.68	162.00	385.00	200.00	246.52	415.46	256.12	2.210	
59	209.16	162.00	385.00	200.00	246.43	415.40	256.12	2.210	
60	211.26	162.09	386.05	200.00	249.63	407.06	247.96	2.212	
61	207.05	162.00	385.53	200.00	245.54	419.34	260.20	2.212	
62	207.58	162.00	385.00	200.00	245.21	419.47	260.20	2.212	
63	210.21	162.00	386.05	200.00	248.40	411.13	252.04	2.212	
64	210.74	162.00	385.53	200.00	248.07	411.26	252.04	2.213	

65	214.42	163.14	385.00	200.00	255.32	386.99	227.55	2.213
66	209.16	162.00	385.53	200.00	246.85	415.33	256.12	2.214
67	212.32	162.44	386.05	200.00	252.12	398.91	239.80	2.214
68	215.47	163.49	385.00	200.00	257.81	378.76	219.39	2.214
69	216.00	163.67	385.00	200.00	259.05	374.62	215.31	2.214
70	208.63	162.00	386.05	200.00	247.18	415.20	256.12	2.214
71	213.89	162.96	385.00	200.00	254.08	391.09	231.63	2.215
72	213.89	162.96	386.58	200.00	256.26	386.54	227.55	2.215
73	206.00	162.00	385.00	200.00	244.01	423.54	264.29	2.215
74	213.37	162.79	386.58	200.00	255.02	390.65	231.63	2.215
75	212.84	162.61	386.58	200.00	253.78	394.75	235.71	2.215
76	213.37	162.79	385.00	200.00	252.84	395.18	235.71	2.215
77	212.32	162.44	386.58	200.00	252.54	398.84	239.80	2.215
78	207.05	162.00	386.05	200.00	245.97	419.28	260.20	2.215
79	210.21	162.00	385.00	200.00	246.62	415.52	256.12	2.215
80	212.84	162.61	385.00	200.00	251.59	399.26	239.80	2.216
81	212.32	162.44	385.00	200.00	250.34	403.33	243.88	2.216
82	208.11	162.00	385.00	200.00	245.31	419.53	260.20	2.216
83	207.58	162.00	385.53	200.00	245.64	419.41	260.20	2.216
84	211.79	162.26	385.00	200.00	249.10	407.40	247.96	2.216
85	210.21	162.00	386.58	200.00	248.83	411.07	252.04	2.216
86	211.26	162.09	386.58	200.00	250.06	406.99	247.96	2.217
87	210.74	162.00	386.05	200.00	248.50	411.20	252.04	2.217
88	208.11	162.00	385.53	200.00	245.74	419.47	260.20	2.217
89	211.26	162.09	385.00	200.00	247.85	411.46	252.04	2.218
90	208.63	162.00	386.58	200.00	247.61	415.14	256.12	2.218
91	213.89	162.96	385.53	200.00	254.50	391.01	231.63	2.218
92	209.16	162.00	386.05	200.00	247.28	415.27	256.12	2.219
93	209.68	162.00	385.53	200.00	246.95	415.40	256.12	2.219
94	206.53	162.00	385.00	200.00	244.11	423.60	264.29	2.219
95	206.00	162.00	385.53	200.00	244.44	423.48	264.29	2.219
96	214.95	163.32	385.53	200.00	256.98	382.80	223.47	2.219
97	206.00	162.00	386.05	200.00	244.87	423.41	264.29	2.219
98	216.00	163.67	385.53	200.00	259.46	374.54	215.31	2.219
99	215.47	163.49	385.53	200.00	258.22	378.67	219.39	2.219

Critical Failure Surface (circle 1)

Intersects:	XL:	213.89	YL:	162.96	XR:	385.00	YR:	200.00	
Centre:	XC:	255.95	YC:	382.44		Radius:	R:	223.47	
Generated failure surface: (20 points)									
	213.89	162.96		223.23	161.38		232.62	160.19	242.05
	251.51	159.02							159.40
	260.98	159.03		270.44	159.44		279.87	160.26	289.26
	298.59	163.08							161.47
	307.84	165.08		317.00	167.47		326.05	170.25	334.97
	343.76	176.95							173.41
	352.38	180.85		360.83	185.11		369.10	189.73	377.16
	385.00	200.00							194.70

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	213.89	8.13	-9.6	5.68	5.77	2	0.00	35.0	1064.81	12419.17
2257.63	1.07									
2	219.58	13.78	-9.6	3.65	3.70	3	100.00	18.0	1816.98	8154.59
2480.32	1.04									
3	223.23	27.12	-7.2	4.70	4.73	3	100.00	18.0	3595.70	10608.49
2660.16	1.03									
4	227.92	37.26	-7.2	4.70	4.73	3	100.00	18.0	4951.84	10783.86
2854.22	1.03									
5	232.62	47.16	-4.8	4.72	4.73	3	100.00	18.0	6271.97	10929.83
3027.65	1.02									
6	237.34	56.43	-4.8	4.72	4.73	3	100.00	18.0	7505.82	11046.28
3192.86	1.02									
7	242.05	65.42	-2.4	4.73	4.73	3	100.00	18.0	8697.47	11133.33
3335.74	1.01									
8	246.78	73.80	-2.4	4.73	4.73	3	100.00	18.0	9803.72	11190.69
3472.03	1.01									
9	251.51	81.77	0.1	4.73	4.73	3	100.00	18.0	10852.53	11218.31
3584.53	1.00									
10	256.25	89.21	0.1	4.73	4.73	3	100.00	18.0	11826.76	11216.49
3691.86	1.00									
11	260.98	96.07	2.5	4.73	4.73	3	100.00	18.0	12721.35	11184.95
3774.18	0.99									
12	265.71	102.55	2.5	4.73	4.73	3	100.00	18.0	13560.09	11123.96
3852.57	0.99									
13	270.44	108.25	4.9	4.72	4.73	3	100.00	18.0	14291.29	11033.34
3904.93	0.99									
14	275.15	113.74	4.9	4.72	4.73	3	100.00	18.0	14991.91	10913.17

3954.44	0.99										
15	279.87	118.21	7.4	4.69	4.73	3	100.00	18.0	15552.85	10763.50	
3977.10	0.99										
16	284.56	122.71	7.4	4.69	4.73	3	100.00	18.0	16114.01	10584.52	
3997.84	0.99										
17	289.26	82.84	9.8	3.08	3.13	3	100.00	18.0	10860.67	6885.84	
3992.43	0.99										
18	292.34	85.46	9.8	3.12	3.17	2	0.00	35.0	11194.80	6867.64	
3946.16	0.96										
19	295.47	87.03	9.8	3.12	3.17	2	0.00	35.0	11400.31	6761.15	
3945.21	0.96										
20	298.59	131.34	12.2	4.63	4.73	2	0.00	35.0	17205.43	9871.91	
3906.75	0.96										
21	303.21	133.84	12.2	4.63	4.73	2	0.00	35.0	17533.28	9576.20	
3878.96	0.96										
22	307.84	119.72	14.6	4.08	4.22	2	0.00	35.0	15683.93	8258.20	
3816.31	0.95										
23	311.92	120.92	14.6	4.08	4.22	2	0.00	35.0	15841.11	7977.81	
3768.43	0.95										
24	316.00	29.84	14.6	1.00	1.03	2	0.00	35.0	3908.58	1913.52	
3748.22	0.95										
25	317.00	59.76	17.1	2.00	2.09	2	0.00	35.0	7828.85	3813.95	
3727.86	0.95										
26	319.00	89.86	17.1	3.00	3.14	2	0.00	35.0	11771.45	5571.76	
3731.42	0.95										
27	322.00	90.10	17.1	3.00	3.14	2	0.00	35.0	11802.47	5391.38	
3735.69	0.95										
28	325.00	31.42	17.1	1.05	1.10	2	0.00	35.0	4115.50	1845.00	
3717.68	0.95										
29	326.05	129.22	19.5	4.46	4.73	2	0.00	35.0	16927.45	7667.43	
3572.17	0.95										
30	330.51	122.17	19.5	4.46	4.73	2	0.00	35.0	16003.96	7200.80	
3376.27	0.95										
31	334.97	112.88	21.9	4.39	4.73	2	0.00	35.0	14786.93	6706.48	
3144.66	0.95										
32	339.37	105.12	21.9	4.39	4.73	2	0.00	35.0	13770.43	6184.54	
2926.99	0.95										
33	343.76	104.26	24.4	4.74	5.21	2	0.00	35.0	13658.28	6166.58	
2664.91	0.96										
34	348.50	41.68	24.4	2.04	2.24	5	0.00	45.0	4584.39	1250.06	
1959.17	0.91										
35	350.54	19.01	24.4	0.96	1.06	5	0.00	45.0	2091.27	0.00	
1801.45	0.91										
36	351.50	17.06	24.4	0.88	0.97	2	0.00	35.0	2234.81	0.00	
2213.96	0.96										
37	352.38	76.43	26.8	4.23	4.73	2	0.00	35.0	10011.79	0.00	
2039.42	0.96										
38	356.61	67.41	26.8	4.23	4.73	2	0.00	35.0	8831.20	0.00	
1798.93	0.96										
39	360.83	56.73	29.2	4.13	4.73	2	0.00	35.0	7432.27	0.00	
1525.60	0.97										
40	364.97	47.19	29.2	4.13	4.73	2	0.00	35.0	6182.16	0.00	
1269.00	0.97										
41	369.10	36.38	31.6	4.03	4.73	2	0.00	35.0	4765.21	0.00	
987.49	0.98										
42	373.13	26.37	31.6	4.03	4.73	2	0.00	35.0	3454.51	0.00	
715.88	0.98										
43	377.16	17.83	34.1	4.88	5.90	2	0.00	35.0	2336.03	0.00	
393.13	0.99										
44	382.04	2.96	34.1	2.96	3.57	1	150.00	22.0	387.56	0.00	
75.21	1.07										

X-S Area: 3206.41

Path Length: 179.87

X-S Weight: 420223.78

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-2\West Farm Expansion Case 8-2 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 13:07:26

DATA: Analysis 1 - Case 8-2 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 198.00 348.50 198.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 162.00 348.50 162.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 159.00 348.50 159.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 198.00 450.00 198.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 162.00 450.00 162.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 159.00 450.00 159.00

Slope Surface (4 points)

100.00	162.00	211.00	162.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	162.00	211.00	162.00	316.00	197.00	348.50	197.00
351.50	172.00						
450.00	172.00						

Failure Surface

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

Intersects: XL:	211.00	YL:	162.00	XR:	390.00	YR:	200.00
Centre: XC:	252.19	YC:	408.58	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 8-2 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.920

