# Attachment R

# Revised Final Grades Slope Stability Analysis

August 12, 2024
File No. 25222268.00

TECHNICAL MEMORANDUM

ANALYSIS BY: Niko Villanueva

REVIEWED BY: Deb Nelson, PE
Phil Gearing, PE

SUBJECT: Final Grades Slope Stability Analyses
Dane County Landfill Site No. 3

## PURPOSE

The purpose of the slope stability analysis is to determine the factor of safety against slope failure of the final buildout conditions at the proposed Dane County Landfill Site No. 3 (Proposed Landfill).

## CONCLUSION

The attached results confirm that the following will be stable:

- Final waste slope of 4H:1V.
- Peak elevation at approximately 1,136 feet (above mean sea level).

## APPROACH

SCS Engineers (SCS) used GeoStudio 2023 Slope/W software to analyze the Proposed Landfill stability and included the following:

- The waste mass slope stability of the final buildout conditions.
- Two modes of failure:
  - Translational (non-circular / block) failure
  - Rotational (circular) failure.
- Critical cross section (A-A') (attached):
  - Oriented from south to north
  - Includes base liner system, peak waste mass, and final cover.
  - Is conservative due to its maximum waste grades and longest slope length in the Proposed Landfill area.
- Leachate recirculation wet waste properties.

## RESULTS

SCS recommends a minimum safety factor of 1.5 for the final waste slope. The results indicate that the 4H:1V waste slope with the assumed parameters has an acceptable minimum safety factor (exceeds 1.5) as shown below:

- Block failure (approximate) = 1.78
- Circular failure (approximate) = 2.53
- Optimized circular failure (approximate) = 2.29

## REFERENCES

1. TRC, 2014, Global Slope Stability, Eastern Expansion Plan of Operation, Dane County No. 2 (Rodefeld) Landfill, Appendix F.
2. SCS Engineers, 2023, Slope Stability Analyses, Eastern Vertical Expansion Plan of Operation, Dane County Landfill Site No. 2 (Rodefeld), Appendix I.
3. Geo-Slope International, Ltd., GeoStudio 2023, Version 1.1, Slope/W slope stability software.

## ASSUMPTIONS

- The waste is municipal solid waste (MSW). The waste properties will likely change over time due to the effects of leachate recirculation.
- A final grade slope of 4H:1V is representative of the design final waste slope for the landfill.
- The final cover soil layer is 5-feet thick.
- Circular (Bishop's method) and sliding block (Janbu's method) failure stability analyses are appropriate to evaluate the waste mass stability.
- The geomembrane liner will be smooth on the base and textured on the sidewalls. An interface friction angle for smooth geomembrane was used for the analyses. This approach is conservative. It is inferred that the textured geomembrane along the sidewalls will further increase the slope stability safety factors.
- Low-strength waste materials, if any, will be well mixed with the municipal solid waste to avoid low-strength waste zones. The site will be operated to avoid buildup of liquids or gas that could result in unstable waste slope conditions.
- The uppermost aquifer is assumed to be 1-foot below the base of the clay liner due to the proposed underdrain system to be installed.
- Material properties are as shown in the table below, based on the 2014 Eastern Expansion and 2023 Eastern Vertical Expansion Plans of Operation at Dane County Landfill Site No. 2 references:

| Material | Unit Weight (pcf) | Friction Angle (degrees) | Cohesion (psf) | Reference |
|---|---|---|---|---|
| MSW with Leachate Recirculation | 119 | 30 | 300 | 1, 2 |
| Geosynthetic Liner Interfaces | 115 | 11 | 0 | 1, 2 |
| Cover General Fill | 115 | 30 | 0 | 1, 2 |
| Clay Liner | 130 | 30 | 0 | 1, 2 |
| Native Sand and Sand Fill | 115 | 32 | 0 | 1, 2 |

Attachments: Cross Section Location Figure
Slope/W Outputs

KRG/NV/REO/DLN/PEG/BLP
Slope/W coordinates checked by RAR

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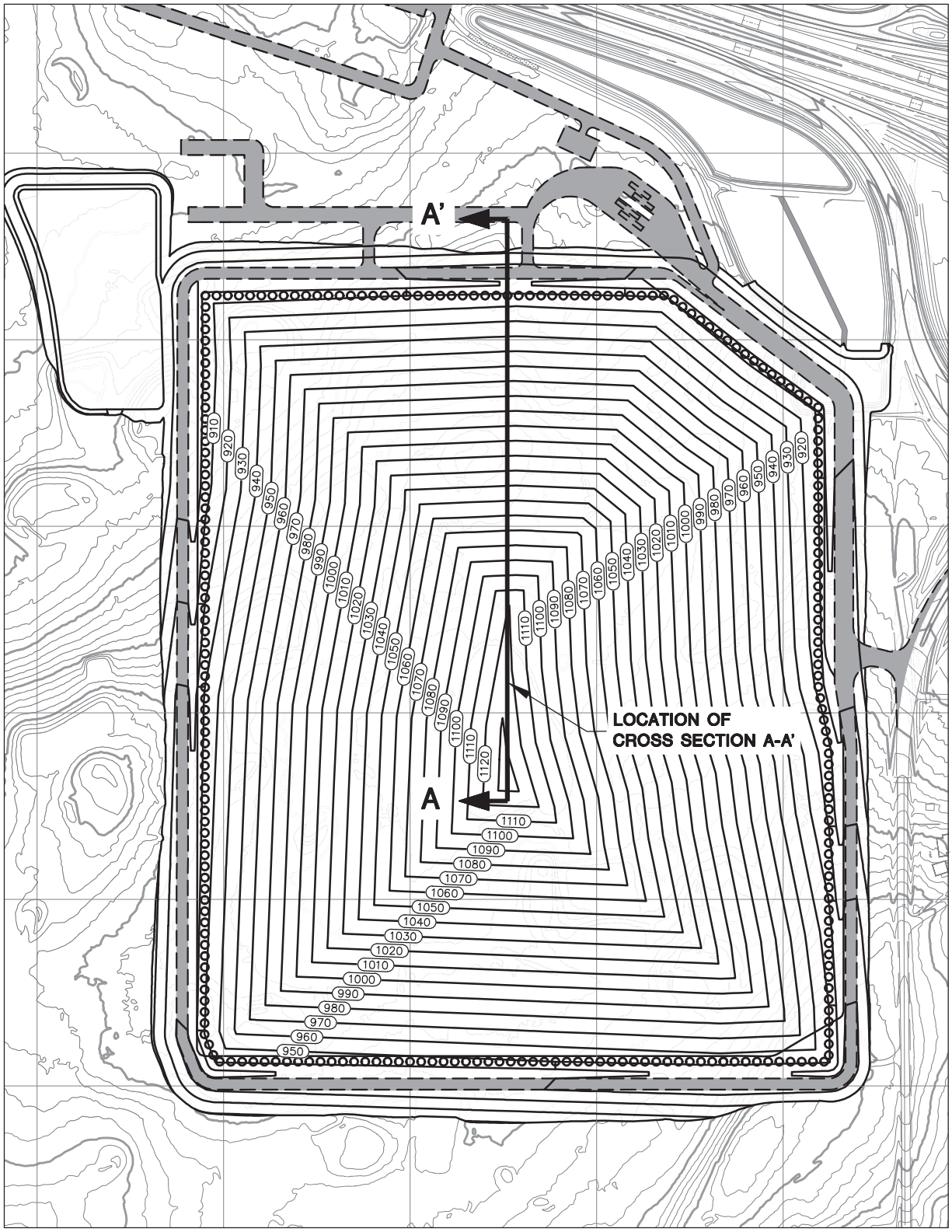


