COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

MEMORANDUM

Date: July 25, 2019

To: Jared Ebert; Division of Reclamation, Mining & Safety

From: Peter Hays; Division of Reclamation, Mining & Safety

Re: Adequacy Review of Exhibit 6.5 – Geotechnical Stability Adequacy Response Aggregate Industries; Tucson South Resource; File No. M-2004-044; AM-01

The Division of Reclamation, Mining and Safety (Division/DRMS) has reviewed the Slope Stability Analysis adequacy response by Tetra Tech dated July 3, 2019 for the Tucson South Resource 112c permit amendment application (AM-01). The Applicant will need to address the following adequacy items identified in the review:

In accordance with Table 1 - Recommended Factors of Safety for Slope Stability Analysis for Operations and Reclamation within Section 30.4 of the Policies of the Mined Land Reclamation Board (MLRB) effective May 16, 2018, the Division will require the Applicant to comply with the factor of safety (FOS) of 1.5 for critical structures in static conditions and 1.30 for critical structures in pseudostatic conditions since the Applicant utilized generalized strength measurements in the analysis.

The Division duplicated the Applicant's slope stability analysis using Clover Technologies Galena Slope Stability Analysis System, Version 7.10. A table of the Applicant's and the Division's analysis results are below:

Structure Name	Analysis Name	Applicant's FOS	DRMS FOS
Tucson Street – West Side	Figure A-1 – Static	1.68	1.52
Tucson Street – West Side	Figure A-1 – Static Fill	1.64	2.03
Tucson Street – West Side	Figure A-2 – Pseudostatic	1.31	1.35
Tucson Street – West Side	Figure A-2 – Pseudostatic Fill	1.34	1.57
Tucson Street – East Side	Figure B-1 – Static	2.17	1.96

Tucson Street – East Side	Figure B-1 – Static Fill	1.91	2.03
Tucson Street – East Side	Figure B-2 – Pseudostatic	1.67	1.54
Tucson Street – East Side	Figure B-2 – Pseudostatic Fill	1.49	1.61
South Platte River	Figure C-1 – Static	2.13	1.87
South Platte River	Figure C-1 – Static Fill	1.89	1.91
South Platte River	Figure C-2 – Pseudostatic	1.63	1.49
South Platte River	Figure C-2 – Pseudostatic Fill	1.46	1.53
Pipeline – North of East Cell	Figure D-1 – Static	2.09	1.94
Pipeline – North of East Cell	Figure D-1 – Static Fill	1.73	1.77
Pipeline – North of East Cell	Figure D-2 – Pseudostatic	1.65	1.55
Pipeline – North of East Cell	Figure D-2 – Pseudostatic Fill	1.37	1.42
Gas Well / Fence	Figure E-1 – Static	2.08	2.10
Gas Well / Fence	Figure E-1 – Static Fill	2.10	2.52
Gas Well / Fence	Figure E-2 – Pseudostatic	1.49	1.55
Gas Well / Fence	Figure E-2 – Pseudostatic Fill	1.52	1.88
Power Poles	Figure F-1 – Static Fill	1.89	2.27
Power Poles	Figure F-2 – Pseudostatic Fill	1.41	1.72
Brighton Ditch	Figure G-1 – Static Fill	1.93	1.85
Brighton Ditch	Figure G-2 – Pseudostatic Fill	1.53	1.48
Hwy 7 North Cell (East)	Figure H-1 – Static	2.00	1.96
Hwy 7 North Cell (East)	Figure H-1 – Static Fill	1.77	1.94
Hwy 7 North Cell (East)	Figure H-2 – Pseudostatic	1.56	1.52
Hwy 7 North Cell (East)	Figure H-2 – Pseudostatic Fill	1.38	1.51
Hwy 7 South Cell	Figure I-1 – Static	2.31	2.02
Hwy 7 South Cell	Figure I-2 – Pseudostatic	1.67	1.49
Brighton Return Ditch	Figure J-1 – Static	1.58	1.07
Brighton Return Ditch	Figure J-2 – Pseudostatic	1.32	0.89
Gravel Road / Building	Figure K-1 – Static	2.19	1.93
Gravel Road / Building	Figure K-2 – Pseudostatic	1.53	1.43
Challenger Pit	Figure L-1 – Static	2.24	2.27
Challenger Pit	Figure L-1 – Static Fill	1.97	2.37
Challenger Pit	Figure L-2 – Pseudostatic	1.75	1.78
Challenger Pit	Figure L-2 – Pseudostatic Fill	1.52	1.86
Pipeline – East Side of East Cell	Figure M-1 – Static	2.42	2.32
Pipeline – East Side of East Cell	Figure M-1 – Static Fill	2.25	2.31
Pipeline – East Side of East Cell	Figure M-2 – Pseudostatic	1.80	1.76
Pipeline – East Side of East Cell	Figure M-2 – Pseudostatic Fill	1.69	1.76
Hwy 7 from North Cells - West	Figure N-1 – Static	3.13	2.86
Hwy 7 from North Cells - West	Figure N-1 – Static Fill	3.07	3.01
Hwy 7 from North Cells - West	Figure N-2 – Pseudostatic	2.19	1.98

Hwy 7 from North Cells - West	Figure N-2 – Pseudostatic Fill	2.16	2.13
City of Aurora Waterline	Figure O-1 – Static	2.76	2.47
City of Aurora Waterline	Figure O-1 – Static Fill	2.61	2.87
City of Aurora Waterline	Figure O-2 – Pseudostatic	1.88	1.74
City of Aurora Waterline	Figure O-2 – Pseudostatic Fill	1.79	2.06

1. The Applicant modeled the Figure C analysis with a 44 feet offset from the top of bank (tob) of the South Platte River to the top of the mine slope. The Exhibit C-3 Map indicates the Applicant modeled a 42 feet offset. Please explain this discrepancy and revise the Figure C models and/or the Exhibit C-3 Map accordingly.

2. The Applicant modeled the Figure D analysis with a 35 feet offset from the pipeline easement to the top of the mine slope. The Exhibit C-3 Map indicates the Applicant modeled a 45 feet offset. Please explain this discrepancy and revise the Figure D models and/or the Exhibit C-3 Map accordingly.

3. The Applicant modeled the Figure F analysis with a 35 feet offset from the power pole easement to the top of the mine slope. The Exhibit C-3 Map indicates the Applicant modeled a 45 feet offset. Please explain this discrepancy and revise the Figure F models and/or the Exhibit C-3 Map accordingly.

4. The Applicant modeled the Figure G analysis with a 53 feet offset from the Brighton Ditch to the top of the mine slope. The Exhibit C-3 Map indicates the Applicant modeled a 35 feet offset. Please explain this discrepancy and revise the Figure G models and/or the Exhibit C-3 Map accordingly.

5. The Applicant modeled the Figure H analysis with a 75 feet offset from the edge of Highway 7 to the top of the mine slope. The Exhibit C-3 Map indicates the Applicant modeled a 106 feet offset. Please explain this discrepancy and revise the Figure H models and/or the Exhibit C-3 Map accordingly.

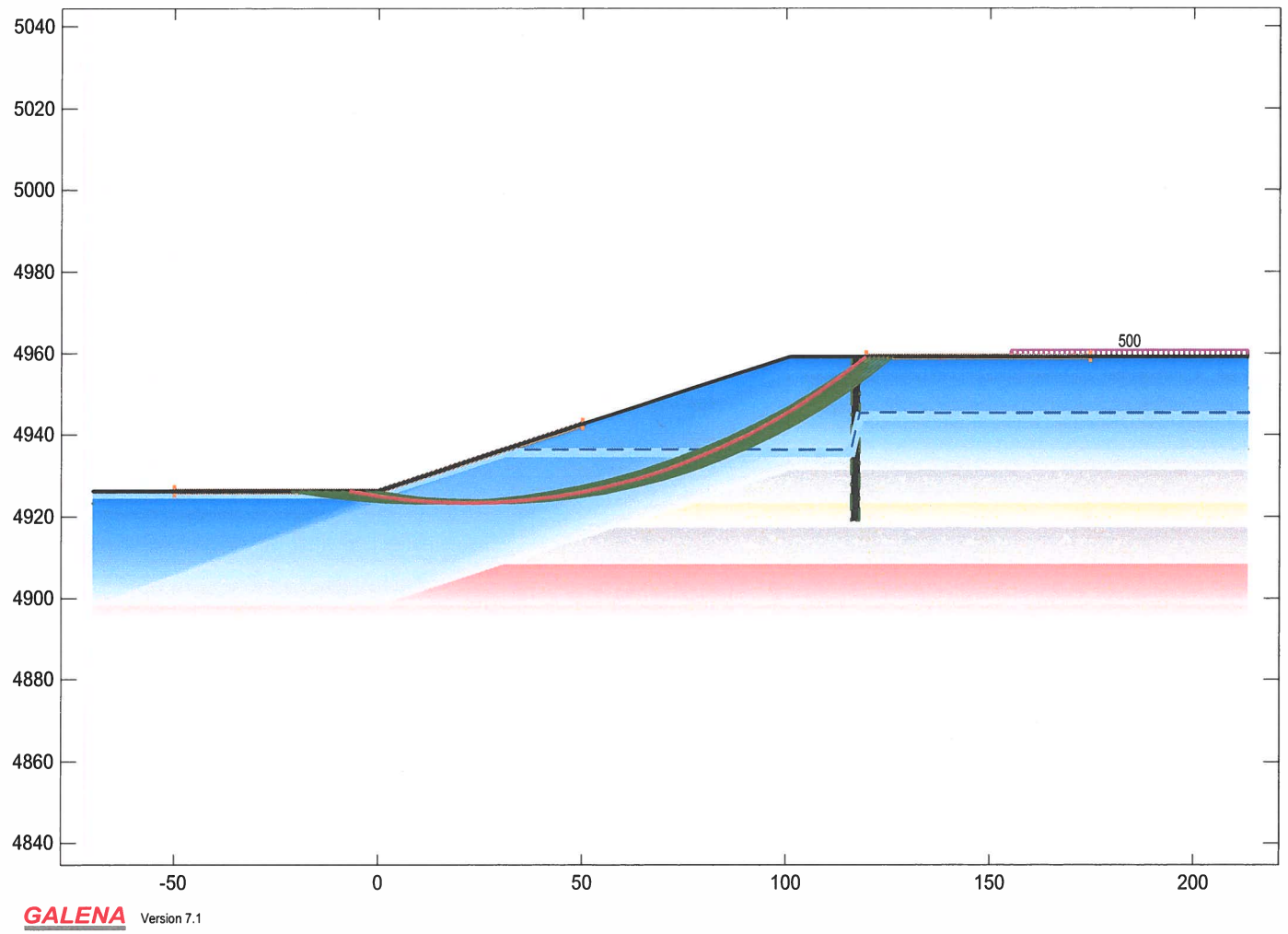
6. The Applicant modeled the Figure J analysis which produced a minimum FOS located 44 feet from the edge of the Brighton Return Ditch. The Exhibit C-3 Map indicates the Applicant modeled a 77 feet offset. Please explain this discrepancy and revise the Figure J models and/or the Exhibit C-3 Map accordingly.

   The Division duplicated the Figure J models with the 77 feet offset from the edge of the Brighton Return Ditch. The models produced factors of safety of 1.07 – Static and 0.89 – Pseudostatic, which do not meet the required FOS. Please review the Applicant's and Division's models and reevaluate the proposed offset distance from the Brighton Return Ditch to conform to the FOS requirement of the MLRB.

7. Please note there are numerous inconsistency in the geometry: offset from top of slope, offset from easements, offset from structures and offset from the slurry wall location between the Stability Analysis Models, the Figures 3 through 7 cross-sections provided in the Stability Analysis, the Mine Plan Map and the Actual Offset from the Mining Excavation Limits listed on the Structures List on the Exhibit C-2 Map. The Division will consider the enforceable offset as the offset distance listed on the "Actual Offset from Mining Excavation Limits" listed on the Structures List on the Exhibit C-2 and C-3 Map if the permit is approved and issued by the Division.

The Applicant must address the adequacy items above prior to the Division accepting the geotechnical stability analysis for the Tucson South amendment application. Copies of the Division's Galena stability analysis results are attached.

If you have any questions regarding these adequacy items, please contact me at peter.hays@state.co.us or (303) 866-3567, Ext. 8124.



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.52

Edited: 18 Jul 2019 *Processed:* 18 Jul 2019

Project Tucson South AM
A-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Mod1.gmf

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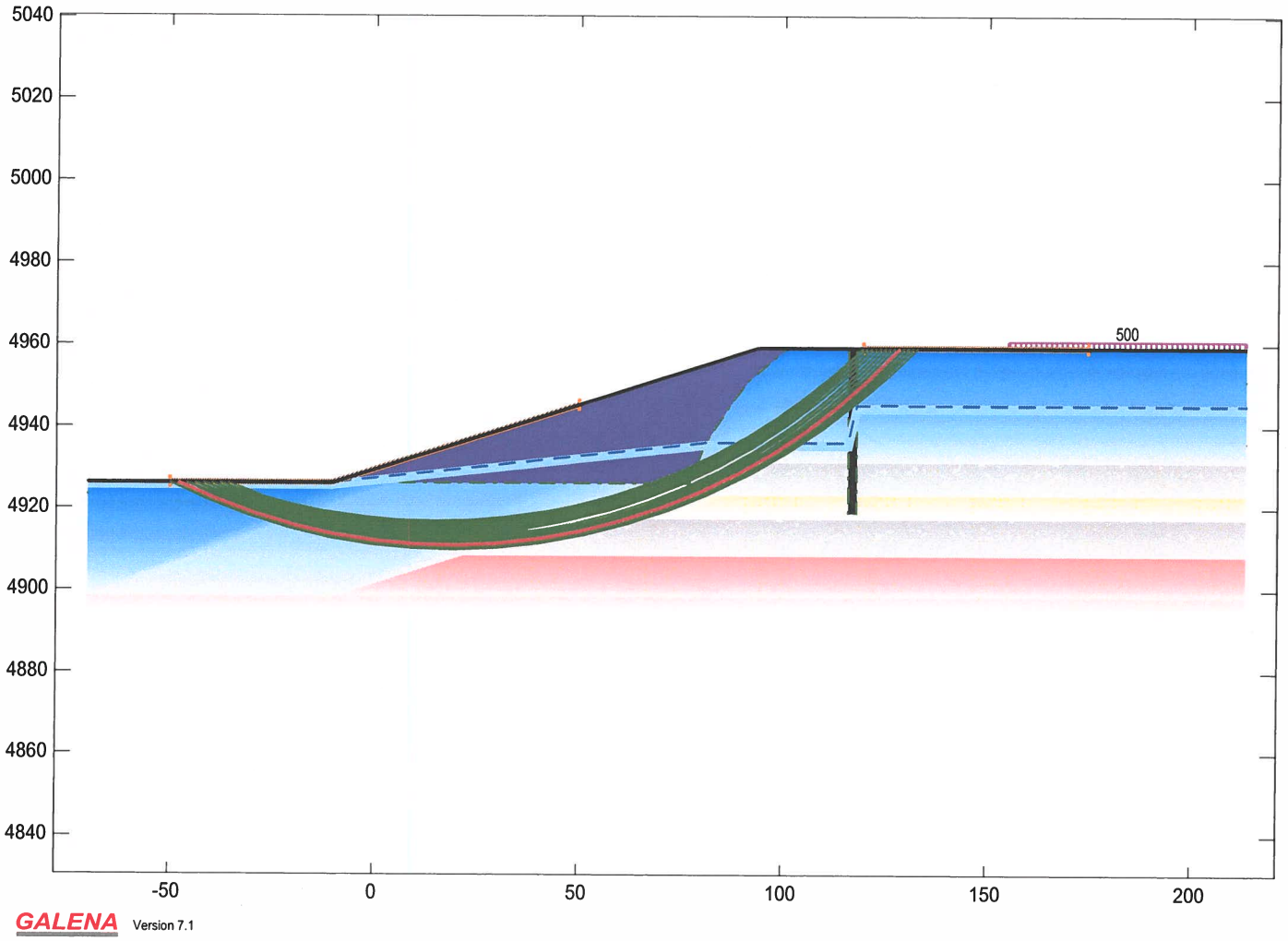

Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1
Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results
Critical Factor of Safety: 2.03

Project Tucson South AM
A-1 - Static - Fill

Edited: 18 Jul 2019 *Processed:* 18 Jul 2019

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure A-1 Static.gmf

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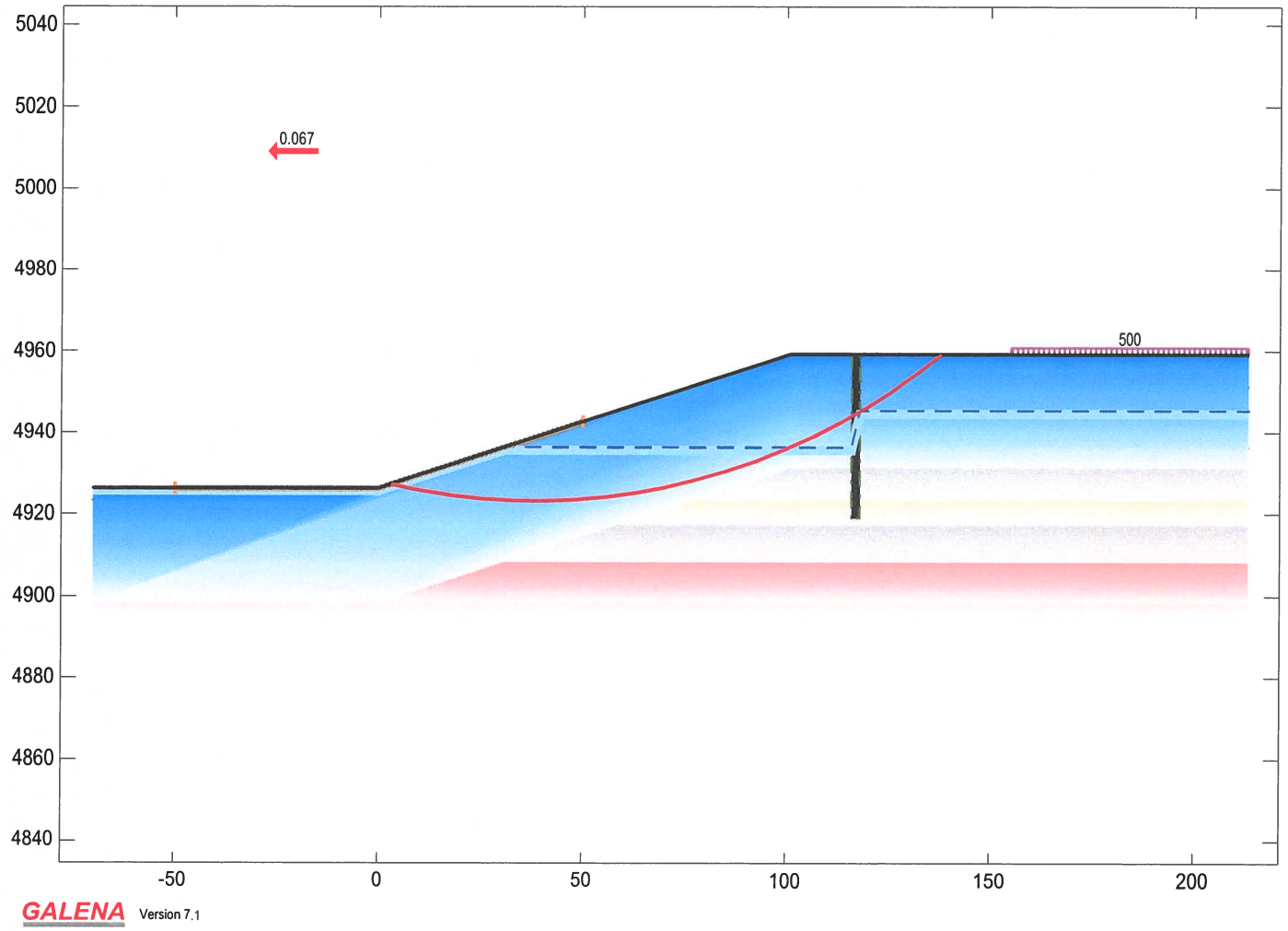

GALENA Version 7.1

Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1
Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results
Critical Factor of Safety: 1.35

Edited: 25 Jul 2019 *Processed:* 25 Jul 2019

Project Tucson South AM
A-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure A-2 Pseudostatic.gmf

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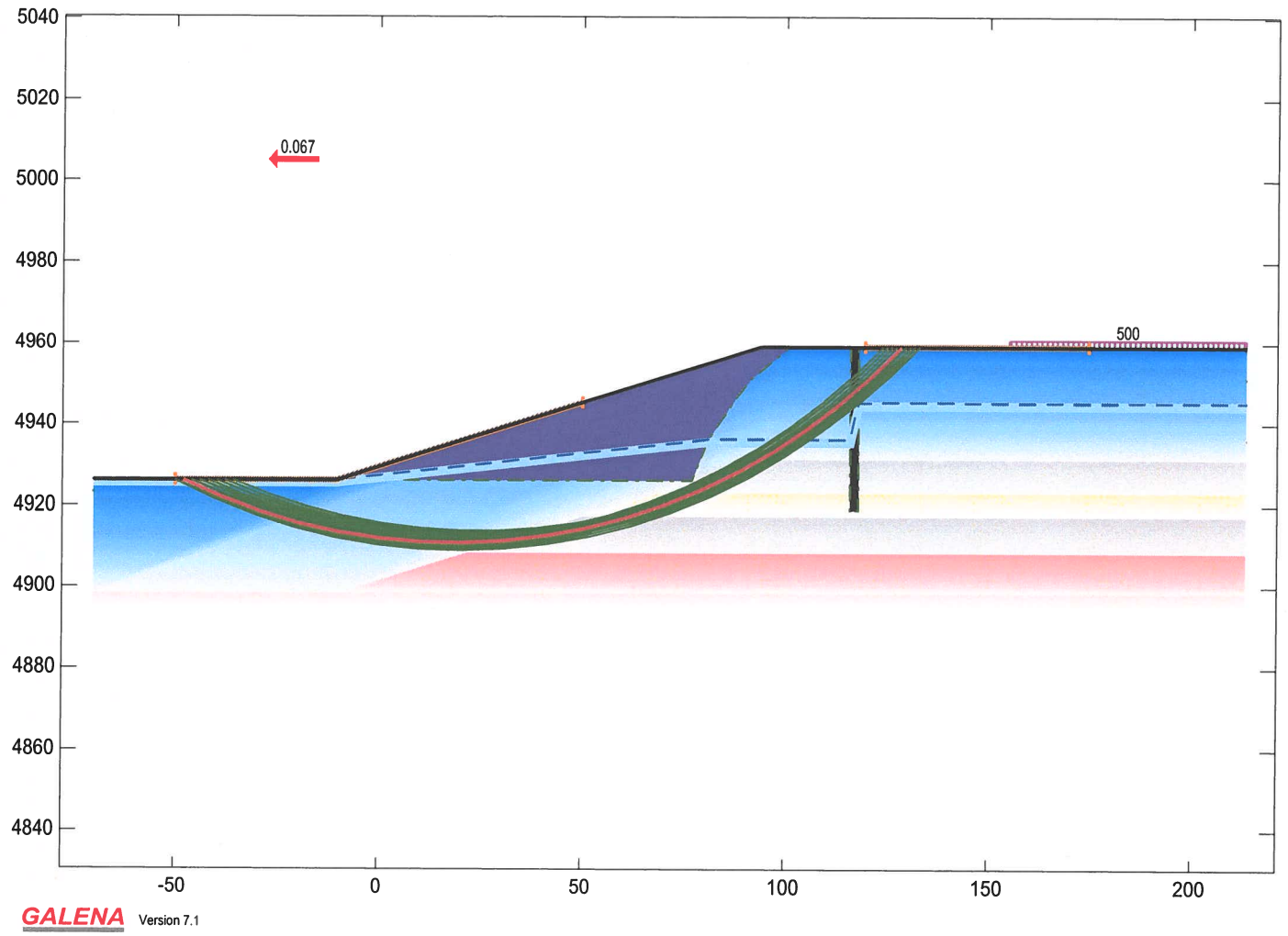

Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1
Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results
Critical Factor of Safety: 1.57

Edited: 18 Jul 2019 *Processed:* 18 Jul 2019

Project Tucson South AM
A-2 - Pseudostatic - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure A-2 Pseudostatic Fill.gmf

