Environmental Consultants
and Contractors

SCS Engineers, P.C.
2520 Whitehall Park Drive
Suite 450
Charlotte, NC 28273-3557

704 504-3107
FAX 704 504-3174
www.scsengineers.com

SCS ENGINEERS, PC

August 6, 2010
File No. 02201314.28

Mr. Edward Mussler, P.E.
Permitting Branch Head
NCDENR – Division of Waste Management
Solid Waste Section – Permitting Branch
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Mr. John Murray, P.E.
NCDENR – Division of Waste Management
Solid Waste Section – Permitting Branch
610 East Center Avenue, Suite 301
Mooresville, North Carolina 28115

SUBJECT: Proposed Modification (Permit Modification) to the Permit Application for Phase 3 Permit to Construct
Charlotte Motor Speedway V Landfill, Phase 3
Permit No. 1304

Gentlemen:

On behalf of Republic Services, Inc. and the Charlotte Motor Speedway (CMS) Landfill, SCS Engineers, PC (SCS) is submitting the enclosed modification Engineering Plans and documentation to the Permit Application for the Phase 3 Permit to Construct for the Charlotte Motor Speedway (CMS) V Landfill. The Permit Application was prepared by Hodges, Harbin, Newberry and Tribble, Inc. (HHNT) and dated May 2009. In addition, the Permit Application for the Phase 3 Landfill Permit to Construct received approval from the NCDENR Division of Waste Management; Solid Waste Section on April 12, 2010.

The proposed modifications include the following changes to the Permit Application for the Phase 3 Permit to Construct:

1. Removal of the proposed Sediment Basin No. 3.
    a. A sediment basin that covers the same drainage area was part of landfill Cell 2H construction. The constructed sediment basin was part of the Facility's NCDENR Division of Land Resources; Land Quality Section approved overall Erosion and Sedimentation Control Plan.

2. Modify the proposed Sediment Basin No. 5 grading to allow for use during cell construction, as well as, during landfill closure construction.

3. Modify sediment basins outlet structures and piping details to be consistent with the Facility's NCDENR Division of Land Resources; Land Quality Section approved overall Erosion and Sedimentation (E&S) Control Plan and with current regulatory E&S control standards.
    a. Provide for sediment basins No. 4 and No. 5 silt fence baffles and dewatering skimmers.

4. Change landfill cells bottom grades and perimeter berms.
    a. Reduction in structural fill volume.
    b. Provide two (2) leachate collection sumps and collection piping for each landfill cell for optimizing leachate collection.

5. Removal of 14-foot high retaining wall from landfill Cell 2M perimeter berm outside slope.

6. Modify leachate sideslope riser and piping details to be consistent with what has been constructed previously.

7. Modify leachate collection cell floor gravity piping and sumps.
    a. Allows for leachate piping to be cleaned and CCTV inspected in accordance with the Solid Waste Rules.
    b. Provide two (2) leachate collection sumps and collection piping for each landfill cell for optimizing leachate collection.

The proposed modification required revising some of the Engineering Plans, supporting documentation and calculations for the Permit Application for the Phase 3 Permit to Construct prepared by HHNT. The modification Engineering Plans, supporting documentation and calculations include the following:

- Amended the Permit Application; Phase 3 Engineering Plans with SCS Drawing Nos. 1 – 13.

- Revised global slope stability calculations for the embankments and waste slopes for Phase 3, Cells 2I, 2J, 2K and 2M.

- Revised Phase 3, Cells 2I, 2J, 2K and 2M settlement and groundwater and bedrock separation calculations.

- Revised quantities for the Phase 3 Landfill construction and closure soil requirements and maximum waste inventory and expected life.

We trust that this Permit Modification is responsive to the requirements of the State Solid Waste Rules. We look forward to your response after you have had an opportunity to review the enclosed drawings and documentation. If you have any questions or need additional information please don't hesitate the contact the undersigned at (704) 504 – 3107.

Sincerely,

NORTH CAROLINA PROFESSIONAL SEAL 031802 ENGINEER ALBERT D. GLENN

8/6/2010

Albert D. Glenn, PE
Project Manager
**SCS ENGINEERS, PC**

Christopher D. Hardin, P.E.
Project Director
**SCS ENGINEERS, PC**

adg/

Enclosures

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# Permit Modification Enclosures

Modification Supporting Documentation and Calculations

Environmental Consultants
and Contractors

SCS Engineers, PC
2520 Whitehall Park Drive
Suite 450
Charlotte, NC 28273-3557

704 504-3107
FAX 704 504-3174
www.scsengineers.com

**SCS ENGINEERS, PC**

File No. 02201314.28
July 27, 2010

# MEMORANDUM

Subject: Addendum -- Geotechnical Evaluation
Permit Modification for the CMS Landfill Phase 3 Permit to Construct

Prepared by: Christopher D. Hardin, PE

Checked by: Albert D. Glenn, PE

## INTRODUCTION

This memorandum summarizes the results of the supplemental geotechnical evaluation for the modification to the Permit Application for Phase 3 Permit to Construct for the Charlotte Motor Speedway (CMS) Landfill, dated May 2009 as prepared by Hodges, Harbin, Newberry and Tribble, Inc. (HHNT). The information in this supplemental geotechnical evaluation of the CMS Landfill Phase 3 Permit to Construct includes the following:

- the static and seismic global stability of the landfill waste mass, constructed perimeter embankments, and residual soils beneath the landfill;
- the estimated settlement of the soil beneath the landfill bottom liner system; and
- Separation between the landfill bottom liner system soil liner and seasonal high groundwater and bedrock.

The Permit Modification that was completed by SCS Engineers, PC includes revisions to the landfill bottom grading plan and exterior embankment berms at select locations in the CMS Phase 3 Landfill footprint. These modifications to the grading plan represent minor changes that were made to decrease the amount of earth fill material that is required, and provide a more efficient waste filling sequence at the landfill. The proposed modifications did not result in any changes to the veneer stability and the bottom liner system protective cover, the allowable stresses on the bottom liner system geosynthetics, and/or the geosynthetic anchor trench stability. The geotechnical analyses for these items are provided in the Appendix VIII in the original Permit Application for Permit to Construct dated May 2009 as prepared by HHNT. General landfill leachate collection analysis and stability calculations are included in Appendix VII of the HHNT Permit Application. The information provided in this memorandum should be considered ***supplemental*** to the original geotechnical evaluation and design calculations

provided in the HHNT Permit Application, dated May 2009, but ***unless noted does not supersede*** the HHNT Permit Application.

## METHODOLOGY

The static and seismic global slope stability was evaluated for three different conditions and four representative cross sections – Section 2I East, Section 2J West, Section 2K East and Section 2M at the stormwater pond (see Figures 1 and 2 in Appendix C). The computer program PCSTABL6 Windows Version was used to compute the factors of safety for static and seismic loading conditions. For the seismic loading of the CMS Phase 3 Landfill, SCS used a peak ground acceleration of 0.12g based on the 2006 USGS Seismic Hazard Maps as presented in the International Building Code (IBC) for a maximum horizontal acceleration of with a 10 percent probability of being exceeded in 250 years. The seismic peak ground acceleration value used by SCS was consistent with the values in Appendix VIII of the Permit Application prepared by HHNT. In accordance with US EPA Guidance Document 600/R-95/051 a design factor of safety of 1.5 was used for static loading conditions and 1.0 for seismic loading conditions.

The analysis of settlement was conducted using primary consolidation settlement calculations for landfill bottom liner system subgrade materials and the 2-foot clay soil liner. Due to the fact that all subgrade and liner soils will be inorganic and compacted or re-compacted to at least 95% of the Standard Proctor Maximum Dry Density, it is assumed that secondary consolidation settlement will be negligible. The following equation (one-dimensional compression theory) was used to determine primary consolidation settlement of the subgrade materials and clay liner soils:

$$Z_c = C_c \frac{H_o}{1+e_o} * \log \frac{\sigma_o + \Delta\sigma}{\sigma_o}$$

$$Z_c = \frac{H_o}{C'} * \log \frac{\sigma_o + \Delta\sigma}{\sigma_o}$$

where: $C_c$ = compression index;
$C'$ = bearing capacity index;
$H_o$ = initial thickness of compressible layer (feet);
$e_o$ = initial void ratio of compressible layer;
$\sigma_o$ = initial vertical stress at the center soil stratum (lb/ft$^2$); and
$\Delta\sigma$ = increase in stress due to additional loadings (lb/ft$^2$).

Soil parameters used for existing (in-situ) soils, as well as, added structural fill were supplied by boring logs and corresponding soils laboratory testing results within the landfill footprint from the Design Hydrogeologic Report for CMS Landfill Dated August 2008 prepared by David Garrett and Associates and for the low permeability clay soil liner from the Cell 2H Construction; Final Certification Report – Construction Quality Assurance Services.