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.33

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	210.21	162.00	385.00	200.00	248.47	406.99	247.96	1.333	
Critical Surface									
2	212.32	162.44	385.00	200.00	252.21	394.75	235.71	1.333	
3	212.84	162.61	385.00	200.00	253.46	390.66	231.63	1.333	
4	213.37	162.79	385.00	200.00	254.70	386.55	227.55	1.334	
5	213.89	162.96	385.00	200.00	255.95	382.44	223.47	1.334	
6	211.26	162.09	385.00	200.00	249.72	402.91	243.88	1.334	
7	208.63	162.00	385.00	200.00	247.25	411.07	252.04	1.335	
8	207.05	162.00	385.00	200.00	246.03	415.14	256.12	1.336	
9	211.79	162.26	385.00	200.00	250.96	398.84	239.80	1.336	
10	210.74	162.00	385.00	200.00	248.57	407.06	247.96	1.337	
11	209.16	162.00	385.00	200.00	247.35	411.13	252.04	1.338	
12	207.58	162.00	385.00	200.00	246.13	415.20	256.12	1.339	
13	209.68	162.00	385.00	200.00	247.45	411.20	252.04	1.340	
14	206.00	162.00	385.00	200.00	244.92	419.28	260.20	1.340	
15	210.74	162.00	385.53	200.00	249.00	406.99	247.96	1.340	
16	207.58	162.00	385.53	200.00	246.55	415.14	256.12	1.341	
17	209.16	162.00	385.53	200.00	247.77	411.07	252.04	1.341	
18	208.11	162.00	385.00	200.00	246.23	415.27	256.12	1.342	
19	212.84	162.61	385.00	200.00	252.52	394.96	235.71	1.342	
20	212.32	162.44	385.00	200.00	251.28	399.05	239.80	1.343	
21	210.21	162.00	385.00	200.00	247.55	411.26	252.04	1.343	
22	211.79	162.26	385.00	200.00	250.03	403.12	243.88	1.343	
23	213.89	162.96	385.00	200.00	255.01	386.77	227.55	1.343	
24	206.53	162.00	385.00	200.00	245.02	419.34	260.20	1.343	
25	206.00	162.00	385.53	200.00	245.34	419.21	260.20	1.344	
26	214.42	163.14	385.00	200.00	256.26	382.66	223.47	1.344	
27	216.00	163.67	385.00	200.00	259.99	370.26	211.22	1.344	
28	214.95	163.32	385.00	200.00	257.50	378.54	219.39	1.344	
29	215.47	163.49	385.00	200.00	258.75	374.40	215.31	1.344	
30	208.11	162.00	385.53	200.00	246.65	415.20	256.12	1.344	
31	211.26	162.09	385.00	200.00	248.78	407.19	247.96	1.344	
32	209.68	162.00	385.53	200.00	247.87	411.13	252.04	1.344	
33	208.63	162.00	385.00	200.00	246.33	415.33	256.12	1.345	
34	213.37	162.79	385.00	200.00	253.77	390.87	231.63	1.345	
35	212.32	162.44	385.53	200.00	251.70	398.98	239.80	1.346	
36	207.05	162.00	385.00	200.00	245.12	419.41	260.20	1.346	
37	211.79	162.26	385.53	200.00	250.45	403.06	243.88	1.346	
38	206.53	162.00	385.53	200.00	245.44	419.28	260.20	1.347	
39	210.74	162.00	385.00	200.00	247.64	411.32	252.04	1.347	
40	213.37	162.79	385.53	200.00	254.19	390.80	231.63	1.347	
41	213.89	162.96	385.53	200.00	255.43	386.69	227.55	1.347	
42	209.68	162.00	386.05	200.00	248.30	411.07	252.04	1.348	
43	210.21	162.00	385.53	200.00	247.97	411.20	252.04	1.348	
44	211.26	162.09	385.53	200.00	249.21	407.13	247.96	1.348	
45	214.42	163.14	385.53	200.00	256.67	382.58	223.47	1.348	
46	208.63	162.00	385.53	200.00	246.75	415.27	256.12	1.348	
47	215.47	163.49	385.53	200.00	259.16	374.32	215.31	1.348	
48	214.95	163.32	385.53	200.00	257.91	378.45	219.39	1.348	
49	209.16	162.00	385.00	200.00	246.43	415.40	256.12	1.348	
50	208.11	162.00	386.05	200.00	247.08	415.14	256.12	1.348	
51	206.53	162.00	386.05	200.00	245.87	419.21	260.20	1.349	
52	212.84	162.61	385.53	200.00	252.94	394.89	235.71	1.349	
53	209.68	162.00	385.00	200.00	246.52	415.46	256.12	1.349	
54	207.58	162.00	385.00	200.00	245.21	419.47	260.20	1.349	
55	207.05	162.00	385.53	200.00	245.54	419.34	260.20	1.350	
56	211.79	162.26	386.05	200.00	250.88	402.99	243.88	1.350	
57	212.84	162.61	386.05	200.00	253.36	394.82	235.71	1.350	
58	206.00	162.00	385.00	200.00	244.01	423.54	264.29	1.350	
59	210.74	162.00	385.53	200.00	248.07	411.26	252.04	1.351	
60	210.21	162.00	386.05	200.00	248.40	411.13	252.04	1.351	
61	213.37	162.79	386.05	200.00	254.60	390.72	231.63	1.351	
62	211.26	162.09	386.05	200.00	249.63	407.06	247.96	1.351	
63	209.16	162.00	385.53	200.00	246.85	415.33	256.12	1.351	
64	213.89	162.96	386.05	200.00	255.84	386.62	227.55	1.351	

65	214.42	163.14	386.05	200.00	257.09	382.50	223.47	1.352
66	208.63	162.00	386.05	200.00	247.18	415.20	256.12	1.352
67	214.95	163.32	386.05	200.00	258.33	378.37	219.39	1.352
68	208.11	162.00	385.00	200.00	245.31	419.53	260.20	1.352
69	207.05	162.00	386.05	200.00	245.97	419.28	260.20	1.352
70	210.21	162.00	385.00	200.00	246.62	415.52	256.12	1.352
71	207.58	162.00	385.53	200.00	245.64	419.41	260.20	1.352
72	212.32	162.44	386.05	200.00	252.12	398.91	239.80	1.353
73	206.53	162.00	385.00	200.00	244.11	423.60	264.29	1.353
74	211.79	162.26	385.00	200.00	249.10	407.40	247.96	1.353
75	214.42	163.14	385.00	200.00	255.32	386.99	227.55	1.353
76	212.32	162.44	385.00	200.00	250.34	403.33	243.88	1.353
77	212.84	162.61	385.00	200.00	251.59	399.26	239.80	1.354
78	213.37	162.79	385.00	200.00	252.84	395.18	235.71	1.354
79	213.89	162.96	385.00	200.00	254.08	391.09	231.63	1.354
80	206.00	162.00	385.53	200.00	244.44	423.48	264.29	1.354
81	211.26	162.09	385.00	200.00	247.85	411.46	252.04	1.354
82	208.11	162.00	385.53	200.00	245.74	419.47	260.20	1.354
83	210.74	162.00	386.05	200.00	248.50	411.20	252.04	1.354
84	210.21	162.00	386.58	200.00	248.83	411.07	252.04	1.354
85	212.32	162.44	386.58	200.00	252.54	398.84	239.80	1.354
86	209.68	162.00	385.53	200.00	246.95	415.40	256.12	1.354
87	212.84	162.61	386.58	200.00	253.78	394.75	235.71	1.354
88	211.26	162.09	386.58	200.00	250.06	406.99	247.96	1.355
89	215.47	163.49	385.00	200.00	257.81	378.76	219.39	1.355
90	208.63	162.00	386.58	200.00	247.61	415.14	256.12	1.355
91	208.63	162.00	385.00	200.00	245.41	419.59	260.20	1.355
92	209.16	162.00	386.05	200.00	247.28	415.27	256.12	1.355
93	213.37	162.79	386.58	200.00	255.02	390.65	231.63	1.355
94	216.00	163.67	385.00	200.00	259.05	374.62	215.31	1.355
95	213.89	162.96	386.58	200.00	256.26	386.54	227.55	1.355
96	206.00	162.00	386.05	200.00	244.87	423.41	264.29	1.355
97	210.74	162.00	385.00	200.00	246.72	415.58	256.12	1.356
98	207.58	162.00	386.05	200.00	246.07	419.34	260.20	1.356
99	207.05	162.00	386.58	200.00	246.39	419.21	260.20	1.356

Critical Failure Surface (circle 1)

Intersects:	XL:	210.21	YL:	162.00	XR:	385.00	YR:	200.00	
Centre:	XC:	248.47	YC:	406.99		Radius:	R:	247.96	
Generated failure surface: (20 points)									
210.21	162.00		219.75	160.70		229.34	159.77	238.95	159.21
248.58	159.03								
258.21	159.22		267.83	159.79		277.41	160.72	286.95	162.03
296.44	163.71								
305.85	165.76		315.17	168.17		324.40	170.94	333.50	174.07
342.49	177.54								
351.32	181.37		360.01	185.53		368.52	190.03	376.86	194.85
385.00	200.00								

Slice Geometry and Properties - Critical Failure Surface (circle 1, 42 slices)

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
	X-Left									
Stress	Factor									
1	210.21	0.04	-7.8	0.79	0.80	3	100.00	18.0	5.99	2.68
18.31	1.04									
2	211.00	4.97	-7.8	4.38	4.42	3	100.00	18.0	668.74	312.95
166.19	1.04									
3	215.38	13.97	-7.8	4.38	4.42	3	100.00	18.0	1873.38	879.52
446.49	1.04									
4	219.75	25.16	-5.5	4.79	4.82	3	100.00	18.0	3369.87	1577.55
719.62	1.03									
5	224.55	35.05	-5.5	4.79	4.82	3	100.00	18.0	4687.12	2197.28
997.98	1.03									
6	229.34	44.63	-3.3	4.81	4.82	3	100.00	18.0	5960.67	2789.68
1253.76	1.02									
7	234.15	53.67	-3.3	4.81	4.82	3	100.00	18.0	7158.48	3354.81
1504.81	1.02									
8	238.95	62.36	-1.1	4.81	4.82	3	100.00	18.0	8306.08	3892.22
1730.90	1.00									
9	243.77	70.53	-1.1	4.81	4.82	3	100.00	18.0	9380.32	4401.91
1954.57	1.00									
10	248.58	78.25	1.1	4.81	4.82	3	100.00	18.0	10391.00	4883.55
2151.28	1.00									
11	253.40	85.51	1.1	4.81	4.82	3	100.00	18.0	11338.25	5337.04
2347.53	1.00									
12	258.21	92.18	3.4	4.81	4.82	3	100.00	18.0	12202.51	5762.02
2515.14	0.99									
13	263.02	98.53	3.4	4.81	4.82	3	100.00	18.0	13020.07	6158.61
2683.98	0.99									
14	267.83	104.09	5.6	4.79	4.82	3	100.00	18.0	13731.30	6526.55

2822.79	0.98										
15	272.62	109.50	5.6	4.79	4.82	3	100.00	18.0	14417.35	6865.66	
2964.24	0.98										
16	277.41	110.95	7.8	4.65	4.69	3	100.00	18.0	14578.40	6987.92	
3073.10	0.98										
17	282.06	115.18	7.8	4.65	4.69	3	100.00	18.0	15103.85	7254.82	
3184.31	0.98										
18	286.71	124.65	9.9	4.86	4.94	2	0.00	35.0	16328.63	7896.17	
3208.98	0.93										
19	291.57	128.34	10.0	4.86	4.94	2	0.00	35.0	16813.14	8133.25	
3302.58	0.93										
20	296.44	127.23	12.3	4.71	4.82	2	0.00	35.0	16667.37	8124.72	
3352.01	0.92										
21	301.14	129.80	12.3	4.71	4.82	2	0.00	35.0	17003.63	8288.64	
3419.64	0.92										
22	305.85	130.69	14.5	4.66	4.82	2	0.00	35.0	17120.23	8422.95	
3442.33	0.91										
23	310.51	132.32	14.5	4.66	4.82	2	0.00	35.0	17333.45	8527.85	
3485.20	0.91										
24	315.17	23.68	16.7	0.83	0.87	2	0.00	35.0	3101.56	1542.57	
3475.55	0.90										
25	316.00	85.90	16.7	3.00	3.13	2	0.00	35.0	11252.41	5498.71	
3478.98	0.90										
26	319.00	155.22	16.7	5.40	5.63	2	0.00	35.0	20333.81	9445.53	
3483.94	0.90										
27	324.40	128.81	18.9	4.55	4.82	2	0.00	35.0	16873.50	7596.17	
3379.81	0.90										
28	328.95	121.69	18.9	4.55	4.82	2	0.00	35.0	15940.83	7126.47	
3191.41	0.90										
29	333.50	112.56	21.2	4.49	4.82	2	0.00	35.0	14744.90	6630.27	
2961.39	0.89										
30	337.99	104.75	21.2	4.49	4.82	2	0.00	35.0	13722.02	6107.79	
2753.75	0.89										
31	342.49	65.58	23.4	3.01	3.28	2	0.00	35.0	8590.92	3845.27	
2545.11	0.89										
32	345.49	61.67	23.4	3.01	3.28	2	0.00	35.0	8078.42	3579.29	
2391.21	0.89										
33	348.50	37.38	23.4	1.92	2.10	5	0.00	45.0	4111.66	1101.74	
1743.36	0.82										
34	350.42	16.98	23.4	0.90	0.98	5	0.00	45.0	1867.87	0.00	
1563.79	0.82										
35	351.32	76.39	25.6	4.34	4.82	2	0.00	35.0	10006.65	0.00	
1841.01	0.89										
36	355.67	67.35	25.6	4.34	4.82	2	0.00	35.0	8822.34	0.00	
1623.13	0.89										
37	360.01	56.82	27.8	4.26	4.82	2	0.00	35.0	7443.46	0.00	
1368.54	0.89										
38	364.27	47.24	27.8	4.26	4.82	2	0.00	35.0	6188.93	0.00	
1137.89	0.89										
39	368.52	36.53	30.1	4.17	4.82	2	0.00	35.0	4784.88	0.00	
880.47	0.89										
40	372.69	26.47	30.1	4.17	4.82	2	0.00	35.0	3467.64	0.00	
638.09	0.89										
41	376.86	17.78	32.3	4.98	5.89	2	0.00	35.0	2329.17	0.00	
351.39	0.89										
42	381.84	3.16	32.3	3.16	3.74	1	150.00	22.0	414.52	0.00	
50.27	0.99										