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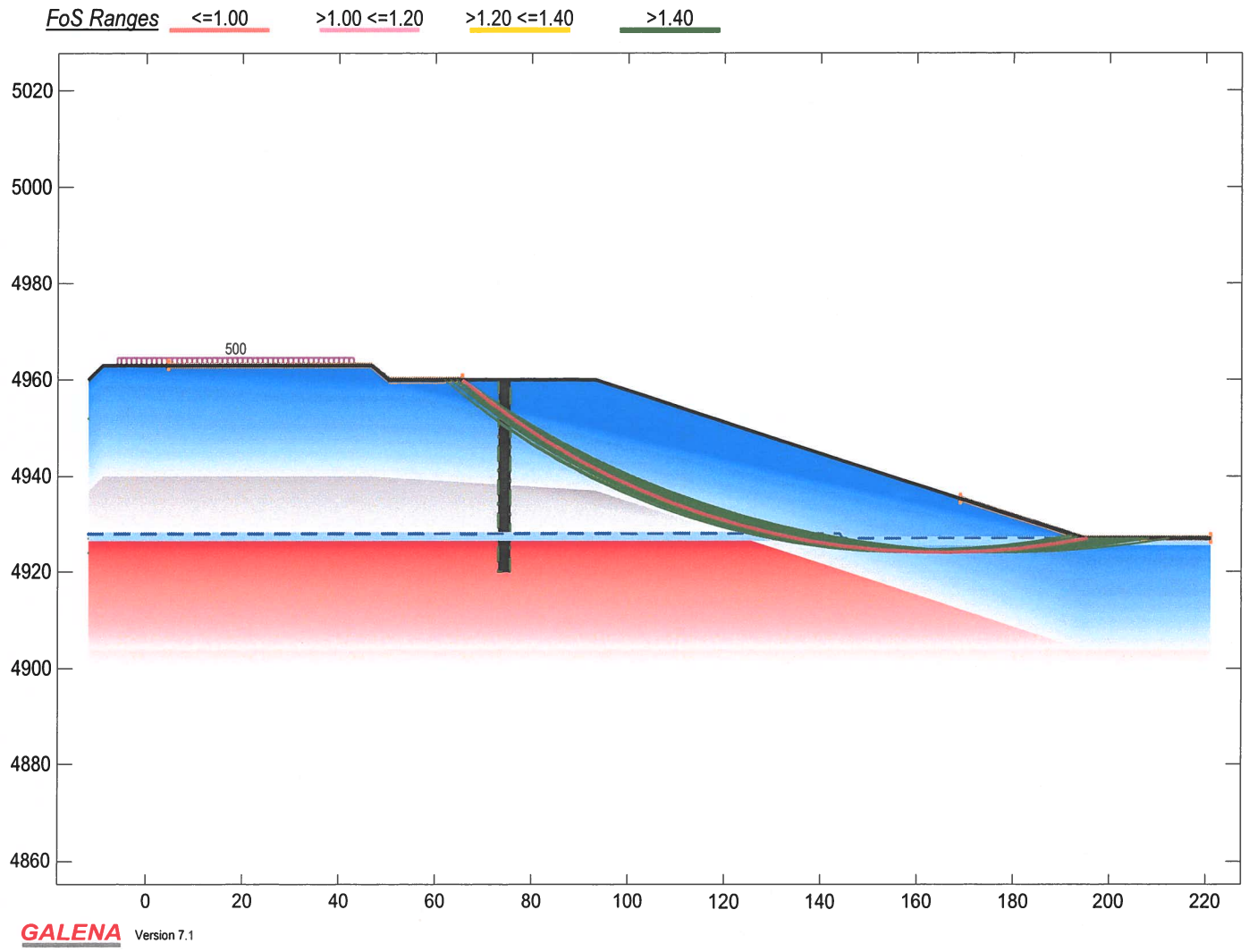

Material Keys

1: Claystone Bedrock
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.96

Project Tucson South AM
B-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure B-1 Static.gmf

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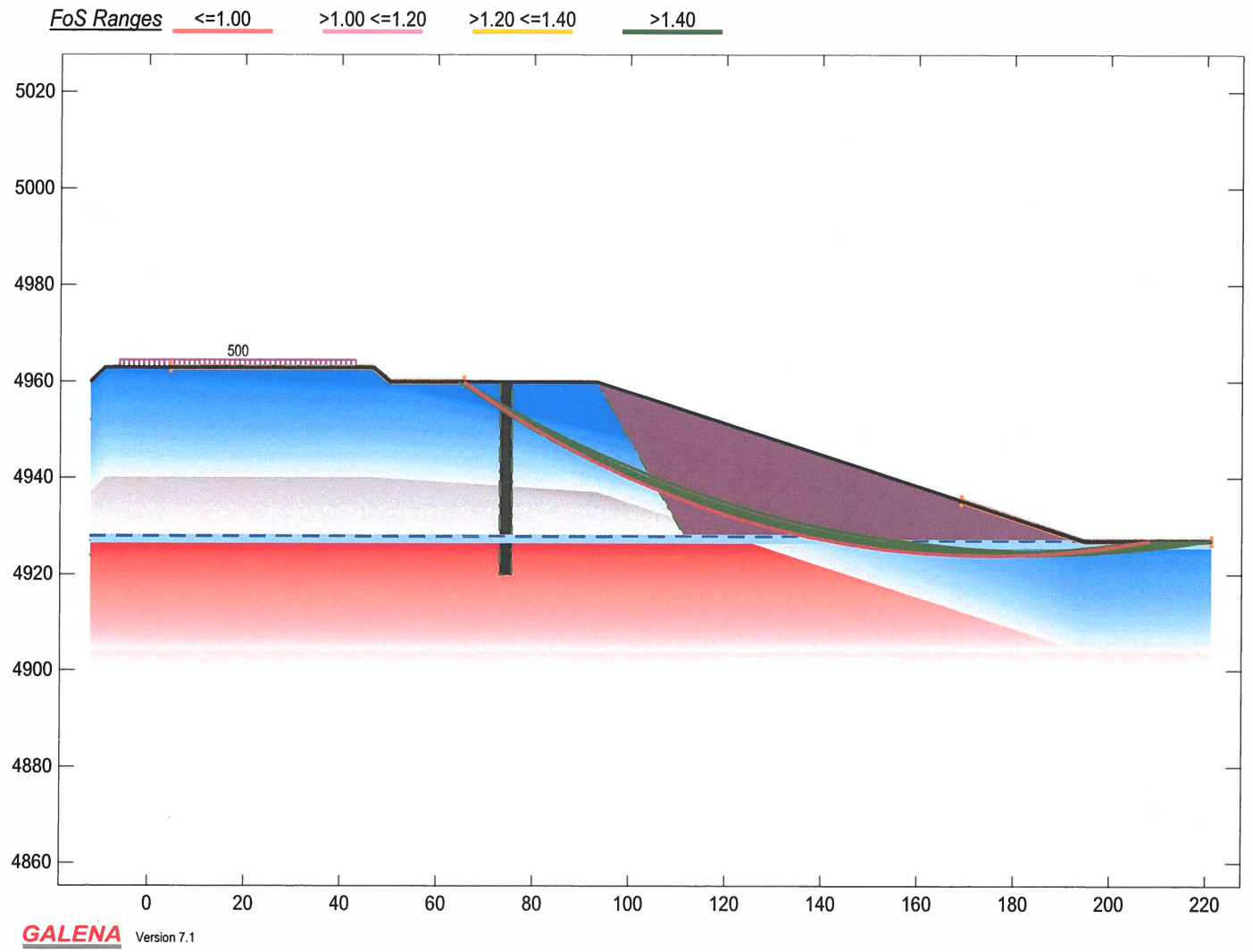

Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 2.03

Edited: 18 Jul 2019 *Processed:* 18 Jul 2019

Project Tucson South AM
B-1 - Static - Fill

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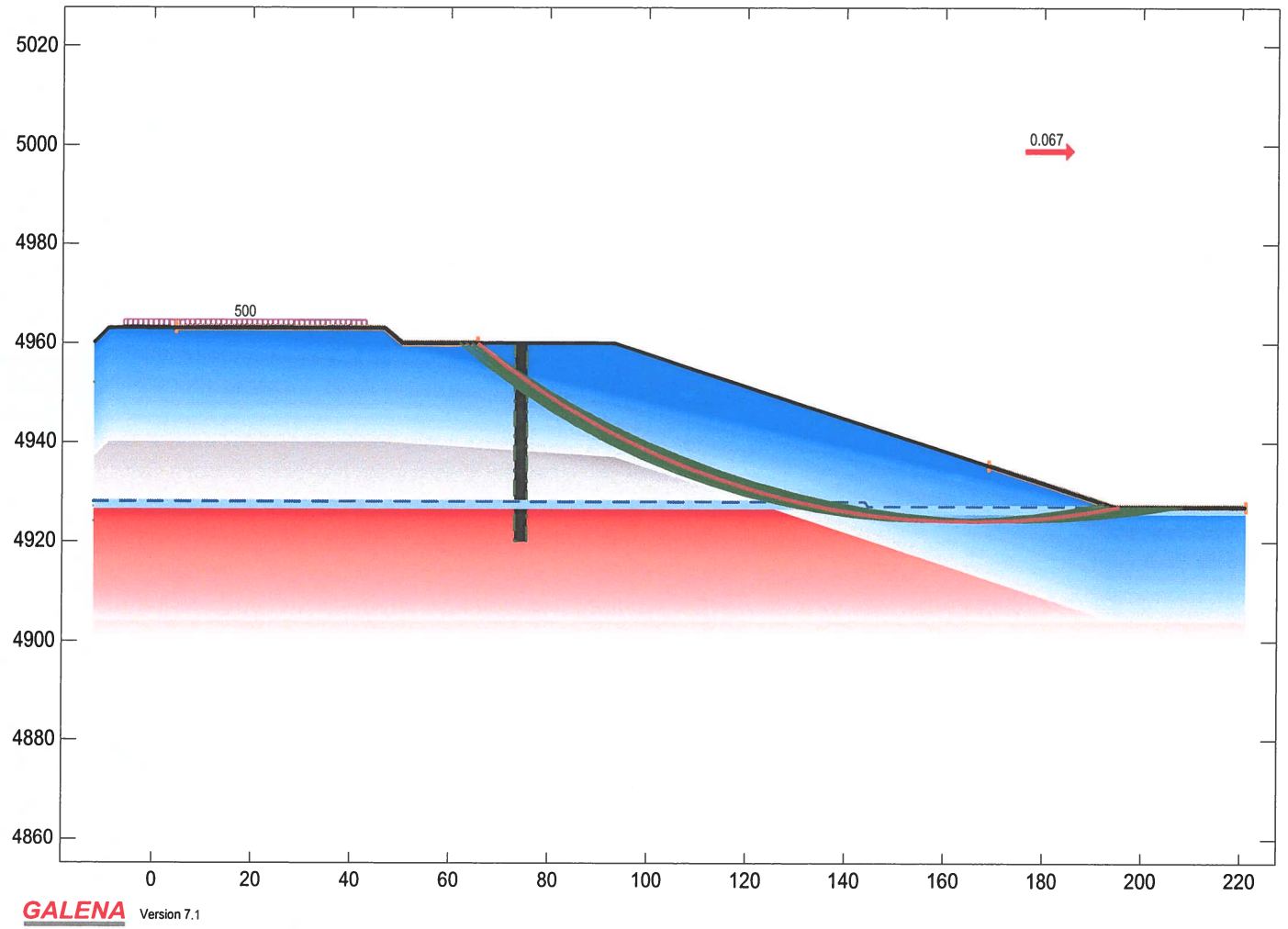

Material Keys

1: Claystone Bedrock
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.54

Edited: 18 Jul 2019 *Processed:* 18 Jul 2019

Project Tucson South AM
B-2 - Pseudostatic

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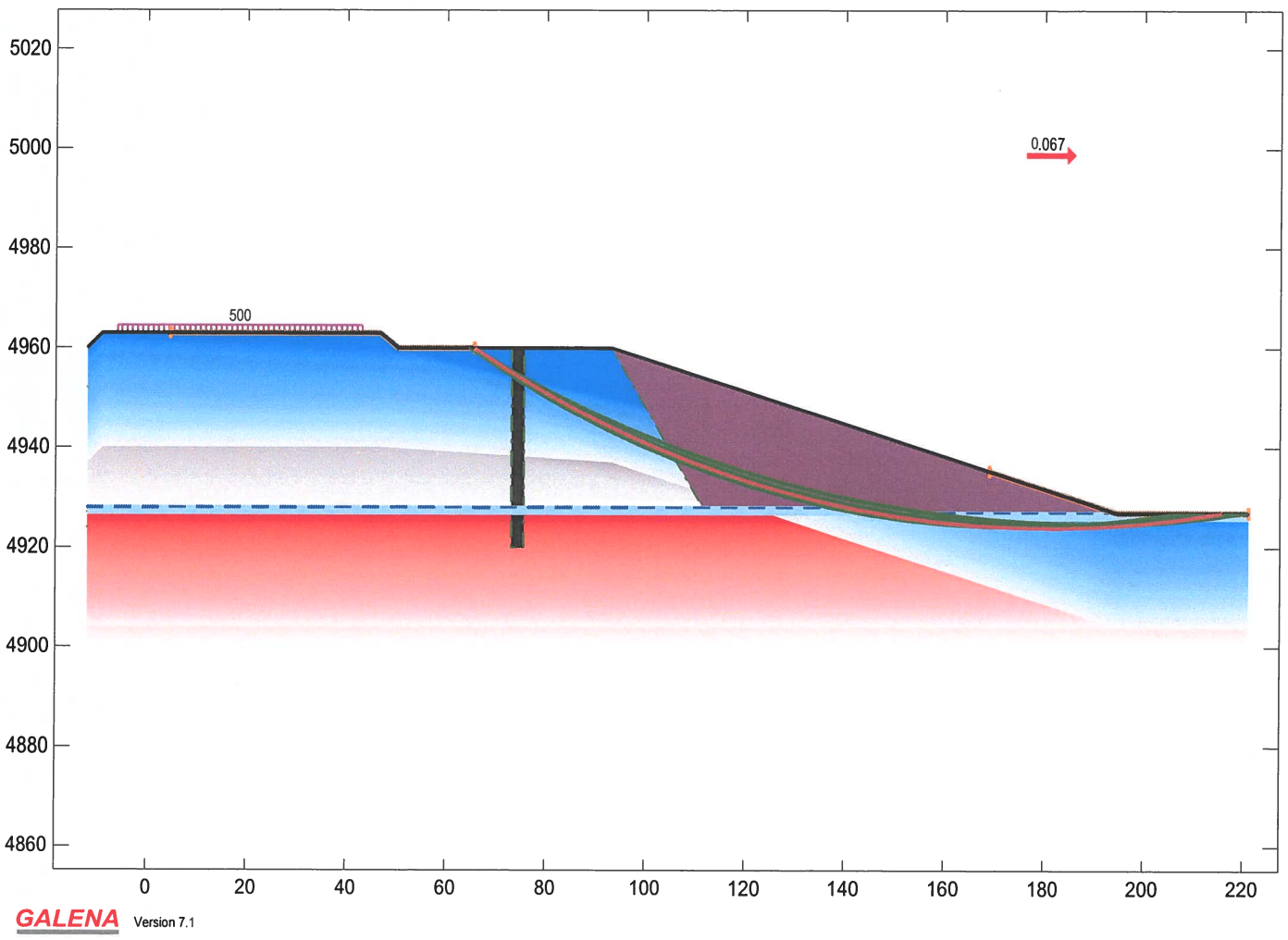

Material Keys

1: Claystone Bedrock
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.61

Edited: 18 Jul 2019 *Processed:* 18 Jul 2019

Project Tucson South AM
B-1 - Static - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure B-2 Pseudostatic Fill.gmf

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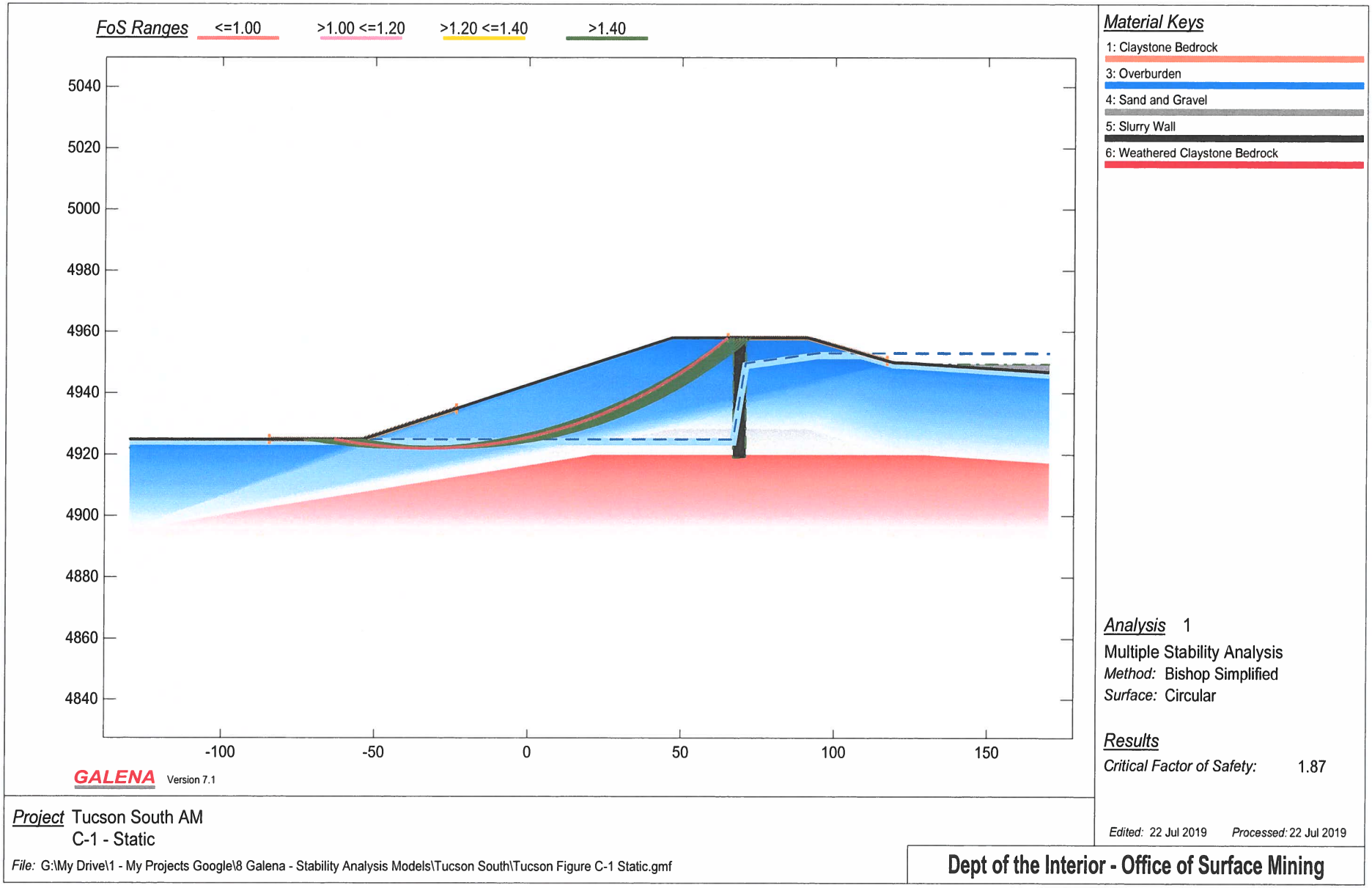
FoS Ranges
<=1.00
>1.00 <=1.20
>1.20 <=1.40
>1.40
5040
5020
5000
4980
4960
4940
4920
4900
4880
4860
4840
-100
-50
0
50
100
150
GALENA
Version 7.1
Material Keys
1: Claystone Bedrock
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
Analysis 1
Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular
Results
Critical Factor of Safety: 1.87
Project Tucson South AM
C-1 - Static
File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure C-1 Static.gmf
Edited: 22 Jul 2019
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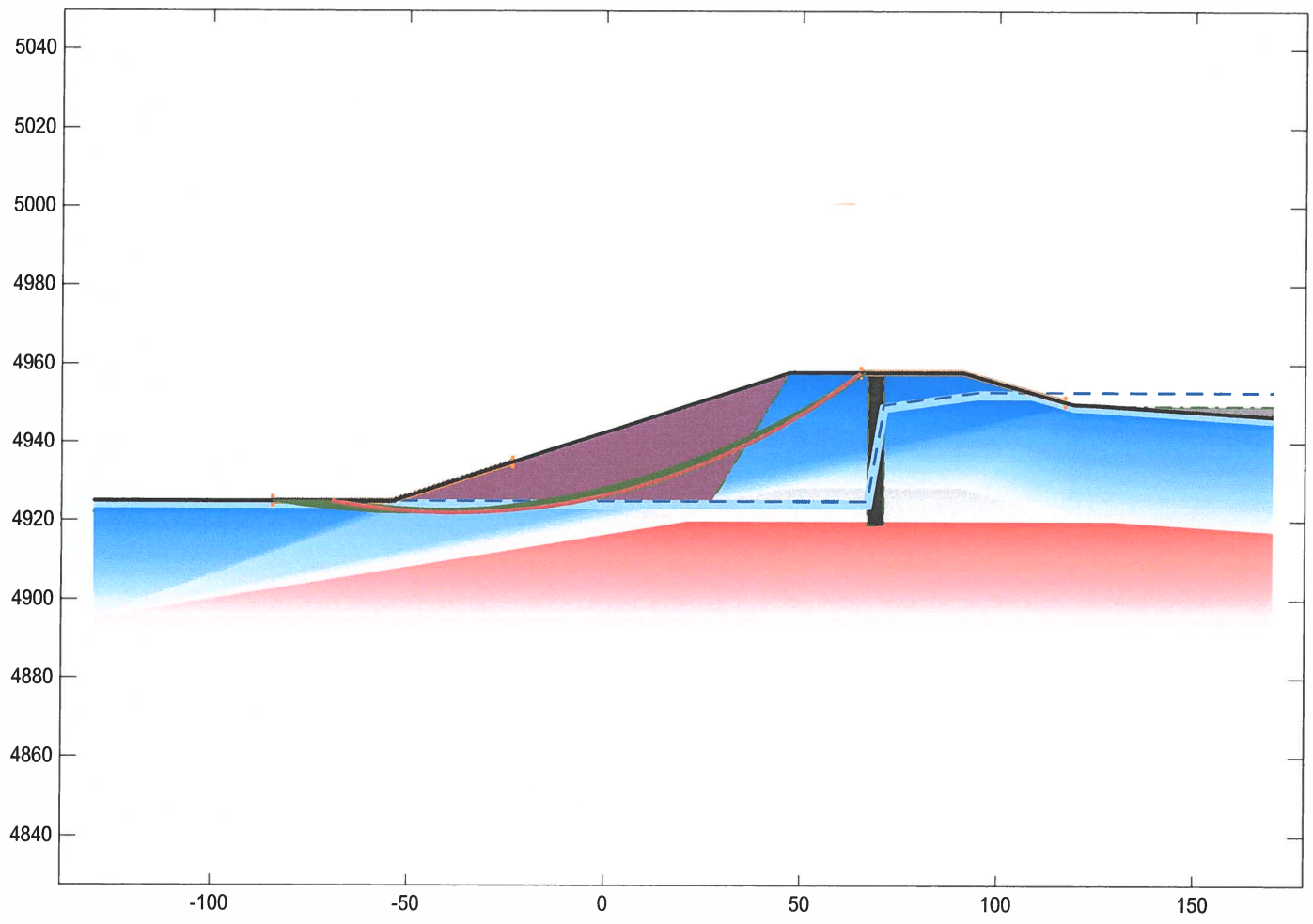

Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.91

Project Tucson South AM
C-1 - Static - Fill

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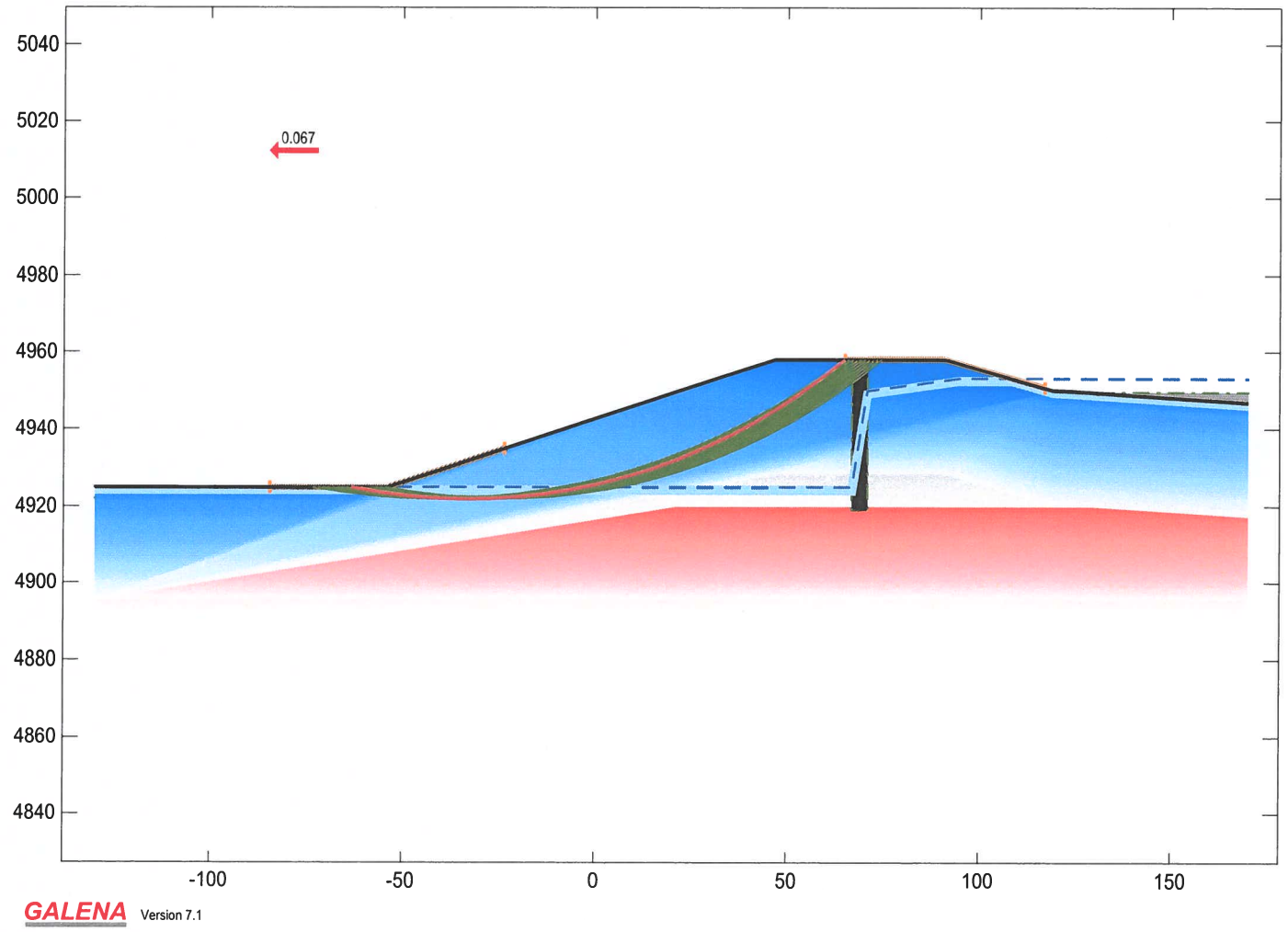

Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.49

Project Tucson South AM
C-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure C-2 Pseudostatic.gmf

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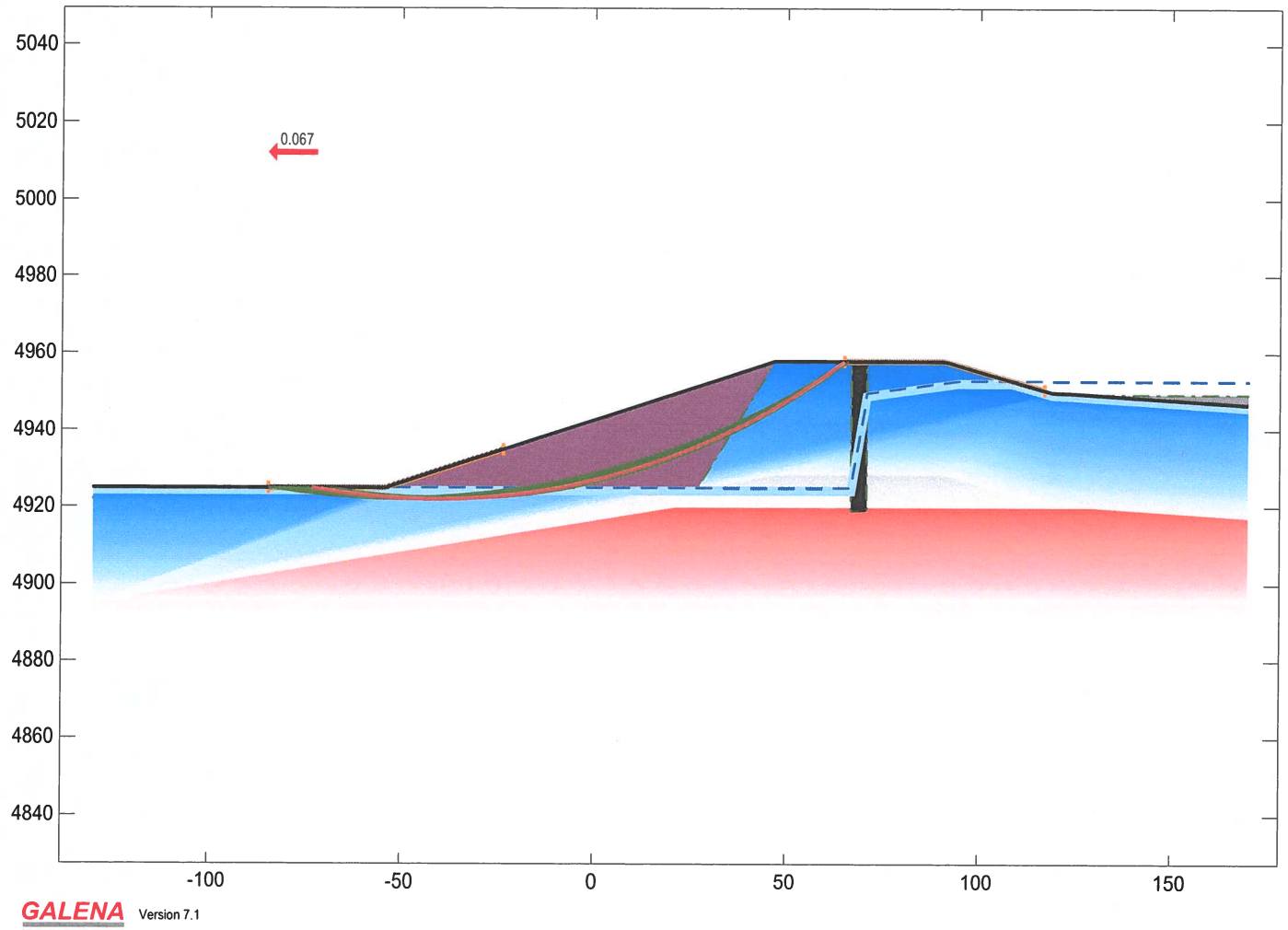

Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.53

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
C-1 - Pseudostatic - Fill

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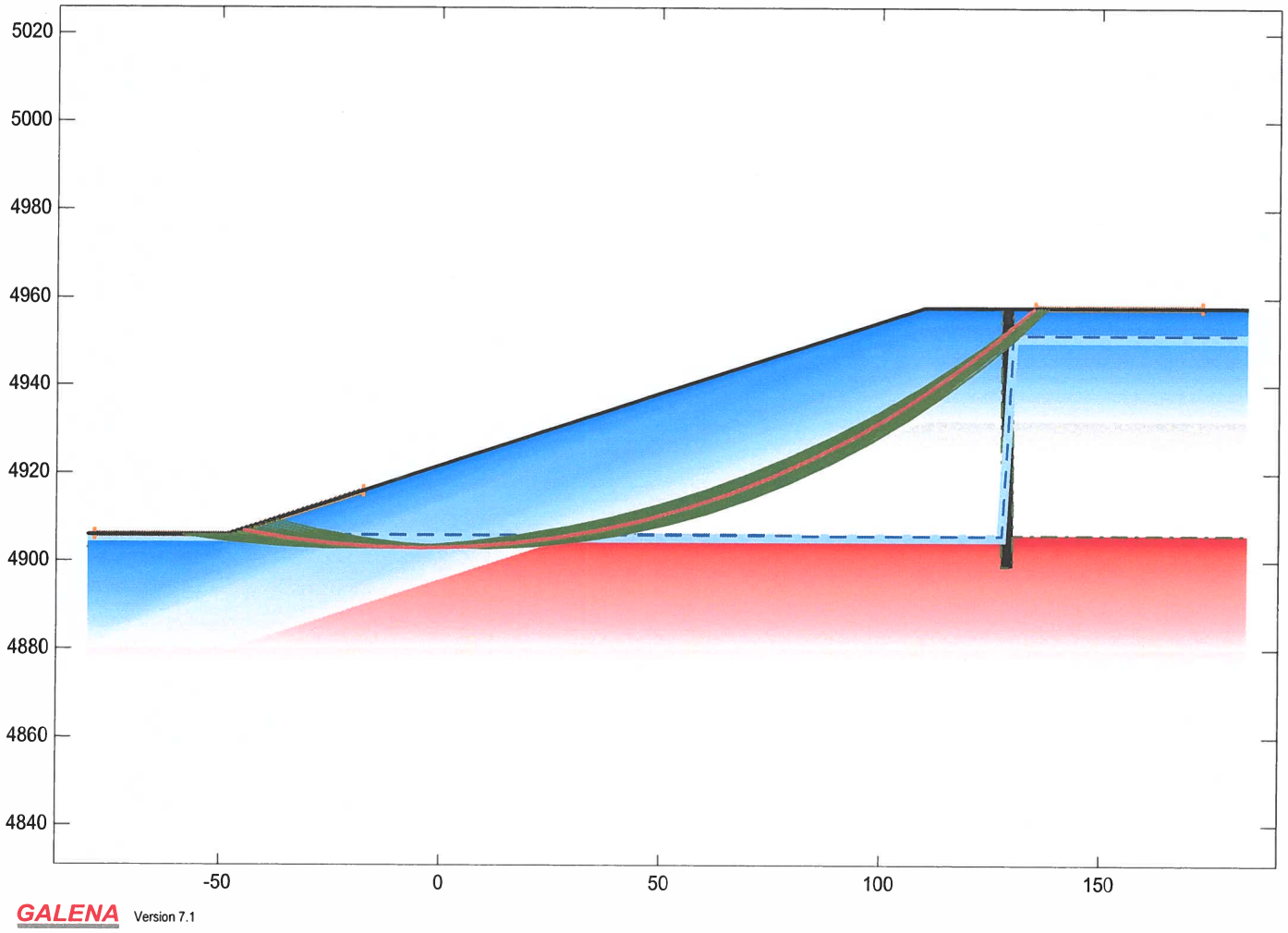

Material Keys

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- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.94

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
D-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure D-1 Static.gmf

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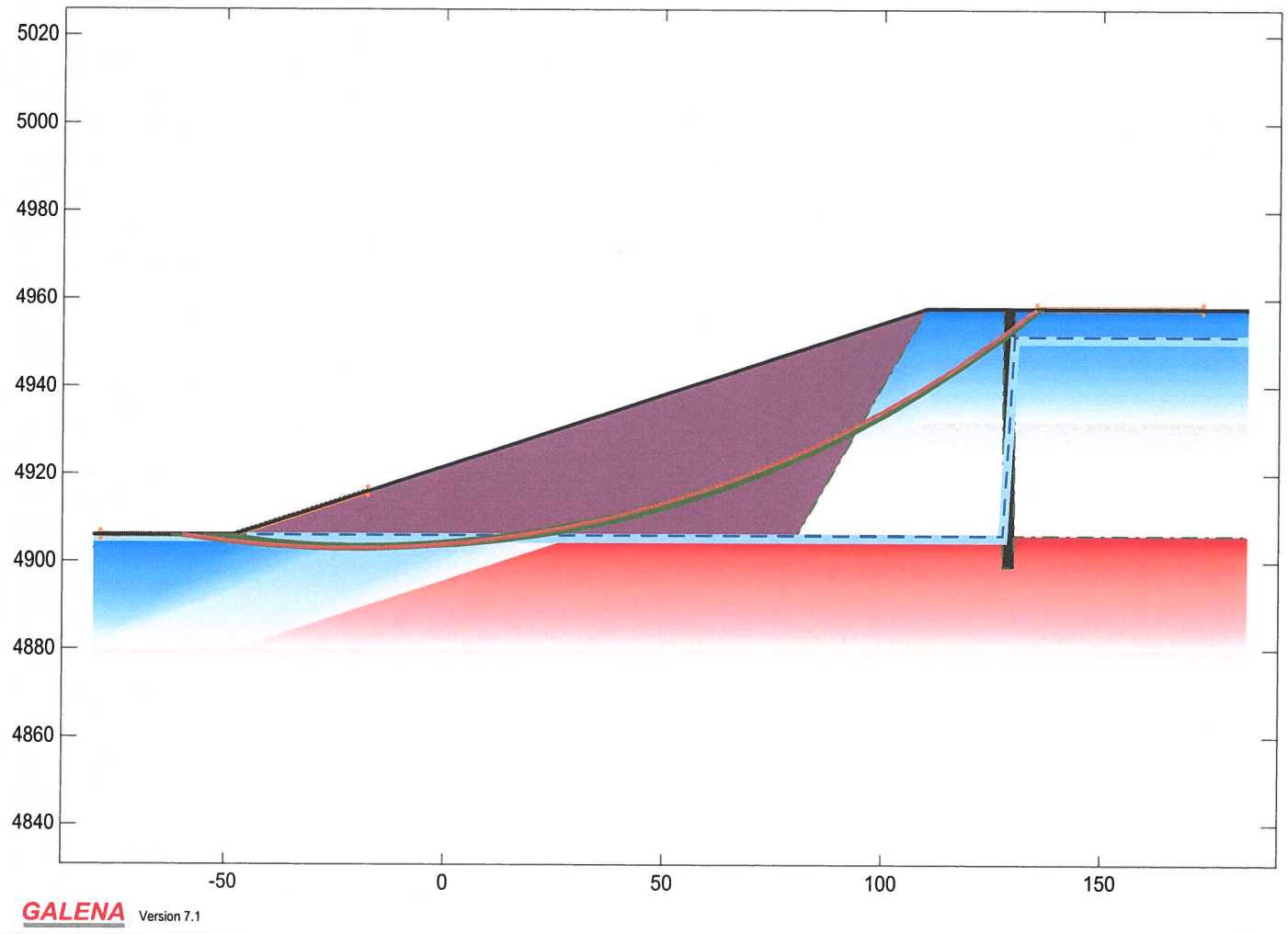

Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.77

Project Tucson South AM
D-1 - Static - Fill

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

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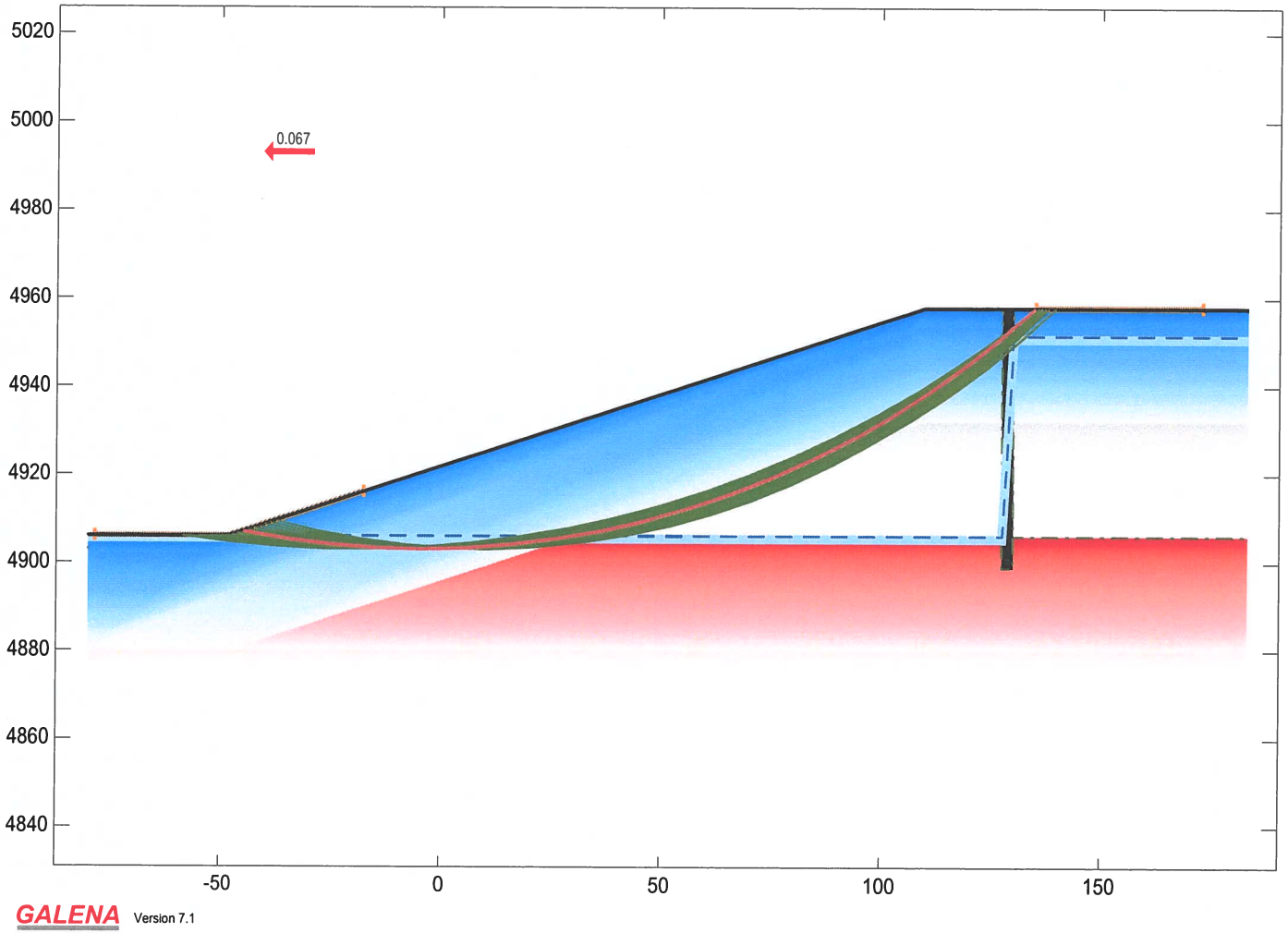

Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.55

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
D-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure D-2 Pseudostatic.gmf

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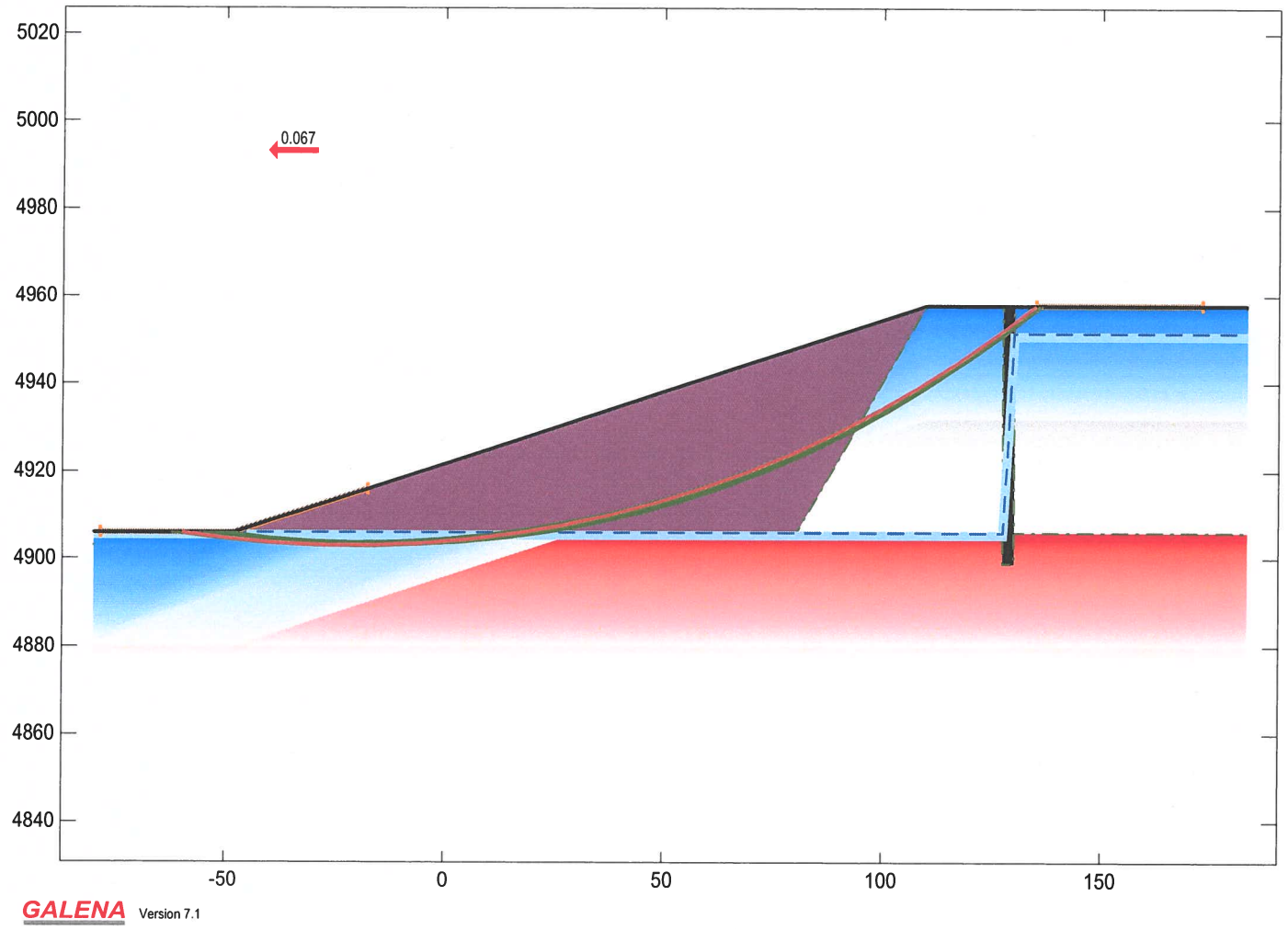

Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.42

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
D-2 - Static - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure D-2 Pseudostatic Fill.gmf

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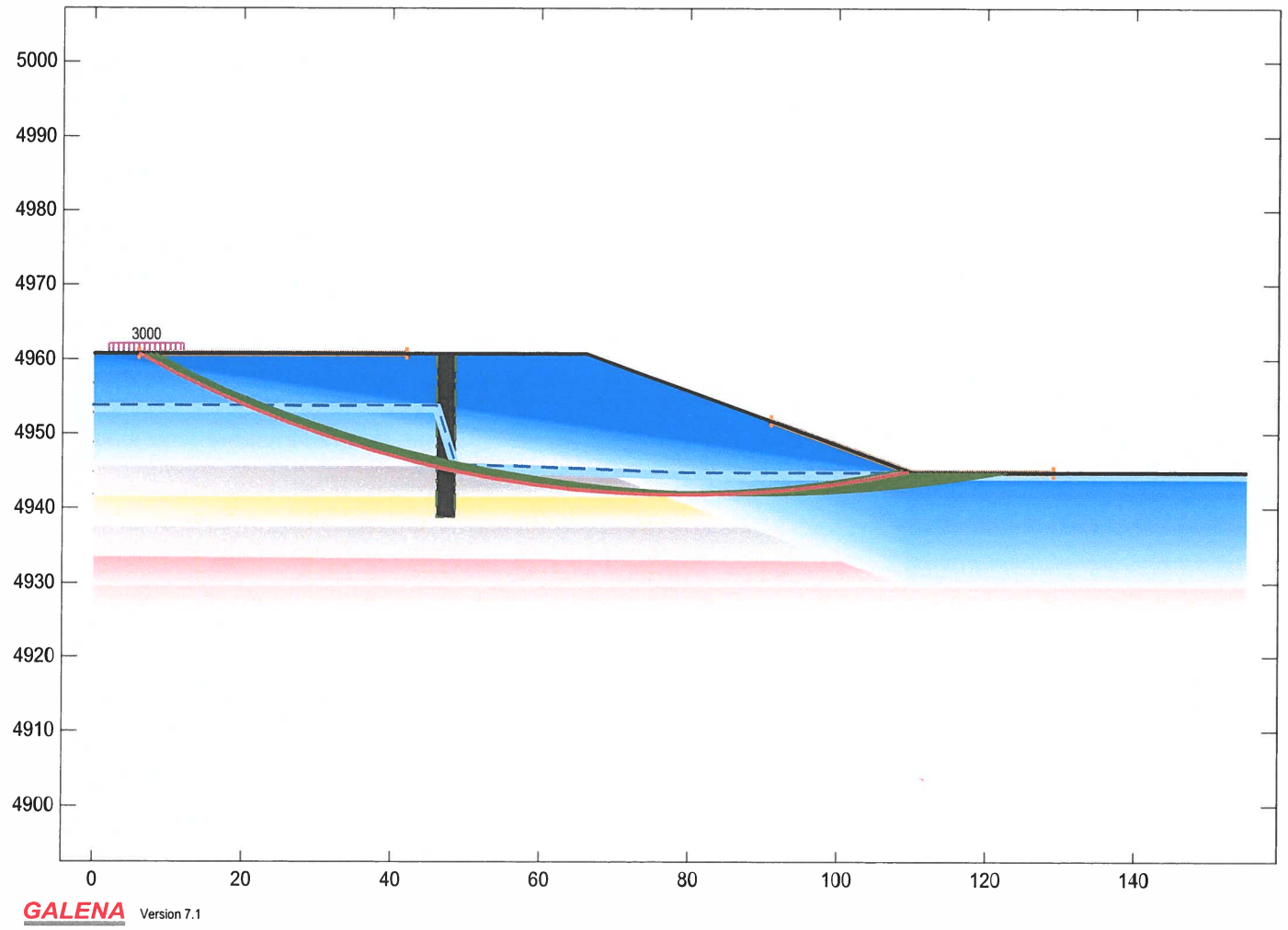


Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

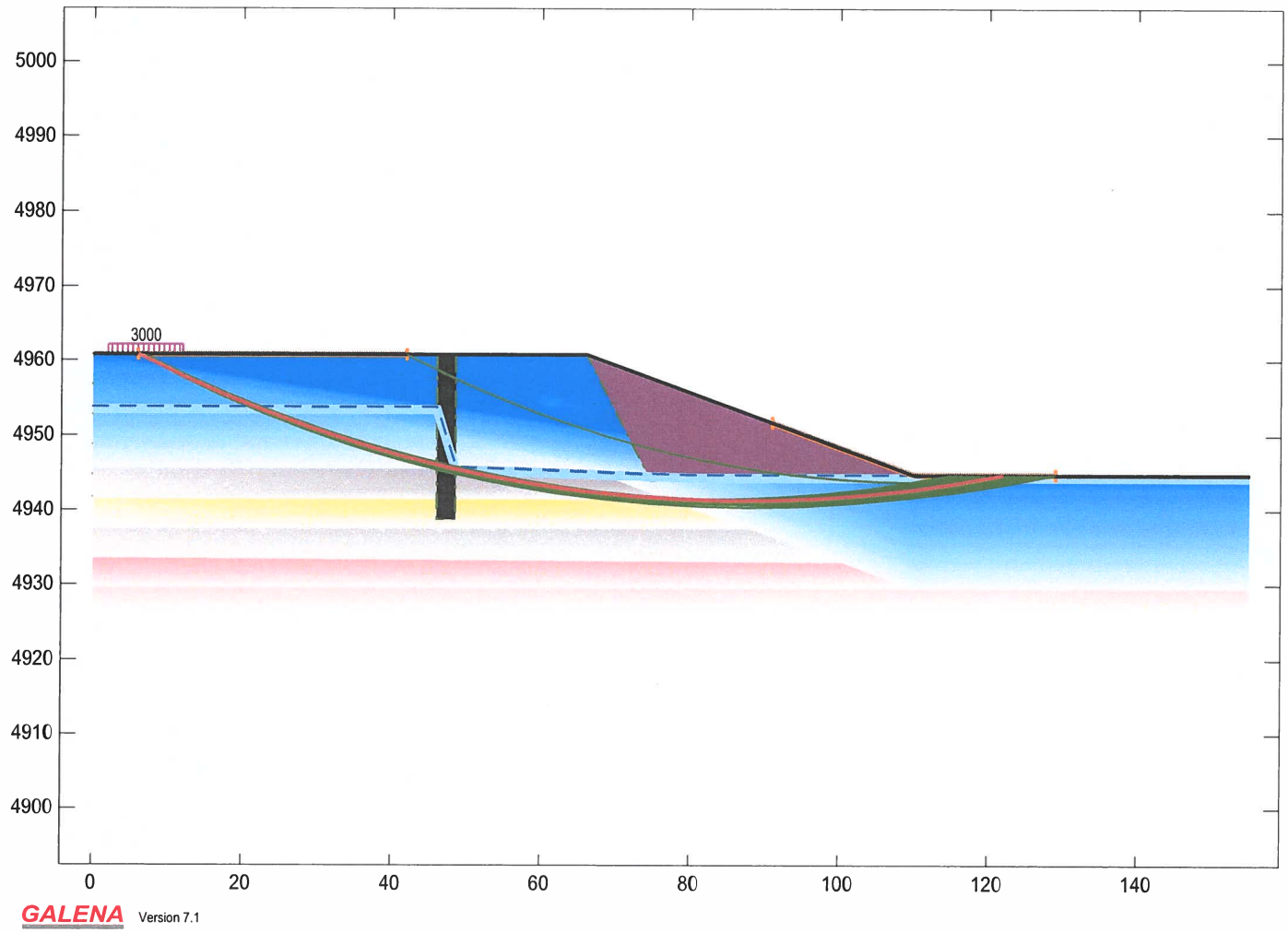
Critical Factor of Safety: 2.10

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
E-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure E-1 Static Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

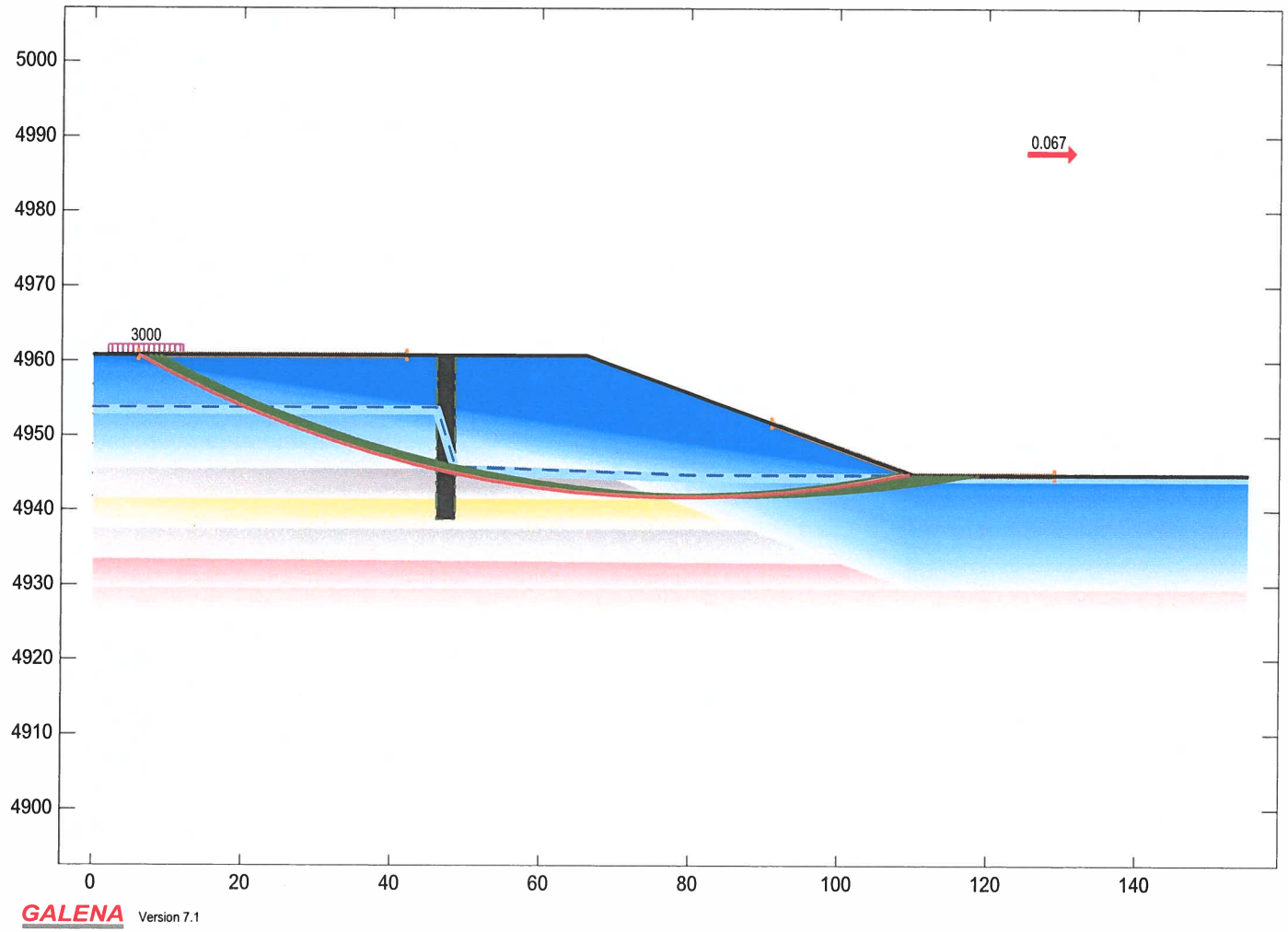
Critical Factor of Safety: 2.52

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
E-1 - Static - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure E-1 Static Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

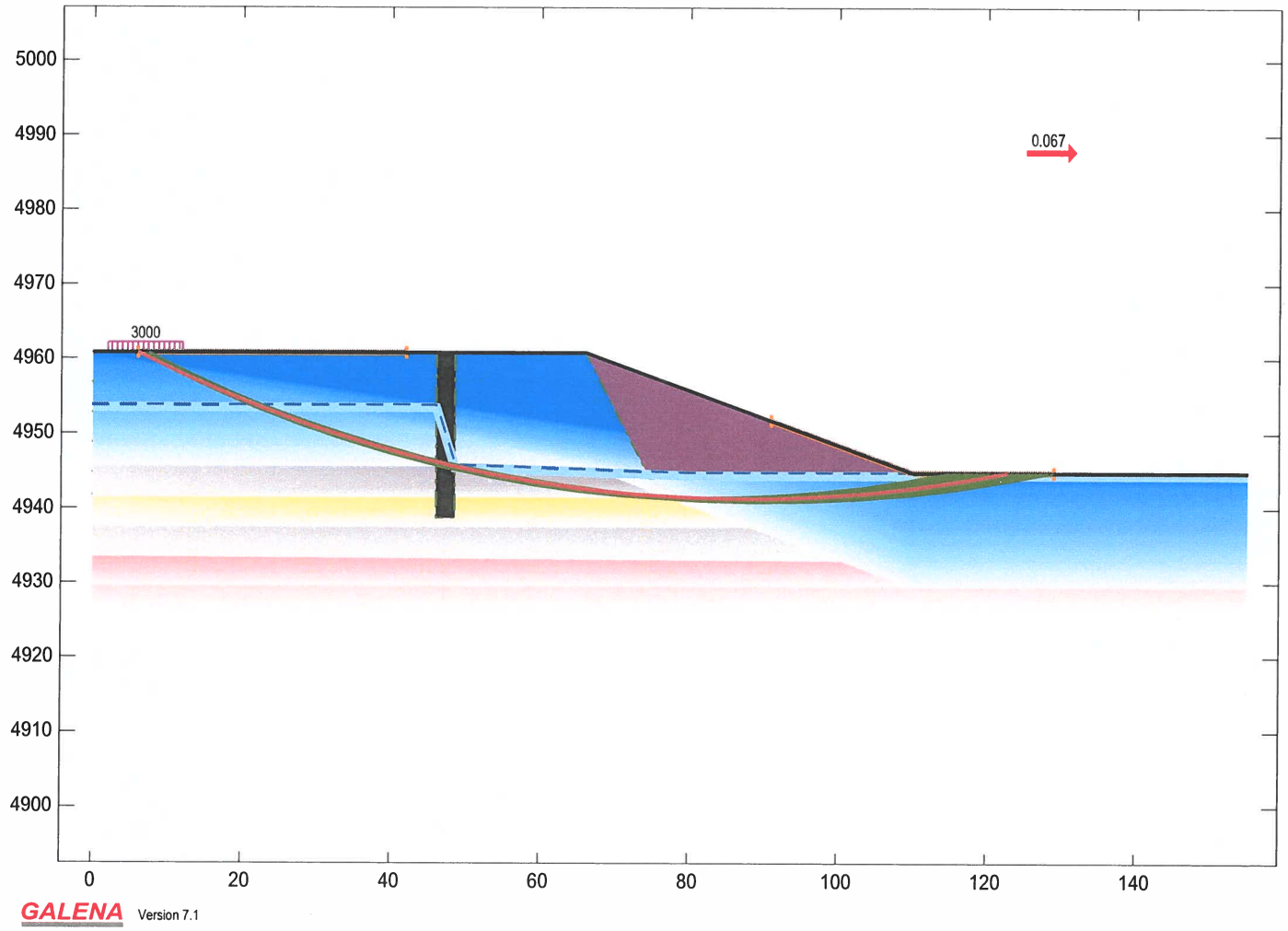
Critical Factor of Safety: 1.55

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
E-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure E-2 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

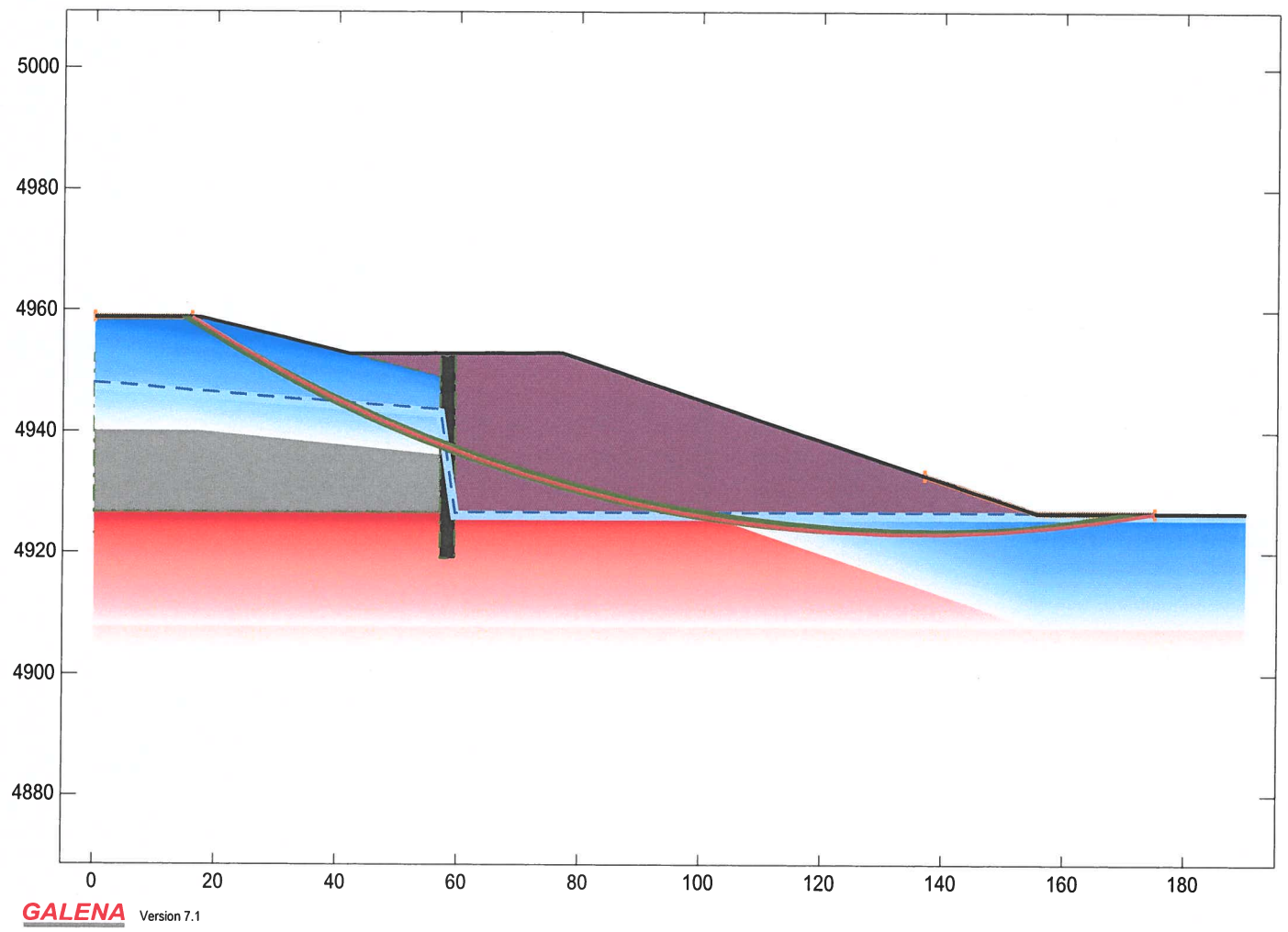
Critical Factor of Safety: 1.38

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
E-2 - Pseudostatic - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure E-2 Pseudostatic Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

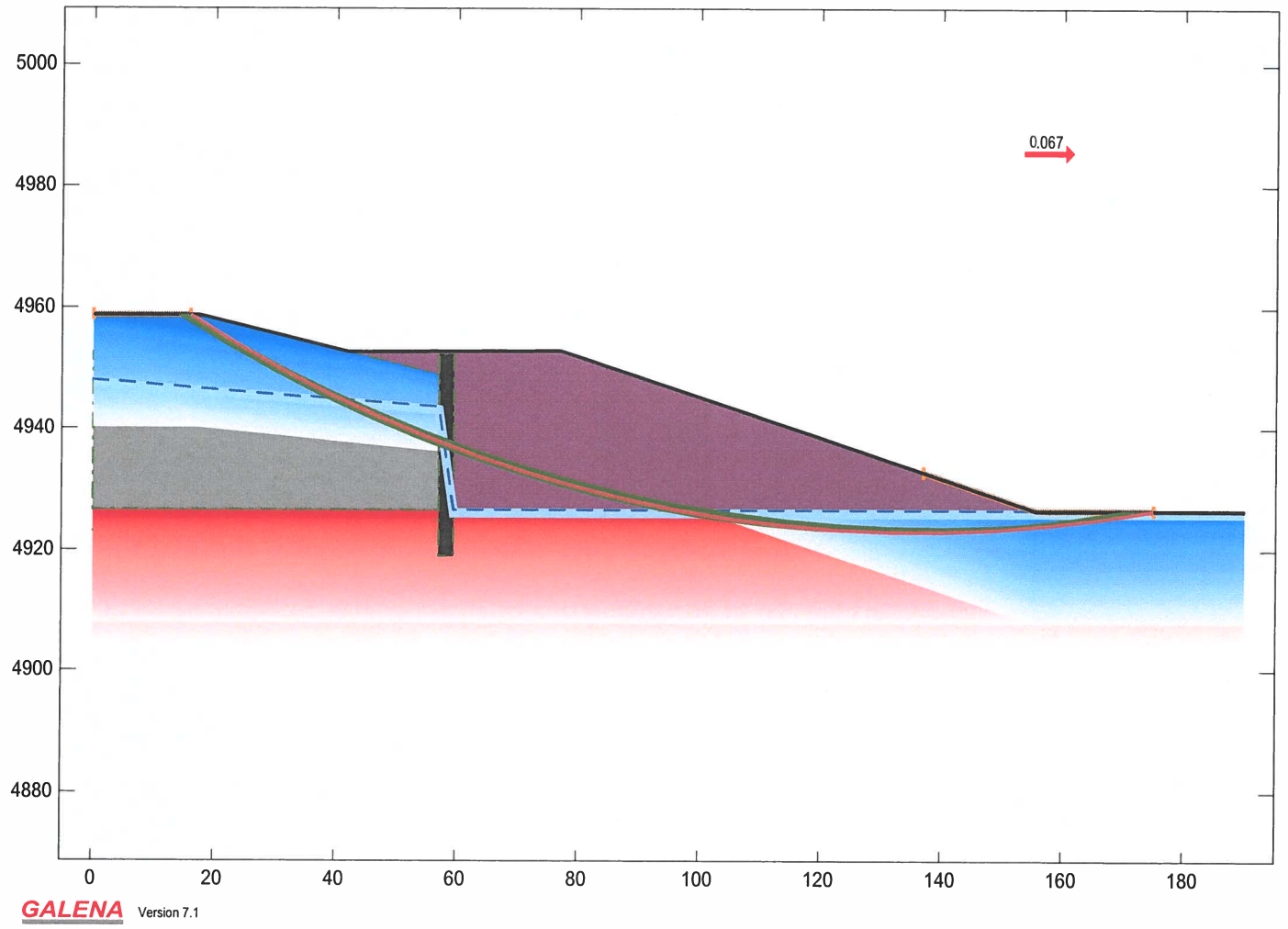
Critical Factor of Safety: 2.27

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
F-1 - Static - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure F-1 Static Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

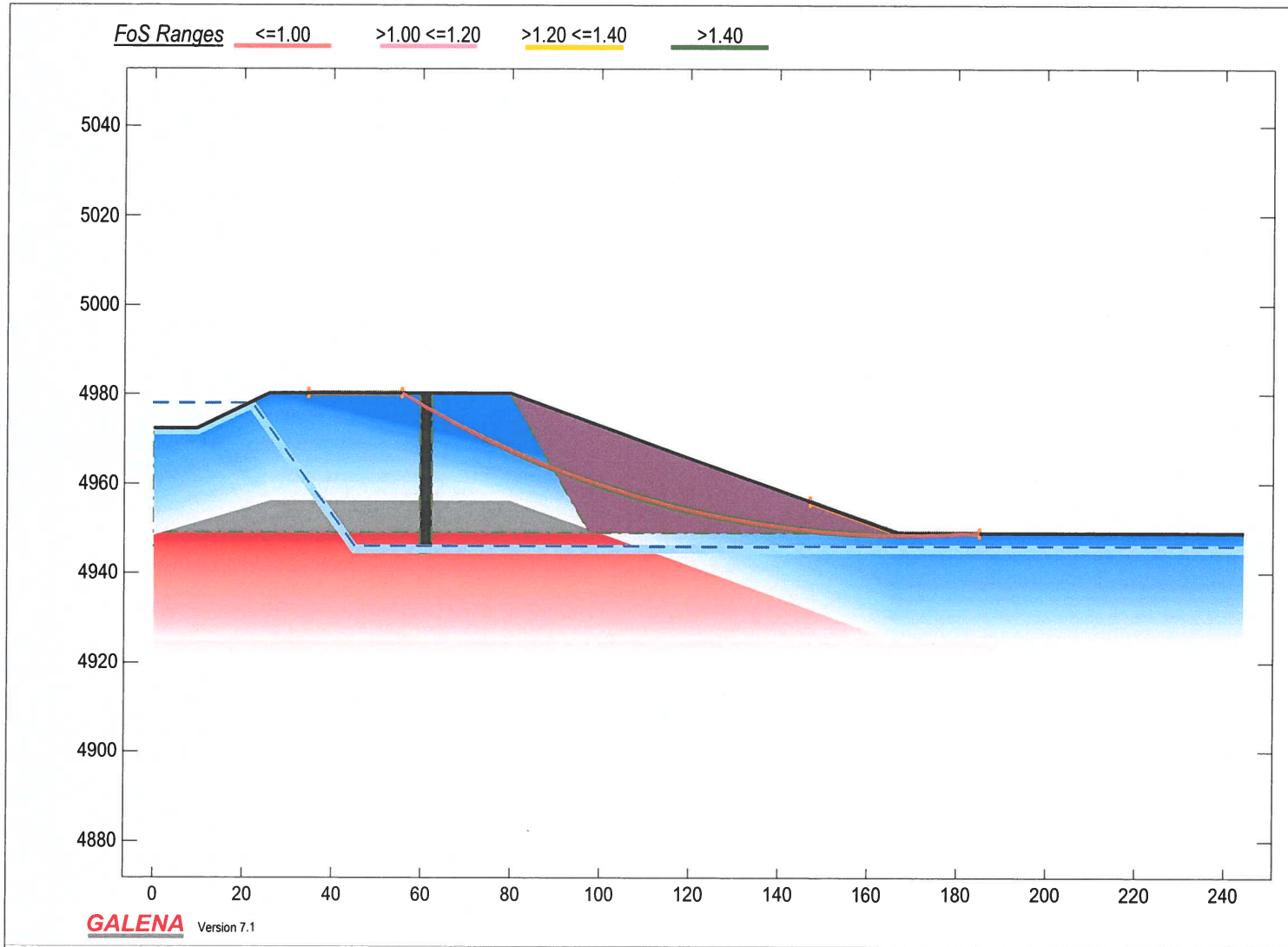
Critical Factor of Safety: 1.72

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
F-2 - Pseudostatic - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure F-2 Pseudostatic Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

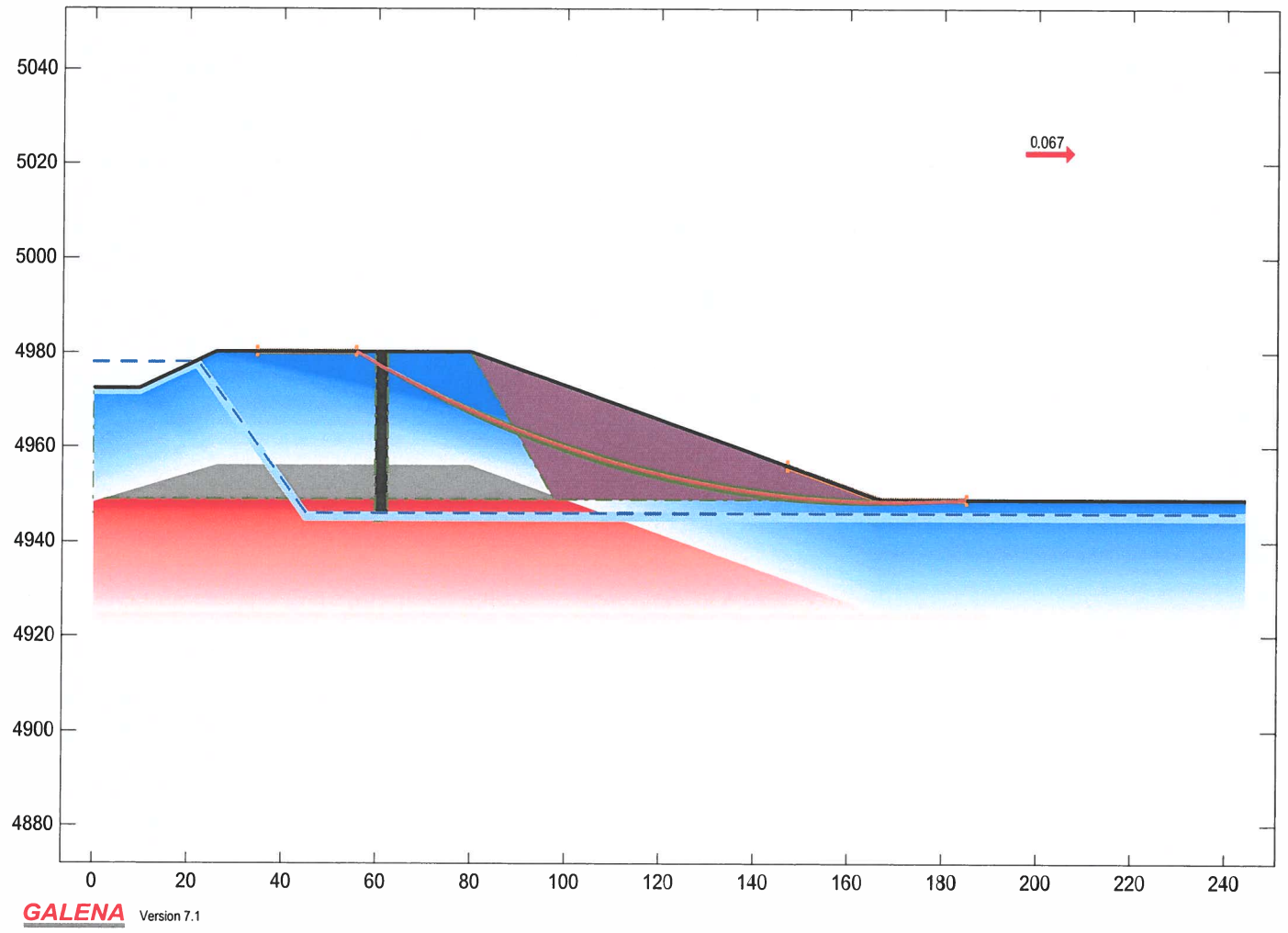
Critical Factor of Safety: 1.85

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
G-1 - Static - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure G-1 Static Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