## PARAMETERS AND ASSUMPTIONS

The global slope stability analysis was performed on the cross section locations 2I, 2J, 2K, and 2M as shown in Figure 1 and 2. The soil properties for the slope stability analysis were based on information from the Design Hydrogeologic Report (DHR) for CMS Landfill dated August 2008 by David Garrett and Associates. SCS developed typical soil properties for different soil types based on a review of the test boring logs and blow count information. A summary of the soil properties that were used for the global slope stability analysis is provided below:

**Table 1**
**CMS Landfill Phase 3 - Permit Modification**
**Soil Properties – Global Stability**

| Soil ID | Moist Unit Weight | Saturated Unit Weight | Cohesion, c – psf | Friction Angle – phi | Unified Soil Classification |
|---|---|---|---|---|---|
| 1 | 70 | 75 | 200 | 30 | Mun. Solid Waste |
| 2 | 105 | 110 | 190 | 28 | ML-CL |
| 3 | 110 | 115 | 350 | 28 | ML-CL |
| 4 | 120 | 125 | 420 | 35 | SM |
| 5 | 150 | 150 | - | 47 | Weathered Rock |

## RESULTS OF ANALYSES

### Global Slope Stability

The results of the global slope stability analyses indicated an acceptable factor of safety at the four critical cross sections that were evaluated. The following Table 2A through 2D provides a summary of the computed factor of safety at each cross section and depth where the stability analysis was performed. A copy of the slope stability cross sections with the 10 most critical failure circles is included in Appendix A.

**Table 2A – Section 2I, East**
**CMS Landfill Phase 3 - Permit Modification**
**Summary of Slope Stability Evaluation**

| Section and Depth | Failure Mode | Analysis Mode | Design Factor of Safety | Computed Factor of Safety |
|---|---|---|---|---|
| Section 2I – East 3H to 1V Side Slopes Through Waste Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 1.70<br>1.33 |
| Section 2I – East 3H to 1V Side Slopes Through Waste and Embankment | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 1.71<br>1.33 |
| Section 2I – East 3H to 1V Side Slopes Embankment Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.14<br>1.71 |

| Table 2B – Section 2J, West<br>CMS Landfill Phase 3 - Permit Modification<br>Summary of Slope Stability Evaluation | | | | |
|---|---|---|---|---|
| **Section and Depth** | **Failure Mode** | **Analysis Mode** | **Design Factor of Safety** | **Computed Factor of Safety** |
| Section 2K – West<br>3H to 1V Side Slopes<br>Through Waste Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.18<br>1.63 |
| Section 2I – East<br>3H to 1V Side Slopes<br>Through Waste and Embankment | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.19<br>1.62 |
| Section 2I – East<br>3H to 1V Side Slopes<br>Embankment Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.86<br>2.32 |

**Table 2 – Section 2K, East**
**CMS Landfill Phase 3 - Permit Modification**
**Summary of Slope Stability Evaluation**

| Section and Depth | Failure Mode | Analysis Mode | Design Factor of Safety | Computed Factor of Safety |
|---|---|---|---|---|
| Section 2K - East<br>3H to 1V Side Slopes<br>Through Waste Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.07<br>1.56 |
| Section 2K - East<br>3H to 1V Side Slopes<br>Through Waste and Embankment | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.06<br>1.56 |
| Section 2K - East<br>3H to 1V Side Slopes<br>Embankment Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 3.67<br>2.77 |

**Table 2 – Section 2M at Stormwater Pond**
**CMS Landfill Phase 3 - Permit Modification**
**Summary of Slope Stability Evaluation**

| Section and Depth | Failure Mode | Analysis Mode | Design Factor of Safety | Computed Factor of Safety |
|---|---|---|---|---|
| Section 2M – SW Pond<br>3H to 1V Side Slopes<br>Through Waste Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.86<br>2.17 |
| Section 2I – SW Pond<br>3H to 1V Side Slopes<br>Through Waste and Embankment | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 2.87<br>2.17 |
| Section 2I – SW Pond<br>3H to 1V Side Slopes<br>Embankment Only | Bishop Circular | Static<br>Seismic = 0.12g | Static: 1.5<br>Seismic: 1.0 | 4.22<br>2.84 |

## Results of Settlement and Groundwater Separation

| Location | Elevation at Bottom of Soil Liner (feet.) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Seasonal High Groundwater (feet) | Separation (feet) |
|---|---|---|---|---|---|
| CELL 2I EAST | | | | | |
| Bottom of Sump | 570 | 0.114 | 569.89 | 565 | 4.89 |
| Top of Sump | 572 | 0.128 | 571.87 | 565 | 6.87 |
| Sta. 8+00 | 594 | 0.806 | 593.19 | 587 | 6.19 |
| CELL 2I WEST | | | | | |
| Bottom of Sump | 580 | 0.292 | 579.71 | 575 | 4.71 |
| Top of Sump | 582 | 0.307 | 581.69 | 575 | 6.69 |
| Sta. 5+00 | 590 | 0.647 | 589.35 | 580 | 9.35 |
| CELL 2J EAST | | | | | |
| Bottom of Sump | 570 | 0.268 | 569.73 | 565 | 4.73 |
| Top of Sump | 572 | 0.278 | 571.72 | 565 | 6.72 |
| Sta. 7+00 | 588.80 | 0.240 | 588.56 | 577 | 11.56 |
| CELL 2J WEST | | | | | |
| Bottom of Sump | 580 | 0.242 | 579.76 | 574 | 5.76 |
| Top of Sump | 582 | 0.257 | 581.74 | 574 | 7.74 |
| Sta. 6+00 | 590.50 | 0.264 | 590.24 | 577 | 13.00 |
| CELL 2K EAST | | | | | |
| Bottom of Sump | 572 | 0.228 | 571.77 | 567 | 4.77 |
| Top of Sump | 574 | 0.265 | 573.74 | 567 | 6.74 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 580 | 8.47 |
| CELL 2K WEST | | | | | |

| Location | Elevation at Bottom of Soil Liner (feet.) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Seasonal High Groundwater (feet) | Separation (feet) |
|---|---|---|---|---|---|
| Bottom of Sump | 576 | 0.261 | 575.74 | 571 | 4.74 |
| Top of Sump | 578 | 0.317 | 577.68 | 571 | 6.68 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 579 | 9.47 |
| CELL 2M EAST | | | | | |
| Bottom of Sump | 574 | 0.353 | 573.65 | 567 | 6.65 |
| Top of Sump | 576 | 0.366 | 575.63 | 567 | 8.63 |
| Sta. 5+00 | 586 | 0.300 | 585.70 | 577 | 8.70 |
| CELL 2M WEST | | | | | |
| Bottom of Sump | 575 | 0.296 | 574.70 | 570 | 4.70 |
| Top of Sump | 577 | 0.328 | 576.67 | 570 | 6.67 |
| Sta. 3+50 | 582 | 0.391 | 581.61 | 574 | 7.61 |
| Reference: Groundwater elevations from Design Hydrogeologic Report for CMS Landfill dated August 2008 prepared by David Garrett and Associates. | | | | | |