X-S Area:	3123.54	Path Length:	182.99	X-S Weight:	409535.38

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-3\West Farm Expansion Case 8-3 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 13:08:49

DATA: Analysis 1 - Case 8-3 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 193.00 348.50 193.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 171.00 348.50 171.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 168.00 348.50 168.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 193.00 450.00 193.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 171.00 450.00 171.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 168.00 450.00 168.00

Slope Surface (4 points)

100.00	171.00	238.00	171.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	197.00	238.00	197.00	316.00	197.00	348.50	197.00
351.50	178.00						
450.00	178.00						

Failure Surface

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

Intersects: XL:	238.00	YL:	171.00	XR:	405.00	YR:	200.00
Centre: XC:	281.26	YC:	417.23	Radius: R:			250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 8-3 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 4.271

Analysis Summary

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

Critical (minimum) Factor of Safety: 2.70

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	234.05	171.00	400.00	200.00	273.90	432.26	264.29	2.702	
Critical Surface									
2	237.21	171.00	400.00	200.00	276.09	424.15	256.12	2.704	
3	233.00	171.00	400.00	200.00	272.93	436.38	268.37	2.706	
4	235.63	171.00	400.00	200.00	274.99	428.21	260.20	2.707	
5	234.58	171.00	400.00	200.00	274.02	432.33	264.29	2.708	
6	238.26	171.09	400.00	200.00	277.20	420.10	252.04	2.711	
7	236.68	171.00	400.00	200.00	275.22	428.33	260.20	2.711	
8	233.53	171.00	400.00	200.00	273.05	436.44	268.37	2.712	
9	237.74	171.00	400.00	200.00	276.20	424.22	256.12	2.712	
10	236.16	171.00	400.53	200.00	275.52	428.21	260.20	2.713	
11	235.11	171.00	400.00	200.00	274.13	432.39	264.29	2.714	
12	236.16	171.00	400.00	200.00	275.11	428.27	260.20	2.714	
13	238.79	171.26	400.00	200.00	278.32	416.05	247.96	2.714	
14	234.58	171.00	400.53	200.00	274.43	432.26	264.29	2.717	
15	233.53	171.00	400.53	200.00	273.46	436.38	268.37	2.717	
16	239.32	171.44	400.00	200.00	279.44	411.99	243.88	2.718	
17	234.05	171.00	400.00	200.00	273.16	436.50	268.37	2.718	
18	237.74	171.00	400.53	200.00	276.62	424.15	256.12	2.718	
19	238.79	171.26	400.53	200.00	278.73	415.98	247.96	2.719	
20	237.21	171.00	400.00	200.00	275.33	428.40	260.20	2.719	
21	235.63	171.00	400.00	200.00	274.25	432.45	264.29	2.720	
22	238.26	171.09	400.53	200.00	277.61	420.04	252.04	2.720	
23	235.63	171.00	400.53	200.00	274.66	432.39	264.29	2.721	
24	236.68	171.00	400.53	200.00	275.63	428.27	260.20	2.721	
25	233.00	171.00	400.00	200.00	272.20	440.61	272.45	2.722	
26	239.84	171.61	400.00	200.00	280.55	407.93	239.80	2.722	
27	235.11	171.00	401.05	200.00	274.96	432.26	264.29	2.722	
28	235.11	171.00	400.53	200.00	274.54	432.33	264.29	2.723	
29	234.05	171.00	400.53	200.00	273.58	436.44	268.37	2.723	
30	239.32	171.44	400.53	200.00	279.84	411.92	243.88	2.723	
31	234.58	171.00	400.00	200.00	273.28	436.56	268.37	2.723	
32	238.26	171.09	400.00	200.00	276.44	424.35	256.12	2.725	
33	240.37	171.79	400.00	200.00	281.67	403.86	235.71	2.726	
34	236.68	171.00	400.00	200.00	274.47	432.57	264.29	2.726	
35	236.68	171.00	401.05	200.00	276.05	428.21	260.20	2.727	
36	233.00	171.00	400.53	200.00	272.61	440.55	272.45	2.727	
37	239.84	171.61	400.53	200.00	280.96	407.86	239.80	2.727	
38	233.53	171.00	400.00	200.00	272.31	440.67	272.45	2.727	
39	237.74	171.00	400.00	200.00	275.45	428.46	260.20	2.727	
40	237.21	171.00	400.53	200.00	275.75	428.33	260.20	2.728	
41	236.16	171.00	400.53	200.00	274.77	432.45	264.29	2.729	
42	235.11	171.00	400.00	200.00	273.39	436.62	268.37	2.729	
43	236.16	171.00	400.00	200.00	274.36	432.51	264.29	2.730	
44	238.79	171.26	400.00	200.00	277.56	420.30	252.04	2.730	
45	234.58	171.00	401.05	200.00	274.10	436.44	268.37	2.730	
46	235.63	171.00	401.05	200.00	275.07	432.33	264.29	2.730	
47	238.26	171.09	400.53	200.00	276.86	424.29	256.12	2.731	
48	234.05	171.00	401.05	200.00	273.99	436.38	268.37	2.732	
49	233.00	171.00	401.05	200.00	273.02	440.49	272.45	2.732	
50	234.05	171.00	400.00	200.00	272.42	440.73	272.45	2.733	
51	233.53	171.00	400.53	200.00	272.73	440.61	272.45	2.733	
52	234.58	171.00	400.53	200.00	273.69	436.50	268.37	2.733	
53	237.21	171.00	401.05	200.00	276.16	428.27	260.20	2.733	
54	237.74	171.00	400.53	200.00	275.86	428.40	260.20	2.734	
55	237.21	171.00	400.00	200.00	274.58	432.63	264.29	2.734	
56	235.63	171.00	400.00	200.00	273.50	436.68	268.37	2.734	
57	239.32	171.44	400.00	200.00	278.68	416.25	247.96	2.734	
58	240.89	171.96	400.00	200.00	282.78	399.78	231.63	2.735	
59	235.63	171.00	400.53	200.00	273.91	436.62	268.37	2.736	
60	238.79	171.26	400.53	200.00	277.97	420.24	252.04	2.736	
61	235.63	171.00	401.58	200.00	275.48	432.26	264.29	2.736	
62	241.42	172.14	400.00	200.00	283.88	395.69	227.55	2.736	
63	236.16	171.00	401.05	200.00	275.19	432.39	264.29	2.737	
64	233.00	171.00	400.00	200.00	271.46	444.84	276.53	2.737	

65	236.68	171.00	400.53	200.00	274.88	432.51	264.29	2.737
66	240.89	171.96	400.53	200.00	283.18	399.71	231.63	2.737
67	240.37	171.79	400.53	200.00	282.07	403.79	235.71	2.737
68	235.11	171.00	401.05	200.00	274.22	436.50	268.37	2.738
69	234.58	171.00	400.00	200.00	272.53	440.79	272.45	2.738
70	234.05	171.00	400.53	200.00	272.84	440.67	272.45	2.738
71	238.26	171.09	401.05	200.00	277.27	424.22	256.12	2.739
72	240.37	171.79	401.05	200.00	282.47	403.71	235.71	2.739
73	235.11	171.00	400.53	200.00	273.80	436.56	268.37	2.739
74	233.53	171.00	401.58	200.00	273.55	440.49	272.45	2.739
75	237.21	171.00	401.58	200.00	276.57	428.21	260.20	2.739
76	234.58	171.00	401.58	200.00	274.51	436.38	268.37	2.740
77	239.84	171.61	400.00	200.00	279.80	412.20	243.88	2.740
78	237.74	171.00	401.05	200.00	276.27	428.33	260.20	2.740
79	238.26	171.09	400.00	200.00	275.68	428.59	260.20	2.740
80	239.32	171.44	400.53	200.00	279.09	416.19	247.96	2.740
81	239.84	171.61	401.05	200.00	281.36	407.79	239.80	2.741
82	233.00	171.00	401.58	200.00	273.43	440.43	272.45	2.741
83	237.74	171.00	400.00	200.00	274.69	432.69	264.29	2.741
84	241.95	172.32	400.00	200.00	284.99	391.60	223.47	2.741
85	233.53	171.00	400.00	200.00	271.58	444.90	276.53	2.742
86	236.16	171.00	401.58	200.00	275.60	432.33	264.29	2.742
87	233.53	171.00	401.05	200.00	273.14	440.55	272.45	2.742
88	233.00	171.00	400.53	200.00	271.88	444.78	276.53	2.742
89	236.68	171.00	400.00	200.00	275.98	424.09	256.12	2.742
90	237.21	171.00	400.53	200.00	275.00	432.57	264.29	2.742
91	241.42	172.14	400.53	200.00	284.28	395.62	227.55	2.743
92	236.68	171.00	401.05	200.00	275.30	432.45	264.29	2.743
93	238.79	171.26	401.05	200.00	278.38	420.17	252.04	2.743
94	236.16	171.00	400.53	200.00	274.03	436.68	268.37	2.743
95	235.11	171.00	400.00	200.00	272.64	440.85	272.45	2.743
96	240.89	171.96	401.05	200.00	283.58	399.63	231.63	2.744
97	234.58	171.00	400.53	200.00	272.95	440.73	272.45	2.744
98	236.16	171.00	400.00	200.00	273.61	436.74	268.37	2.745
99	238.79	171.26	400.00	200.00	276.81	424.55	256.12	2.745

Critical Failure Surface (circle 1)

Intersects:	XL:	234.05	YL:	171.00	XR:	400.00	YR:	200.00	
Centre:	XC:	273.90	YC:	432.26		Radius:	R:	264.29	
Generated failure surface: (20 points)									
234.05	171.00		242.99	169.79		251.97	168.89	260.98	168.29
270.00	168.01								
279.02	168.03		288.04	168.36		297.04	168.99	306.01	169.94
314.95	171.18								
323.84	172.74		332.67	174.59		341.43	176.75	350.11	179.20
358.71	181.95								
367.20	184.99		375.59	188.32		383.86	191.94	392.00	195.83
400.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	234.05	1.05	-7.7	3.95	3.98	3	100.00	18.0	148.41	6528.68
1665.43	1.03									
2	238.00	8.51	-7.7	4.99	5.04	3	100.00	18.0	1157.94	8451.18
1809.43	1.03									
3	242.99	17.27	-5.7	4.49	4.51	3	100.00	18.0	2326.57	7723.44
1997.26	1.02									
4	247.48	26.01	-5.7	4.49	4.51	3	100.00	18.0	3492.05	7850.41
2165.20	1.02									
5	251.97	34.52	-3.8	4.50	4.51	3	100.00	18.0	4623.27	7955.69
2318.78	1.01									
6	256.47	42.61	-3.8	4.50	4.51	3	100.00	18.0	5697.12	8039.47
2464.69	1.01									
7	260.98	50.45	-1.8	4.51	4.51	3	100.00	18.0	6734.25	8101.70
2595.20	1.00									
8	265.49	57.88	-1.8	4.51	4.51	3	100.00	18.0	7713.56	8142.15
2719.01	1.00									
9	270.00	64.99	0.1	4.51	4.51	3	100.00	18.0	8648.49	8160.90
2826.51	1.00									
10	274.51	71.73	0.1	4.51	4.51	3	100.00	18.0	9530.86	8158.05
2928.20	1.00									
11	279.02	78.07	2.1	4.51	4.51	3	100.00	18.0	10357.00	8133.45
3012.76	1.00									
12	283.53	84.10	2.1	4.51	4.51	3	100.00	18.0	11140.21	8087.19
3092.29	1.00									
13	288.04	89.62	4.0	4.50	4.51	3	100.00	18.0	11852.02	8019.27
3154.01	0.99									
14	292.54	94.94	4.0	4.50	4.51	3	100.00	18.0	12534.59	7929.70