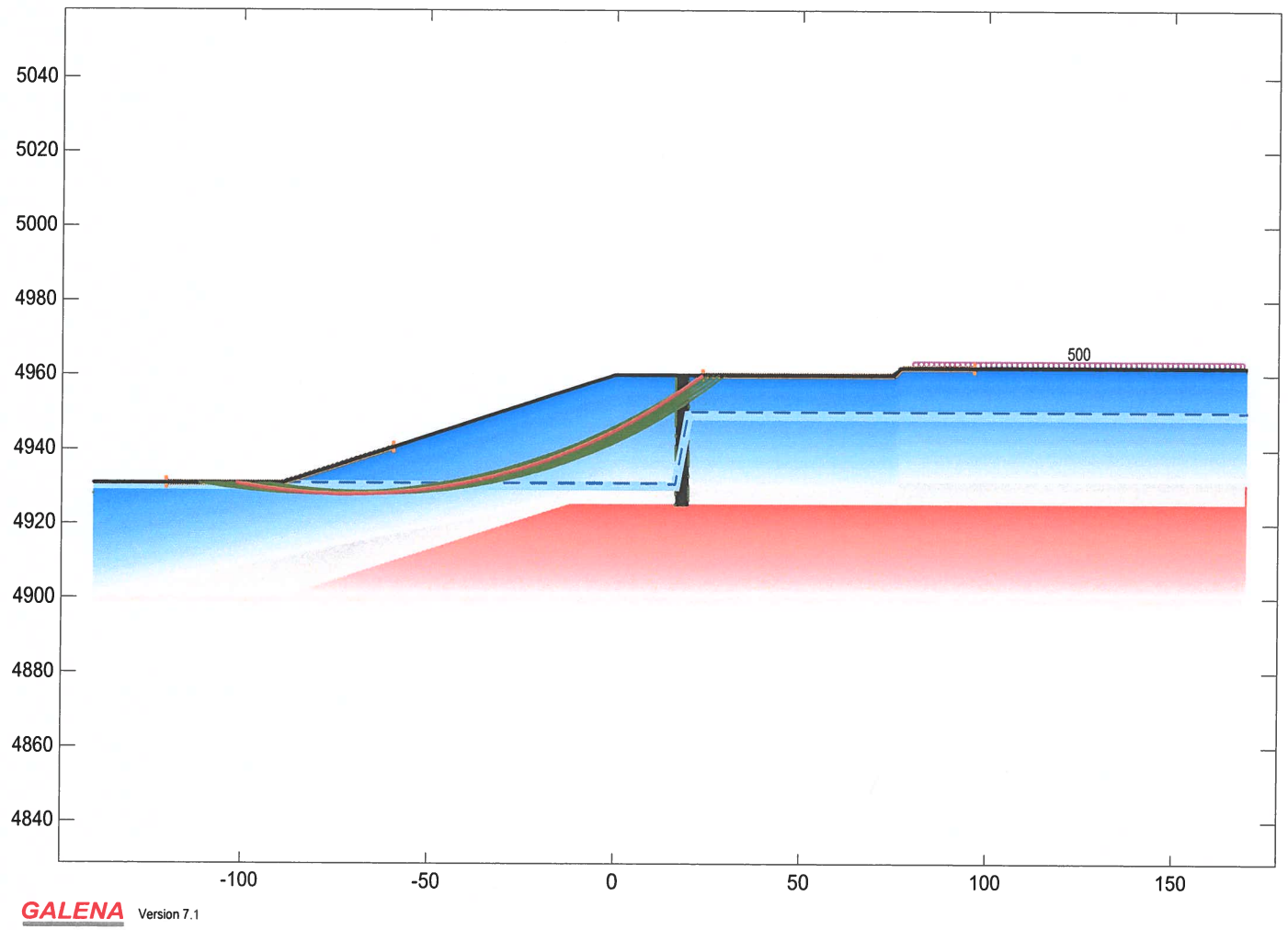
Critical Factor of Safety: 1.48

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
G-2 - Pseudostatic - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure G-2 Pseudostatic Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

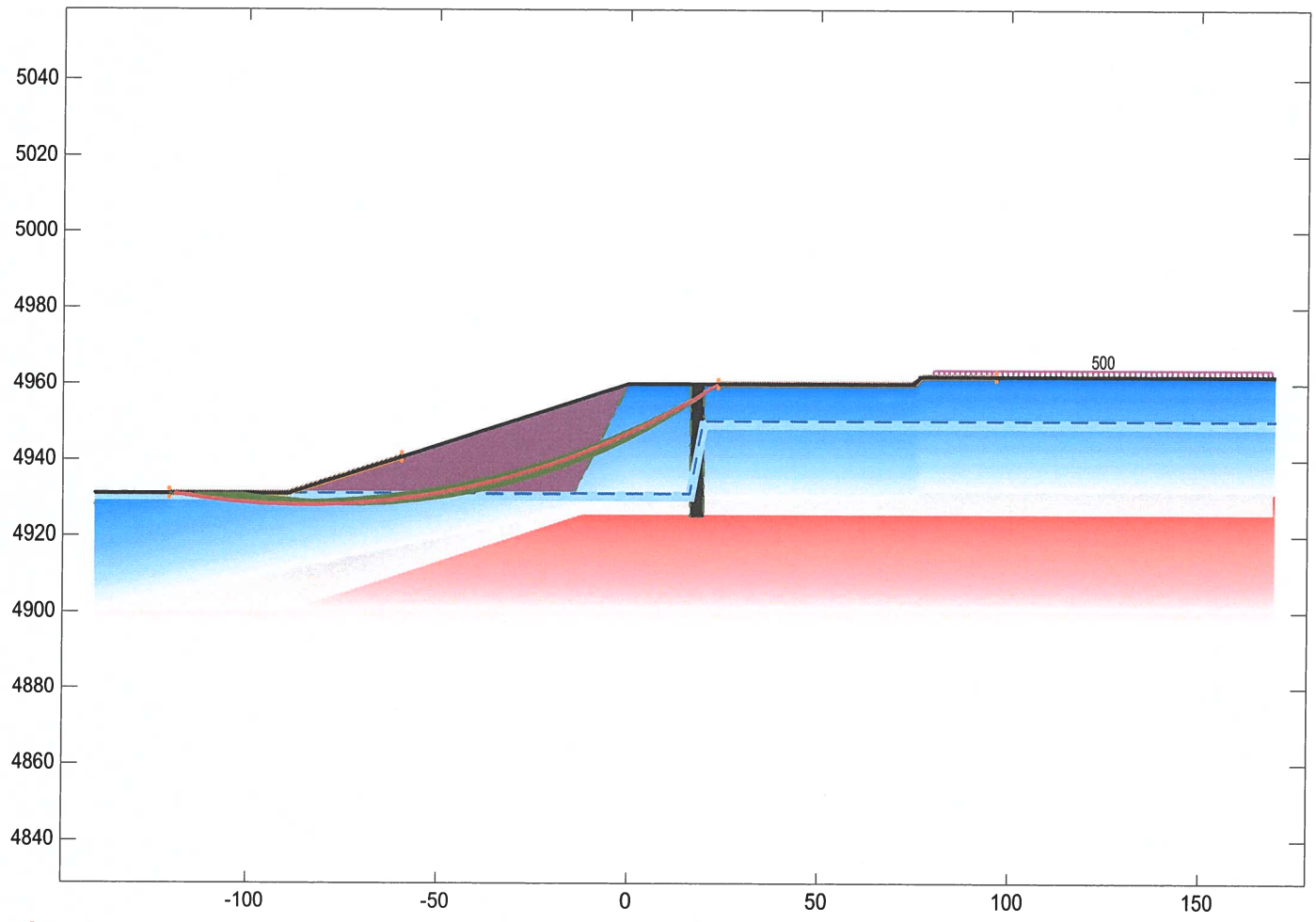
Critical Factor of Safety: 1.96

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
H-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure H-1 Static.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

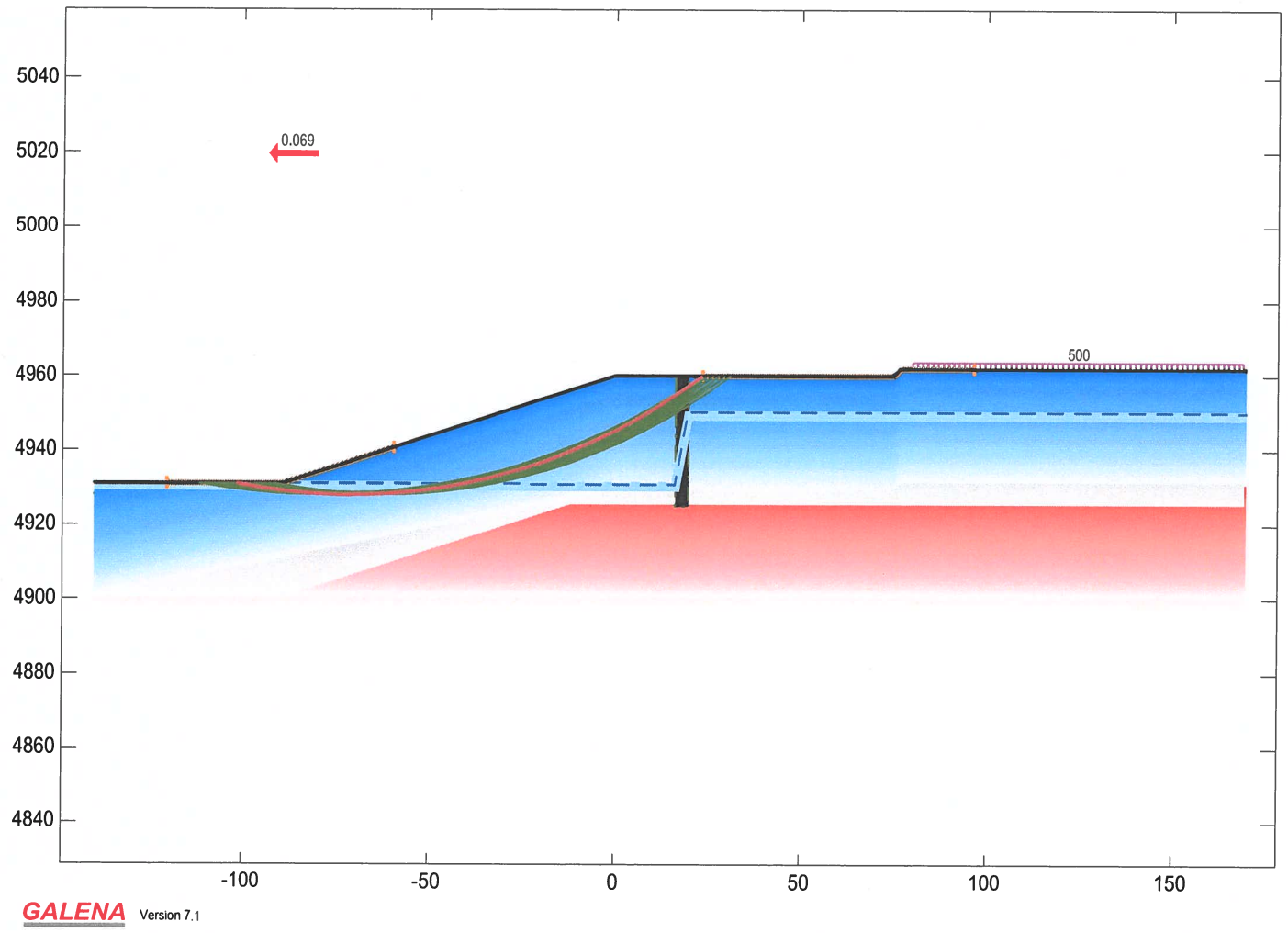
Critical Factor of Safety: 1.94

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
H-1 - Static - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure H-1 Static Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

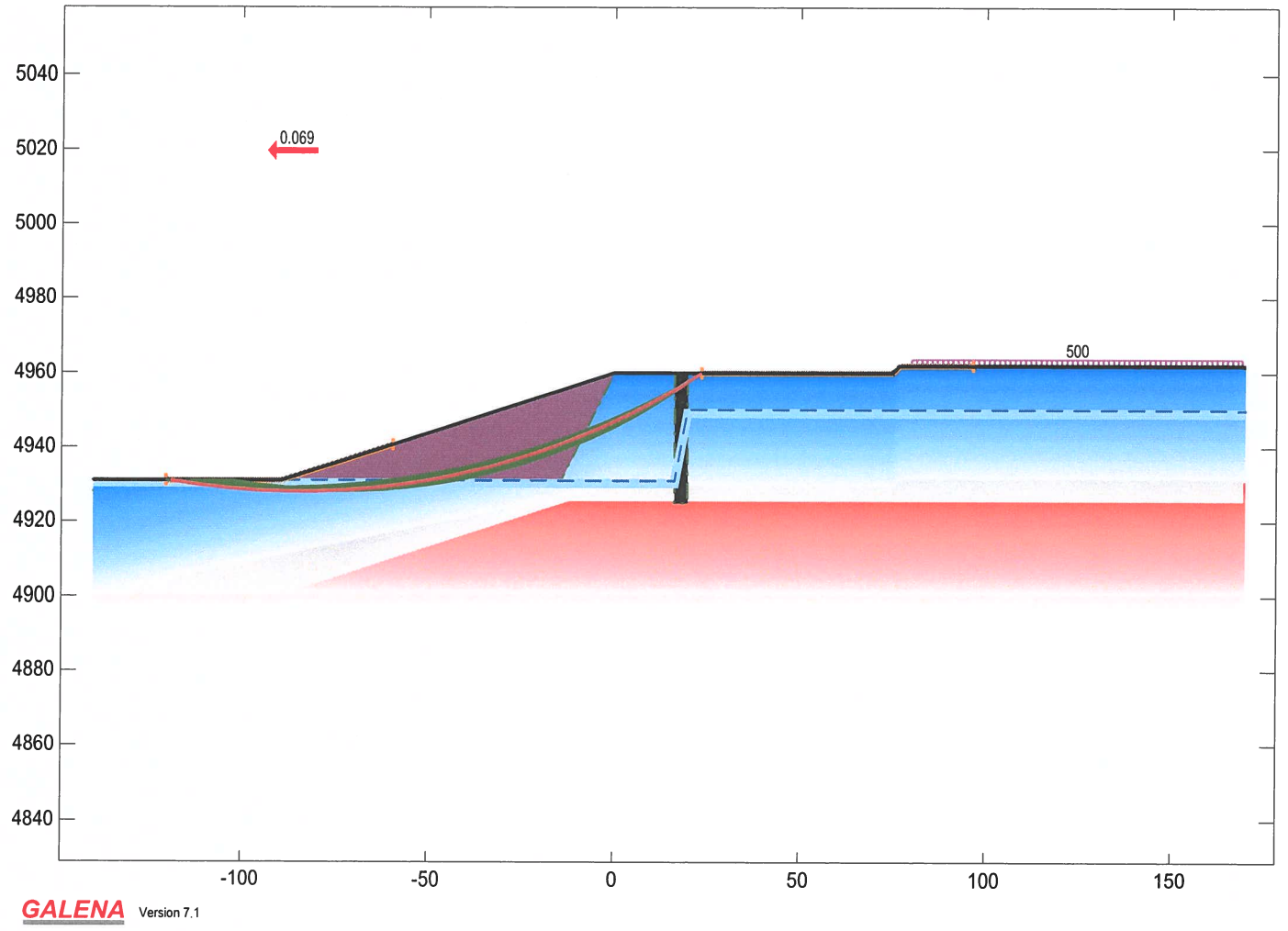
Critical Factor of Safety: 1.52

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
H-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure H-2 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

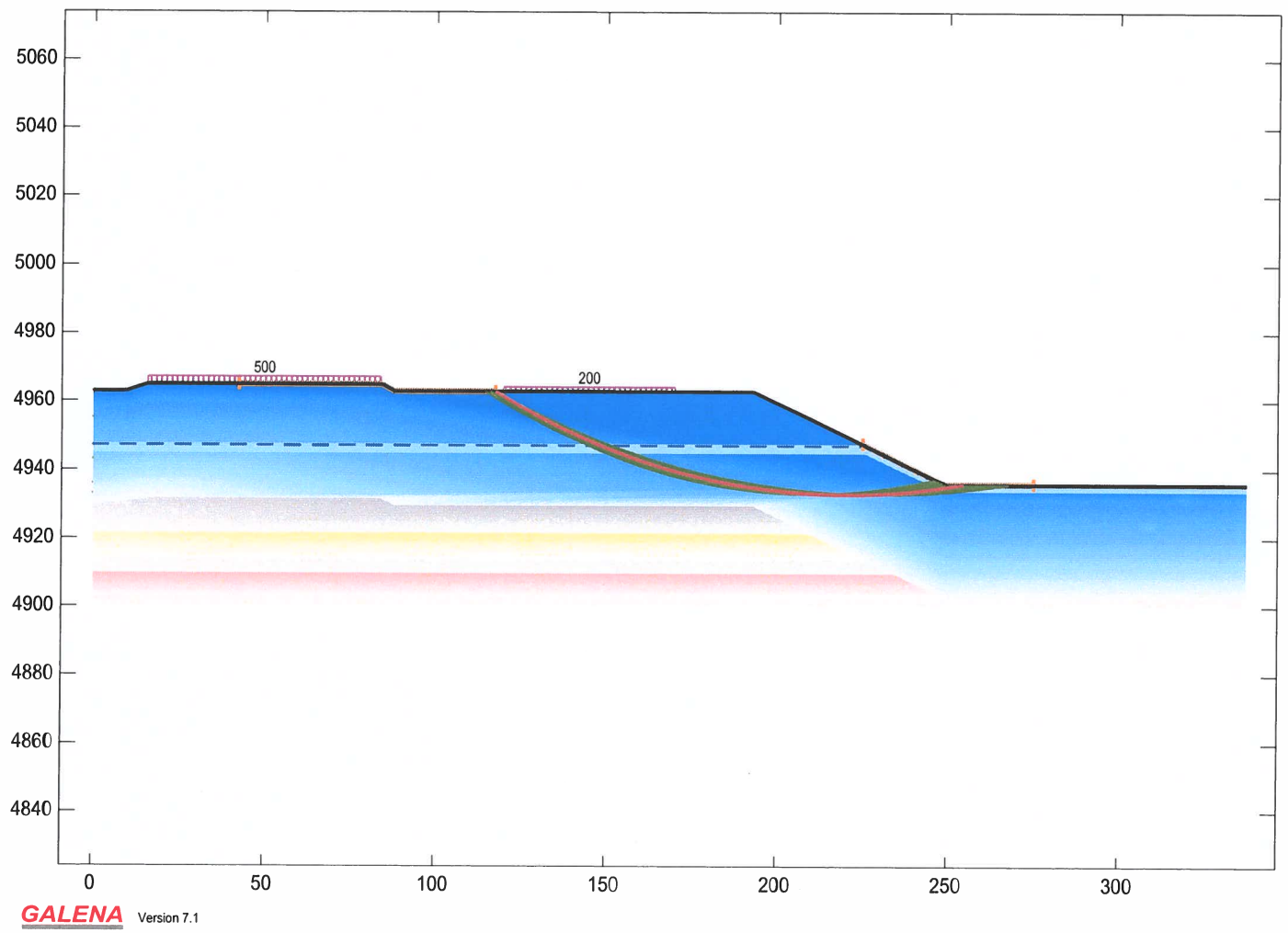
Critical Factor of Safety: 1.51

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
H-2 - Pseudostatic - Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure H-2 Pseudostatic Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
6: Weathered Claystone Bedrock

Analysis 1
Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

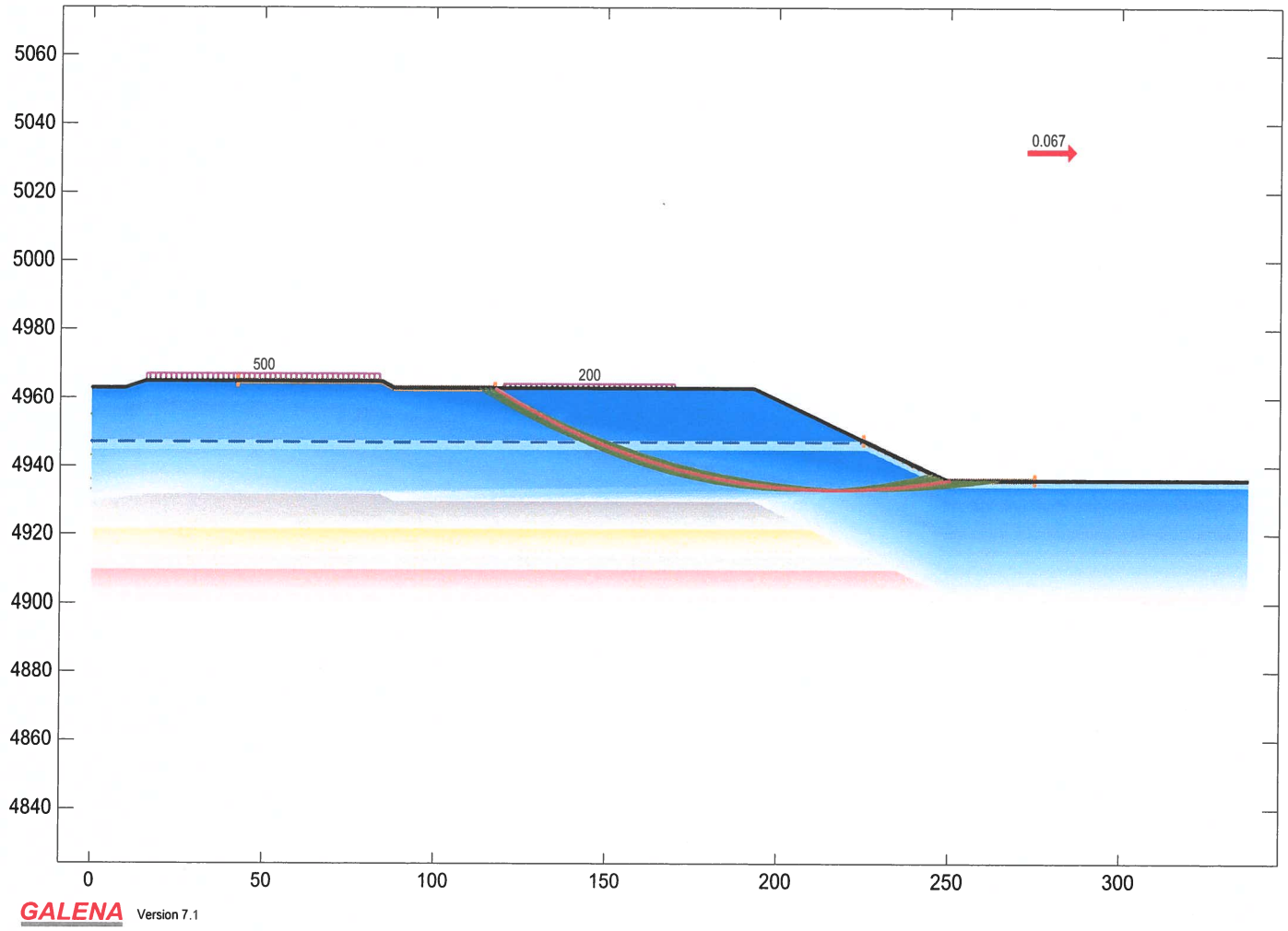
Results
Critical Factor of Safety: 2.02

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
I-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure I-1 Static.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
6: Weathered Claystone Bedrock

Analysis 1
Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

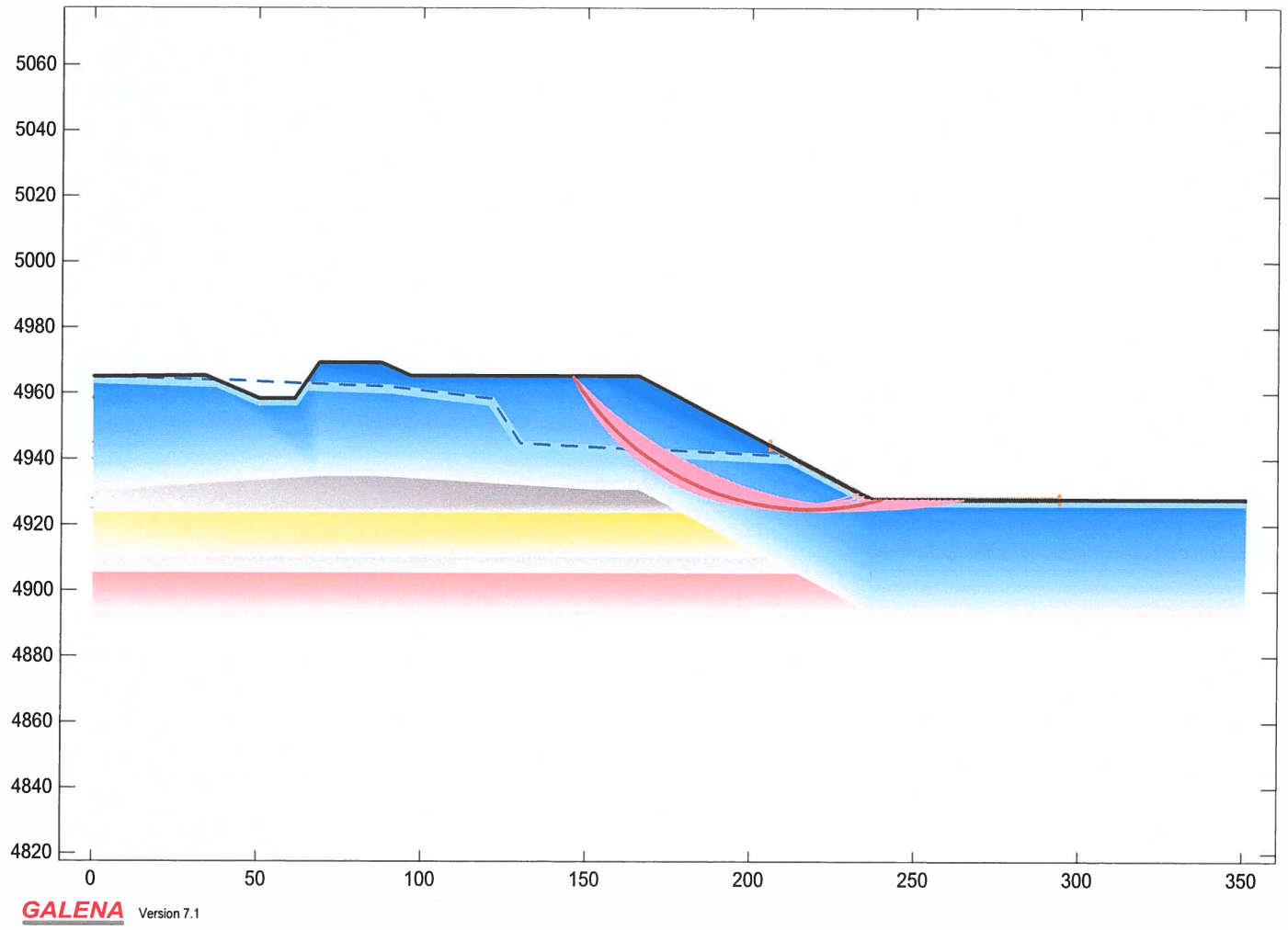
Results
Critical Factor of Safety: 1.49

Edited: 22 Jul 2019 *Processed:* 22 Jul 2019

Project Tucson South AM
I-1 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure I-1 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