## Results of Settlement and Bedrock Separation

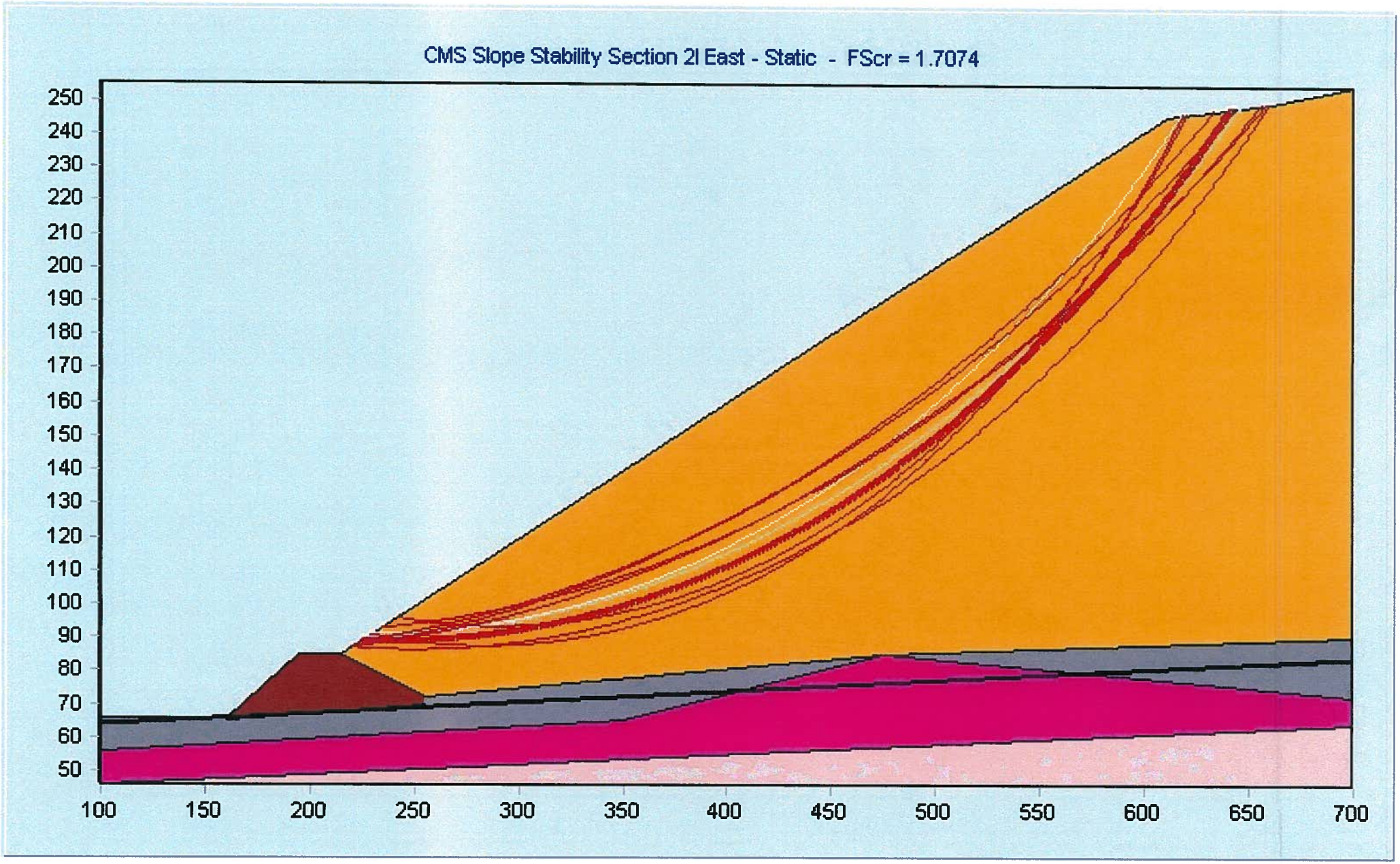
| Location | Elevation at Bottom of Soil Liner (feet) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Bedrock (feet) | Separation (feet) |
|---|---|---|---|---|---|
| CELL 2I EAST | | | | | |
| Bottom of Sump | 570 | 0.114 | 569.89 | 551 | 18.89 |
| Top of Sump | 572 | 0.128 | 571.87 | 551 | 20.87 |
| Sta. 8+00 | 594 | 0.806 | 593.19 | 562 | 31.19 |
| CELL 2I WEST | | | | | |

| Location | Elevation at Bottom of Soil Liner (feet) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Bedrock (feet) | Separation (feet) |
|---|---|---|---|---|---|
| Bottom of Sump | 580 | 0.292 | 579.71 | 555 | 24.71 |
| Top of Sump | 582 | 0.307 | 581.69 | 555 | 26.69 |
| Sta. 5+00 | 590 | 0.647 | 589.35 | 564 | 25.35 |
| CELL 2J EAST | | | | | |
| Bottom of Sump | 570 | 0.268 | 569.73 | 555 | 14.89 |
| Top of Sump | 572 | 0.278 | 571.72 | 555 | 16.87 |
| Sta. 7+00 | 588.80 | 0.240 | 588.56 | 565 | 23.56 |
| CELL 2J WEST | | | | | |
| Bottom of Sump | 580 | 0.242 | 579.76 | 550 | 29.76 |
| Top of Sump | 582 | 0.257 | 581.74 | 550 | 31.74 |
| Sta. 6+00 | 590.50 | 0.264 | 590.24 | 564 | 26.24 |
| CELL 2K EAST | | | | | |
| Bottom of Sump | 572 | 0.228 | 571.77 | 545 | 26.77 |
| Top of Sump | 574 | 0.265 | 573.74 | 545 | 28.74 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 557 | 31.47 |
| CELL 2K WEST | | | | | |
| Bottom of Sump | 576 | 0.261 | 575.74 | 552 | 23.74 |
| Top of Sump | 578 | 0.317 | 577.68 | 552 | 25.68 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 556 | 32.47 |
| CELL 2M EAST | | | | | |
| Bottom of Sump | 574 | 0.353 | 573.65 | 543 | 30.65 |
| Top of Sump | 576 | 0.366 | 575.63 | 543 | 32.63 |
| Sta. 5+00 | 586 | 0.300 | 585.70 | 560 | 25.70 |

| Location | Elevation at Bottom of Soil Liner (feet) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Bedrock (feet) | Separation (feet) |
|---|---|---|---|---|---|
| CELL 2M WEST | | | | | |
| Bottom of Sump | 575 | 0.296 | 574.70 | 552 | 22.70 |
| Top of Sump | 577 | 0.328 | 576.67 | 552 | 24.67 |
| Sta. 3+50 | 582 | 0.391 | 581.61 | 560 | 21.69 |
| Reference: Bedrock elevations from Design Hydrogeologic Report for CMS Landfill dated August 2008 prepared by David Garrett and Associates. | | | | | |