3211.41	0.99										
15	297.04	76.88	6.0	3.48	3.50	3	100.00	18.0	10134.67	6077.59	
3246.44	0.99										
16	300.52	79.65	6.0	3.48	3.50	3	100.00	18.0	10484.27	5997.67	
3273.82	0.99										
17	304.00	47.28	6.0	2.01	2.02	3	100.00	18.0	6216.89	3428.87	
3295.42	0.99										
18	306.01	91.75	8.0	3.81	3.84	3	100.00	18.0	12049.89	6427.38	
3301.09	0.99										
19	309.82	94.56	8.0	3.81	3.84	3	100.00	18.0	12397.09	6299.77	
3312.37	0.99										
20	313.62	33.53	8.0	1.32	1.34	2	0.00	35.0	4391.81	2159.94	
3293.94	0.97										
21	314.95	26.88	9.9	1.05	1.07	2	0.00	35.0	3521.00	1714.28	
3281.76	0.97										
22	316.00	101.65	9.9	3.92	3.98	2	0.00	35.0	13316.02	6276.93	
3319.51	0.97										
23	319.92	104.08	9.9	3.92	3.98	2	0.00	35.0	13634.97	6106.97	
3395.53	0.97										
24	323.84	31.35	11.9	1.16	1.19	2	0.00	35.0	4106.41	1790.61	
3425.34	0.97										
25	325.00	102.03	11.9	3.83	3.92	2	0.00	35.0	13365.85	5772.39	
3382.50	0.97										
26	328.83	98.94	11.9	3.83	3.92	2	0.00	35.0	12961.12	5575.39	
3279.81	0.97										
27	332.67	108.94	13.8	4.38	4.51	2	0.00	35.0	14271.36	6156.19	
3144.04	0.97										
28	337.05	104.22	13.8	4.38	4.51	2	0.00	35.0	13652.61	5852.66	
3007.24	0.97										
29	341.43	80.43	15.8	3.54	3.67	2	0.00	35.0	10536.28	4527.65	
2860.96	0.97										
30	344.96	76.90	15.8	3.54	3.67	2	0.00	35.0	10073.61	4298.63	
2734.74	0.97										
31	348.50	33.90	15.8	1.61	1.68	5	0.00	45.0	3728.85	1350.59	
2169.90	0.94										
32	350.11	23.50	17.7	1.14	1.20	5	0.00	45.0	2584.51	283.15	
2052.46	0.94										
33	351.25	73.93	17.7	3.73	3.91	2	0.00	35.0	9684.84	0.00	
2399.44	0.97										
34	354.98	69.49	17.7	3.73	3.91	2	0.00	35.0	9102.77	0.00	
2255.21	0.97										
35	358.71	73.43	19.7	4.25	4.51	2	0.00	35.0	9619.10	0.00	
2072.25	0.97										
36	362.95	66.97	19.7	4.25	4.51	2	0.00	35.0	8773.03	0.00	
1889.98	0.97										
37	367.20	59.43	21.7	4.19	4.51	2	0.00	35.0	7785.89	0.00	
1683.49	0.98										
38	371.40	52.45	21.7	4.19	4.51	2	0.00	35.0	6871.48	0.00	
1485.78	0.98										
39	375.59	44.54	23.6	4.13	4.51	2	0.00	35.0	5834.33	0.00	
1267.67	0.98										
40	379.72	37.07	23.6	4.13	4.51	2	0.00	35.0	4855.82	0.00	
1055.07	0.98										
41	383.86	16.74	25.6	2.22	2.46	2	0.00	35.0	2192.34	0.00	
877.80	0.99										
42	386.08	18.62	25.6	2.96	3.28	1	150.00	22.0	2439.09	0.00	
744.48	1.03										
43	389.04	14.43	25.6	2.96	3.28	1	150.00	22.0	1890.45	0.00	
571.44	1.03										
44	392.00	12.51	27.5	4.00	4.51	1	150.00	22.0	1638.99	0.00	
353.18	1.05										
45	396.00	4.17	27.5	4.00	4.51	1	150.00	22.0	546.32	0.00	
99.84	1.05										

X-S Area:

2581.96

Path Length:

171.44

X-S Weight:

338617.97

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-3\West Farm Expansion Case 8-3 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 13:08:26

DATA: Analysis 1 - Case 8-3 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 193.00 348.50 193.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 171.00 348.50 171.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 168.00 348.50 168.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 193.00 450.00 193.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 171.00 450.00 171.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 168.00 450.00 168.00

Slope Surface (4 points)

100.00 171.00 238.00 171.00 325.00 200.00 450.00 200.00

Phreatic Surface (6 points)

100.00 171.00 238.00 171.00 316.00 197.00 348.50 197.00
 351.50 178.00
 450.00 178.00

Failure Surface

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

Intersects: XL: 238.00 YL: 171.00 XR: 405.00 YR: 200.00
 Centre: XC: 281.26 YC: 417.23 Radius: R: 250.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 10.00 10.00 200.00
 Trial positions within range: 20 20 50

RESULTS: Analysis 1 - Case 8-3 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.862

Analysis Summary

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

Critical (minimum) Factor of Safety: 1.77

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	234.05	171.00	400.00	200.00	273.90	432.26	264.29	1.770	
Critical Surface									
2	233.00	171.00	400.00	200.00	272.93	436.38	268.37	1.773	
3	237.21	171.00	400.00	200.00	276.09	424.15	256.12	1.775	
4	235.63	171.00	400.00	200.00	274.99	428.21	260.20	1.775	
5	234.58	171.00	400.00	200.00	274.02	432.33	264.29	1.775	
6	233.53	171.00	400.00	200.00	273.05	436.44	268.37	1.777	
7	235.11	171.00	400.00	200.00	274.13	432.39	264.29	1.780	
8	236.16	171.00	400.00	200.00	275.11	428.27	260.20	1.780	
9	236.68	171.00	400.00	200.00	275.22	428.33	260.20	1.780	
10	238.26	171.09	400.00	200.00	277.20	420.10	252.04	1.780	
11	237.74	171.00	400.00	200.00	276.20	424.22	256.12	1.781	
12	236.16	171.00	400.53	200.00	275.52	428.21	260.20	1.781	
13	234.58	171.00	400.53	200.00	274.43	432.26	264.29	1.781	
14	233.53	171.00	400.53	200.00	273.46	436.38	268.37	1.782	
15	234.05	171.00	400.00	200.00	273.16	436.50	268.37	1.782	
16	238.79	171.26	400.00	200.00	278.32	416.05	247.96	1.784	
17	233.00	171.00	400.00	200.00	272.20	440.61	272.45	1.784	
18	235.63	171.00	400.00	200.00	274.25	432.45	264.29	1.784	
19	237.74	171.00	400.53	200.00	276.62	424.15	256.12	1.785	
20	237.21	171.00	400.00	200.00	275.33	428.40	260.20	1.786	
21	235.11	171.00	400.53	200.00	274.54	432.33	264.29	1.786	
22	234.58	171.00	400.00	200.00	273.28	436.56	268.37	1.786	
23	234.05	171.00	400.53	200.00	273.58	436.44	268.37	1.786	
24	235.63	171.00	400.53	200.00	274.66	432.39	264.29	1.787	
25	236.68	171.00	400.53	200.00	275.63	428.27	260.20	1.787	
26	238.26	171.09	400.53	200.00	277.61	420.04	252.04	1.787	
27	235.11	171.00	401.05	200.00	274.96	432.26	264.29	1.788	
28	239.32	171.44	400.00	200.00	279.44	411.99	243.88	1.788	
29	238.79	171.26	400.53	200.00	278.73	415.98	247.96	1.788	
30	233.53	171.00	400.00	200.00	272.31	440.67	272.45	1.788	
31	233.00	171.00	400.53	200.00	272.61	440.55	272.45	1.788	
32	235.11	171.00	400.00	200.00	273.39	436.62	268.37	1.790	
33	238.26	171.09	400.00	200.00	276.44	424.35	256.12	1.791	
34	236.68	171.00	400.00	200.00	274.47	432.57	264.29	1.791	
35	236.16	171.00	400.00	200.00	274.36	432.51	264.29	1.791	
36	237.74	171.00	400.00	200.00	275.45	428.46	260.20	1.791	
37	236.68	171.00	401.05	200.00	276.05	428.21	260.20	1.792	
38	237.21	171.00	400.53	200.00	275.75	428.33	260.20	1.792	
39	239.84	171.61	400.00	200.00	280.55	407.93	239.80	1.792	
40	239.32	171.44	400.53	200.00	279.84	411.92	243.88	1.792	
41	236.16	171.00	400.53	200.00	274.77	432.45	264.29	1.792	
42	234.05	171.00	401.05	200.00	273.99	436.38	268.37	1.792	
43	234.05	171.00	400.00	200.00	272.42	440.73	272.45	1.793	
44	233.00	171.00	401.05	200.00	273.02	440.49	272.45	1.793	
45	234.58	171.00	400.53	200.00	273.69	436.50	268.37	1.793	
46	233.53	171.00	400.53	200.00	272.73	440.61	272.45	1.793	
47	234.58	171.00	401.05	200.00	274.10	436.44	268.37	1.793	
48	235.63	171.00	401.05	200.00	275.07	432.33	264.29	1.793	
49	233.00	171.00	400.00	200.00	271.46	444.84	276.53	1.795	
50	235.63	171.00	400.00	200.00	273.50	436.68	268.37	1.795	
51	238.79	171.26	400.00	200.00	277.56	420.30	252.04	1.795	
52	238.26	171.09	400.53	200.00	276.86	424.29	256.12	1.795	
53	237.21	171.00	400.00	200.00	274.58	432.63	264.29	1.796	
54	240.37	171.79	400.00	200.00	281.67	403.86	235.71	1.796	
55	239.84	171.61	400.53	200.00	280.96	407.86	239.80	1.796	
56	237.74	171.00	400.53	200.00	275.86	428.40	260.20	1.796	
57	237.21	171.00	401.05	200.00	276.16	428.27	260.20	1.797	
58	234.58	171.00	400.00	200.00	272.53	440.79	272.45	1.797	
59	234.05	171.00	400.53	200.00	272.84	440.67	272.45	1.797	
60	235.63	171.00	400.53	200.00	273.91	436.62	268.37	1.797	
61	235.11	171.00	400.53	200.00	273.80	436.56	268.37	1.797	
62	235.63	171.00	401.58	200.00	275.48	432.26	264.29	1.798	
63	236.68	171.00	400.53	200.00	274.88	432.51	264.29	1.798	
64	236.16	171.00	401.05	200.00	275.19	432.39	264.29	1.798	

65	235.11	171.00	401.05	200.00	274.22	436.50	268.37	1.799
66	233.53	171.00	400.00	200.00	271.58	444.90	276.53	1.799
67	233.00	171.00	401.58	200.00	273.43	440.43	272.45	1.799
68	233.00	171.00	400.53	200.00	271.88	444.78	276.53	1.799
69	233.53	171.00	401.05	200.00	273.14	440.55	272.45	1.799
70	233.53	171.00	401.58	200.00	273.55	440.49	272.45	1.800
71	239.32	171.44	400.00	200.00	278.68	416.25	247.96	1.800
72	234.58	171.00	401.58	200.00	274.51	436.38	268.37	1.800
73	238.79	171.26	400.53	200.00	277.97	420.24	252.04	1.800
74	235.11	171.00	400.00	200.00	272.64	440.85	272.45	1.801
75	238.26	171.09	400.00	200.00	275.68	428.59	260.20	1.801
76	236.68	171.00	400.00	200.00	275.98	424.09	256.12	1.801
77	237.21	171.00	401.58	200.00	276.57	428.21	260.20	1.801
78	238.26	171.09	401.05	200.00	277.27	424.22	256.12	1.801
79	237.74	171.00	401.05	200.00	276.27	428.33	260.20	1.801
80	237.74	171.00	400.00	200.00	274.69	432.69	264.29	1.801
81	234.58	171.00	400.53	200.00	272.95	440.73	272.45	1.801
82	236.16	171.00	400.00	200.00	273.61	436.74	268.37	1.802
83	237.21	171.00	400.53	200.00	275.00	432.57	264.29	1.802
84	236.16	171.00	400.53	200.00	274.03	436.68	268.37	1.803
85	236.16	171.00	401.58	200.00	275.60	432.33	264.29	1.803
86	236.68	171.00	401.05	200.00	275.30	432.45	264.29	1.803
87	234.05	171.00	400.00	200.00	271.68	444.96	276.53	1.803
88	240.89	171.96	400.00	200.00	282.78	399.78	231.63	1.804
89	233.53	171.00	400.53	200.00	271.99	444.84	276.53	1.804
90	234.05	171.00	401.05	200.00	273.25	440.61	272.45	1.804
91	234.58	171.00	401.05	200.00	273.36	440.67	272.45	1.804
92	233.00	171.00	401.05	200.00	272.29	444.72	276.53	1.804
93	235.63	171.00	401.05	200.00	274.33	436.56	268.37	1.804
94	235.11	171.00	401.58	200.00	274.63	436.44	268.37	1.804
95	239.32	171.44	400.53	200.00	279.09	416.19	247.96	1.805
96	239.84	171.61	400.00	200.00	279.80	412.20	243.88	1.805
97	240.37	171.79	400.53	200.00	282.07	403.79	235.71	1.805
98	235.63	171.00	400.00	200.00	272.75	440.91	272.45	1.805
99	233.00	171.00	400.00	200.00	270.73	449.06	280.61	1.805