400 0 400

SCALE: 1" = 400'

| | | | | | |
|---|---|---|---|---|---|
| CLIENT | DANE COUNTY DEPARTMENT OF WASTE AND RENEWABLES<br>1919 ALLIANT ENERGY CENTER WAY<br>MADISON, WI 53713 | SITE | DANE COUNTY LANDFILL NO. 3<br>MADISON, WISCONSIN | LOCATION OF STABILITY ANLSYSIS CROSS SECTION A–A' | |
| PROJECT NO. | 25222268.00 | DRAWN BY: | NV | ENGINEER | FIGURE |
| DRAWN: | 09/27/2023 | CHECKED BY: | DLN | SCS ENGINEERS<br>2830 DAIRY DRIVE MADISON, WI 53718–6751<br>PHONE: (608) 224–2830 | 1 OF 1 |
| REVISED: | 07/29/2024 | APPROVED BY: | | | |

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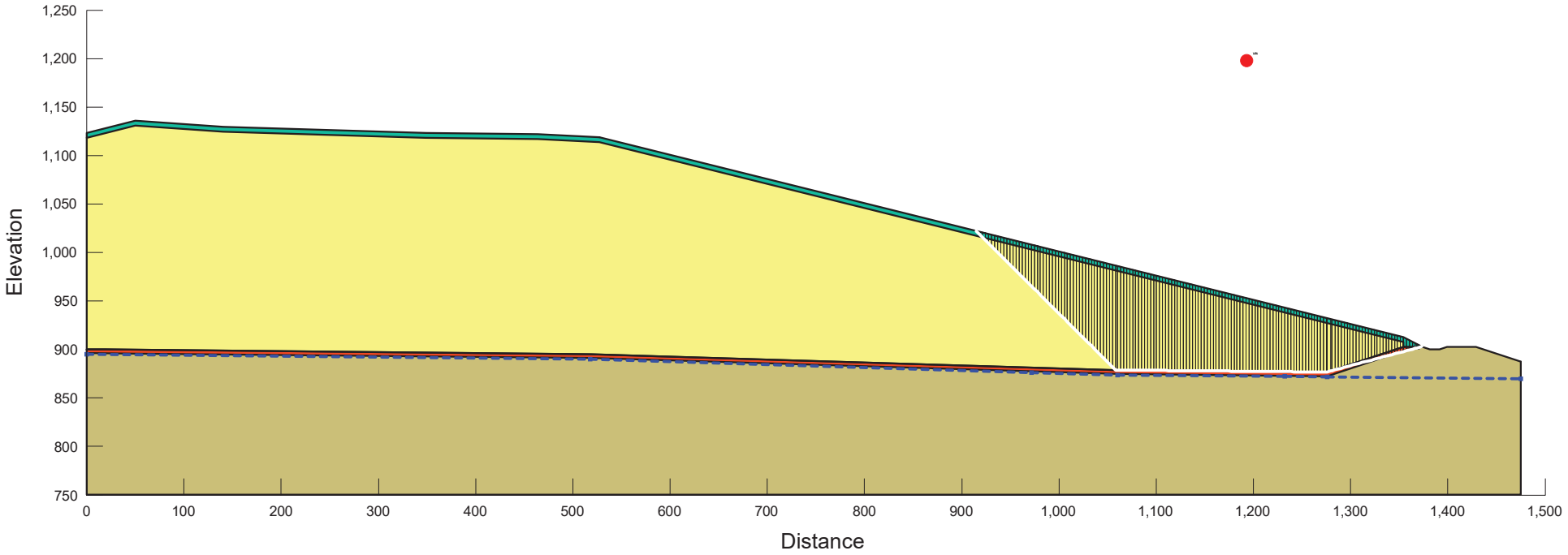
Dane Co. Landfill No.3
Block Failure A-A
Block Static Conditions
08/08/2024, 11:25:57 AM

Analysis Type: Janbu
Factor of Safety: 1.782

| Color | Name | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) | Piezometric Surface |
|---|---|---|---|---|---|
| | Clay Liner | 130 | 0 | 30 | |
| | General Cover Fill | 115 | 0 | 30 | |
| | Geosynthetic Liner | 115 | 0 | 11 | |
| | MSW with Leachate Recirculation | 119 | 300 | 30 | |
| | Native Sand Fill | 115 | 0 | 32 | 1 |



# Block Failure A-A



## File Information

File Version: 11.05
Title: Dane Co. Landfill No.3
Created By: Villanueva, Niko
Last Edited By: Villanueva, Niko
Revision Number: 56
Date: 08/08/2024
Time: 11:14:55 AM
Tool Version: 23.1.1.829
File Name: SlopeW_DaneCoLF_AA'.gsz
Directory: I:\25222268.00\Data and Calculations\Geotechnical\Slope Stability\
Last Solved Date: 08/08/2024
Last Solved Time: 11:25:57 AM

## Project Settings

Unit System: U.S. Customary Units

## Analysis Settings

### Block Failure A-A

Description: Block Static Conditions
Kind: SLOPE/W
Analysis Type: Janbu
Settings
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 10
- Restrict Block Crossing: No
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft³
  - Number of Columns: 150
- Factor of Safety Convergence Settings
  - Maximum Number of Iterations: 20,000
  - Tolerable difference in F of S: 0.001

Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50

# Materials

## MSW with Leachate Recirculation

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 119 pcf
Effective Cohesion: 300 psf
Effective Friction Angle: 30 °
Phi-B: 0 °

## Geosynthetic Liner

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 11 °
Phi-B: 0 °

## General Cover Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 30 °
Phi-B: 0 °

## Native Sand Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

## Clay Liner

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 30 °
Phi-B: 0 °

# Slip Surface Limits

Left Coordinate: (0, 1,123.2947) ft
Right Coordinate: (1,474.7899, 887.7658) ft

# Slip Surface Block

Left Grid

Upper Left: (1,044.8, 881.2) ft
Lower Left: (1,044.8, 877.3) ft
Lower Right: (1,089.6, 877.3) ft
X Increments: 20
Y Increments: 20
Starting Angle: 115 °
Ending Angle: 135 °
Angle Increments: 3

Right Grid
Upper Left: (1,235.2, 880.9) ft
Lower Left: (1,235.2, 874.95) ft
Lower Right: (1,282, 875.3) ft
X Increments: 20
Y Increments: 20
Angle Increments: 3

# Piezometric Surfaces

## Piezometric Surface 1

### Coordinates

| | X | Y |
|---|---|---|
| Coordinate 1 | 0 ft | 895.1666 ft |
| Coordinate 2 | 517.9584 ft | 890.0612 ft |
| Coordinate 3 | 971.6 ft | 876.4519 ft |
| Coordinate 4 | 1,060.391 ft | 873.7882 ft |
| Coordinate 5 | 1,232.3 ft | 872.0691 ft |
| Coordinate 6 | 1,275.8558 ft | 871.6336 ft |
| Coordinate 7 | 1,474.7899 ft | 869.7 ft |