# APPENDIX A

PCSTABL6 Results for Static and Seismic Loading Conditions


CMS Slope Stability Section 2I East - Static - FScr = 1.7074
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230
220
210
200
190
180
170
160
150
140
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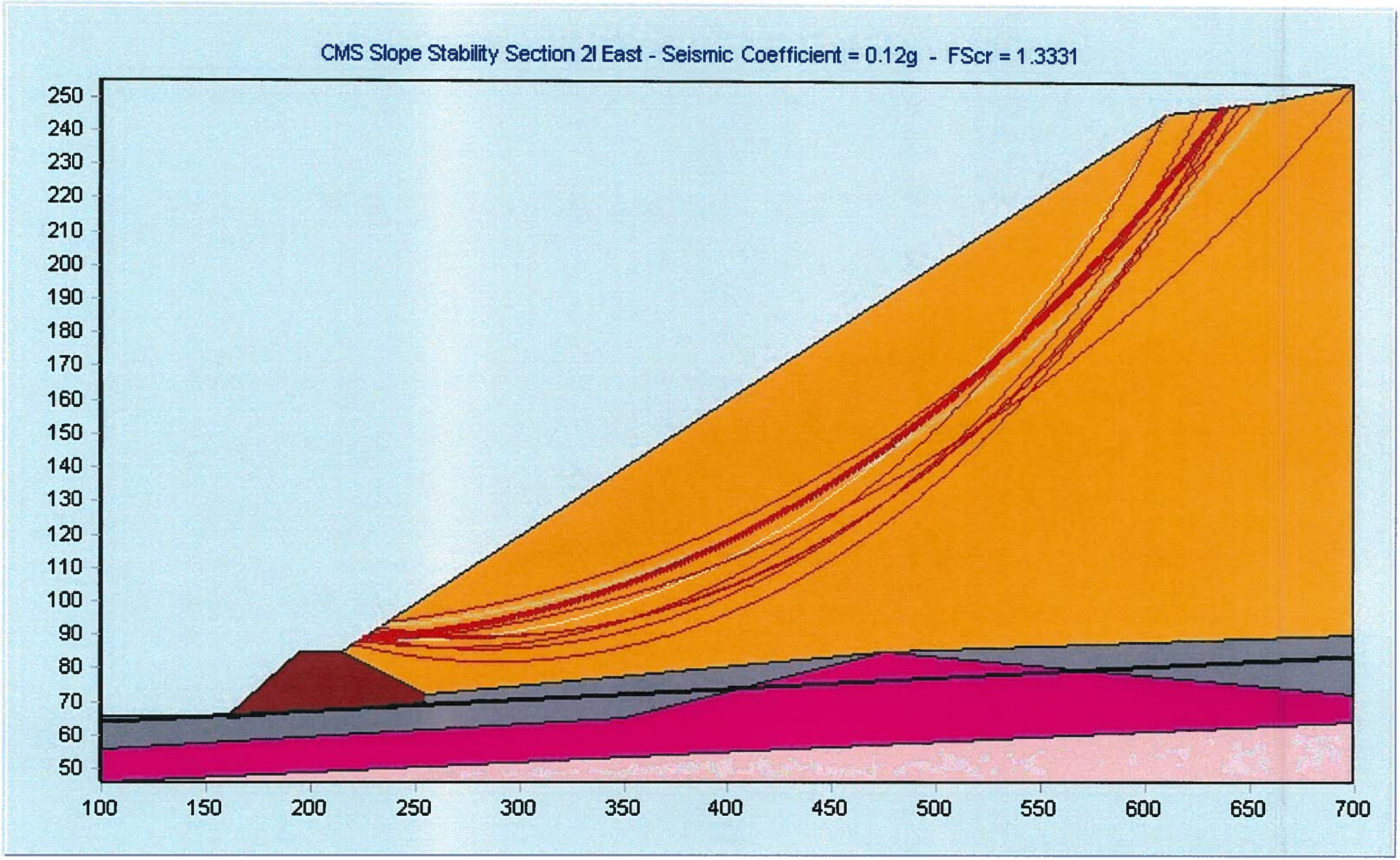
550
600
650
700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230
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210
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190
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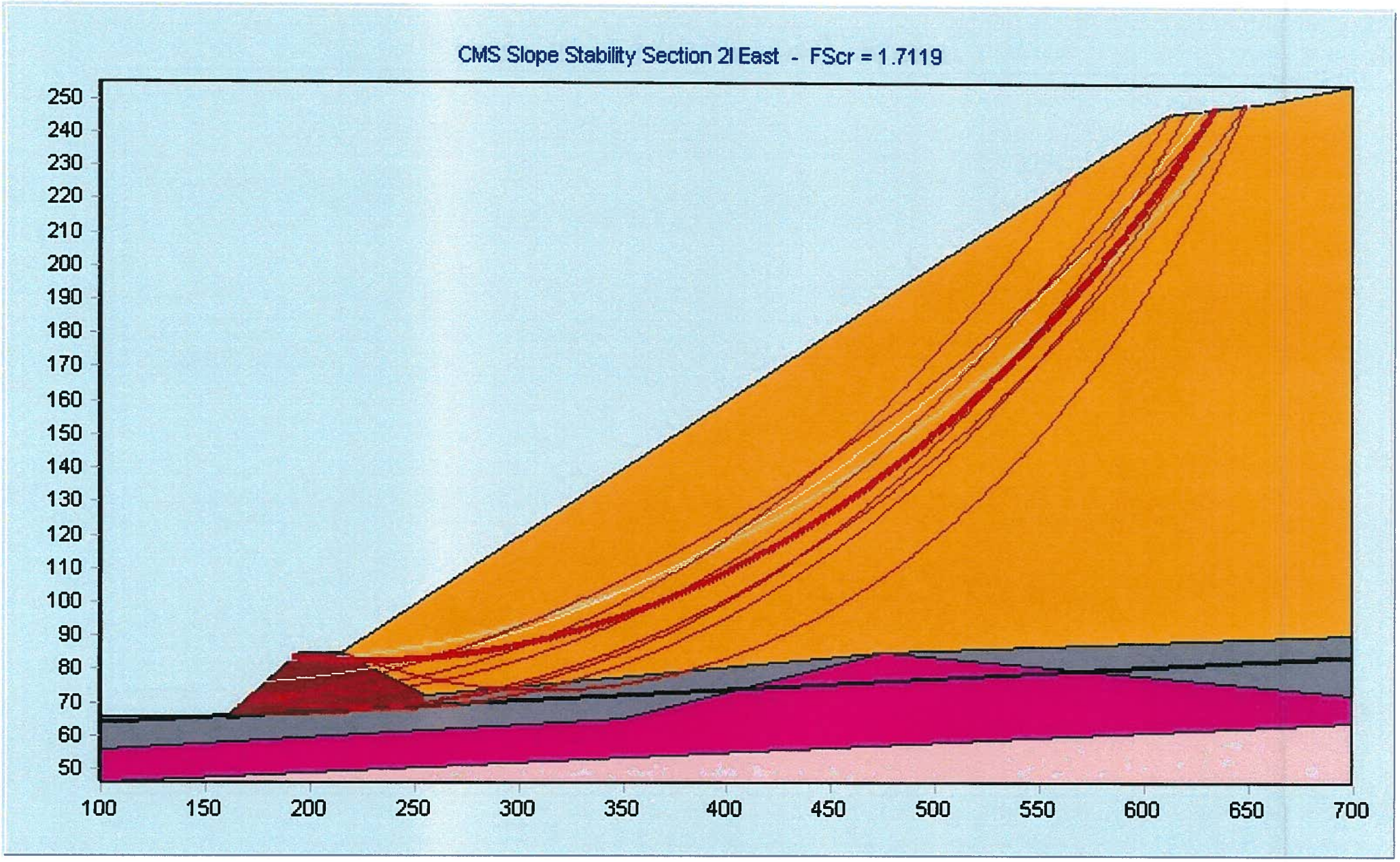
CMS Slope Stability Section 2I East - FScr = 1.7119
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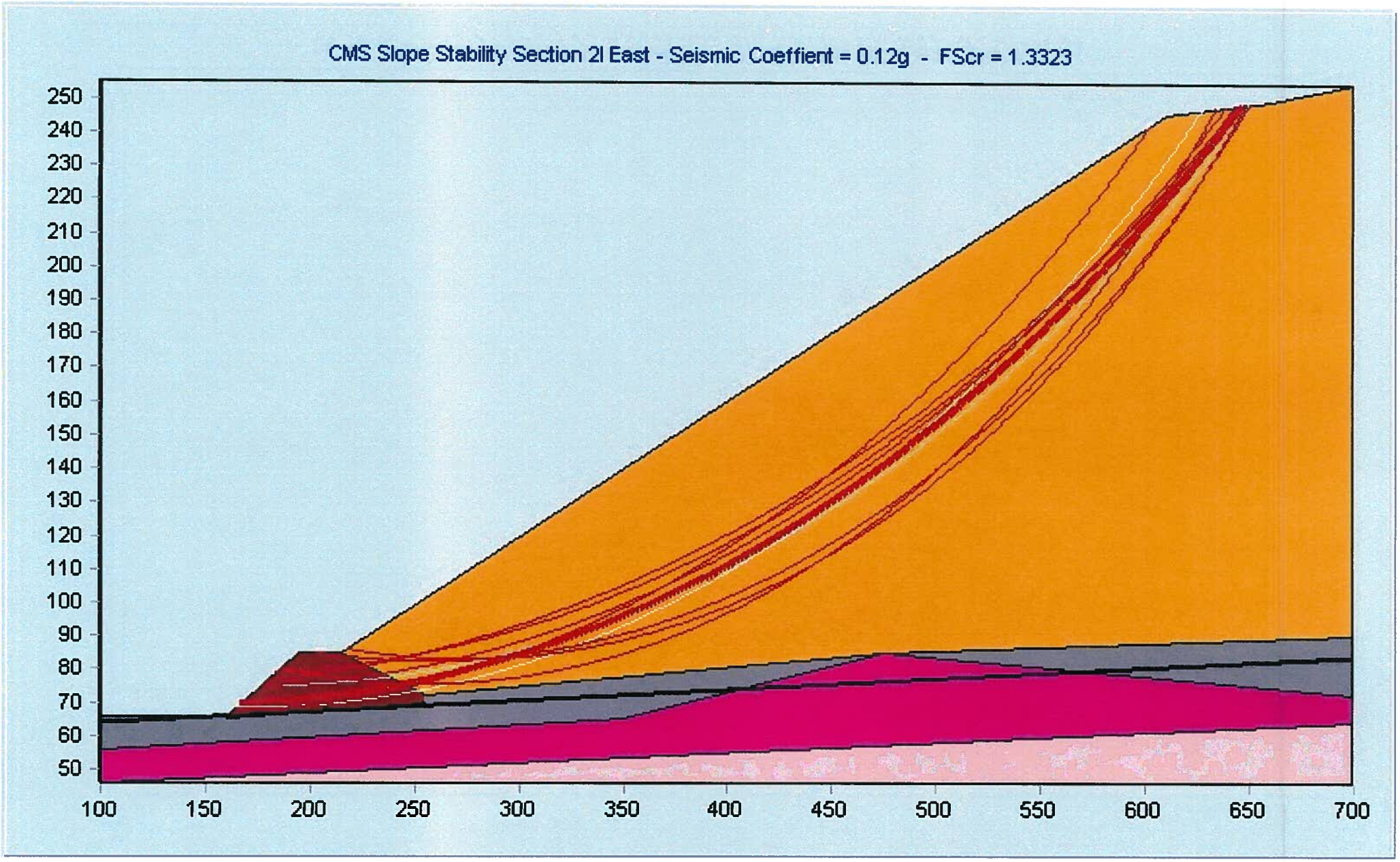