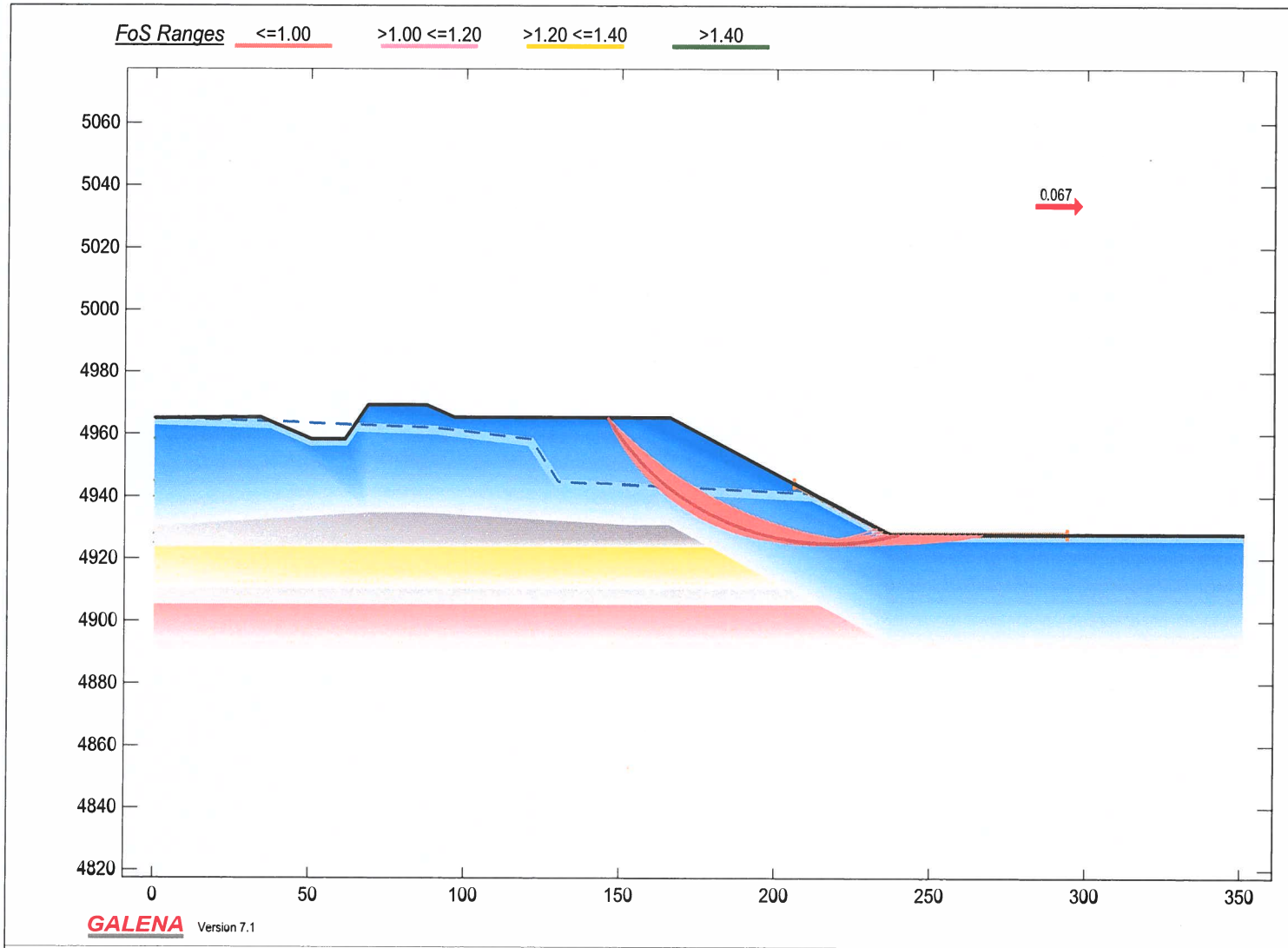
Critical Factor of Safety: 1.07

Edited: 25 Jul 2019 *Processed:* 25 Jul 2019

Project Tucson South AM
J-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure J -1 Static.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
6: Weathered Claystone Bedrock

Analysis 1
Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

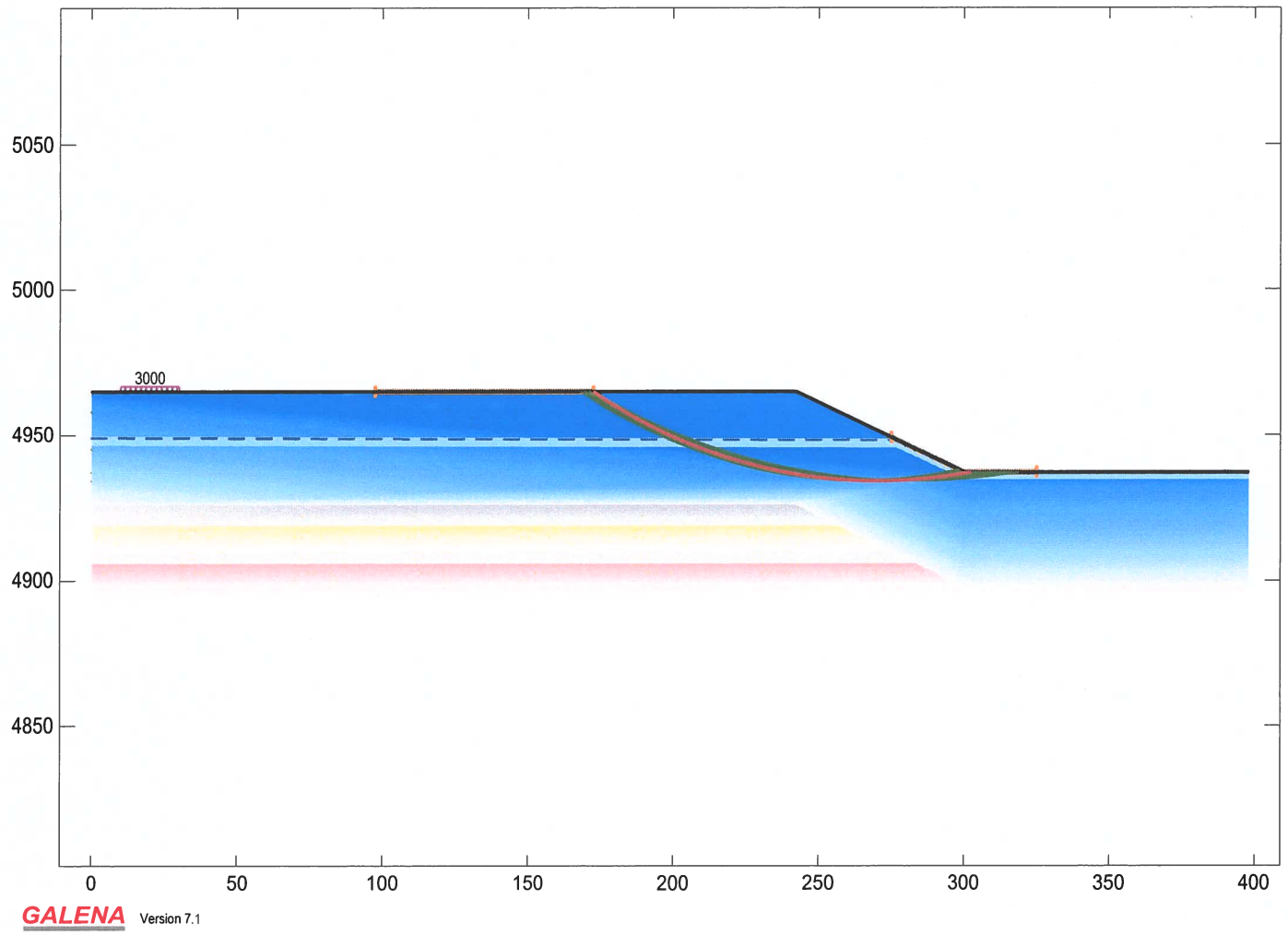
Results
Critical Factor of Safety: 0.89

Edited: 25 Jul 2019 *Processed:* 25 Jul 2019

Project Tucson South AM
J-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure J -2 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

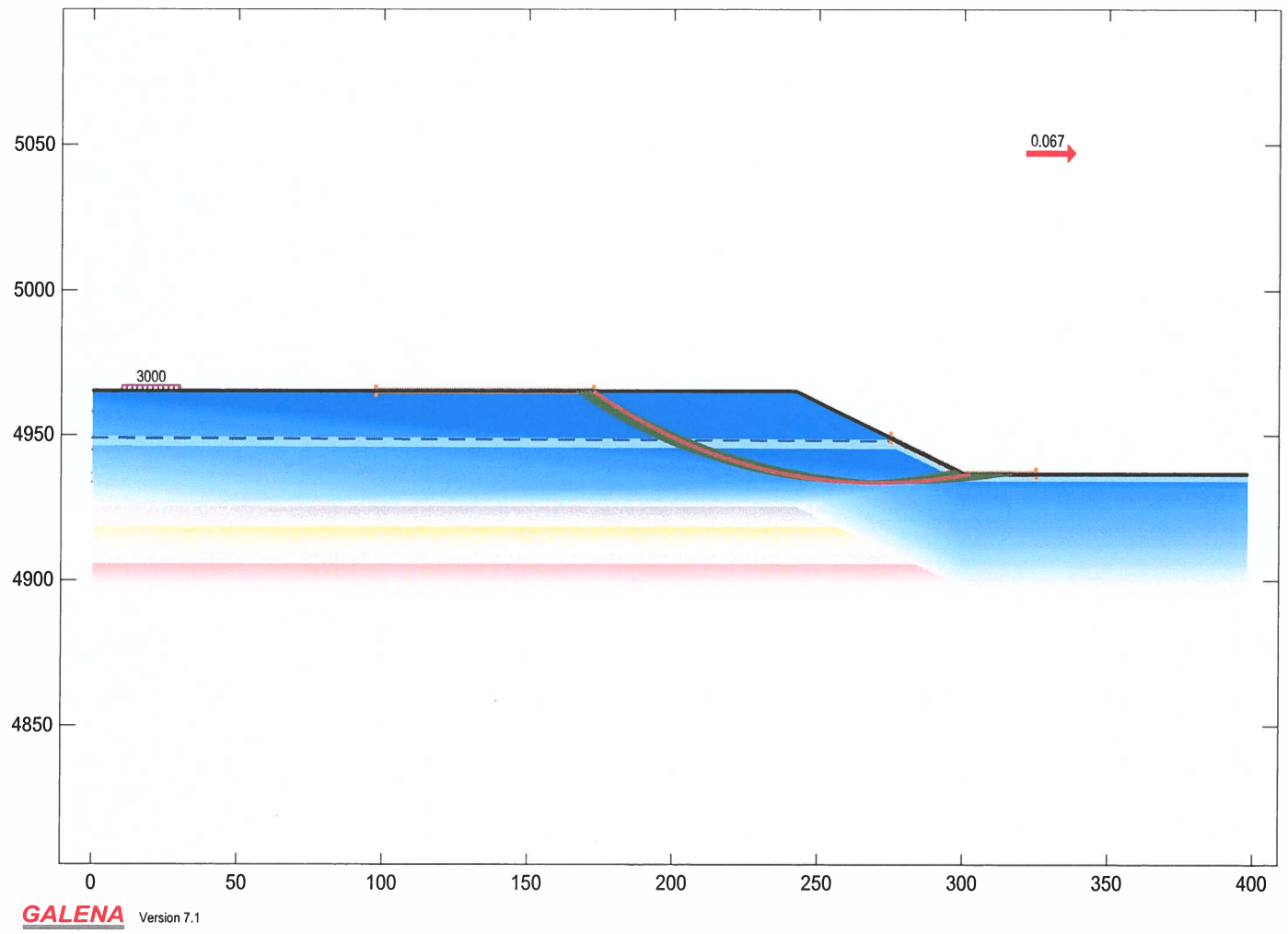
Critical Factor of Safety: 1.93

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
K-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure K -1 Static.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

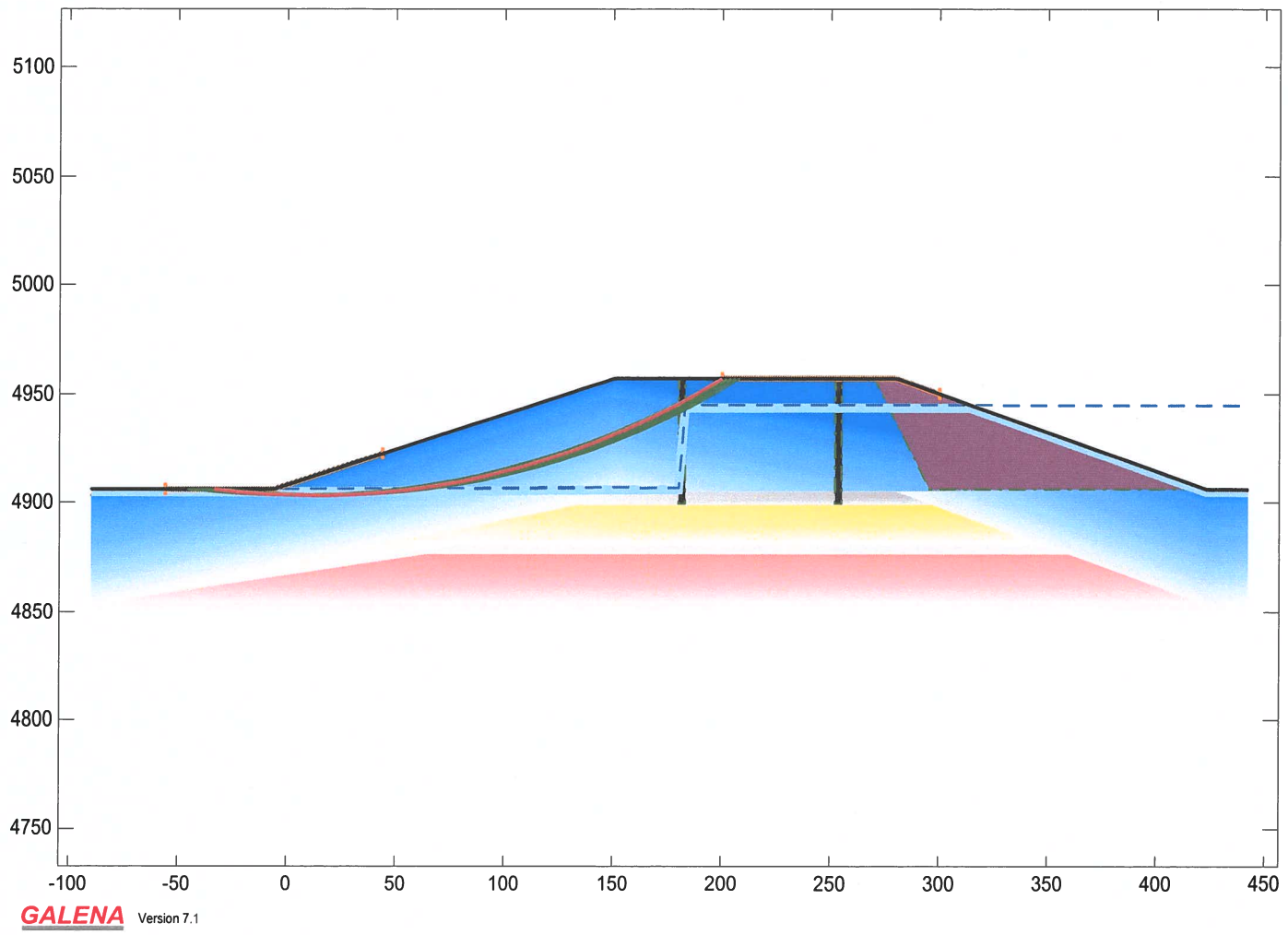
Critical Factor of Safety: 1.43

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
K-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure K -2 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

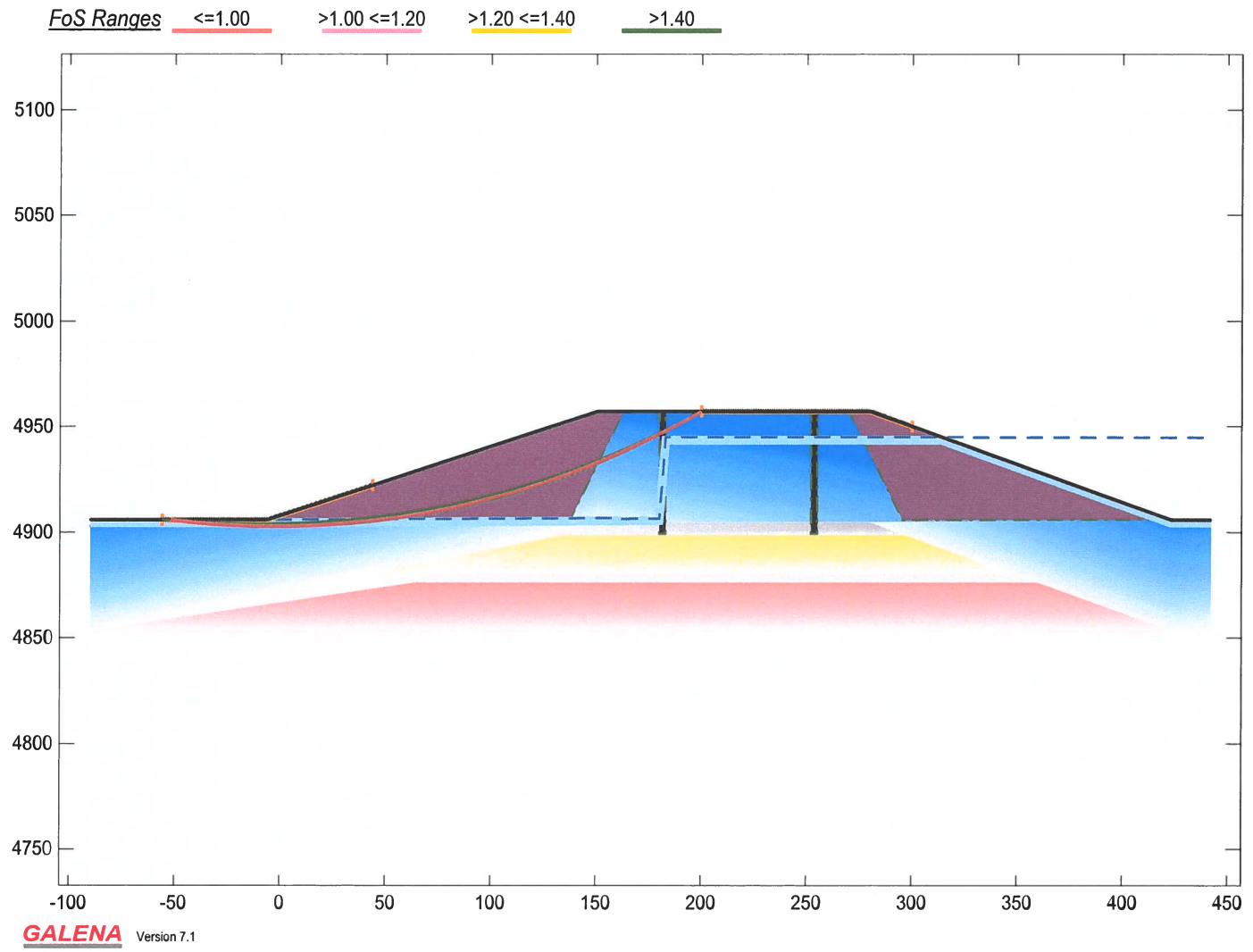
Critical Factor of Safety: 2.27

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
L-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure L-1 Static.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

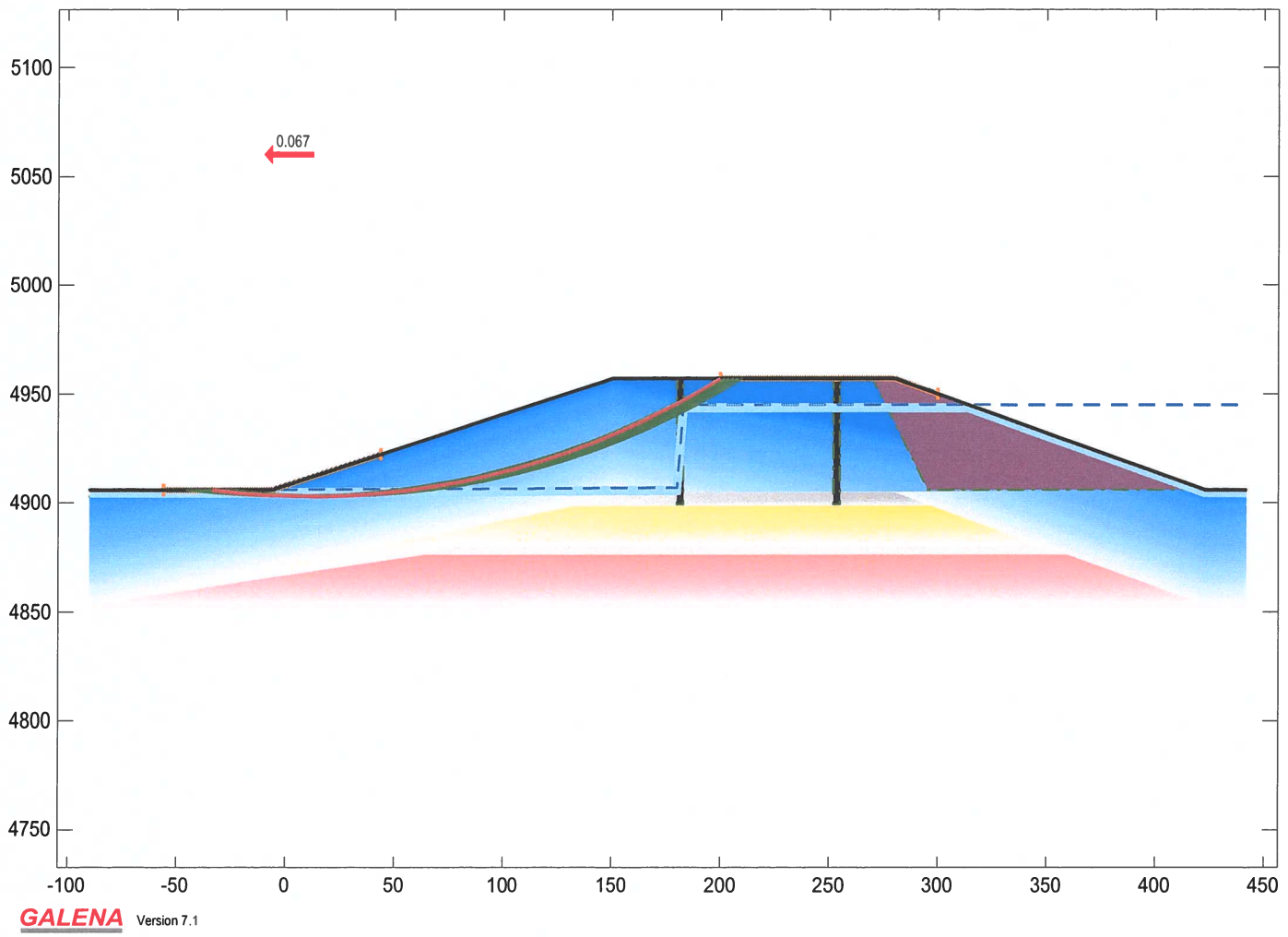
Critical Factor of Safety: 2.37

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
L-1 - Static Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure L-1 Static Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