# Geometry

Name: 2D Geometry

## Settings

View: 2D
Element Thickness: 1 ft

## Points

| | X | Y |
|---|---|---|
| Point 1 | 527.5669 ft | 1,119.1646 ft |
| Point 2 | 464.1298 ft | 1,122.0367 ft |
| Point 3 | 349.1604 ft | 1,123.1864 ft |
| Point 4 | 140.1979 ft | 1,129.4553 ft |
| Point 5 | 50 ft | 1,135.7847 ft |
| Point 6 | 0 ft | 1,123.2947 ft |
| Point 7 | 0 ft | 1,118.2947 ft |
| Point 8 | 50 ft | 1,130.7847 ft |
| Point 9 | 140.1979 ft | 1,124.4553 ft |
| Point 10 | 349.1604 ft | 1,118.1864 ft |
| Point 11 | 464.1298 ft | 1,117.0367 ft |

| | | |
|---|---|---|
| Point 12 | 527.5669 ft | 1,114.1646 ft |
| Point 13 | 1,354.0888 ft | 907.6995 ft |
| Point 14 | 1,354.0893 ft | 905.358 ft |
| Point 15 | 1,354.0898 ft | 902.7995 ft |
| Point 16 | 1,363.4551 ft | 902.7995 ft |
| Point 17 | 1,368.1888 ft | 902.7995 ft |
| Point 18 | 1,368.1888 ft | 900.7995 ft |
| Point 19 | 1,370.0888 ft | 900.7995 ft |
| Point 20 | 1,370.0888 ft | 902.6995 ft |
| Point 21 | 1,374.0888 ft | 902.6995 ft |
| Point 22 | 1,354.0888 ft | 912.6995 ft |
| Point 23 | 0 ft | 900.2666 ft |
| Point 24 | 19.1215 ft | 900.1496 ft |
| Point 25 | 519.6736 ft | 895.1098 ft |
| Point 26 | 1,060.393 ft | 878.8882 ft |
| Point 27 | 1,275.84 ft | 876.7337 ft |
| Point 28 | 1,333.4366 ft | 895.9239 ft |
| Point 29 | 1,354.0898 ft | 902.8052 ft |
| Point 30 | 1,366.0888 ft | 902.6995 ft |
| Point 31 | 1,363.4551 ft | 902.6995 ft |
| Point 32 | 1,354.0888 ft | 902.6995 ft |
| Point 33 | 1,275.8558 ft | 876.6336 ft |
| Point 34 | 1,060.391 ft | 878.7882 ft |
| Point 35 | 517.9584 ft | 895.0612 ft |
| Point 36 | 19.1207 ft | 900.0496 ft |
| Point 37 | 0 ft | 900.1666 ft |
| Point 38 | 0 ft | 896.1666 ft |
| Point 39 | 50.7907 ft | 895.7329 ft |
| Point 40 | 517.9584 ft | 891.0612 ft |
| Point 41 | 581.0124 ft | 889.1696 ft |
| Point 42 | 1,060.391 ft | 874.7882 ft |
| Point 43 | 1,275.8558 ft | 872.6336 ft |
| Point 44 | 1,474.7899 ft | 887.7658 ft |
| Point 45 | 1,429.0888 ft | 902.9995 ft |
| Point 46 | 1,399.0888 ft | 902.6995 ft |
| Point 47 | 1,391.5888 ft | 900.1995 ft |
| Point 48 | 1,381.5888 ft | 900.1995 ft |
| Point 49 | 1,370.0888 ft | 900.6995 ft |
| Point 50 | 1,368.0888 ft | 900.6995 ft |
| Point 51 | 1,368.0888 ft | 902.6995 ft |
| Point 52 | 0 ft | 750.2408 ft |
| Point 53 | 1,474.7899 ft | 750.2408 ft |
| Point 54 | 0.0006 ft | 900.2666 ft |
| Point 55 | 1,354.0726 ft | 902.7995 ft |
| Point 56 | 1,354.0727 ft | 902.7995 ft |

## Regions

| | Material | Points | Area |
|---|---|---|---|
| Region 1 | General Cover Fill | 1,2,3,4,5,6,7,8,9,10,11,12,13,14,29,15,16,17,18,19,20,21,22 | 6,872.6 ft² |

| | | | |
|---|---|---|---|
| Region 2 | MSW with Leachate Recirculation | 12,11,10,9,8,7,23,54,24,25,26,27,28,55,56,29,14,13 | 2.2218e+05 ft² |
| Region 3 | Clay Liner | 30,31,32,33,34,35,36,37,38,39,40,41,42,43 | 5,441.5 ft² |
| Region 4 | Native Sand Fill | 44,45,46,47,48,21,20,19,49,50,51,30,43,42,41,40,39,38,52,53 | 2.0145e+05 ft² |
| Region 5 | Geosynthetic Liner | 54,37,36,35,34,33,32,31,30,51,50,49,19,18,17,16,15,56,55,28,27,26,25,24 | 129.12 ft² |

# Slip Results

Slip Surfaces Analysed: 2333760 of 3111696 converged

# Current Slip Surface

Slip Surface: 1,233,526
Factor of Safety: 1.782
Volume: 28,382.17 ft³
Weight: 3,370,340 lbf
Resisting Moment: 1.9609141e+08 lbf·ft
Activating Moment: 1.1547451e+08 lbf·ft
Resisting Force: 1,059,367.4 lbf
Activating Force: 594,521.12 lbf
Slip Rank: 1 of 3,111,696 slip surfaces
Exit: (1,373.3184, 903.0847) ft
Entry: (914.62164, 1,022.4784) ft
Radius: 228.22825 ft
Center: (1,167.2777, 1,052.3268) ft