Critical Failure Surface (circle 1)

Intersects:	XL:	234.05	YL:	171.00	XR:	400.00	YR:	200.00	
Centre:	XC:	273.90	YC:	432.26		Radius:	R:	264.29	
Generated failure surface: (20 points)									
234.05	171.00		242.99	169.79		251.97	168.89	260.98	168.29
270.00	168.01								
279.02	168.03		288.04	168.36		297.04	168.99	306.01	169.94
314.95	171.18								
323.84	172.74		332.67	174.59		341.43	176.75	350.11	179.20
358.71	181.95								
367.20	184.99		375.59	188.32		383.86	191.94	392.00	195.83
400.00	200.00								

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

Slice	X-S		Base						PoreWater	
Normal	Test	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
Stress	X-Left									
1	234.05	1.05	-7.7	3.95	3.98	3	100.00	18.0	148.41	66.28
45.96	1.03									
2	238.00	8.51	-7.7	4.99	5.04	3	100.00	18.0	1157.94	535.67
242.84	1.03									
3	242.99	17.27	-5.7	4.49	4.51	3	100.00	18.0	2326.57	1083.00
529.28	1.02									
4	247.48	26.01	-5.7	4.49	4.51	3	100.00	18.0	3492.05	1631.26
791.50	1.02									
5	251.97	34.52	-3.8	4.50	4.51	3	100.00	18.0	4623.27	2158.48
1037.49	1.01									
6	256.47	42.61	-3.8	4.50	4.51	3	100.00	18.0	5697.12	2664.72
1277.58	1.01									
7	260.98	50.45	-1.8	4.51	4.51	3	100.00	18.0	6734.25	3149.71
1499.86	1.01									
8	265.49	57.88	-1.8	4.51	4.51	3	100.00	18.0	7713.56	3613.34
1717.70	1.01									
9	270.00	64.99	0.1	4.51	4.51	3	100.00	18.0	8648.49	4055.39
1916.35	1.00									
10	274.51	71.73	0.1	4.51	4.51	3	100.00	18.0	9530.86	4475.91
2111.87	1.00									
11	279.02	78.07	2.1	4.51	4.51	3	100.00	18.0	10357.00	4874.58
2286.97	0.99									
12	283.53	84.10	2.1	4.51	4.51	3	100.00	18.0	11140.21	5251.43
2460.08	0.99									
13	288.04	89.62	4.0	4.50	4.51	3	100.00	18.0	11852.02	5606.24
2611.74	0.99									
14	292.54	94.94	4.0	4.50	4.51	3	100.00	18.0	12534.59	5939.02

2762.41	0.99										
15	297.04	76.88	6.0	3.48	3.50	3	100.00	18.0	10134.67	4823.68	
2876.36	0.99										
16	300.52	79.65	6.0	3.48	3.50	3	100.00	18.0	10484.27	4997.22	
2975.83	0.99										
17	304.00	47.28	6.0	2.01	2.02	3	100.00	18.0	6216.89	2966.37	
3054.29	0.99										
18	306.01	91.75	8.0	3.81	3.84	3	100.00	18.0	12049.89	5780.97	
3116.22	0.98										
19	309.82	94.56	8.0	3.81	3.84	3	100.00	18.0	12397.09	5957.71	
3206.29	0.98										
20	313.62	33.53	8.0	1.32	1.34	2	0.00	35.0	4391.81	2112.31	
3228.01	0.96										
21	314.95	26.88	9.9	1.05	1.07	2	0.00	35.0	3521.00	1702.60	
3233.46	0.95										
22	316.00	101.65	9.9	3.92	3.98	2	0.00	35.0	13316.02	6276.93	
3280.70	0.95										
23	319.92	104.08	9.9	3.92	3.98	2	0.00	35.0	13634.97	6106.97	
3354.07	0.95										
24	323.84	31.35	11.9	1.16	1.19	2	0.00	35.0	4106.41	1790.61	
3374.57	0.94										
25	325.00	102.03	11.9	3.83	3.92	2	0.00	35.0	13365.85	5772.39	
3332.00	0.94										
26	328.83	98.94	11.9	3.83	3.92	2	0.00	35.0	12961.12	5575.39	
3230.70	0.94										
27	332.67	108.94	13.8	4.38	4.51	2	0.00	35.0	14271.36	6156.19	
3089.63	0.94										
28	337.05	104.22	13.8	4.38	4.51	2	0.00	35.0	13652.61	5852.66	
2954.96	0.94										
29	341.43	80.43	15.8	3.54	3.67	2	0.00	35.0	10536.28	4527.65	
2804.51	0.93										
30	344.96	76.90	15.8	3.54	3.67	2	0.00	35.0	10073.61	4298.63	
2680.51	0.93										
31	348.50	33.90	15.8	1.61	1.68	5	0.00	45.0	3728.85	1350.59	
2105.17	0.90										
32	350.11	23.50	17.7	1.14	1.20	5	0.00	45.0	2584.51	283.15	
1956.67	0.89										
33	351.25	73.93	17.7	3.73	3.91	2	0.00	35.0	9684.84	0.00	
2306.54	0.93										
34	354.98	69.49	17.7	3.73	3.91	2	0.00	35.0	9102.77	0.00	
2167.90	0.93										
35	358.71	73.43	19.7	4.25	4.51	2	0.00	35.0	9619.10	0.00	
1983.66	0.93										
36	362.95	66.97	19.7	4.25	4.51	2	0.00	35.0	8773.03	0.00	
1809.18	0.93										
37	367.20	59.43	21.7	4.19	4.51	2	0.00	35.0	7785.89	0.00	
1604.74	0.93										
38	371.40	52.45	21.7	4.19	4.51	2	0.00	35.0	6871.48	0.00	
1416.27	0.93										
39	375.59	44.54	23.6	4.13	4.51	2	0.00	35.0	5834.33	0.00	
1203.27	0.93										
40	379.72	37.07	23.6	4.13	4.51	2	0.00	35.0	4855.82	0.00	
1001.47	0.93										
41	383.86	16.74	25.6	2.22	2.46	2	0.00	35.0	2192.34	0.00	
829.66	0.93										
42	386.08	18.62	25.6	2.96	3.28	1	150.00	22.0	2439.09	0.00	
706.62	1.00										
43	389.04	14.43	25.6	2.96	3.28	1	150.00	22.0	1890.45	0.00	
539.46	1.00										
44	392.00	12.51	27.5	4.00	4.51	1	150.00	22.0	1638.99	0.00	
326.64	1.01										
45	396.00	4.17	27.5	4.00	4.51	1	150.00	22.0	546.32	0.00	
82.58	1.01										

X-S Area:

2581.96

Path Length:

171.44

X-S Weight:

338617.97

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Full Reservoir-EQ.gmf
 Processed: 04 Dec 2020 13:09:42

DATA: Analysis 1 - Case 8-4 Full Reservoir - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 182.00 348.50 182.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 164.00 348.50 164.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 161.00 348.50 161.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 182.00 450.00 182.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 164.00 450.00 164.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 161.00 450.00 161.00

Slope Surface (4 points)

100.00	164.00	217.00	164.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	197.00	217.00	197.00	316.00	197.00	348.50	197.00
351.50	172.00						
450.00	172.00						

Failure Surface

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

Intersects: XL:	217.00	YL:	164.00	XR:	380.00	YR:	200.00
Centre: XC:	192.18	YC:	663.38	Radius: R:			500.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 8-4 Full Reservoir - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 2.241

Analysis Summary

There were: 11023 successful analyses from a total of 20001 trial failure surfaces
8978 analyses terminated due to unacceptable geometry

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	217.79	164.26	375.00	200.00	166.43	753.87	591.84	2.137	
Critical Surface									
2	217.79	164.26	375.00	200.00	165.52	757.88	595.92	2.138	
3	217.26	164.09	375.00	200.00	170.56	733.60	571.43	2.138	
4	217.79	164.26	375.00	200.00	164.60	761.90	600.00	2.138	
5	217.26	164.09	375.00	200.00	171.47	729.58	567.35	2.138	
6	217.26	164.09	375.00	200.00	172.39	725.56	563.27	2.139	
7	217.26	164.09	375.00	200.00	173.30	721.54	559.18	2.139	
8	217.26	164.09	375.00	200.00	174.22	717.52	555.10	2.139	
9	217.26	164.09	375.00	200.00	175.13	713.50	551.02	2.140	
10	217.26	164.09	375.00	200.00	176.05	709.47	546.94	2.140	
11	216.74	164.00	375.00	200.00	180.48	689.28	526.53	2.140	
12	217.26	164.09	375.00	200.00	176.97	705.45	542.86	2.140	
13	217.79	164.26	375.00	200.00	167.34	749.85	587.76	2.140	
14	216.74	164.00	375.00	200.00	181.39	685.25	522.45	2.141	
15	217.26	164.09	375.00	200.00	177.88	701.42	538.78	2.141	
16	217.79	164.26	375.00	200.00	168.26	745.83	583.67	2.141	
17	217.79	164.26	375.00	200.00	169.17	741.81	579.59	2.141	
18	218.32	164.44	375.00	200.00	169.61	741.98	579.59	2.141	
19	217.26	164.09	375.00	200.00	178.80	697.40	534.69	2.141	
20	217.79	164.26	375.00	200.00	170.08	737.79	575.51	2.141	
21	216.74	164.00	375.00	200.00	182.31	681.22	518.37	2.141	
22	217.79	164.26	375.00	200.00	171.00	733.77	571.43	2.141	
23	217.26	164.09	375.00	200.00	179.72	693.37	530.61	2.141	
24	218.32	164.44	375.00	200.00	168.70	746.00	583.67	2.141	
25	217.79	164.26	375.00	200.00	171.91	729.75	567.35	2.142	
26	216.74	164.00	375.00	200.00	183.23	677.19	514.29	2.142	
27	217.79	164.26	375.00	200.00	172.82	725.73	563.27	2.142	
28	217.26	164.09	375.00	200.00	180.63	689.34	526.53	2.142	
29	218.32	164.44	375.00	200.00	167.79	750.02	587.76	2.142	
30	217.79	164.26	375.00	200.00	173.74	721.71	559.18	2.142	
31	216.74	164.00	375.00	200.00	184.14	673.16	510.20	2.142	
32	217.26	164.09	375.00	200.00	181.55	685.31	522.45	2.142	
33	217.79	164.26	375.00	200.00	174.65	717.69	555.10	2.142	
34	218.32	164.44	375.00	200.00	166.88	754.04	591.84	2.142	
35	216.74	164.00	375.00	200.00	185.06	669.13	506.12	2.143	
36	217.79	164.26	375.00	200.00	175.57	713.66	551.02	2.143	
37	217.26	164.09	375.00	200.00	182.47	681.29	518.37	2.143	
38	218.32	164.44	375.00	200.00	165.97	758.05	595.92	2.143	
39	217.79	164.26	375.00	200.00	176.48	709.64	546.94	2.143	
40	216.74	164.00	375.00	200.00	185.98	665.10	502.04	2.143	
41	218.32	164.44	375.00	200.00	165.05	762.07	600.00	2.143	
42	217.26	164.09	375.00	200.00	183.39	677.26	514.29	2.143	
43	217.79	164.26	375.00	200.00	177.40	705.62	542.86	2.143	
44	217.79	164.26	375.00	200.00	178.31	701.59	538.78	2.144	
45	216.74	164.00	375.00	200.00	186.90	661.06	497.96	2.144	
46	217.26	164.09	375.00	200.00	184.30	673.23	510.20	2.144	
47	216.74	164.00	375.00	200.00	164.01	761.68	600.00	2.144	
48	217.79	164.26	375.00	200.00	179.23	697.56	534.69	2.144	
49	216.74	164.00	375.00	200.00	164.92	757.66	595.92	2.144	
50	216.74	164.00	375.00	200.00	165.84	753.64	591.84	2.144	
51	218.32	164.44	375.00	200.00	170.53	737.96	575.51	2.144	
52	216.74	164.00	375.00	200.00	166.75	749.63	587.76	2.144	
53	217.26	164.09	375.00	200.00	185.22	669.19	506.12	2.144	
54	216.74	164.00	375.00	200.00	187.81	657.03	493.88	2.144	
55	218.32	164.44	375.00	200.00	171.44	733.94	571.43	2.144	
56	216.74	164.00	375.00	200.00	167.67	745.61	583.67	2.145	
57	217.79	164.26	375.00	200.00	180.14	693.54	530.61	2.145	
58	216.74	164.00	375.00	200.00	168.58	741.59	579.59	2.145	
59	218.32	164.44	375.00	200.00	172.35	729.92	567.35	2.145	
60	216.74	164.00	375.00	200.00	169.49	737.57	575.51	2.145	
61	217.26	164.09	375.00	200.00	164.15	761.73	600.00	2.145	
62	217.26	164.09	375.00	200.00	165.07	757.72	595.92	2.145	
63	217.79	164.26	375.00	200.00	181.06	689.51	526.53	2.145	