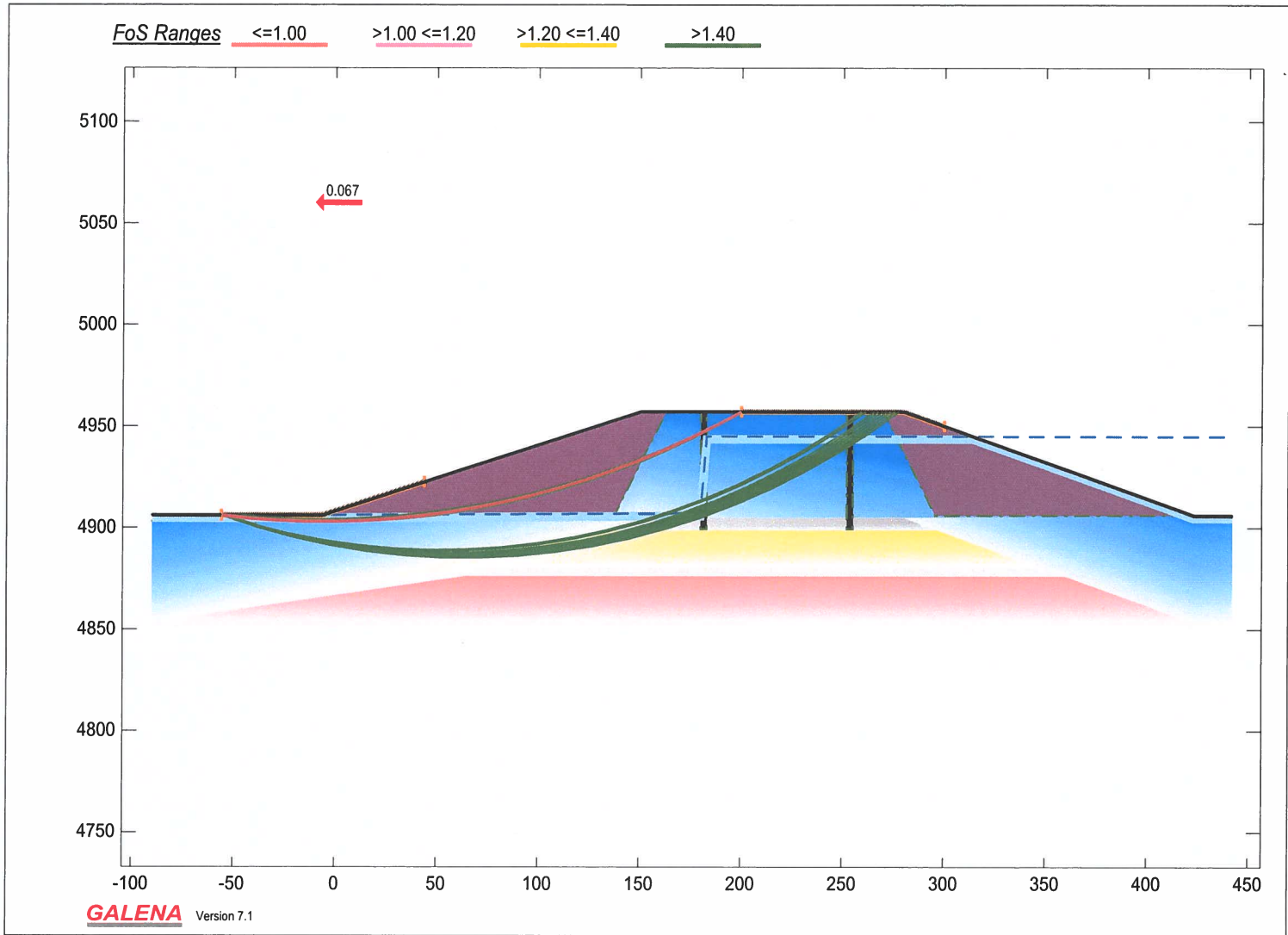
Critical Factor of Safety: 1.78

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
L-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure L-2 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.86

Project Tucson South AM
L-2 - Pseudostatic Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure L-2 Pseudostatic Fill.gmf

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

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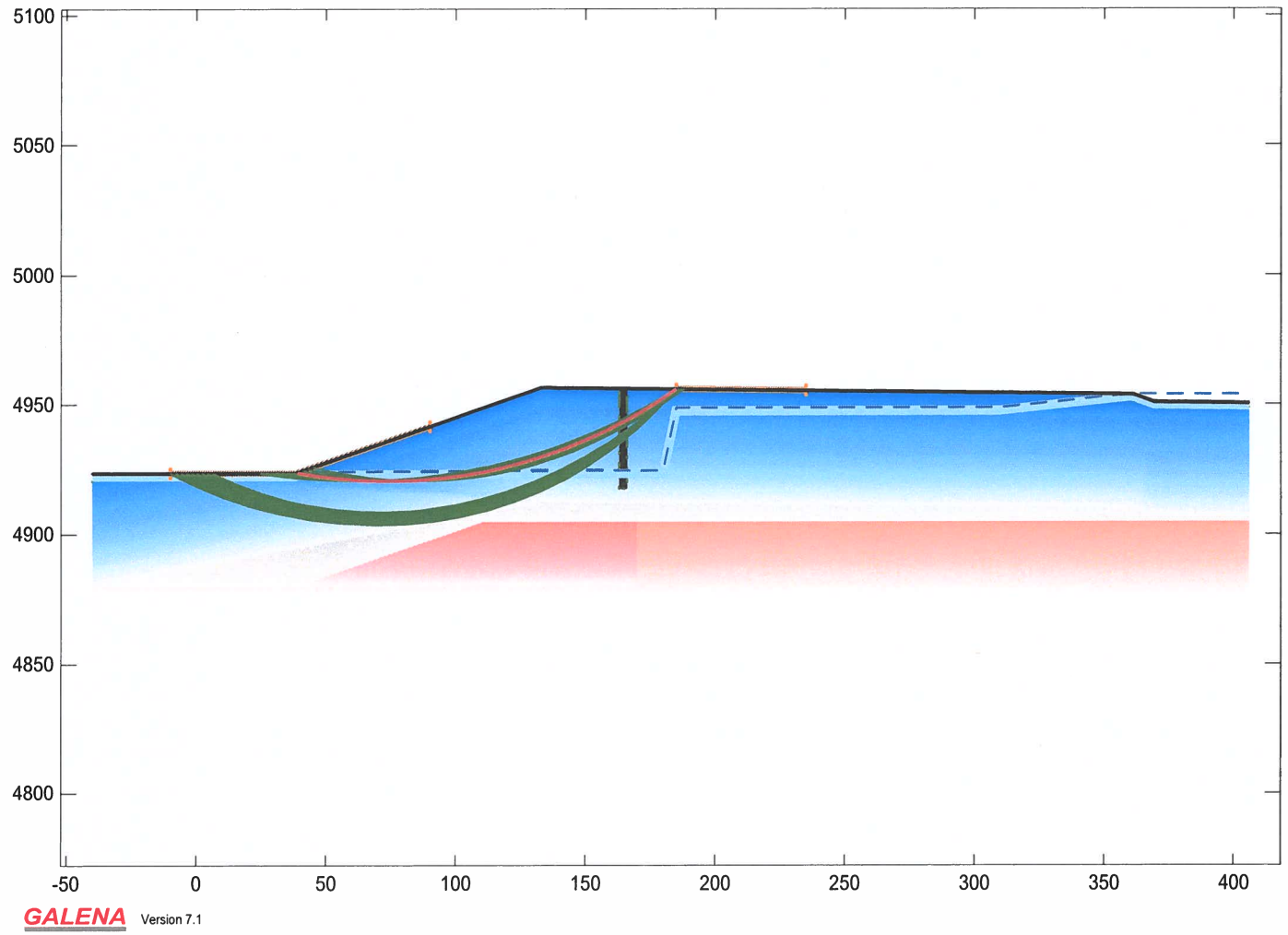


Material Keys

1: Claystone Bedrock
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

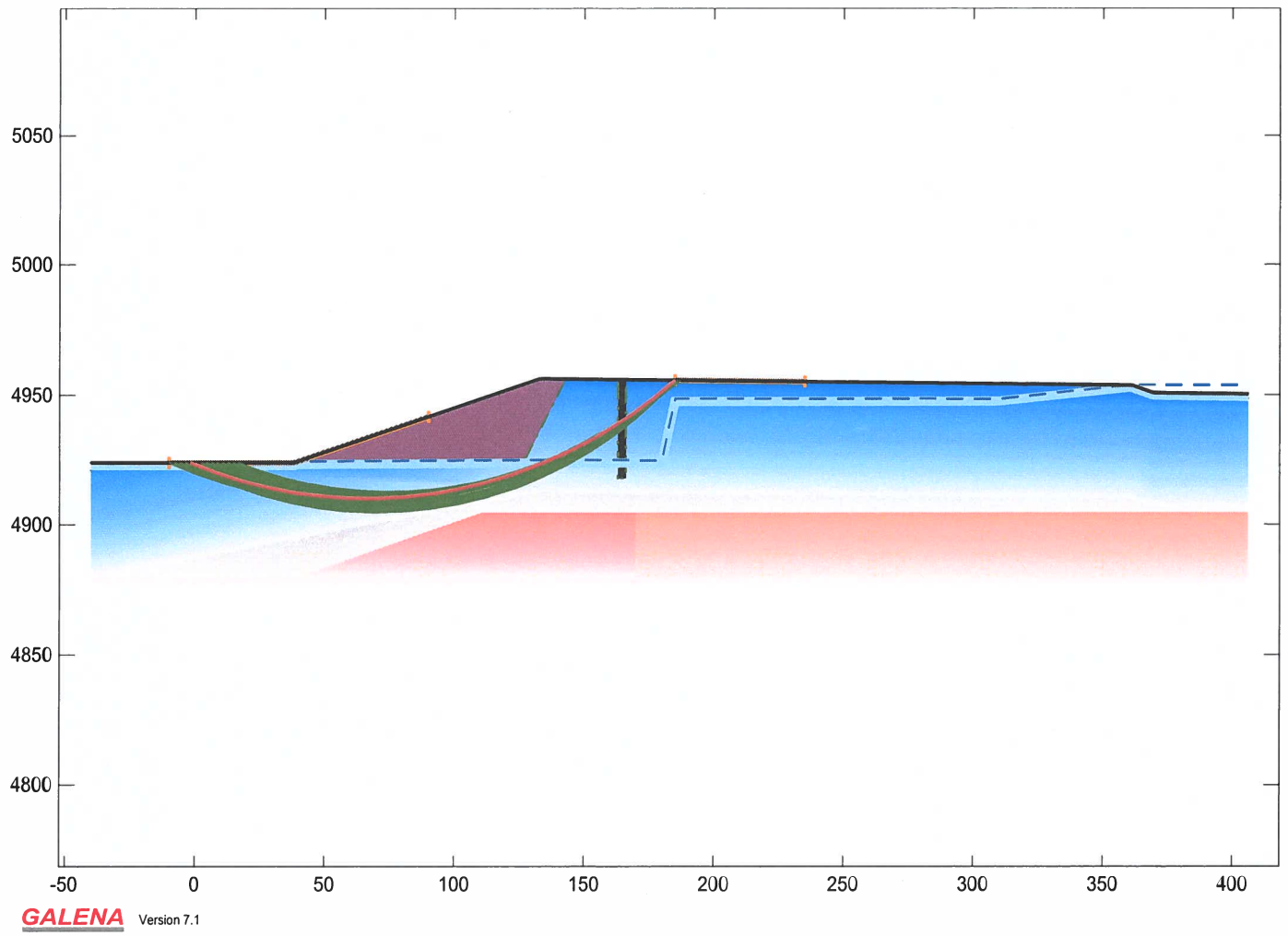
Critical Factor of Safety: 2.32

Project Tucson South AM
M-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure M-1 Static.gmf

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Dept of the Interior - Office of Surface Mining



Material Keys

- 1: Claystone Bedrock
- 3: Overburden
- 4: Sand and Gravel
- 5: Slurry Wall
- 6: Weathered Claystone Bedrock
- 7: Fill

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 2.31

Project Tucson South AM
M-1 -Static Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure M-1 Static Fill.gmf

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

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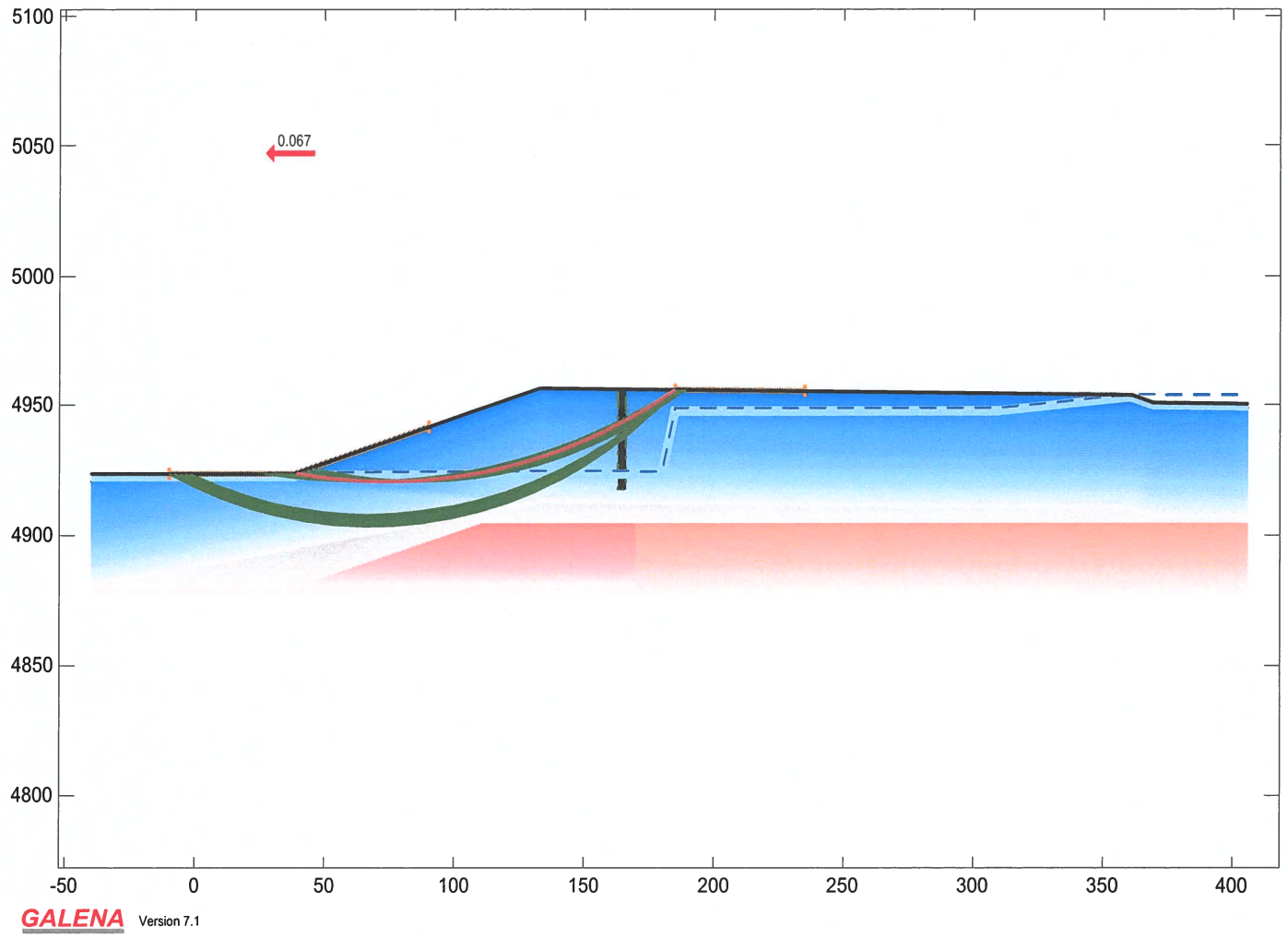


Material Keys

1: Claystone Bedrock
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

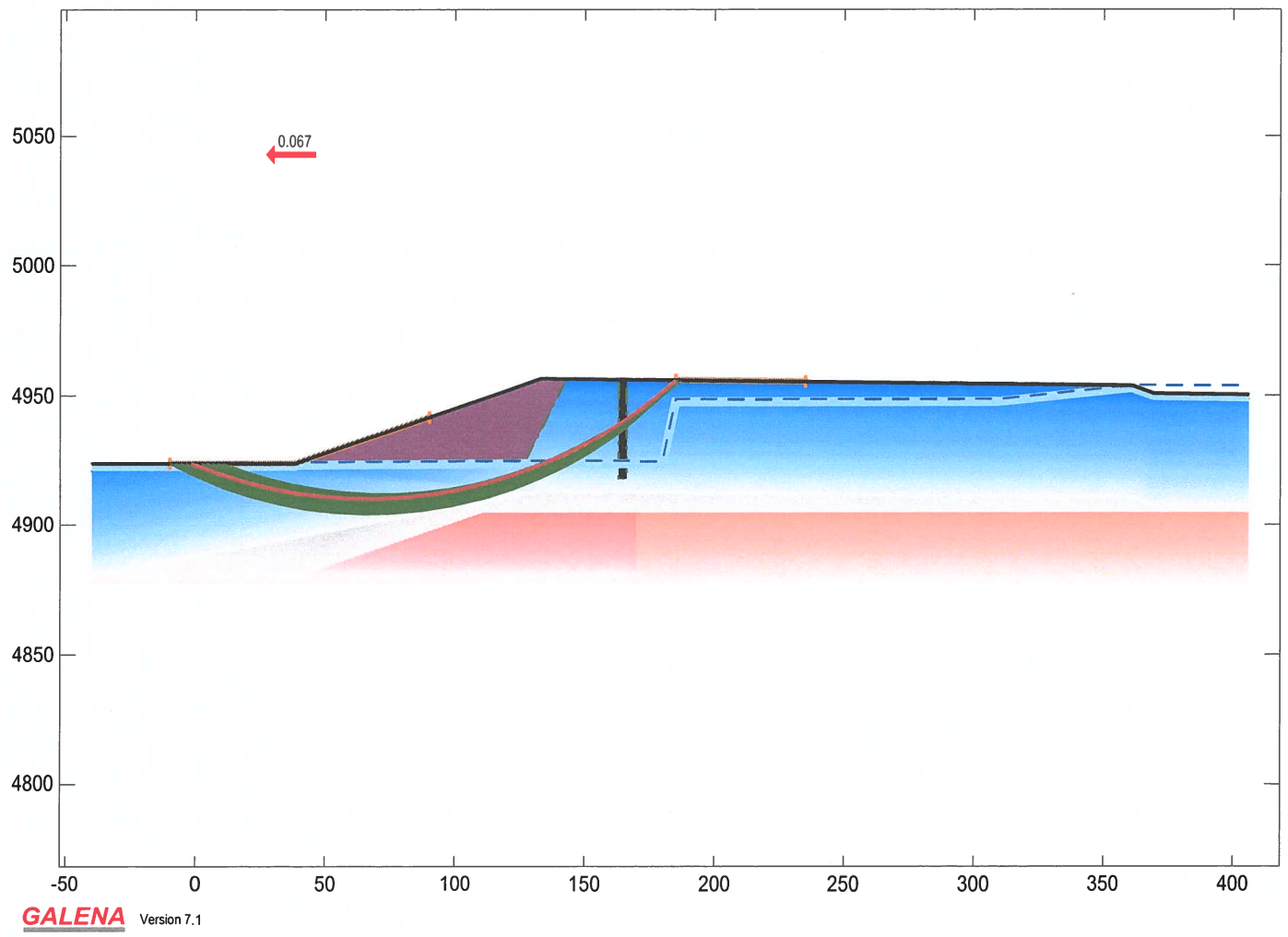
Critical Factor of Safety: 1.76

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
M-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure M-2 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

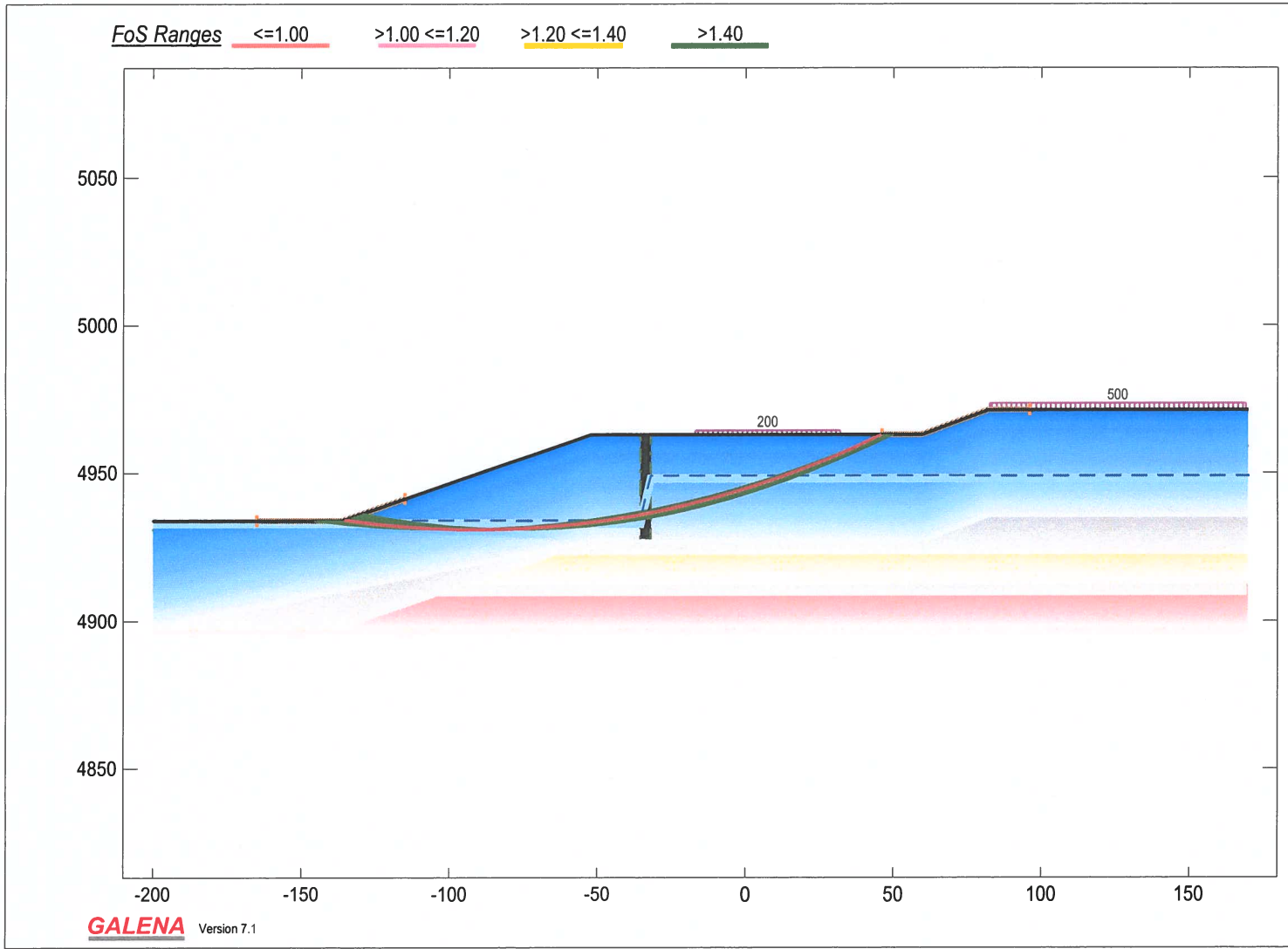
Critical Factor of Safety: 1.76

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
M-2 - Pseudostatic Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure M-2 Pseudostatic Fill.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

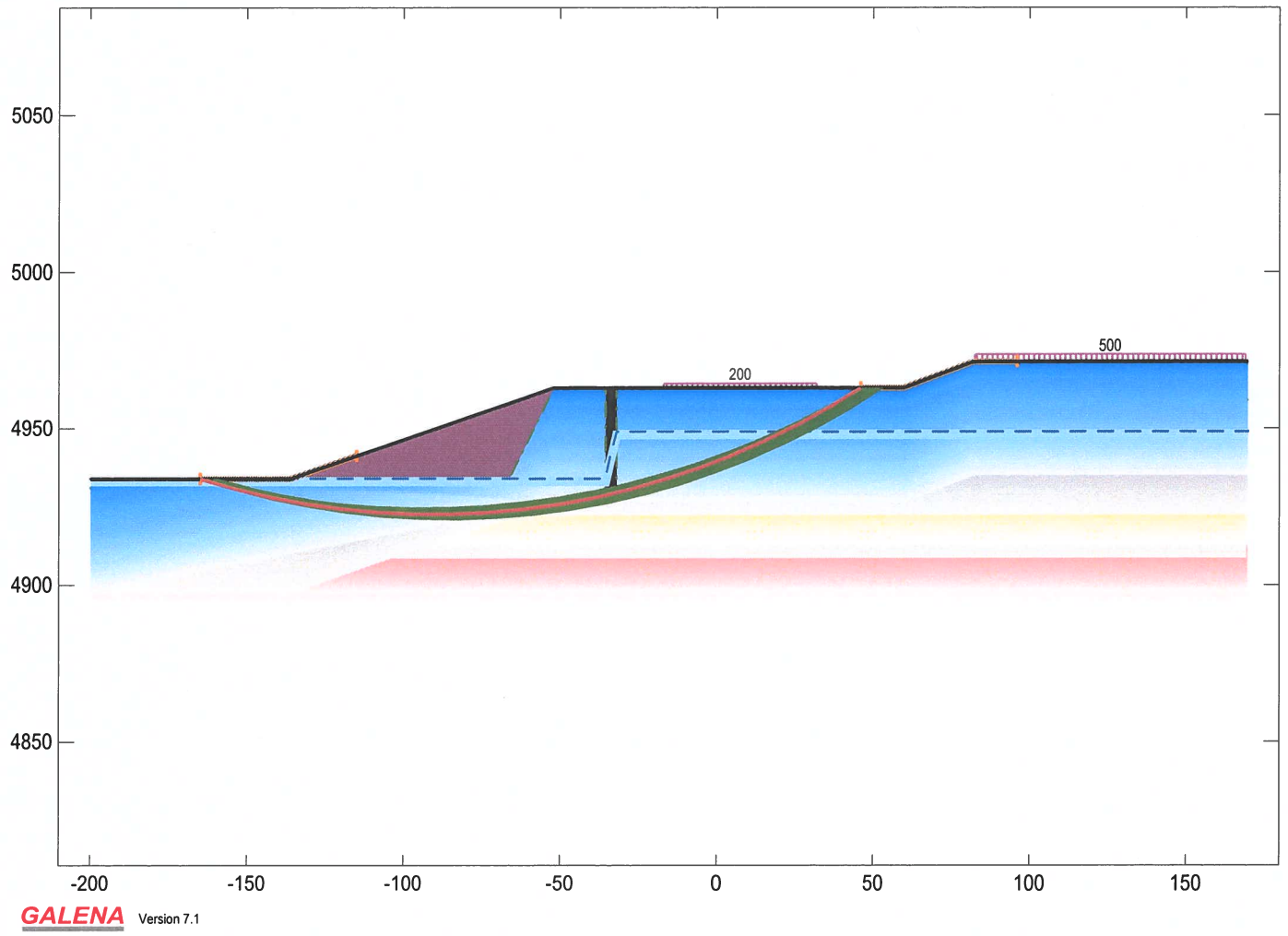
Critical Factor of Safety: 2.86

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
N-1 - Static

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure N-1 Static.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