## Slip Columns

| | X | Y | PWP | Base Normal Stress | Frictional Strength | Cohesive Strength | Suction Strength | Base Material |
|---|---|---|---|---|---|---|---|---|
| Column 1 | 916.2879 ft | 1,020.8121 ft | 0 psf | 108.58181 psf | 62.689738 psf | 0 psf | 0 psf | General Cover Fill |
| Column 2 | 919.6203 ft | 1,017.4797 ft | 0 psf | 325.74543 psf | 188.06921 psf | 0 psf | 0 psf | General Cover Fill |
| Column 3 | 922.8588 ft | 1,014.2412 ft | 0 psf | 413.22911 psf | 238.57794 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 4 | 926.0034 ft | 1,011.0966 ft | 0 psf | 625.27877 psf | 361.00487 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 5 | 929.1480 ft | 1,007.9520 ft | 0 psf | 837.32844 psf | 483.4318 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 6 | 932.2926 ft | 1,004.8074 ft | 0 psf | 1,049.3781 psf | 605.85873 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 7 | 935.4372 ft | 1,001.6628 ft | 0 psf | 1,261.4278 psf | 728.28566 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 8 | 938.5818 ft | 998.5182 ft | 0 psf | 1,473.4774 psf | 850.71259 psf | 300 psf | 0 psf | MSW with Leachate |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Recirculation |
| Column 9 | 941.7264 ft | 995.3736 ft | 0 psf | 1,685.5271 psf | 973.13952 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 10 | 944.8710 ft | 992.2290 ft | 0 psf | 1,897.5768 psf | 1,095.5665 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 11 | 948.0156 ft | 989.0844 ft | 0 psf | 2,109.6264 psf | 1,217.9934 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 12 | 951.1602 ft | 985.9398 ft | 0 psf | 2,321.6761 psf | 1,340.4203 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 13 | 954.3047 ft | 982.7953 ft | 0 psf | 2,533.7257 psf | 1,462.8472 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 14 | 957.4493 ft | 979.6507 ft | 0 psf | 2,745.7754 psf | 1,585.2742 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 15 | 960.5939 ft | 976.5061 ft | 0 psf | 2,957.8251 psf | 1,707.7011 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 16 | 963.7385 ft | 973.3615 ft | 0 psf | 3,169.8747 psf | 1,830.128 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 17 | 966.8831 ft | 970.2169 ft | 0 psf | 3,381.9244 psf | 1,952.555 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 18 | 970.0277 ft | 967.0723 ft | 0 psf | 3,593.9741 psf | 2,074.9819 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 19 | 973.1454 ft | 963.9546 ft | 0 psf | 3,804.2124 psf | 2,196.363 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 20 | 976.2363 ft | 960.8637 ft | 0 psf | 4,012.6394 psf | 2,316.6984 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 21 | 979.3272 ft | 957.7728 ft | 0 psf | 4,221.0664 psf | 2,437.0338 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 22 | 982.4180 ft | 954.6820 ft | 0 psf | 4,429.4933 psf | 2,557.3692 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 23 | 985.5089 ft | 951.5911 ft | 0 psf | 4,637.9203 psf | 2,677.7045 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 24 | 988.5998 ft | 948.5002 ft | 0 psf | 4,846.3473 psf | 2,798.0399 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 25 | 991.6907 ft | 945.4093 ft | 0 psf | 5,054.7743 psf | 2,918.3753 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 26 | 994.7815 ft | 942.3185 ft | 0 psf | 5,263.2013 psf | 3,038.7107 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Column 27 | 997.8724 ft | 939.2276 ft | 0 psf | 5,471.6282 psf | 3,159.046 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 28 | 1,000.9633 ft | 936.1367 ft | 0 psf | 5,680.0552 psf | 3,279.3814 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 29 | 1,004.0541 ft | 933.0459 ft | 0 psf | 5,888.4822 psf | 3,399.7168 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 30 | 1,007.1450 ft | 929.9550 ft | 0 psf | 6,096.9092 psf | 3,520.0522 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 31 | 1,010.2359 ft | 926.8641 ft | 0 psf | 6,305.3362 psf | 3,640.3875 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 32 | 1,013.3267 ft | 923.7733 ft | 0 psf | 6,513.7631 psf | 3,760.7229 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 33 | 1,016.4176 ft | 920.6824 ft | 0 psf | 6,722.1901 psf | 3,881.0583 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 34 | 1,019.5085 ft | 917.5915 ft | 0 psf | 6,930.6171 psf | 4,001.3937 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 35 | 1,022.5993 ft | 914.5007 ft | 0 psf | 7,139.0441 psf | 4,121.729 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 36 | 1,025.6902 ft | 911.4098 ft | 0 psf | 7,347.4711 psf | 4,242.0644 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 37 | 1,028.7811 ft | 908.3189 ft | 0 psf | 7,555.8981 psf | 4,362.3998 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 38 | 1,031.8720 ft | 905.2280 ft | 0 psf | 7,764.325 psf | 4,482.7352 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 39 | 1,034.9628 ft | 902.1372 ft | 0 psf | 7,972.752 psf | 4,603.0705 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 40 | 1,038.0537 ft | 899.0463 ft | 0 psf | 8,181.179 psf | 4,723.4059 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 41 | 1,041.1446 ft | 895.9554 ft | 0 psf | 8,389.606 psf | 4,843.7413 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 42 | 1,044.2354 ft | 892.8646 ft | 0 psf | 8,598.033 psf | 4,964.0766 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 43 | 1,047.3263 ft | 889.7737 ft | 0 psf | 8,806.4599 psf | 5,084.412 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 44 | 1,050.4172 ft | 886.6828 ft | 0 psf | 9,014.8869 psf | 5,204.7474 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 45 | 1,053.5080 ft | 883.5920 ft | 0 psf | 9,223.3139 psf | 5,325.0828 psf | 300 psf | 0 psf | MSW with Leachate |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Recirculation |
| Column 46 | 1,056.5989 ft | 880.5011 ft | 0 psf | 9,431.7409 psf | 5,445.4181 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 47 | 1,059.2677 ft | 878.8973 ft | 0 psf | 12,694.293 psf | 2,467.5205 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 48 | 1,061.9269 ft | 878.8239 ft | 0 psf | 12,682.307 psf | 2,465.1907 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 49 | 1,064.9977 ft | 878.7937 ft | 0 psf | 12,594.704 psf | 2,448.1625 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 50 | 1,068.0674 ft | 878.7636 ft | 0 psf | 12,507.129 psf | 2,431.1397 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 51 | 1,071.1372 ft | 878.7336 ft | 0 psf | 12,419.554 psf | 2,414.1168 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 52 | 1,074.2070 ft | 878.7035 ft | 0 psf | 12,331.98 psf | 2,397.094 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 53 | 1,077.2767 ft | 878.6734 ft | 0 psf | 12,244.405 psf | 2,380.0712 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 54 | 1,080.3465 ft | 878.6433 ft | 0 psf | 12,156.83 psf | 2,363.0483 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 55 | 1,083.4163 ft | 878.6132 ft | 0 psf | 12,069.255 psf | 2,346.0255 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 56 | 1,086.4860 ft | 878.5831 ft | 0 psf | 11,981.68 psf | 2,329.0026 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 57 | 1,089.5558 ft | 878.5530 ft | 0 psf | 11,894.105 psf | 2,311.9798 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 58 | 1,092.6256 ft | 878.5229 ft | 0 psf | 11,806.53 psf | 2,294.957 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 59 | 1,095.6953 ft | 878.4928 ft | 0 psf | 11,718.955 psf | 2,277.9341 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 60 | 1,098.7651 ft | 878.4627 ft | 0 psf | 11,631.38 psf | 2,260.9113 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 61 | 1,101.8349 ft | 878.4326 ft | 0 psf | 11,543.805 psf | 2,243.8885 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 62 | 1,104.9046 ft | 878.4025 ft | 0 