14	271.00	31.43	10.3	2.89	2.94	2	0.00	35.0	4117.96	4658.51
2286.99	0.96									
15	273.89	32.70	10.3	2.89	2.94	2	0.00	35.0	4283.52	4561.61
2282.34	0.96									
16	276.79	49.28	11.2	4.18	4.26	2	0.00	35.0	6455.76	6420.73
2269.20	0.96									
17	280.96	51.65	11.2	4.18	4.26	2	0.00	35.0	6766.48	6201.96
2254.42	0.96									
18	285.14	53.73	12.0	4.16	4.26	2	0.00	35.0	7038.99	5975.28
2231.88	0.96									
19	289.30	55.83	12.0	4.16	4.26	2	0.00	35.0	7313.97	5740.67
2209.08	0.96									
20	293.46	57.62	12.8	4.15	4.26	2	0.00	35.0	7547.77	5498.27
2178.26	0.95									
21	297.61	59.44	12.8	4.15	4.26	2	0.00	35.0	7786.92	5247.69
2147.49	0.95									
22	301.76	60.93	13.6	4.14	4.26	2	0.00	35.0	7981.37	4989.09
2108.47	0.95									
23	305.90	62.48	13.6	4.14	4.26	2	0.00	35.0	8184.92	4722.74
2069.76	0.95									
24	310.04	45.94	14.5	2.98	3.08	2	0.00	35.0	6018.29	3246.91
2029.06	0.95									
25	313.02	46.61	14.5	2.98	3.08	2	0.00	35.0	6106.30	3099.22
1995.35	0.95									
26	316.00	36.07	14.5	2.28	2.35	2	0.00	35.0	4725.47	2268.73
1987.47	0.95									
27	318.28	53.83	15.3	3.36	3.48	1	150.00	22.0	7052.13	3195.39
2022.17	0.99									
28	321.64	54.51	15.3	3.36	3.48	1	150.00	22.0	7141.14	2995.81
2044.54	0.99									
29	325.00	24.01	15.3	1.49	1.54	1	150.00	22.0	3144.80	1263.84
2029.76	0.99									
30	326.49	62.66	16.1	4.09	4.26	1	150.00	22.0	8208.39	3272.94
1924.21	0.99									
31	330.58	57.83	16.1	4.09	4.26	1	150.00	22.0	7576.11	2959.46
1773.77	0.99									
32	334.67	52.66	16.9	4.07	4.26	1	150.00	22.0	6898.71	2638.21
1615.75	0.99									
33	338.74	47.62	16.9	4.07	4.26	1	150.00	22.0	6237.78	2309.14
1458.06	0.99									
34	342.81	30.21	17.8	2.85	2.99	1	150.00	22.0	3958.16	1420.46
1317.83	0.99									
35	345.65	27.62	17.8	2.85	2.99	1	150.00	22.0	3618.76	1250.70
1202.09	0.99									
36	348.50	6.60	17.8	0.72	0.76	5	0.00	45.0	726.53	148.07
899.71	0.91									
37	349.22	14.82	17.8	1.69	1.78	5	0.00	45.0	1630.74	0.00
837.29	0.91									
38	350.92	31.48	18.6	4.03	4.26	1	150.00	22.0	4123.52	0.00
938.93	0.99									
39	354.95	26.01	18.6	4.03	4.26	1	150.00	22.0	3407.10	0.00
771.95	0.99									
40	358.98	20.32	19.4	4.01	4.26	1	150.00	22.0	2662.19	0.00
598.63	0.99									
41	363.00	14.65	19.4	4.01	4.26	1	150.00	22.0	1918.86	0.00
425.01	0.99									
42	367.01	8.81	20.2	3.99	4.26	1	150.00	22.0	1154.35	0.00
246.08	1.00									
43	371.01	2.94	20.2	3.99	4.26	1	150.00	22.0	384.78	0.00
65.91	1.00									

X-S Area:

1485.13

Path Length:

161.72

X-S Weight:

194102.33

Project: West Farm Pit Expansion
 File: C:\Galena Models\Case 8-4\West Farm Expansion Case 8-4 Rapid Drawdown-EQ.gmf
 Processed: 04 Dec 2020 13:09:18

DATA: Analysis 1 - Case 8-4 Rapid Drawdown - Pseudostatic

Material Properties (5 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Overburden
 Cohesion Phi UnitWeight Ru
 150.00 22.0 131.00 Auto
 Material: 2 (Mohr-Coulomb Isotropic) - Sand and Gravel
 Cohesion Phi UnitWeight Ru
 0.00 35.0 131.00 Auto
 Material: 3 (Mohr-Coulomb Isotropic) - Weathered Bedrock
 Cohesion Phi UnitWeight Ru
 100.00 18.0 141.00 Auto
 Material: 4 (Mohr-Coulomb Isotropic) - Stable Bedrock
 Cohesion Phi UnitWeight Ru
 2000.00 20.0 141.00 Auto
 Material: 5 (Mohr-Coulomb Isotropic) - Slurry Wall
 Cohesion Phi UnitWeight Ru
 0.00 45.0 110.00 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: 1 - Overburden
 100.00 200.00 348.50 200.00
 Profile: 2 (2 points) Material beneath: 2 - Sand and Gravel
 100.00 182.00 348.50 182.00
 Profile: 3 (2 points) Material beneath: 3 - Weathered Bedrock
 100.00 164.00 348.50 164.00
 Profile: 4 (2 points) Material beneath: 4 - Stable Bedrock
 100.00 161.00 348.50 161.00
 Profile: 5 (2 points) Material beneath: 5 - Slurry Wall
 348.50 200.00 351.50 200.00
 Profile: 6 (2 points) Material beneath: 1 - Overburden
 351.50 200.00 450.00 200.00
 Profile: 7 (2 points) Material beneath: 2 - Sand and Gravel
 351.50 182.00 450.00 182.00
 Profile: 8 (2 points) Material beneath: 3 - Weathered Bedrock
 351.50 164.00 450.00 164.00
 Profile: 9 (2 points) Material beneath: 4 - Stable Bedrock
 348.50 161.00 450.00 161.00

Slope Surface (4 points)

100.00	164.00	217.00	164.00	325.00	200.00	450.00	200.00

Phreatic Surface (6 points)

100.00	164.00	217.00	164.00	316.00	197.00	348.50	197.00
351.50	172.00						
450.00	172.00						

Failure Surface

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

Intersects: XL:	217.00	YL:	164.00	XR:	380.00	YR:	200.00
Centre: XC:	192.18	YC:	663.38	Radius: R:			500.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.042

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.00	200.00
Trial positions within range:	20	20	50

RESULTS: Analysis 1 - Case 8-4 Rapid Drawdown - Pseudostatic

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.403

Analysis Summary

There were: 11023 successful analyses from a total of 20001 trial failure surfaces
8978 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.33

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	<--
1	216.74	164.00	375.00	200.00	180.48	689.28	526.53	1.334	
Critical Surface									
2	216.74	164.00	375.00	200.00	181.39	685.25	522.45	1.334	
3	216.74	164.00	375.00	200.00	182.31	681.22	518.37	1.334	
4	216.74	164.00	375.00	200.00	183.23	677.19	514.29	1.334	
5	216.74	164.00	375.00	200.00	184.14	673.16	510.20	1.335	
6	216.74	164.00	375.00	200.00	185.06	669.13	506.12	1.335	
7	216.74	164.00	375.00	200.00	185.98	665.10	502.04	1.335	
8	216.74	164.00	375.00	200.00	186.90	661.06	497.96	1.335	
9	216.74	164.00	375.00	200.00	187.81	657.03	493.88	1.335	
10	217.26	164.09	375.00	200.00	173.30	721.54	559.18	1.335	
11	217.26	164.09	375.00	200.00	172.39	725.56	563.27	1.335	
12	217.26	164.09	375.00	200.00	174.22	717.52	555.10	1.335	
13	217.26	164.09	375.00	200.00	171.47	729.58	567.35	1.335	
14	217.26	164.09	375.00	200.00	175.13	713.50	551.02	1.335	
15	217.26	164.09	375.00	200.00	170.56	733.60	571.43	1.335	
16	217.26	164.09	375.00	200.00	176.05	709.47	546.94	1.335	
17	217.26	164.09	375.00	200.00	176.97	705.45	542.86	1.335	
18	217.26	164.09	375.00	200.00	177.88	701.42	538.78	1.335	
19	216.74	164.00	375.00	200.00	188.73	652.99	489.80	1.335	
20	217.26	164.09	375.00	200.00	178.80	697.40	534.69	1.335	
21	217.26	164.09	375.00	200.00	179.72	693.37	530.61	1.335	
22	217.26	164.09	375.00	200.00	180.63	689.34	526.53	1.336	
23	216.74	164.00	375.00	200.00	189.65	648.96	485.71	1.336	
24	217.26	164.09	375.00	200.00	181.55	685.31	522.45	1.336	
25	217.26	164.09	375.00	200.00	182.47	681.29	518.37	1.336	
26	216.74	164.00	375.00	200.00	190.57	644.92	481.63	1.336	
27	217.26	164.09	375.00	200.00	183.39	677.26	514.29	1.336	
28	217.26	164.09	375.00	200.00	184.30	673.23	510.20	1.336	
29	216.74	164.00	375.00	200.00	191.49	640.88	477.55	1.336	
30	217.26	164.09	375.00	200.00	185.22	669.19	506.12	1.336	
31	217.26	164.09	375.00	200.00	186.14	665.16	502.04	1.336	
32	216.74	164.00	375.00	200.00	192.41	636.84	473.47	1.336	
33	217.26	164.09	375.00	200.00	187.06	661.13	497.96	1.336	
34	216.74	164.00	375.00	200.00	193.32	632.80	469.39	1.337	
35	217.26	164.09	375.00	200.00	187.98	657.10	493.88	1.337	
36	217.79	164.26	375.00	200.00	166.43	753.87	591.84	1.337	
37	217.26	164.09	375.00	200.00	188.89	653.06	489.80	1.337	
38	216.74	164.00	375.00	200.00	194.24	628.76	465.31	1.337	
39	217.26	164.09	375.00	200.00	189.81	649.03	485.71	1.337	
40	216.74	164.00	375.00	200.00	199.77	604.49	440.82	1.337	
41	216.74	164.00	375.00	200.00	195.16	624.72	461.22	1.337	
42	217.79	164.26	375.00	200.00	165.52	757.88	595.92	1.337	
43	217.26	164.09	375.00	200.00	190.73	644.99	481.63	1.337	
44	217.26	164.09	375.00	200.00	191.65	640.95	477.55	1.338	
45	216.74	164.00	375.00	200.00	196.08	620.68	457.14	1.338	
46	216.74	164.00	375.00	200.00	198.84	608.54	444.90	1.338	
47	217.79	164.26	375.00	200.00	164.60	761.90	600.00	1.338	
48	217.26	164.09	375.00	200.00	192.57	636.91	473.47	1.338	
49	216.74	164.00	375.00	200.00	197.00	616.63	453.06	1.338	
50	216.74	164.00	375.00	200.00	176.81	705.39	542.86	1.338	
51	216.74	164.00	375.00	200.00	177.73	701.36	538.78	1.338	
52	216.74	164.00	375.00	200.00	175.90	709.41	546.94	1.338	
53	216.74	164.00	375.00	200.00	178.65	697.34	534.69	1.338	
54	216.74	164.00	375.00	200.00	174.98	713.44	551.02	1.338	
55	216.74	164.00	375.00	200.00	179.56	693.31	530.61	1.338	
56	216.74	164.00	375.00	200.00	197.92	612.59	448.98	1.338	
57	216.74	164.00	375.00	200.00	174.07	717.46	555.10	1.338	
58	217.26	164.09	375.00	200.00	193.49	632.87	469.39	1.338	
59	216.74	164.00	375.00	200.00	173.15	721.48	559.18	1.338	
60	216.74	164.00	375.00	200.00	172.24	725.50	563.27	1.338	
61	216.74	164.00	375.00	200.00	171.32	729.53	567.35	1.338	
62	217.79	164.26	375.00	200.00	173.74	721.71	559.18	1.338	
63	217.79	164.26	375.00	200.00	174.65	717.69	555.10	1.338	