CMS Slope Stability Section 2I East - Seismic Coeffient = 0.12g - FScr = 1.3323
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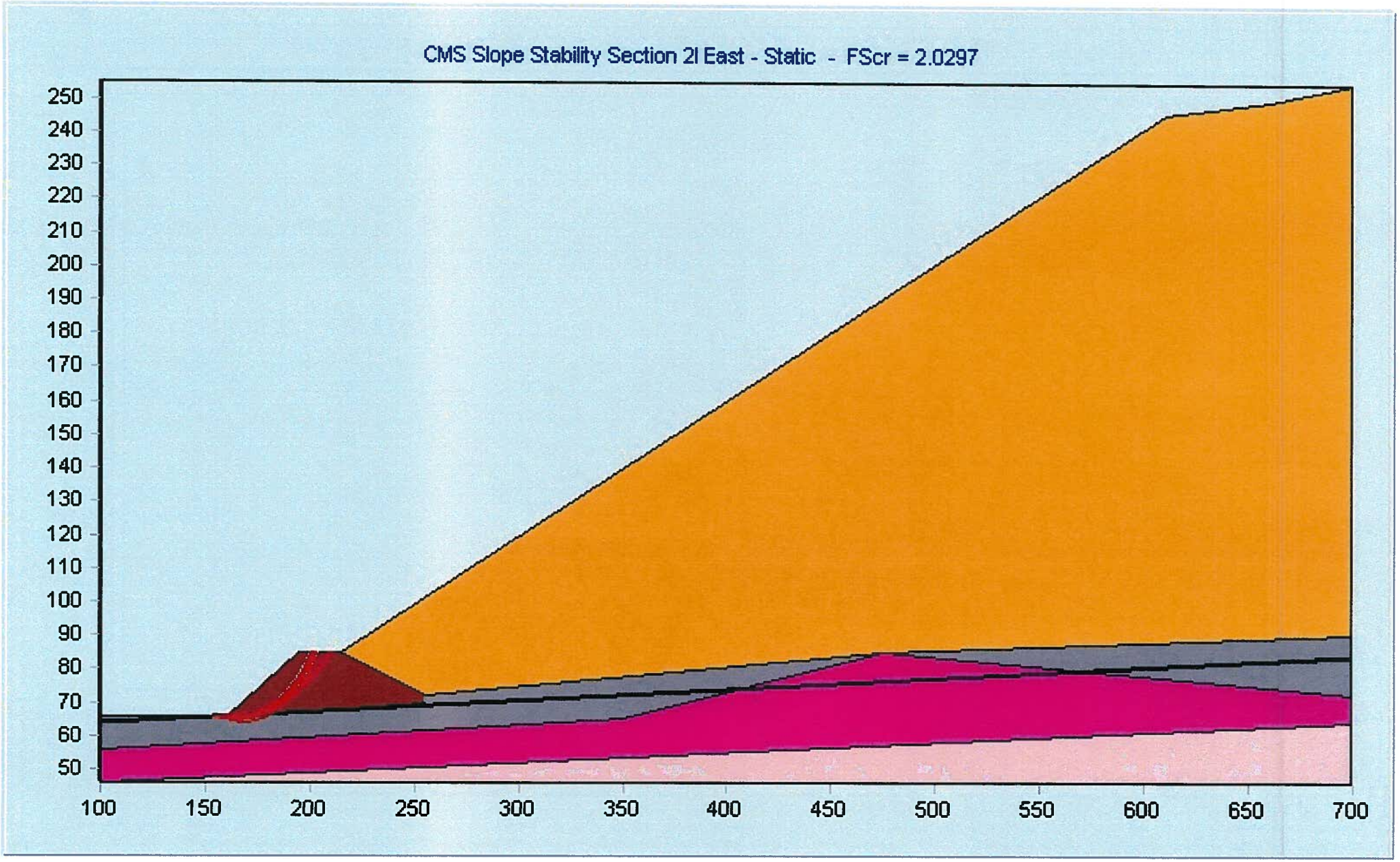
650
700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240
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220
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200
190
180
170
160
150
140
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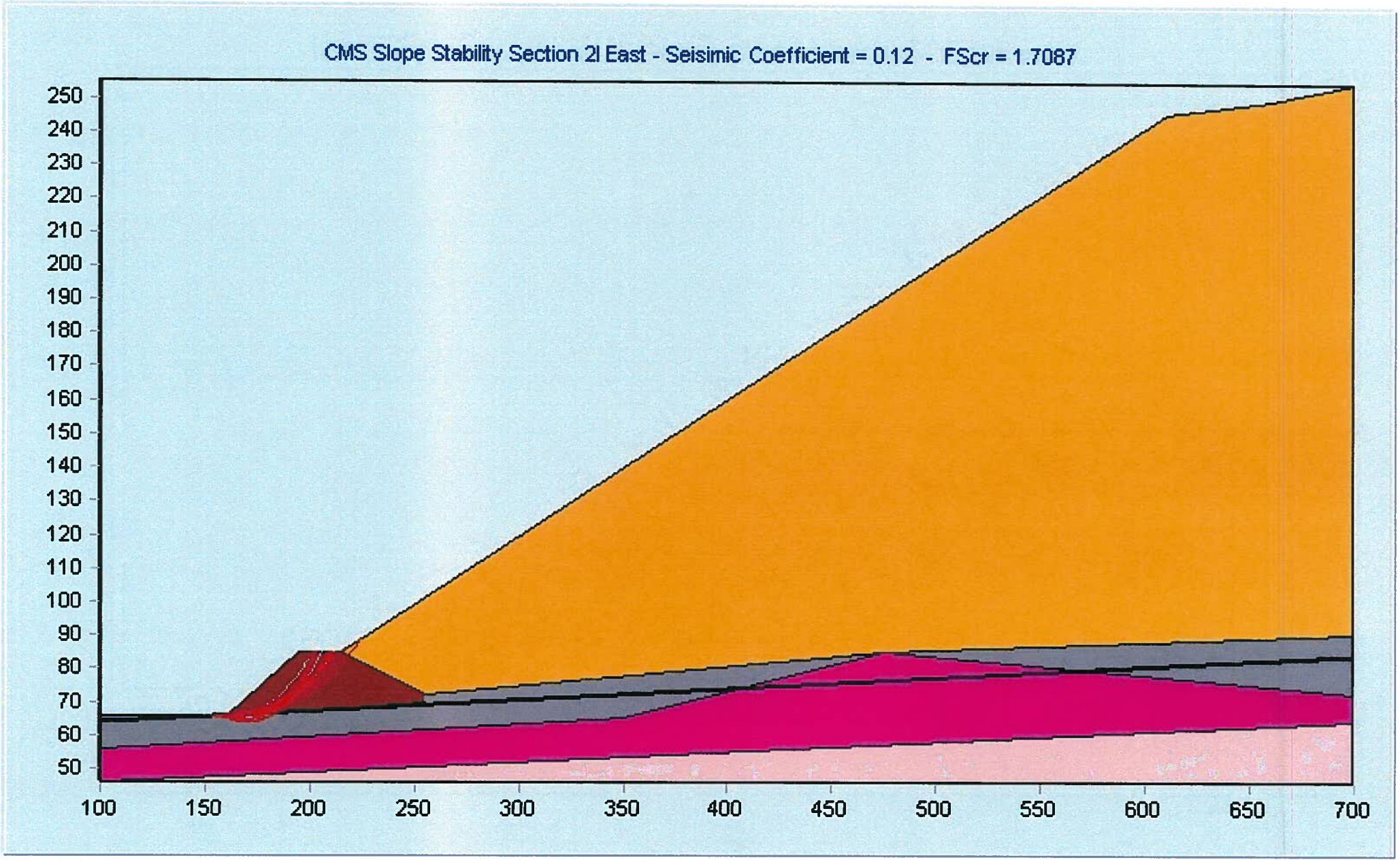
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230
220
210
200
190
180
170
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150
140
130
120
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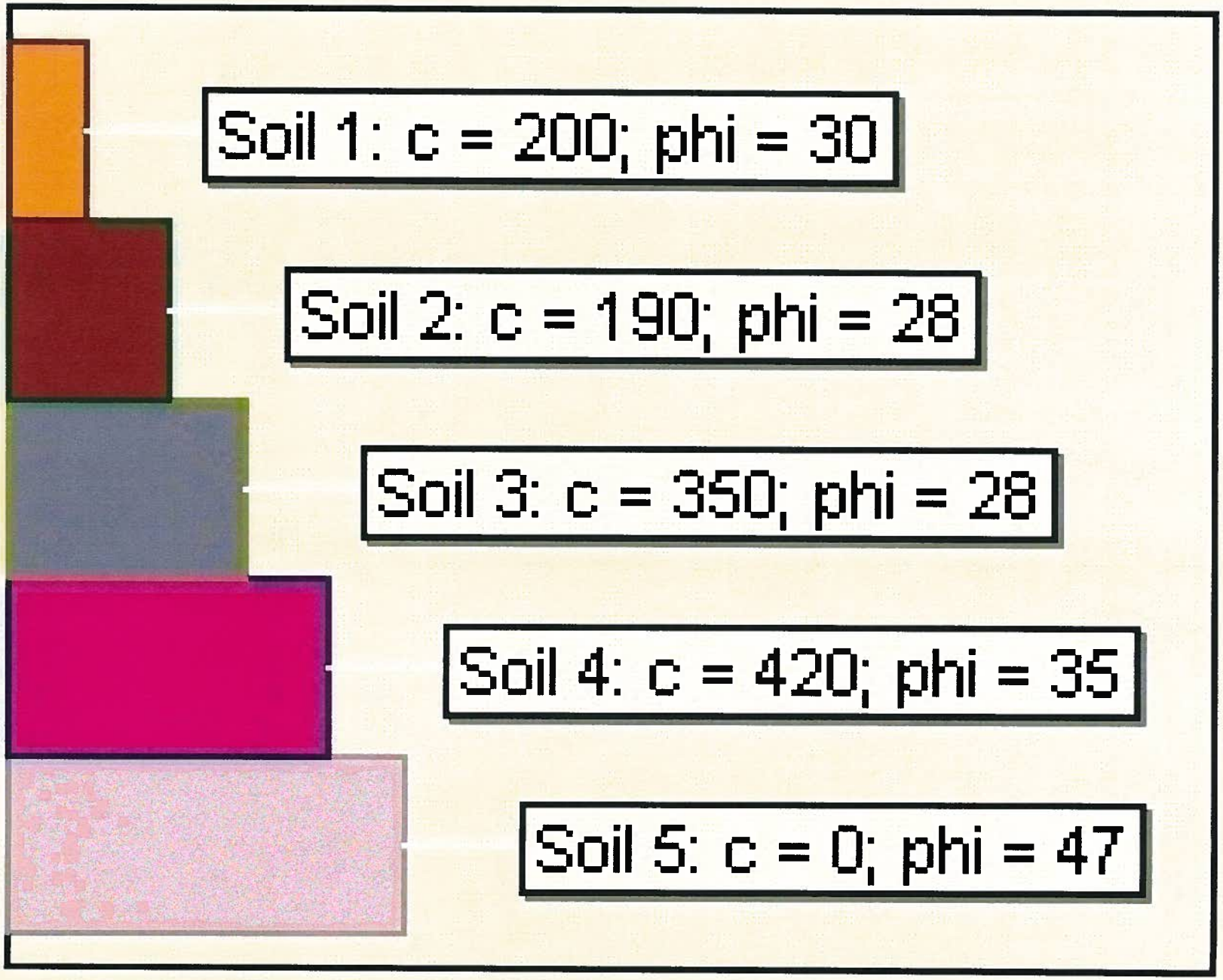
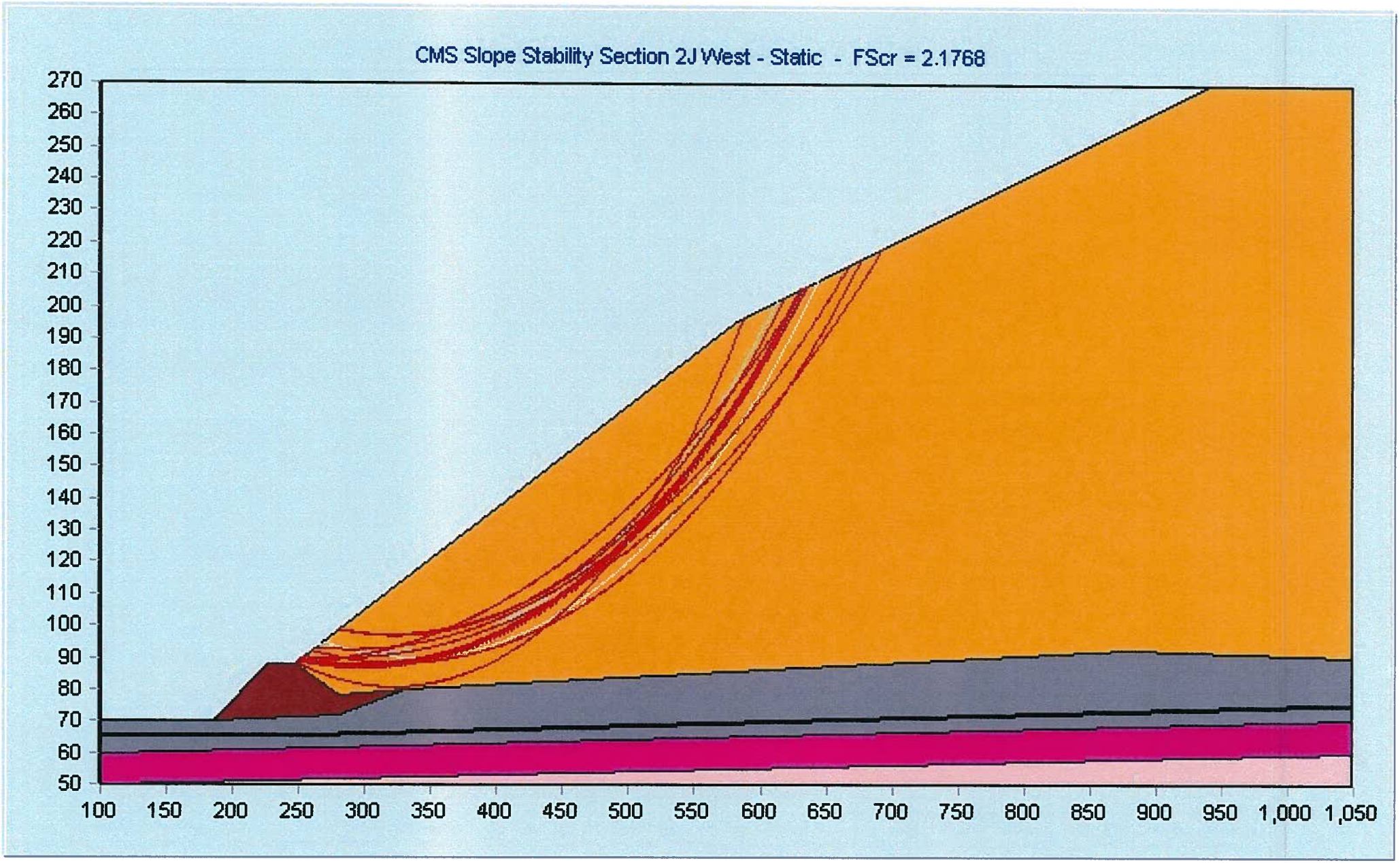