psf | 11,456.23 psf | 2,226.8656 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 63 | 1,107.9744 ft | 878.3724 ft | 0 psf | 11,368.656 psf | 2,209.8428 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 64 | 1,111.0442 ft | 878.3423 ft | 0 psf | 11,281.081 psf | 2,192.8199 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 65 | 1,114.1139 ft | 878.3122 ft | 0 psf | 11,193.506 psf | 2,175.7971 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 66 | 1,117.1837 ft | 878.2821 ft | 0 psf | 11,105.931 psf | 2,158.7743 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 67 | 1,120.2535 ft | 878.2520 ft | 0 psf | 11,018.356 psf | 2,141.7514 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 68 | 1,123.3232 ft | 878.2219 ft | 0 psf | 10,930.781 psf | 2,124.7286 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 69 | 1,126.3930 ft | 878.1918 ft | 0 psf | 10,843.206 psf | 2,107.7058 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 70 | 1,129.4628 ft | 878.1617 ft | 0 psf | 10,755.631 psf | 2,090.6829 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 71 | 1,132.5325 ft | 878.1316 ft | 0 psf | 10,668.056 psf | 2,073.6601 psf | 0 psf | 0 psf | Geosynthetic Liner |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Column 72 | 1,135.6023 ft | 878.1015 ft | 0 psf | 10,580.481 psf | 2,056.6372 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 73 | 1,138.6721 ft | 878.0714 ft | 0 psf | 10,492.906 psf | 2,039.6144 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 74 | 1,141.7418 ft | 878.0413 ft | 0 psf | 10,405.332 psf | 2,022.5916 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 75 | 1,144.8116 ft | 878.0112 ft | 0 psf | 10,317.757 psf | 2,005.5687 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 76 | 1,147.8814 ft | 877.9811 ft | 0 psf | 10,230.182 psf | 1,988.5459 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 77 | 1,150.9512 ft | 877.9510 ft | 0 psf | 10,142.607 psf | 1,971.5231 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 78 | 1,154.0209 ft | 877.9209 ft | 0 psf | 10,055.032 psf | 1,954.5002 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 79 | 1,157.0907 ft | 877.8908 ft | 0 psf | 9,967.457 psf | 1,937.4774 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 80 | 1,160.1605 ft | 877.8607 ft | 0 psf | 9,879.8821 psf | 1,920.4545 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 81 | 1,163.2302 ft | 877.8306 ft | 0 psf | 9,792.3072 psf | 1,903.4317 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 82 | 1,166.3000 ft | 877.8005 ft | 0 psf | 9,704.7323 psf | 1,886.4089 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 83 | 1,169.3698 ft | 877.7704 ft | 0 psf | 9,617.1574 psf | 1,869.386 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 84 | 1,172.4395 ft | 877.7403 ft | 0 psf | 9,529.5825 psf | 1,852.3632 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 85 | 1,175.5093 ft | 877.7102 ft | 0 psf | 9,442.0076 psf | 1,835.3403 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 86 | 1,178.5791 ft | 877.6802 ft | 0 psf | 9,354.4326 psf | 1,818.3175 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 87 | 1,181.6488 ft | 877.6501 ft | 0 psf | 9,266.8577 psf | 1,801.2947 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 88 | 1,184.7186 ft | 877.6200 ft | 0 psf | 9,179.2828 psf | 1,784.2718 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 89 | 1,187.7884 ft | 877.5899 ft | 0 psf | 9,091.7079 psf | 1,767.249 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 90 | 1,190.8581 ft | 877.5598 ft | 0 psf | 9,004.133 psf | 1,750.2262 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 91 | 1,193.9279 ft | 877.5297 ft | 0 psf | 8,916.5581 psf | 1,733.2033 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 92 | 1,196.9977 ft | 877.4996 ft | 0 psf | 8,828.9832 psf | 1,716.1805 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 93 | 1,200.0674 ft | 877.4695 ft | 0 psf | 8,741.4083 psf | 1,699.1576 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 94 | 1,203.1372 ft | 877.4394 ft | 0 psf | 8,653.8334 psf | 1,682.1348 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 95 | 1,206.2070 ft | 877.4093 ft | 0 psf | 8,566.2585 psf | 1,665.112 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 96 | 1,209.2767 ft | 877.3792 ft | 0 psf | 8,478.6836 psf | 1,648.0891 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 97 | 1,212.3465 ft | 877.3491 ft | 0 psf | 8,391.1086 psf | 1,631.0663 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 98 | 1,215.4163 ft | 877.3190 ft | 0 psf | 8,303.5337 psf | 1,614.0435 psf | 0 psf | 0 psf | Geosynthetic Liner |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Column 99 | 1,218.4860 ft | 877.2889 ft | 0 psf | 8,215.9588 psf | 1,597.0206 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 100 | 1,221.5558 ft | 877.2588 ft | 0 psf | 8,128.3839 psf | 1,579.9978 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 101 | 1,224.6256 ft | 877.2287 ft | 0 psf | 8,040.809 psf | 1,562.9749 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 102 | 1,227.6953 ft | 877.1986 ft | 0 psf | 7,953.2341 psf | 1,545.9521 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 103 | 1,230.7651 ft | 877.1685 ft | 0 psf | 7,865.6592 psf | 1,528.9293 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 104 | 1,233.8243 ft | 877.1385 ft | 0 psf | 7,778.3866 psf | 1,511.9652 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 105 | 1,236.8729 ft | 877.1086 ft | 0 psf | 7,691.4164 psf | 1,495.0599 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 106 | 1,239.9214 ft | 877.0787 ft | 0 psf | 7,604.4462 psf | 1,478.1546 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 107 | 1,242.9700 ft | 877.0488 ft | 0 psf | 7,517.476 psf | 1,461.2493 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 108 | 1,246.0186 ft | 877.0189 ft | 0 psf | 7,430.5058 psf | 1,444.344 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 109 | 1,249.0671 ft | 876.9891 ft | 0 psf | 7,343.5356 psf | 1,427.4387 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 110 | 1,252.1157 ft | 876.9592 ft | 0 psf | 7,256.5653 psf | 1,410.5334 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 111 | 1,255.1643 ft | 876.9293 ft | 0 psf | 7,169.5951 psf | 1,393.6281 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 112 | 1,258.2129 ft | 876.8994 ft | 0 psf | 7,082.6249 psf | 1,376.7228 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 113 | 1,261.2614 ft | 876.8695 ft | 0 psf | 6,995.6547 psf | 1,359.8175 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 114 | 1,264.3100 ft | 876.8396 ft | 0 psf | 6,908.6845 psf | 1,342.9122 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 115 | 1,267.3586 ft | 876.8097 ft | 0 psf | 6,821.7143 psf | 1,326.0069 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 116 | 1,270.4071 ft | 876.7798 ft | 0 psf | 6,734.7441 psf | 1,309.1016 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 117 | 1,273.4557 ft | 876.7499 ft | 0 psf | 6,647.7738 psf | 1,292.1963 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 118 | 1,275.4179 ft | 876.8523 ft | 0 psf | 7,259.497 psf | 4,191.2725 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 119 | 1,277.6241 ft | 877.4435 ft | 0 psf | 7,110.6649 psf | 4,105.3443 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 120 | 1,280.2000 ft | 878.1337 ft | 0 psf | 6,478.8557 psf | 1,259.362 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 121 | 1,282.5496 ft | 878.7633 ft | 0 psf | 6,729.7239 psf | 3,885.4079 psf | 0 psf | 0 psf | Clay Liner |
| Column 122 | 1,285.6337 ft | 879.5896 ft | 0 psf | 6,524.074 psf | 3,766.6759 psf | 0 psf | 0 psf | Clay Liner |
| Column 123 | 1,288.7177 ft | 880.4160 ft | 0 psf | 6,318.4241 psf | 3,647.9439 psf | 0 psf | 0 psf | Clay Liner |
| Column 124 | 1,291.8018 ft | 881.2424 ft | 0 psf | 6,112.7743 psf | 3,529.2119 psf | 0 psf | 0 psf | Clay Liner |