14	271.00	62.17	10.0	5.27	5.35	2	0.00	35.0	8144.18	3939.40
1477.92	0.93									
15	276.27	52.68	10.9	4.21	4.29	2	0.00	35.0	6901.48	3348.37
1560.13	0.92									
16	280.48	55.16	10.9	4.21	4.29	2	0.00	35.0	7226.37	3505.99
1633.56	0.92									
17	284.69	57.30	11.9	4.20	4.29	2	0.00	35.0	7506.26	3653.79
1695.62	0.92									
18	288.88	59.46	11.9	4.20	4.29	2	0.00	35.0	7789.90	3791.85
1759.68	0.92									
19	293.08	61.26	12.8	4.18	4.29	2	0.00	35.0	8024.91	3920.20
1811.95	0.92									
20	297.26	63.11	12.8	4.18	4.29	2	0.00	35.0	8267.46	4038.68
1866.71	0.92									
21	301.44	64.56	13.7	4.17	4.29	2	0.00	35.0	8457.01	4147.20
1909.32	0.91									
22	305.61	66.10	13.7	4.17	4.29	2	0.00	35.0	8658.47	4246.00
1954.82	0.91									
23	309.77	50.33	14.7	3.11	3.22	2	0.00	35.0	6593.07	3246.52
1983.39	0.91									
24	312.89	51.02	14.7	3.11	3.22	2	0.00	35.0	6683.66	3291.13
2010.64	0.91									
25	316.00	34.28	14.7	2.07	2.14	2	0.00	35.0	4491.20	2165.51
2030.73	0.91									
26	318.07	57.17	15.6	3.42	3.55	2	0.00	35.0	7489.06	3425.39
2035.54	0.91									
27	321.48	59.49	15.6	3.52	3.65	1	150.00	22.0	7792.85	3304.44
2085.59	0.96									
28	325.00	22.37	15.6	1.33	1.38	1	150.00	22.0	2930.16	1190.93
2071.30	0.96									
29	326.33	65.92	16.5	4.11	4.29	1	150.00	22.0	8635.15	3488.18
1963.73	0.96									
30	330.44	60.90	16.5	4.11	4.29	1	150.00	22.0	7977.42	3161.35
1810.64	0.96									
31	334.55	55.46	17.5	4.09	4.29	1	150.00	22.0	7265.24	2825.51
1646.65	0.96									
32	338.64	50.19	17.5	4.09	4.29	1	150.00	22.0	6574.97	2480.79
1485.59	0.96									
33	342.73	32.15	18.4	2.88	3.04	1	150.00	22.0	4212.29	1545.60
1339.05	0.96									
34	345.62	29.38	18.4	2.88	3.04	1	150.00	22.0	3849.35	1363.39
1219.26	0.96									
35	348.50	7.41	18.4	0.77	0.82	5	0.00	45.0	815.24	170.65
884.89	0.84									
36	349.27	14.64	18.4	1.59	1.68	5	0.00	45.0	1610.26	0.00
808.41	0.84									
37	350.87	33.21	19.3	4.05	4.29	1	150.00	22.0	4350.21	0.00
936.15	0.96									
38	354.91	27.46	19.3	4.05	4.29	1	150.00	22.0	3597.19	0.00
767.93	0.96									
39	358.96	21.45	20.3	4.02	4.29	1	150.00	22.0	2810.26	0.00
590.96	0.96									
40	362.98	15.47	20.3	4.02	4.29	1	150.00	22.0	2026.97	0.00
415.83	0.96									
41	367.00	9.30	21.2	4.00	4.29	1	150.00	22.0	1218.89	0.00
233.79	0.96									
42	371.00	3.10	21.2	4.00	4.29	1	150.00	22.0	406.30	0.00
51.90	0.96									

X-S Area:	1574.95	Path Length:	162.95	X-S Weight:	205854.88

APPENDIX D

MEMO

Project Name: West Farm Gravel Evaluation
Project No. 20.139
From: J. Crystal
Date: September 30, 2020
Subject: Boring Logs

Cesare drilled 22 borings to depths ranging from 18 to 69 feet on September 8 through 10, 2020. All borings extended about a foot into bedrock. Occasional grab samples were recovered from auger cuttings of the various soils encountered. Elevations are from the boring location plan you forwarded to Cesare. A vicinity map in Figure 1 and the boring location plan J&T Consulting, Inc. provided are attached with a boring log profile and key to symbols.

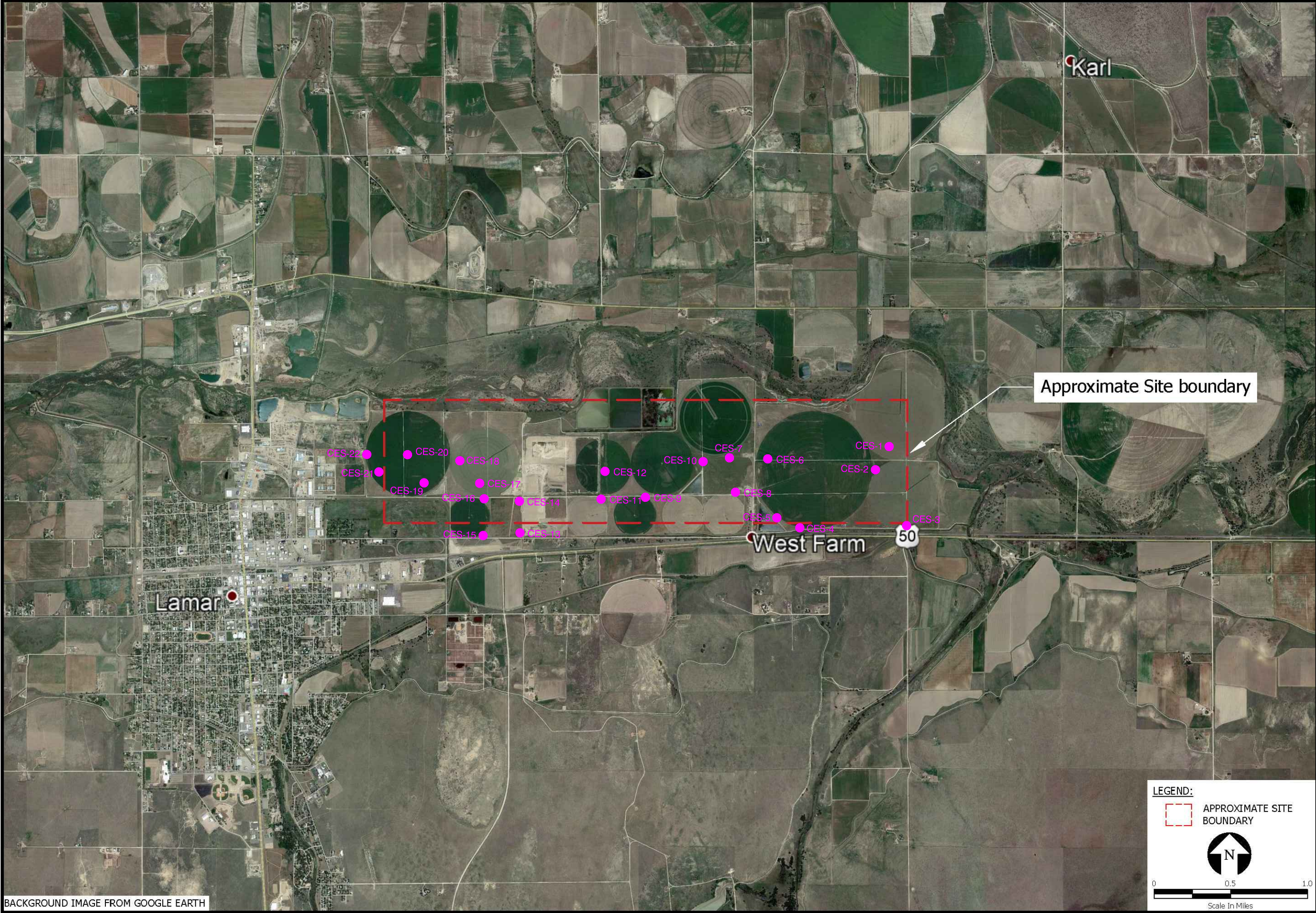


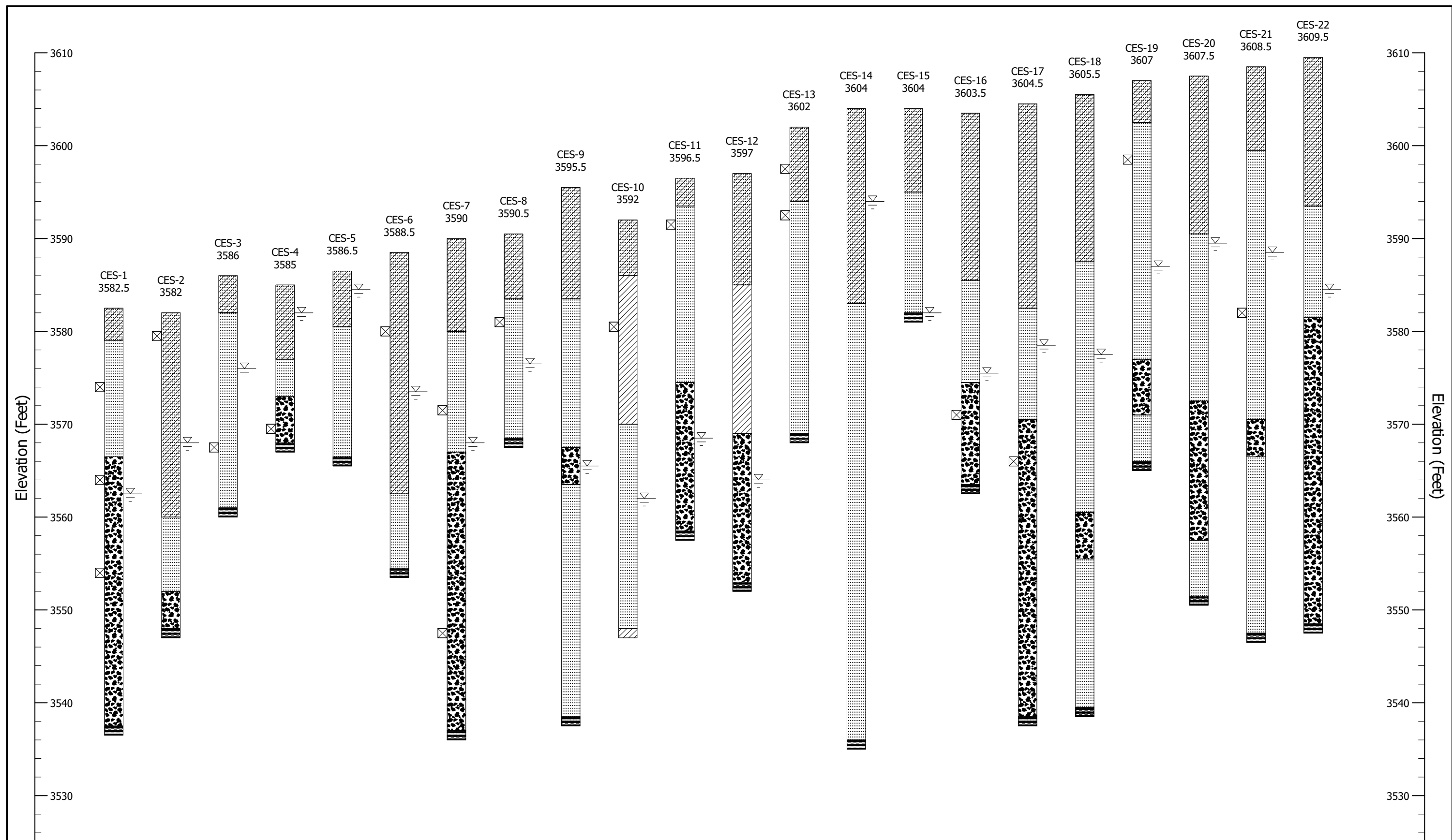
FIGURE 1
Vicinity Map



SITE PLAN PROVIDED BY CLIENT

PROJECT NO:	20.139		
PROJECT NAME:	West Farm Gravel Evaluation		
DRAWN BY:	JBE/KNZ	CHECKED BY:	JAC2
DWG DATE:	09.23.20	REV. DATE:	--