Soil 1: c = 200; phi = 30
Soil 2: c = 190; phi = 28
Soil 3: c = 350; phi = 28
Soil 4: c = 420; phi = 35
Soil 5: c = 0; phi = 47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200
190
180
170
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120
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100
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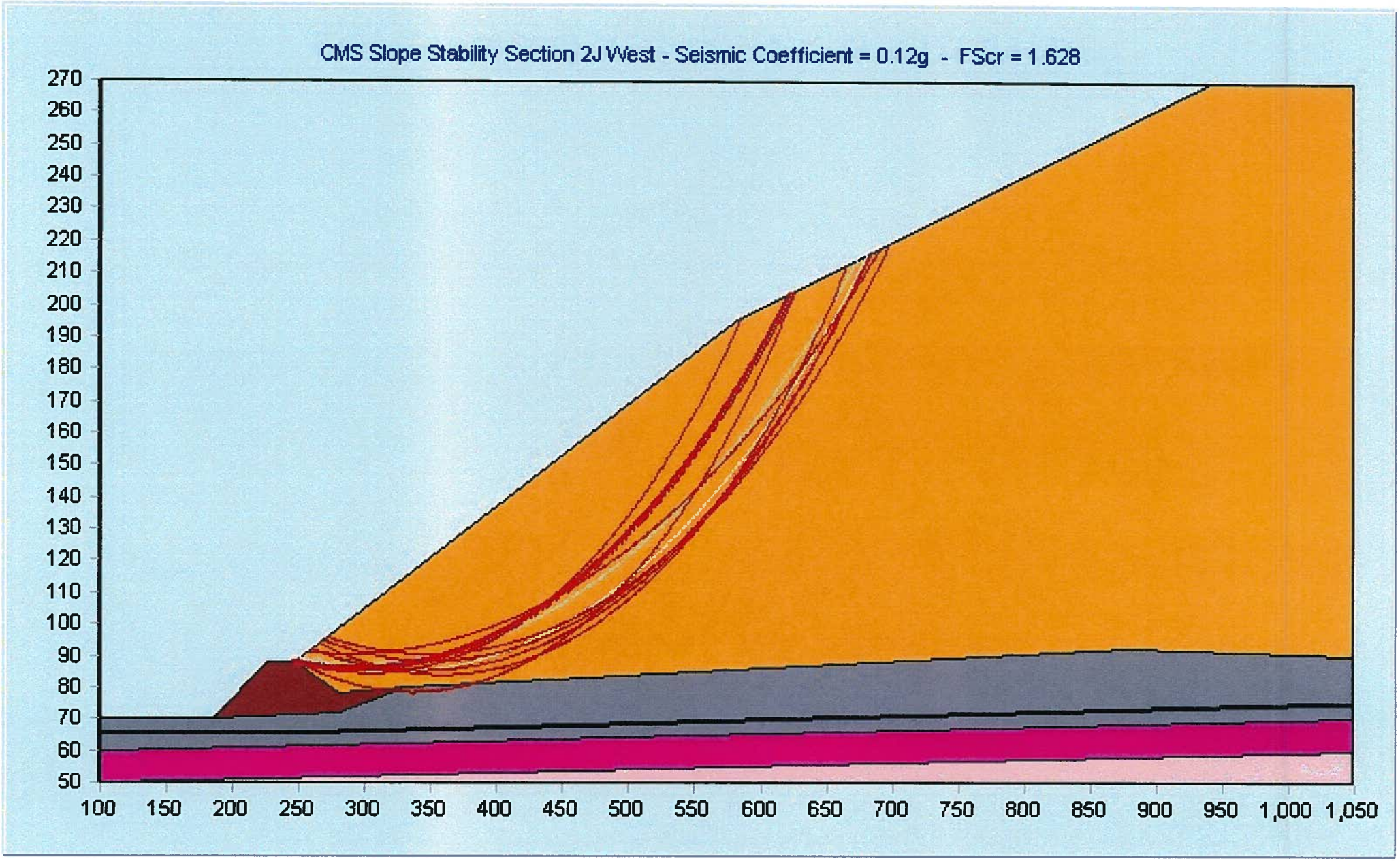
850
900
950
1,000
1,050