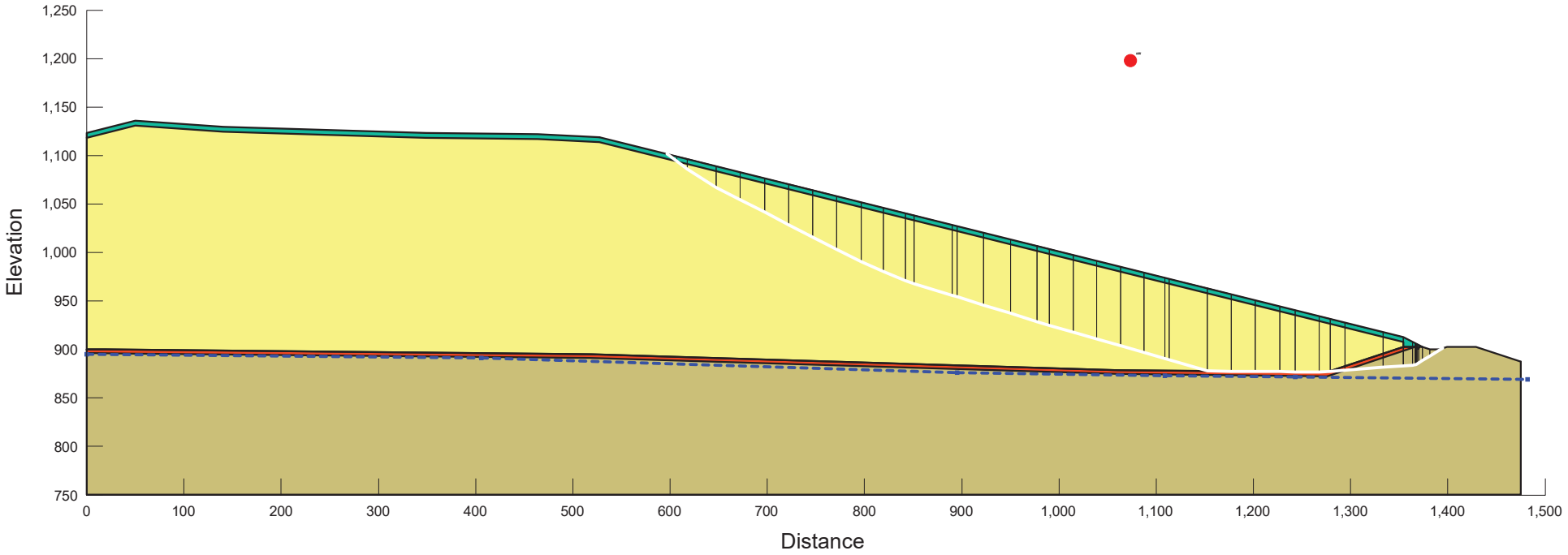
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Column 125 | 1,294.8859 ft | 882.0688 ft | 0 psf | 5,907.1244 psf | 3,410.4799 psf | 0 psf | 0 psf | Clay Liner |
| Column 126 | 1,297.9699 ft | 882.8951 ft | 0 psf | 5,701.4745 psf | 3,291.7479 psf | 0 psf | 0 psf | Clay Liner |
| Column 127 | 1,301.0540 ft | 883.7215 ft | 0 psf | 5,495.8247 psf | 3,173.0158 psf | 0 psf | 0 psf | Clay Liner |
| Column 128 | 1,304.1380 ft | 884.5479 ft | 0 psf | 5,290.1748 psf | 3,054.2838 psf | 0 psf | 0 psf | Clay Liner |
| Column 129 | 1,307.2221 ft | 885.3742 ft | 0 psf | 5,084.5249 psf | 2,935.5518 psf | 0 psf | 0 psf | Clay Liner |
| Column 130 | 1,310.3062 ft | 886.2006 ft | 0 psf | 4,878.8751 psf | 2,816.8198 psf | 0 psf | 0 psf | Clay Liner |
| Column 131 | 1,313.3902 ft | 887.0270 ft | 0 psf | 4,673.2252 psf | 2,698.0878 psf | 0 psf | 0 psf | Clay Liner |
| Column 132 | 1,316.4743 ft | 887.8534 ft | 0 psf | 4,467.5753 psf | 2,579.3558 psf | 0 psf | 0 psf | Clay Liner |
| Column 133 | 1,319.5583 ft | 888.6797 ft | 0 psf | 4,261.9255 psf | 2,460.6238 psf | 0 psf | 0 psf | Clay Liner |
| Column 134 | 1,322.6424 ft | 889.5061 ft | 0 psf | 4,056.2756 psf | 2,341.8918 psf | 0 psf | 0 psf | Clay Liner |
| Column 135 | 1,325.7265 ft | 890.3325 ft | 0 psf | 3,850.6257 psf | 2,223.1598 psf | 0 psf | 0 psf | Clay Liner |
| Column 136 | 1,328.8105 ft | 891.1588 ft | 0 psf | 3,644.9759 psf | 2,104.4278 psf | 0 psf | 0 psf | Clay Liner |
| Column 137 | 1,331.8946 ft | 891.9852 ft | 0 psf | 3,439.326 psf | 1,985.6958 psf | 0 psf | 0 psf | Clay Liner |
| Column 138 | 1,334.9147 ft | 892.7945 ft | 0 psf | 3,237.9394 psf | 1,869.4252 psf | 0 psf | 0 psf | Clay Liner |
| Column 139 | 1,337.8709 ft | 893.5866 ft | 0 psf | 3,040.816 psf | 1,755.616 psf | 0 psf | 0 psf | Clay Liner |
| Column 140 | 1,340.8271 ft | 894.3787 ft | 0 psf | 2,843.6927 psf | 1,641.8067 psf | 0 psf | 0 psf | Clay Liner |
| Column 141 | 1,343.7761 ft | 895.1689 ft | -1,510.5253 psf | 2,666.3258 psf | 1,666.1053 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 142 | 1,346.7180 ft | 895.9571 ft | -1,561.5222 psf | 2,465.4338 psf | 1,540.574 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 143 | 1,349.6598 ft | 896.7454 ft | -1,612.5191 psf | 2,264.5417 psf | 1,415.0427 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 144 | 1,352.6098 ft | 897.5358 ft | -1,663.6564 psf | 2,063.1174 psf | 1,289.1788 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 145 | 1,354.0891 ft | 897.9322 ft | -1,689.2996 psf | 1,956.2112 psf | 1,222.3764 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 146 | 1,355.6504 ft | 898.3506 ft | -1,716.366 psf | 1,779.6625 psf | 1,112.0566 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 147 | 1,358.7724 ft | 899.1871 ft | -1,770.486 psf | 1,458.1417 psf | 911.14808 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 148 | 1,361.8942 ft | 900.0236 ft | -1,824.6016 psf | 1,136.6453 psf | 710.2548 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 149 | 1,364.7720 ft | 900.7947 ft | -1,874.4869 psf | 840.28071 psf | 525.06566 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 150 | 1,367.1388 ft | 901.4289 ft | -1,915.5161 psf | 602.32164 psf | 376.37233 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 151 | 1,369.1388 ft | 901.9648 ft | 0 psf | 404.19671 psf | 233.36308 psf | 0 psf | 0 psf | General Cover Fill |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Column 152 | 1,370.9848 ft | 902.4594 ft | -1,982.1865 psf | 227.45328 psf | 142.12858 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 153 | 1,372.5996 ft | 902.8921 ft | 0 psf | 69.511622 psf | 40.132553 psf | 0 psf | 0 psf | General Cover Fill |