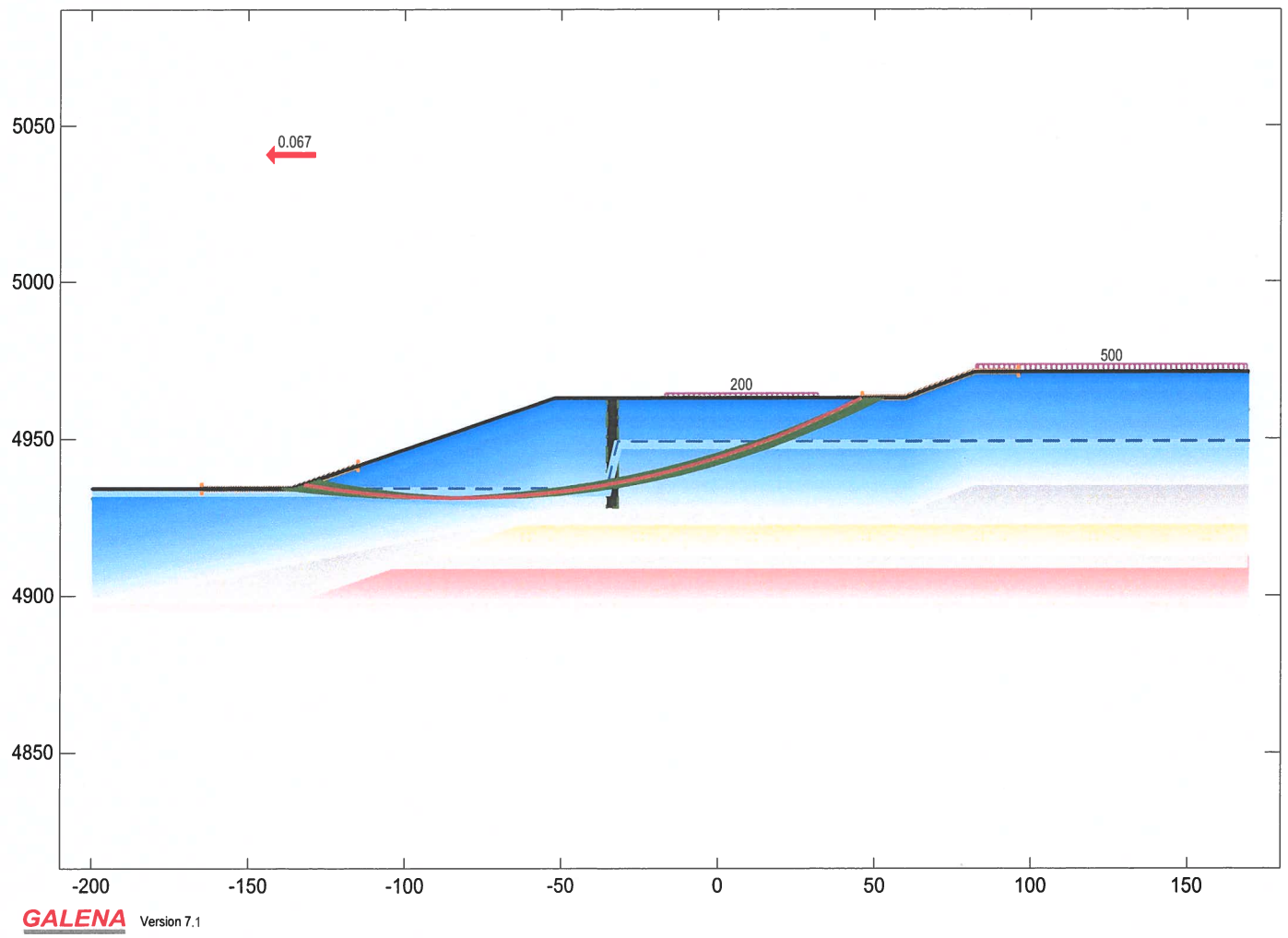
Critical Factor of Safety: 3.01

Project Tucson South AM
N-1 - Static Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure N-1Static Fill.gmf

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

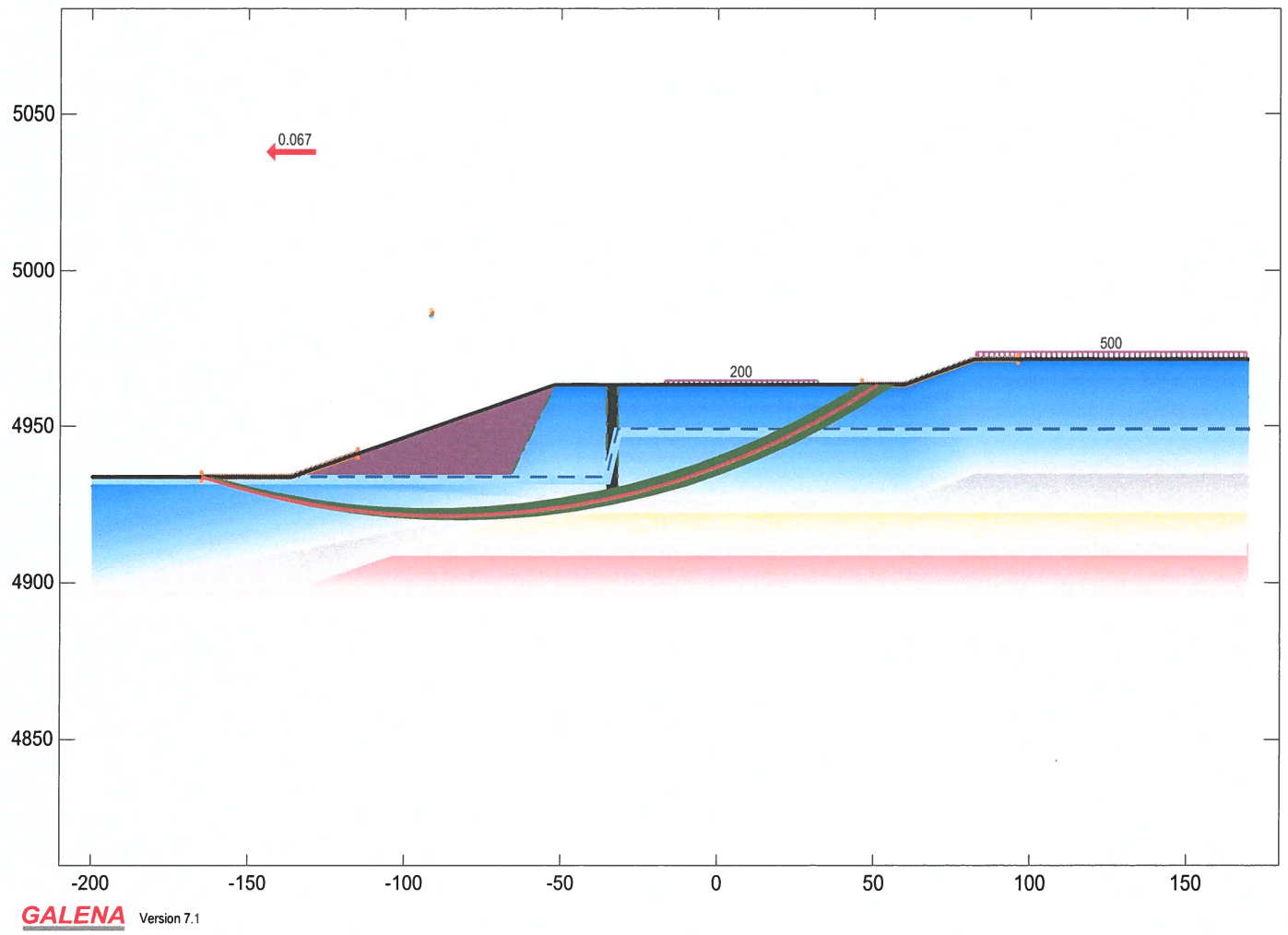
Critical Factor of Safety: 1.98

Edited: 24 Jul 2019 *Processed:* 24 Jul 2019

Project Tucson South AM
N-2 - Pseudostatic

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure N-2 Pseudostatic.gmf

Dept of the Interior - Office of Surface Mining



Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 2.13

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Project Tucson South AM
N-2 - Pseudostatic Fill

File: G:\My Drive\1 - My Projects Google\8 Galena - Stability Analysis Models\Tucson South\Tucson Figure N-2 Pseudostatic Fill.gmf

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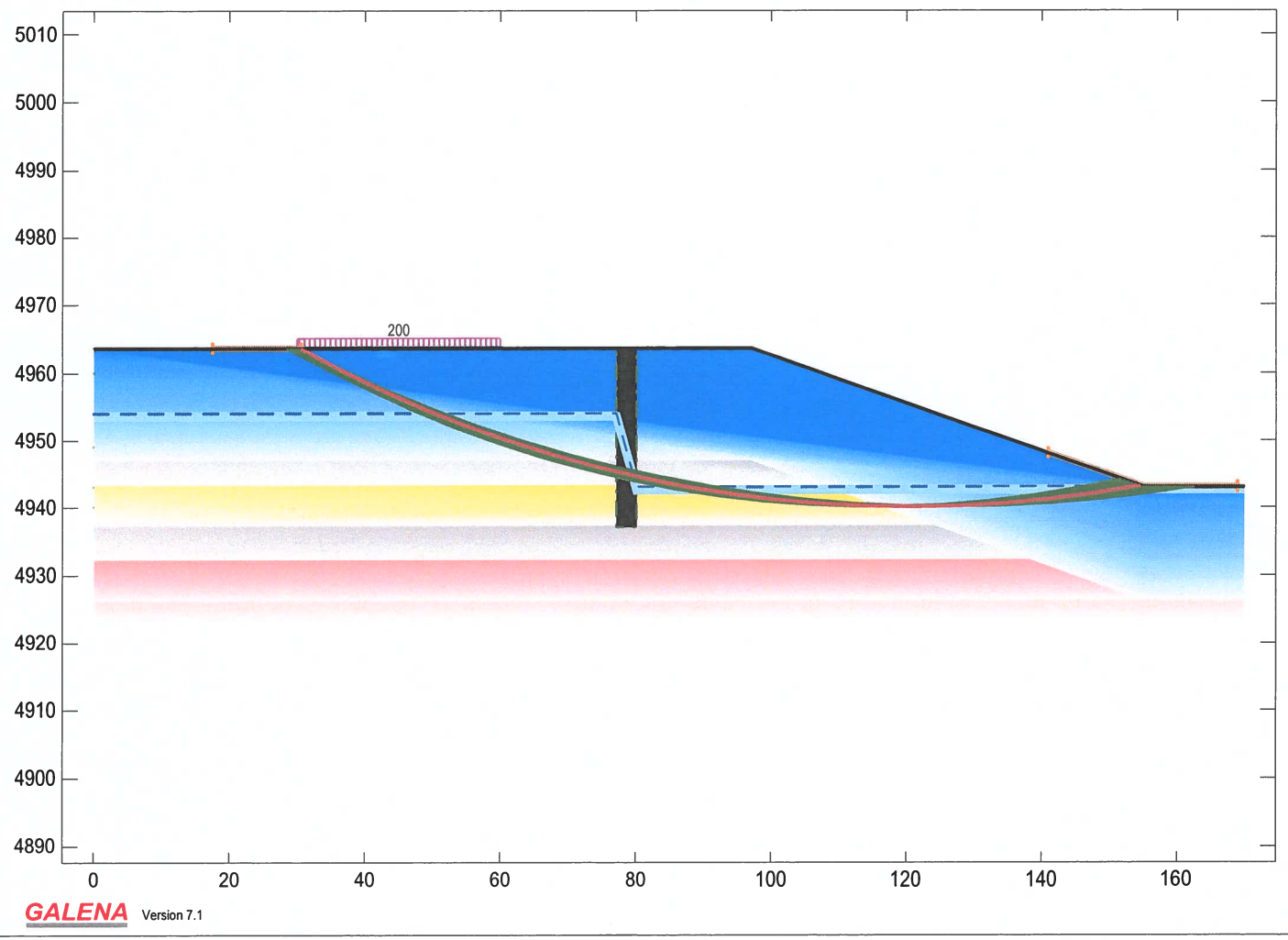

Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 2.47

Project Tucson South AM
O-1 - Static

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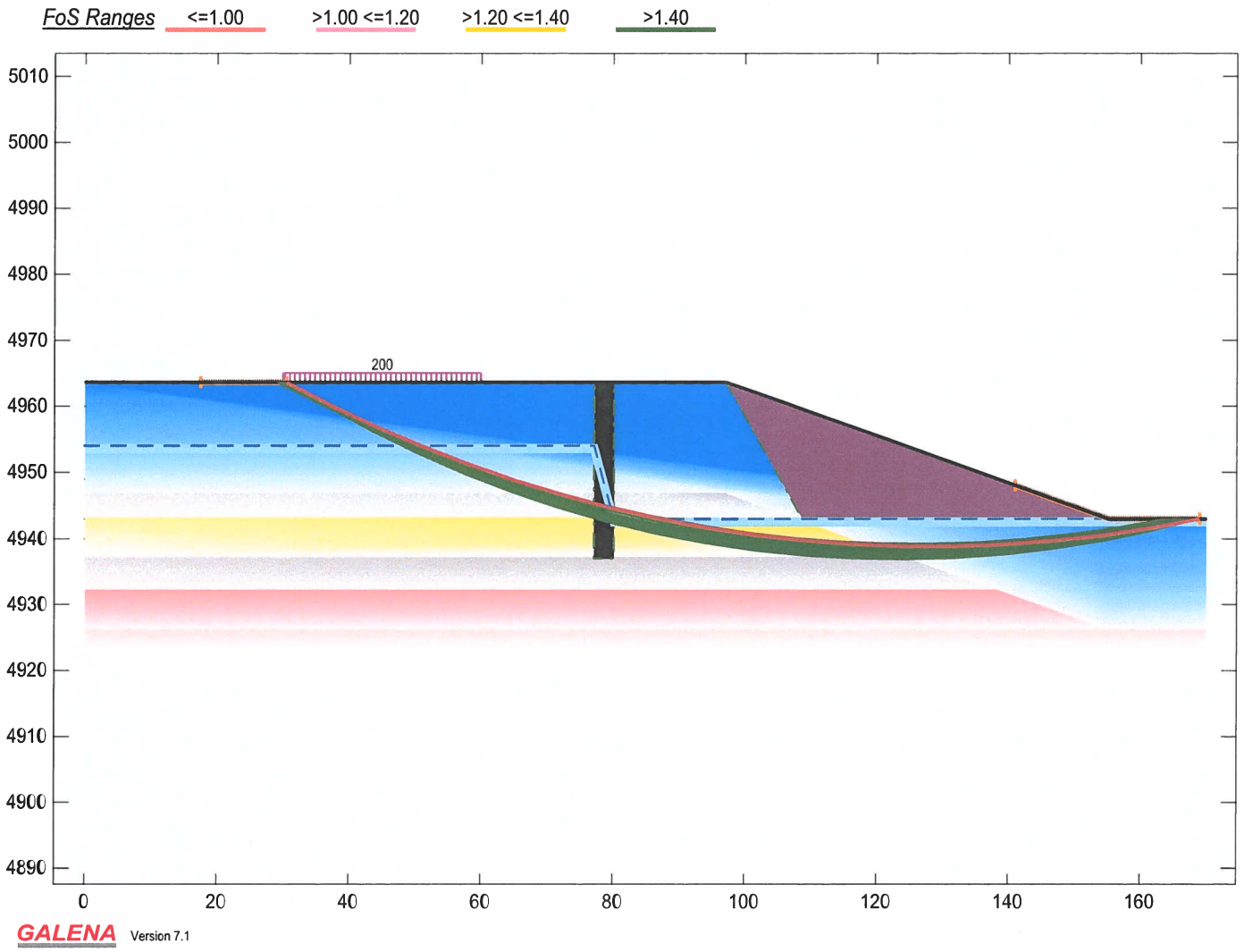

Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 2.87

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Project Tucson South AM
O-1 - Static Fill

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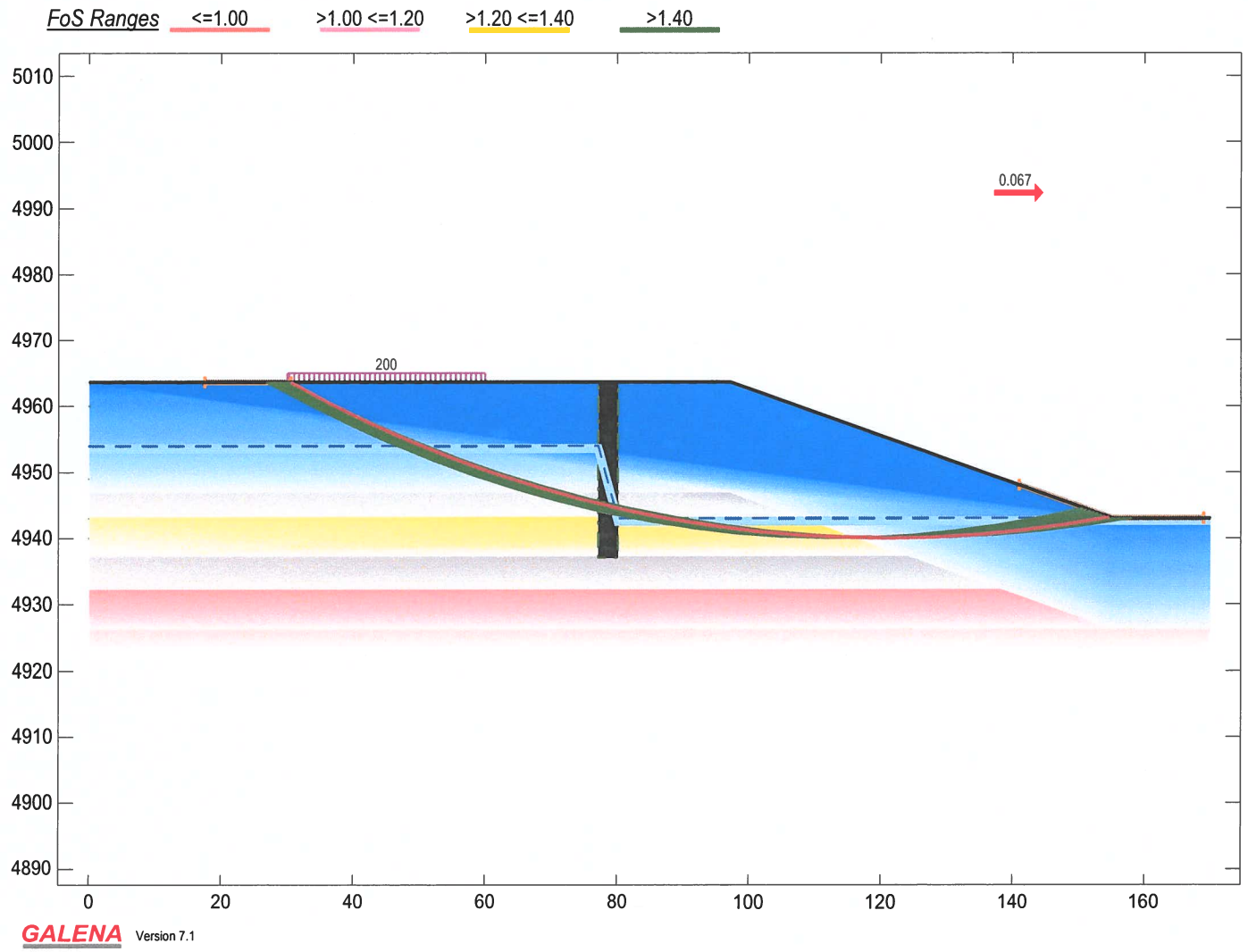

Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 1.74

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Project Tucson South AM
O-2 - Pseudostatic

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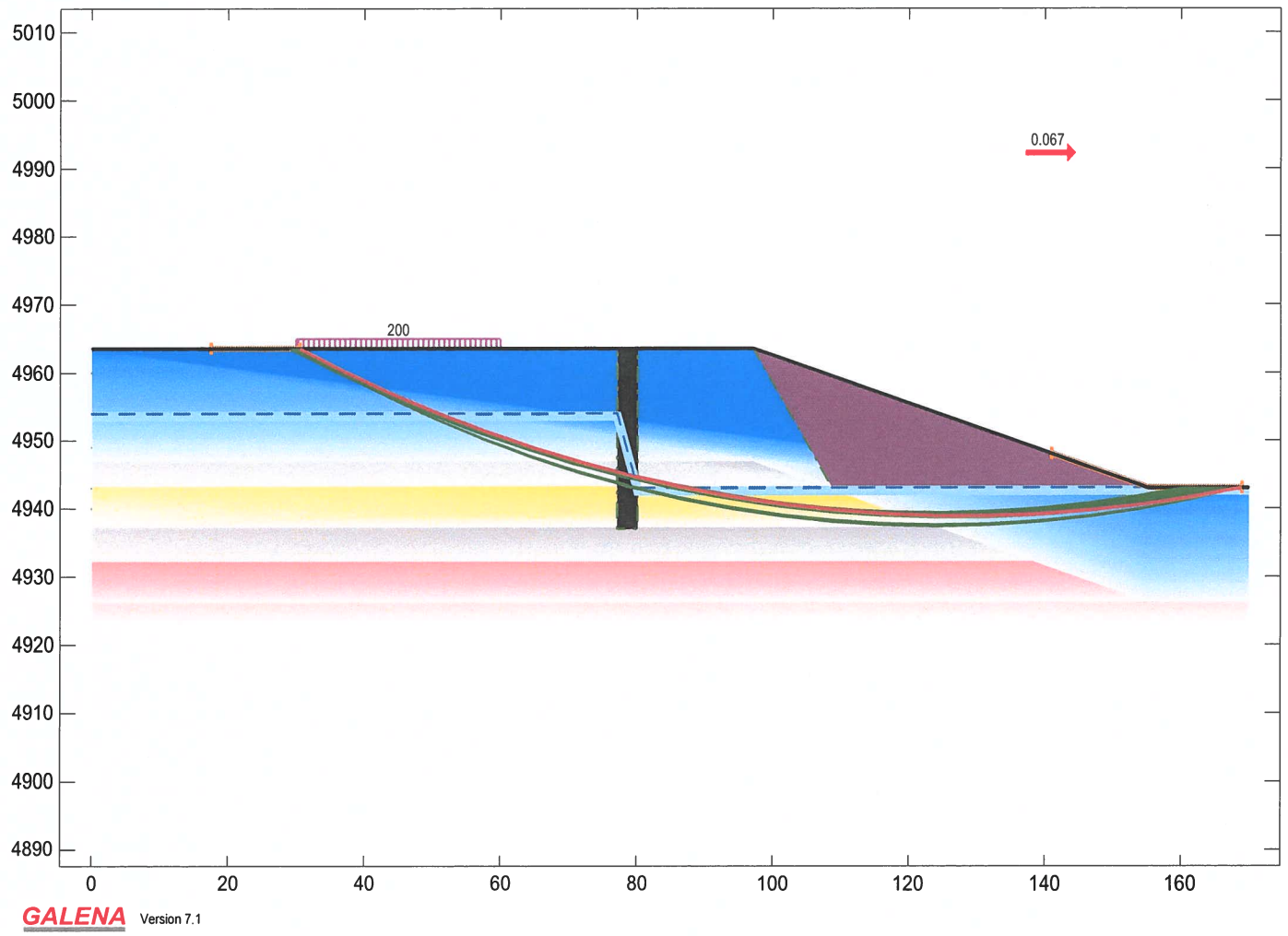

Material Keys

1: Claystone Bedrock
2: Mud Lens
3: Overburden
4: Sand and Gravel
5: Slurry Wall
6: Weathered Claystone Bedrock
7: Fill

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

Critical Factor of Safety: 2.06

Project Tucson South AM
O-2 - Pseudostatic Fill

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