Boring Location Plan



PROJECT NO:	20.139	Boring Logs	 Geotechnical Engineers & Construction Materials Consultants
PROJECT NAME:	West Farm Expansion		
DWG DATE:	9/30/2020		

KEY TO SYMBOLS

Symbol Description

Strata symbols



INTERBEDDED: SAND, clayey, slightly moist to wet, medium dense, tan to brown (SC, A-6); CLAY, sandy, slightly moist to wet, stiff to hard for clays, (CL, A-6).



SAND, to with gravel, moist to wet, dense to very dense, tan to brown (SP, SW, A-1-b).



GRAVEL, with sand to sandy, wet, dense to very dense, tan to brown (GP, GW, A-1-a).



CLAY, low to medium plasticity, wet, brown to gray (CL, A-6).



CLAYSTONE, very hard, slightly moist to moist, gray to brown.

Misc. Symbols



Water level during drilling, estimated from auger cutting return at surface during drilling.

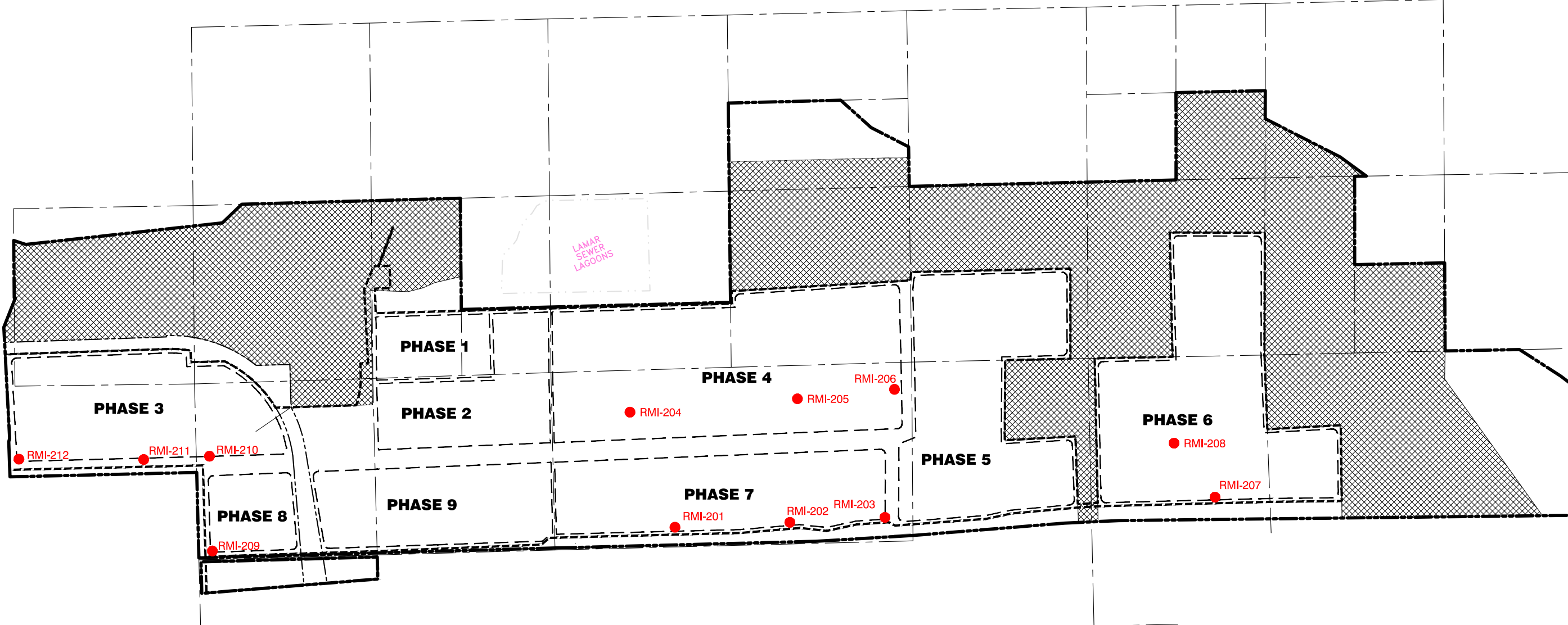
Soil Samplers



Grab sample recovered from auger cuttings.

Notes:

1. Exploratory borings B-1 through B-22 were drilled on September 8, 9, and 10, 2020 using a CME-55 drill rig equipped with 6-inch diameter continuous flight solid stem auger.
 2. Elevations shown are rounded to the nearest half foot from surveyed values provided by J&T Consulting, Inc.
 3. Borings were backfilled at the completion of each boring.
 4. Contacts between soil units are approximate and may be gradational.
 4. These logs are subject to the limitations, conclusions, and recommendations in this report.
- Project No. 20.139.



LAMAR
SEWER
LAGOONS

PHASE 3

PHASE 1

PHASE 2

PHASE 4

PHASE 7

PHASE

PHASE 8

PHASE 9

PHASE

LEGEND:

WEST FARM PROPERTY BOUNDARY

WEST FARM GRAVEL PIT PERMIT BOUNDARY

WEST FARM GRAVEL PIT MINING PHASE BOUNDARY



800 400 0 800 1600 2400

SCALE IN FEET

[illegible]

Job #	07115
Date	1.28.22
Drawn By	TPY
Designed By	TPY
Checked By	JCY
File	JT-GP Gravel 2015 Est
Scale	1" = 800'

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



J&T Consulting, Inc.

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

West Farm Property

Boring Layout

Brannan Sand & Gravel

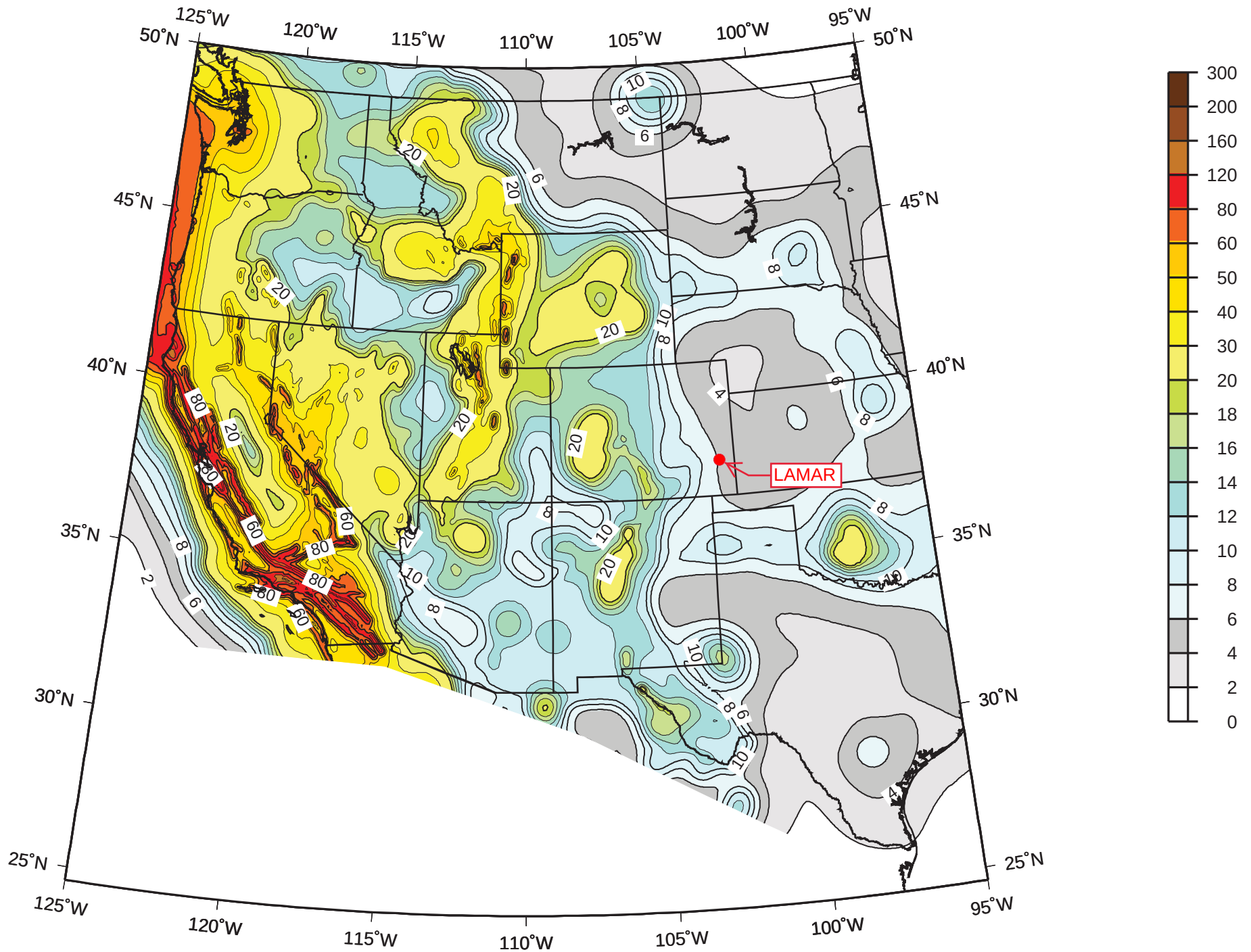
Brannan Sand and Gravel Exploratory Drilling Hole Information and Analysis

5/26/2020

Hole Number	RMI-201	RMI-202	RMI-203	RMI-204	RMI-205	RMI-206	RMI-207	RMI-208	RMI-209	RMI-210	RMI-211	RMI-212
OB Thickness (feet)	2	7.5	11.5	5	8	8	7	10	7	2	2	12
S&G Thickness (feet)	39	27.5	7.5	46	44	33.5	18	10.5	23	40.5	40	32
TD (feet)	41	35	19	51	52	41.5	25	20.5	30	42.5	42	44

APPENDIX E

Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
USGS Map, Oct. 2002rev



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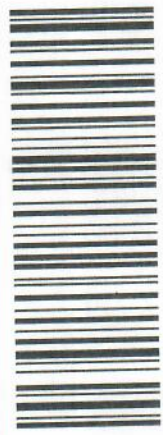
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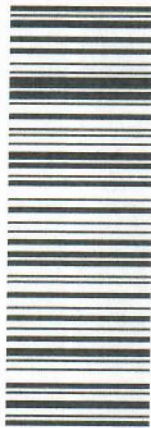
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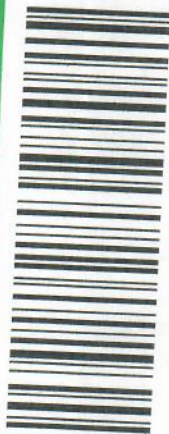
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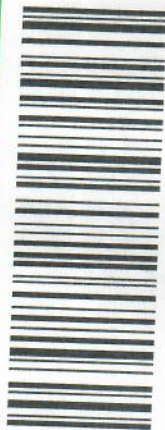
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