Dane Co. Landfill No.3
Circular Optimized Failure A-A
Circular Static Conditions
08/05/2024, 12:15:48 PM

Analysis Type: Bishop
Factor of Safety: 2.290

| Color | Name | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) | Piezometric Surface |
|---|---|---|---|---|---|
| | Clay Liner | 130 | 0 | 30 | |
| | General Cover Fill | 115 | 0 | 30 | |
| | Geosynthetic Liner | 115 | 0 | 11 | |
| | MSW with Leachate Recirculation | 119 | 300 | 30 | |
| | Native Sand Fill | 115 | 0 | 32 | 1 |



# Circular Optimized Failure A-A



## File Information

File Version: 11.05
Title: Dane Co. Landfill No.3
Created By: Villanueva, Niko
Last Edited By: Villanueva, Niko
Revision Number: 54
Date: 08/05/2024
Time: 12:13:49 PM
Tool Version: 23.1.1.829
File Name: SlopeW_DaneCoLF_AA'.gsz
Directory: I:\25222268.00\Data and Calculations\Geotechnical\Slope Stability\
Last Solved Date: 08/05/2024
Last Solved Time: 12:15:48 PM

## Project Settings

Unit System: U.S. Customary Units

## Analysis Settings

### Circular Optimized Failure A-A

Description: Circular Static Conditions
Kind: SLOPE/W
Analysis Type: Bishop
Settings
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 10
- Optimize Critical Slip Surface Location: Yes
- Optimizations Settings
  - Maximum Iterations: 2,000
  - Starting Points: 8
  - Ending Points: 16
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft

Minimum Slip Surface Volume: 35.314667 ft³
Number of Columns: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 20,000
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50

# Materials

## MSW with Leachate Recirculation

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 119 pcf
Effective Cohesion: 300 psf
Effective Friction Angle: 30 °
Phi-B: 0 °

## Geosynthetic Liner

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 11 °
Phi-B: 0 °

## General Cover Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 30 °
Phi-B: 0 °

## Native Sand Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

## Clay Liner

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 30 °
Phi-B: 0 °

# Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (449.0988, 1,122.187) ft

Left-Zone Right Coordinate: (644.65, 1,089.9173) ft
Left-Zone Increment: 500
Right Type: Range
Right-Zone Left Coordinate: (1,276.545, 932.0699) ft
Right-Zone Right Coordinate: (1,447.9873, 896.7) ft
Right-Zone Increment: 500
Radius Increments: 4

# Slip Surface Limits

Left Coordinate: (0, 1,123.2947) ft
Right Coordinate: (1,474.7899, 887.7658) ft

# Piezometric Surfaces

## Piezometric Surface 1

### Coordinates

| | X | Y |
|---|---|---|
| Coordinate 1 | 0.0237 ft | 895 ft |
| Coordinate 2 | 406.0237 ft | 891 ft |
| Coordinate 3 | 895.0237 ft | 876 ft |
| Coordinate 4 | 1,109.0237 ft | 873 ft |
| Coordinate 5 | 1,243.0237 ft | 872 ft |
| Coordinate 6 | 1,482.0922 ft | 869 ft |

# Geometry

Name: 2D Geometry

## Settings

View: 2D
Element Thickness: 1 ft

## Points

| | X | Y |
|---|---|---|
| Point 1 | 527.5669 ft | 1,119.1646 ft |
| Point 2 | 464.1298 ft | 1,122.0367 ft |
| Point 3 | 349.1604 ft | 1,123.1864 ft |
| Point 4 | 140.1979 ft | 1,129.4553 ft |
| Point 5 | 50 ft | 1,135.7847 ft |
| Point 6 | 0 ft | 1,123.2947 ft |
| Point 7 | 0 ft | 1,118.2947 ft |
| Point 8 | 50 ft | 1,130.7847 ft |
| Point 9 | 140.1979 ft | 1,124.4553 ft |
| Point 10 | 349.1604 ft | 1,118.1864 ft |
| Point 11 | 464.1298 ft | 1,117.0367 ft |
| Point 12 | 527.5669 ft | 1,114.1646 ft |
| Point 13 | 1,354.0888 ft | 907.6995 ft |
| Point 14 | 1,354.0893 ft | 905.358 ft |

| | | |
|---|---|---|
| Point 15 | 1,354.0898 ft | 902.7995 ft |
| Point 16 | 1,363.4551 ft | 902.7995 ft |
| Point 17 | 1,368.1888 ft | 902.7995 ft |
| Point 18 | 1,368.1888 ft | 900.7995 ft |
| Point 19 | 1,370.0888 ft | 900.7995 ft |
| Point 20 | 1,370.0888 ft | 902.6995 ft |
| Point 21 | 1,374.0888 ft | 902.6995 ft |
| Point 22 | 1,354.0888 ft | 912.6995 ft |
| Point 23 | 0 ft | 900.2666 ft |
| Point 24 | 19.1215 ft | 900.1496 ft |
| Point 25 | 519.6736 ft | 895.1098 ft |
| Point 26 | 1,060.393 ft | 878.8882 ft |
| Point 27 | 1,275.84 ft | 876.7337 ft |
| Point 28 | 1,333.4366 ft | 895.9239 ft |
| Point 29 | 1,354.0898 ft | 902.8052 ft |
| Point 30 | 1,366.0888 ft | 902.6995 ft |
| Point 31 | 1,363.4551 ft | 902.6995 ft |
| Point 32 | 1,354.0888 ft | 902.6995 ft |
| Point 33 | 1,275.8558 ft | 876.6336 ft |
| Point 34 | 1,060.391 ft | 878.7882 ft |
| Point 35 | 517.9584 ft | 895.0612 ft |
| Point 36 | 19.1207 ft | 900.0496 ft |
| Point 37 | 0 ft | 900.1666 ft |
| Point 38 | 0 ft | 896.1666 ft |
| Point 39 | 50.7907 ft | 895.7329 ft |
| Point 40 | 517.9584 ft | 891.0612 ft |
| Point 41 | 581.0124 ft | 889.1696 ft |
| Point 42 | 1,060.391 ft | 874.7882 ft |
| Point 43 | 1,275.8558 ft | 872.6336 ft |
| Point 44 | 1,474.7899 ft | 887.7658 ft |
| Point 45 | 1,429.0888 ft | 902.9995 ft |
| Point 46 | 1,399.0888 ft | 902.6995 ft |
| Point 47 | 1,391.5888 ft | 900.1995 ft |
| Point 48 | 1,381.5888 ft | 900.1995 ft |
| Point 49 | 1,370.0888 ft | 900.6995 ft |
| Point 50 | 1,368.0888 ft | 900.6995 ft |
| Point 51 | 1,368.0888 ft | 902.6995 ft |
| Point 52 | 0 ft | 750.2408 ft |
| Point 53 | 1,474.7899 ft | 750.2408 ft |
| Point 54 | 0.0006 ft | 900.2666 ft |
| Point 55 | 1,354.0726 ft | 902.7995 ft |
| Point 56 | 1,354.0727 ft | 902.7995 ft |

## Regions

| | Material | Points | Area |
|---|---|---|---|
| Region 1 | General Cover Fill | 1,2,3,4,5,6,7,8,9,10,11,12,13,14,29,15,16,17,18,19,20,21,22 | 6,872.6 ft² |
| Region 2 | MSW with Leachate Recirculation | 12,11,10,9,8,7,23,54,24,25,26,27,28,55,56,29,14,13 | 2.2218e+05 ft² |

| | | | |
|---|---|---|---|
| Region 3 | Clay Liner | 30,31,32,33,34,35,36,37,38,39,40,41,42,43 | 5,441.5 ft² |
| Region 4 | Native Sand Fill | 44,45,46,47,48,21,20,19,49,50,51,30,43,42,41,40,39,38,52,53 | 2.0145e+05 ft² |
| Region 5 | Geosynthetic Liner | 54,37,36,35,34,33,32,31,30,51,50,49,19,18,17,16,15,56,55,28,27,26,25,24 | 129.12 ft² |