CMS Slope Stability Section 2J West - Seismic Coefficient = 0.12g - FScr = 1.628
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100
150
200
250
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350
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500
550
600
650
700
750
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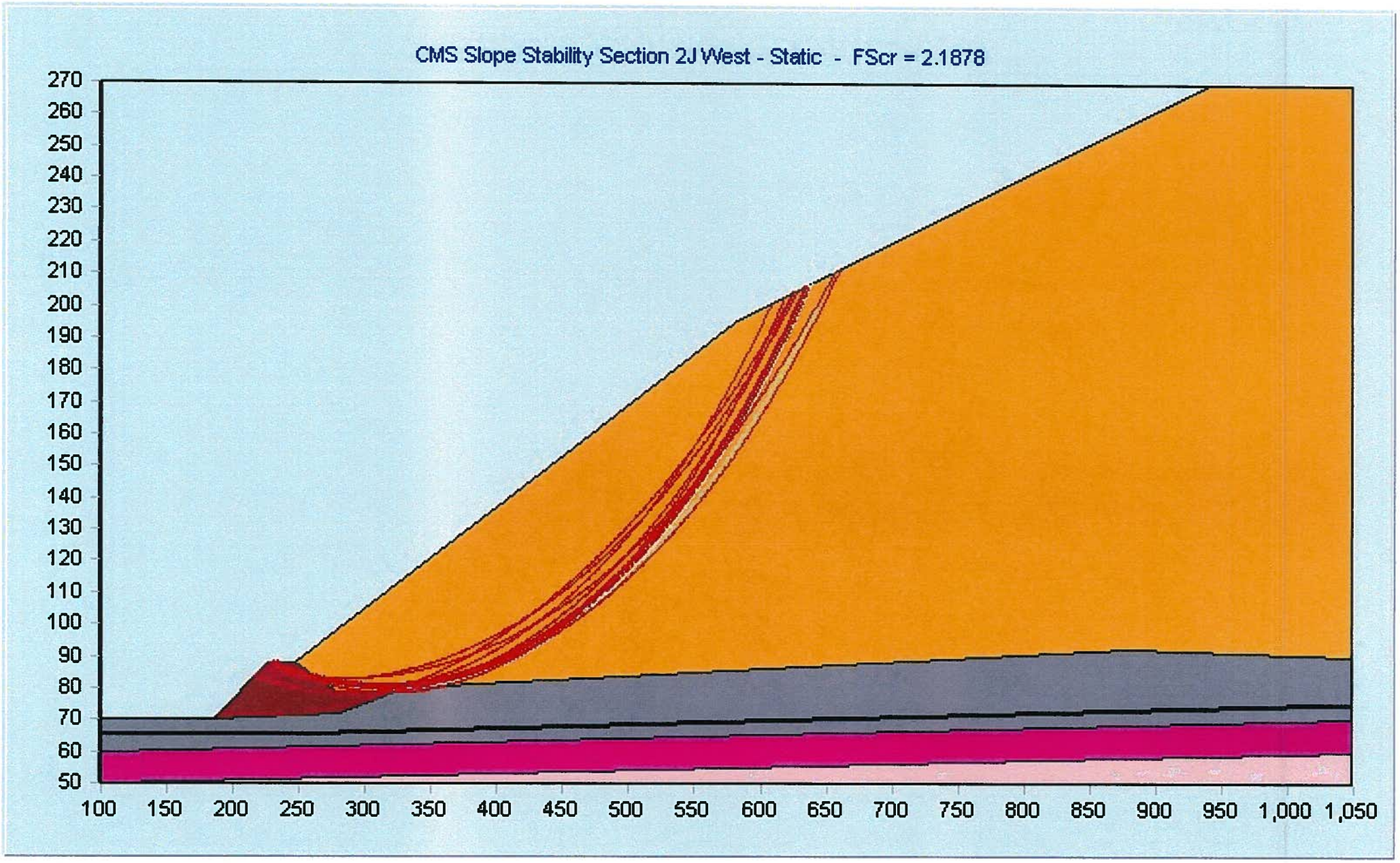
1,050