# Slip Results

Slip Surfaces Analysed: 1254978 of 1255006 converged

# Current Slip Surface

Slip Surface: 1,255,006
Factor of Safety: 2.290
Volume: 46,628.908 ft³
Weight: 5,532,880.2 lbf
Resisting Moment: 3.3325529e+09 lbf·ft
Activating Moment: 1.4549932e+09 lbf·ft
Resisting Force: 2,802,349.4 lbf
Activating Force: 1,251,791.9 lbf
Slip Rank: 1 of 1,255,006 slip surfaces
Exit: (1,394.696, 901.23524) ft
Entry: (597.09685, 1,101.796) ft
Radius: 370.1908 ft
Center: (1,220.3003, 2,028.0572) ft

## Slip Columns

| | X | Y | PWP | Base Normal Stress | Frictional Strength | Cohesive Strength | Suction Strength | Base Material |
|---|---|---|---|---|---|---|---|---|
| Column 1 | 601.9809 ft | 1,098.0760 ft | 0 psf | 241.19936 psf | 139.25651 psf | 0 psf | 0 psf | General Cover Fill |
| Column 2 | 612.3304 ft | 1,090.1930 ft | 0 psf | 678.02203 psf | 391.4562 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 3 | 632.5937 ft | 1,076.5702 ft | 0 psf | 1,587.2443 psf | 916.39593 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 4 | 659.8061 ft | 1,060.7153 ft | 0 psf | 2,599.5636 psf | 1,500.8587 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 5 | 684.6356 ft | 1,047.9253 ft | 0 psf | 3,293.4133 psf | 1,901.4531 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 6 | 709.4651 ft | 1,035.1353 ft | 0 psf | 3,987.263 psf | 2,302.0474 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 7 | 734.2946 ft | 1,022.3452 ft | 0 psf | 4,681.1127 psf | 2,702.6417 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 8 | 759.1241 ft | 1,009.5552 ft | 0 psf | 5,374.9624 psf | 3,103.236 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Column 9 | 783.9536 ft | 996.7652 ft | 0 psf | 6,068.8121 psf | 3,503.8303 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 10 | 807.8440 ft | 985.5405 ft | 0 psf | 6,775.8823 psf | 3,912.0575 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 11 | 830.7956 ft | 975.8810 ft | 0 psf | 7,198.2922 psf | 4,155.9359 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 12 | 846.5868 ft | 969.4717 ft | 0 psf | 7,564.4669 psf | 4,367.347 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 13 | 870.5734 ft | 961.9613 ft | 0 psf | 7,854.6038 psf | 4,534.8576 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 14 | 892.6341 ft | 955.2810 ft | 0 psf | 7,959.8642 psf | 4,595.6297 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 15 | 908.7794 ft | 950.2173 ft | 0 psf | 8,073.5134 psf | 4,661.2451 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 16 | 936.2910 ft | 941.5890 ft | 0 psf | 8,267.1703 psf | 4,773.053 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 17 | 963.8025 ft | 932.9606 ft | 0 psf | 8,460.8273 psf | 4,884.8609 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 18 | 983.8273 ft | 926.8816 ft | 0 psf | 8,648.3447 psf | 4,993.1242 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 19 | 1,002.2789 ft | 921.6369 ft | 0 psf | 8,709.9928 psf | 5,028.7167 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 20 | 1,026.6439 ft | 914.6771 ft | 0 psf | 8,806.9401 psf | 5,084.6893 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 21 | 1,051.0088 ft | 907.7175 ft | 0 psf | 8,903.8874 psf | 5,140.6618 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 22 | 1,075.3738 ft | 900.7577 ft | 0 psf | 9,000.8347 psf | 5,196.6343 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 23 | 1,098.2900 ft | 894.1202 ft | 0 psf | 9,082.908 psf | 5,244.0194 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 24 | 1,111.1360 ft | 890.3410 ft | 0 psf | 9,146.0804 psf | 5,280.492 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 25 | 1,132.7697 ft | 883.8059 ft | 0 psf | 9,251.4548 psf | 5,341.3299 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 26 | 1,164.7278 ft | 877.7647 ft | 0 psf | 9,757.414 psf | 1,896.6491 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 27 | 1,189.6011 ft | 877.5096 ft | 0 psf | 9,048.9696 psf | 1,758.9415 psf | 0 psf | 0 psf | Geosynthetic Liner |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Column 28 | 1,214.4744 ft | 877.2545 ft | 0 psf | 8,340.5252 psf | 1,621.2339 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 29 | 1,234.9674 ft | 877.0620 ft | 0 psf | 7,756.2565 psf | 1,507.6635 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 30 | 1,255.4157 ft | 876.8970 ft | 0 psf | 7,168.6017 psf | 1,393.435 psf | 0 psf | 0 psf | Geosynthetic Liner |
| Column 31 | 1,273.2964 ft | 877.2033 ft | 0 psf | 6,741.2578 psf | 3,892.067 psf | 300 psf | 0 psf | MSW with Leachate Recirculation |
| Column 32 | 1,286.5016 ft | 878.1808 ft | 0 psf | 6,234.7268 psf | 3,599.6212 psf | 0 psf | 0 psf | Clay Liner |
| Column 33 | 1,313.8274 ft | 880.2035 ft | -567.61619 psf | 5,171.4996 psf | 3,231.5116 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 34 | 1,343.7627 ft | 882.4194 ft | -729.4076 psf | 3,962.5101 psf | 2,476.0511 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 35 | 1,354.0891 ft | 883.1838 ft | -785.21839 psf | 3,540.0095 psf | 2,212.0434 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 36 | 1,358.7722 ft | 883.5305 ft | -810.52939 psf | 3,186.039 psf | 1,990.8581 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 37 | 1,364.7720 ft | 883.9746 ft | -842.95622 psf | 2,751.2142 psf | 1,719.1494 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 38 | 1,366.5807 ft | 884.1085 ft | -852.73197 psf | 2,622.6359 psf | 1,638.8048 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 39 | 1,367.5807 ft | 884.4593 ft | -875.41393 psf | 2,973.6762 psf | 1,858.1591 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 40 | 1,368.1388 ft | 884.8045 ft | -897.40774 psf | 2,887.3003 psf | 1,804.1855 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 41 | 1,369.1388 ft | 885.4232 ft | -936.81611 psf | 2,732.5326 psf | 1,707.4759 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 42 | 1,372.0888 ft | 887.2484 ft | -1,053.0708 psf | 2,275.9679 psf | 1,422.1826 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 43 | 1,377.8388 ft | 890.8058 ft | -1,279.6689 psf | 1,472.5206 psf | 920.13297 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 44 | 1,386.5888 ft | 896.2194 ft | -1,624.4921 psf | 550.63824 psf | 344.07696 psf | 0 psf | 0 psf | Native Sand Fill |
| Column 45 | 1,393.1424 ft | 900.2740 ft | -1,882.7591 psf | 61.333899 psf | 38.325674 psf | 0 psf | 0 psf | Native Sand Fill |

Dane Co. Landfill No.3
Circular Failure A-A
Circular Static Conditions
08/05/2024, 10:17:44 AM

Analysis Type: Bishop
Factor of Safety: 2.530

| Color | Name | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) | Piezometric Surface |
|---|---|---|---|---|---|
| | Clay Liner | 130 | 0 | 30 | |
| | General Cover Fill | 115 | 0 | 30 | |
| | Geosynthetic Liner | 115 | 0 | 11 | |
| | MSW with Leachate Recirculation | 119 | 300 | 30 | |
| | Native Sand Fill | 115 | 0 | 32 | 1 |