CMS Slope Stability Section 2J West - Static - FScr = 2.1878
270
260
250
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210
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170
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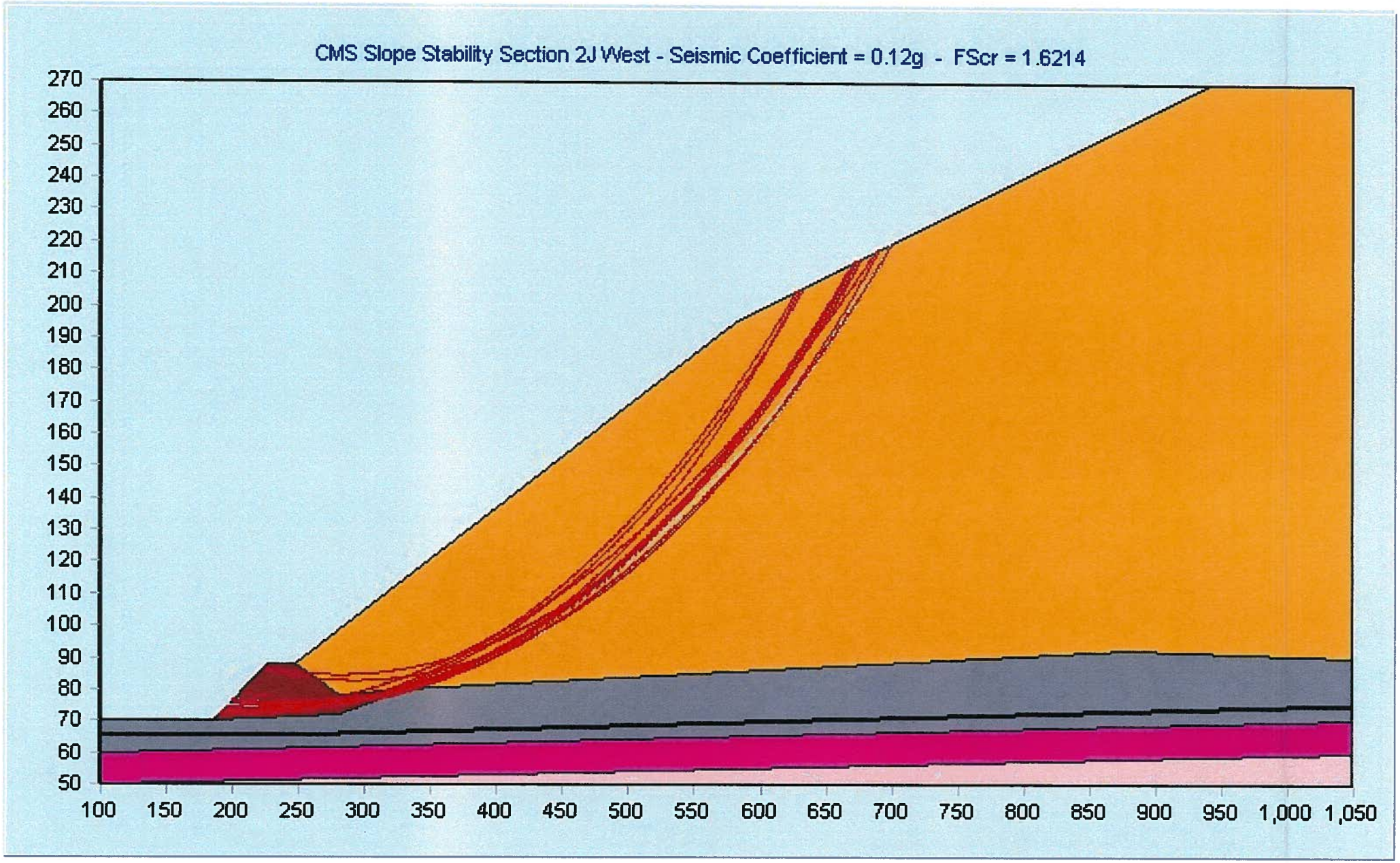
CMS Slope Stability Section 2J West - Seismic Coefficient = 0.12g - FScr = 1.6214
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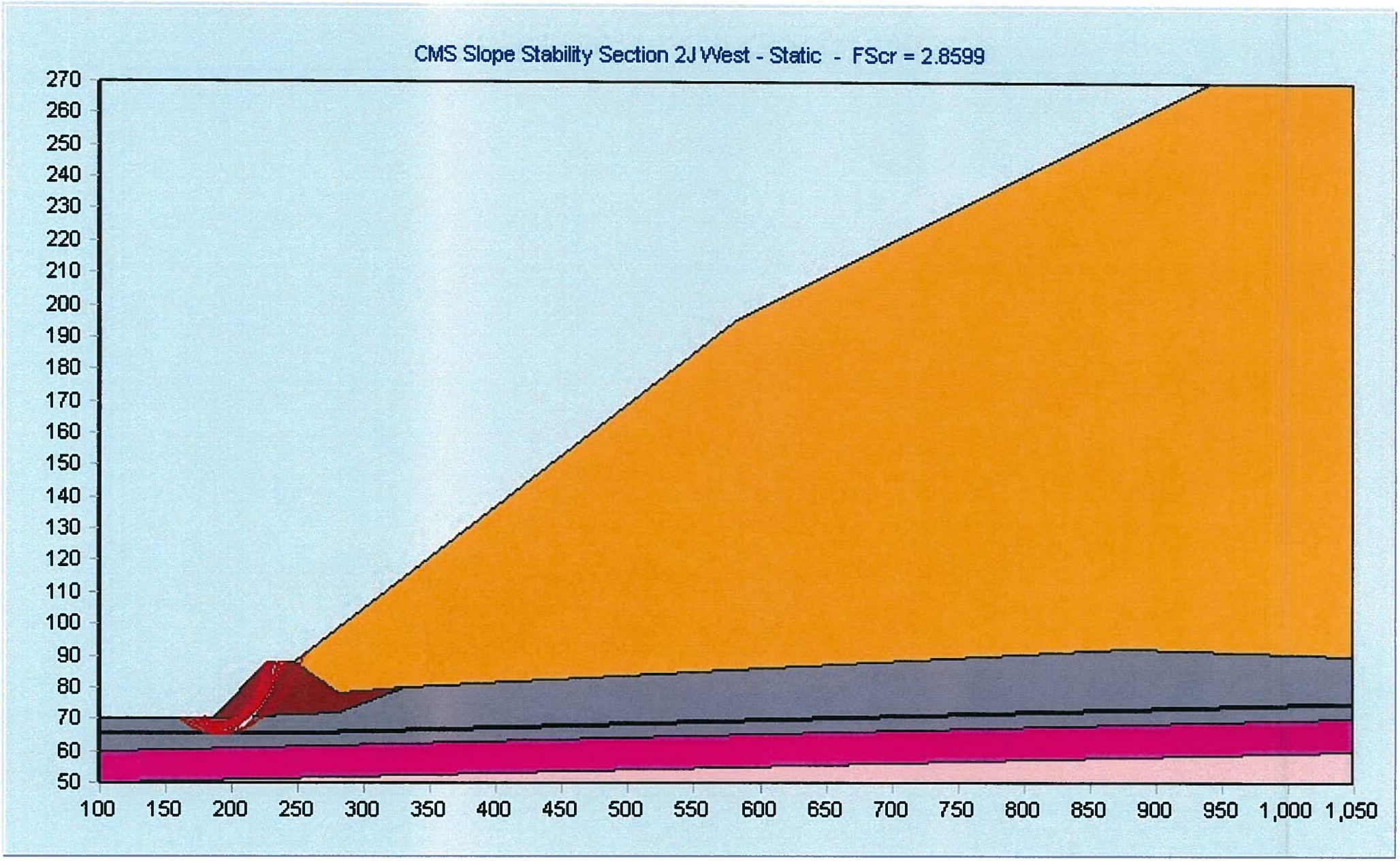
CMS Slope Stability Section 2J West - Static - FScr = 2.8599
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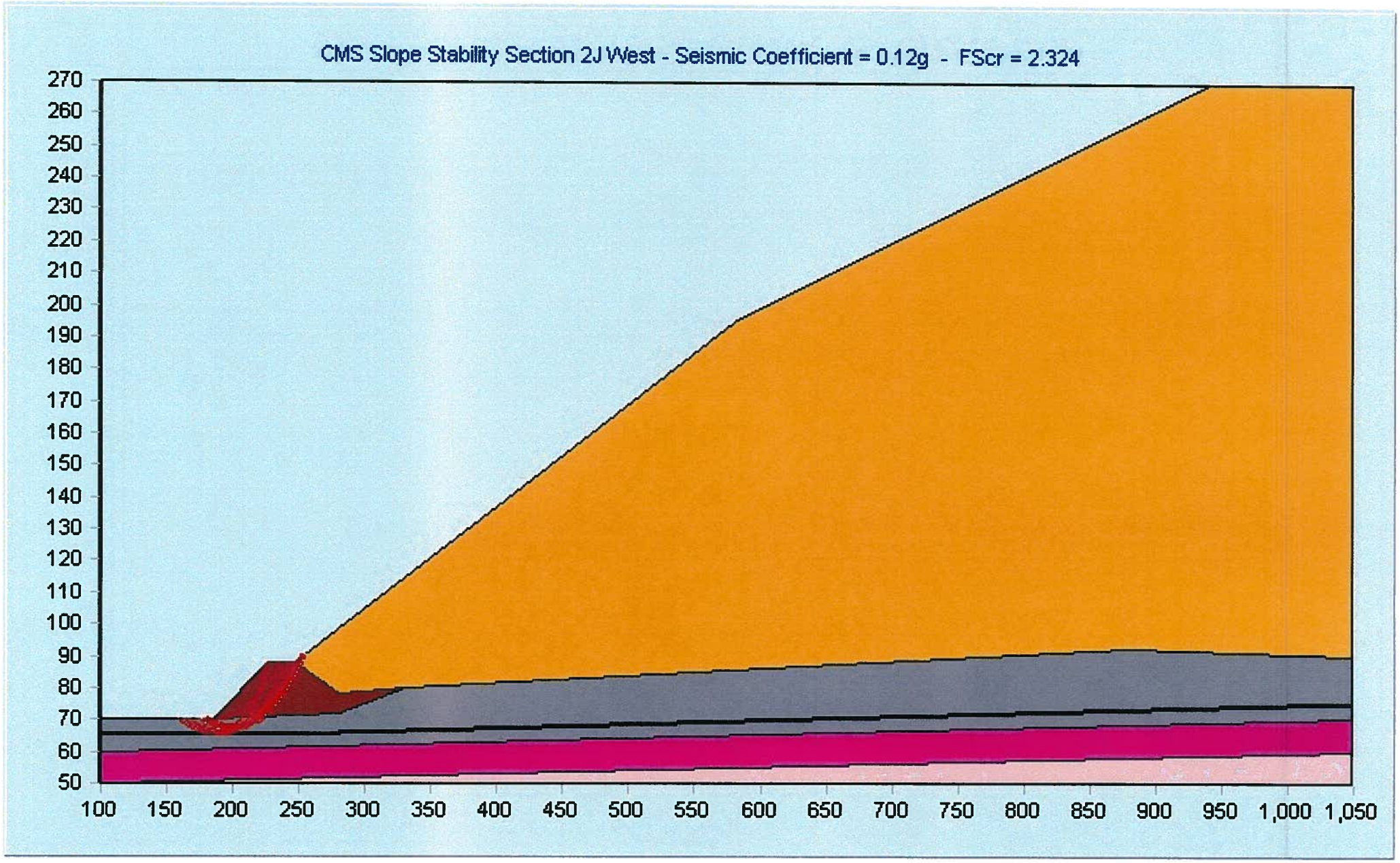
CMS Slope Stability Section 2J West - Seismic Coefficient = 0.12g - FScr = 2.324
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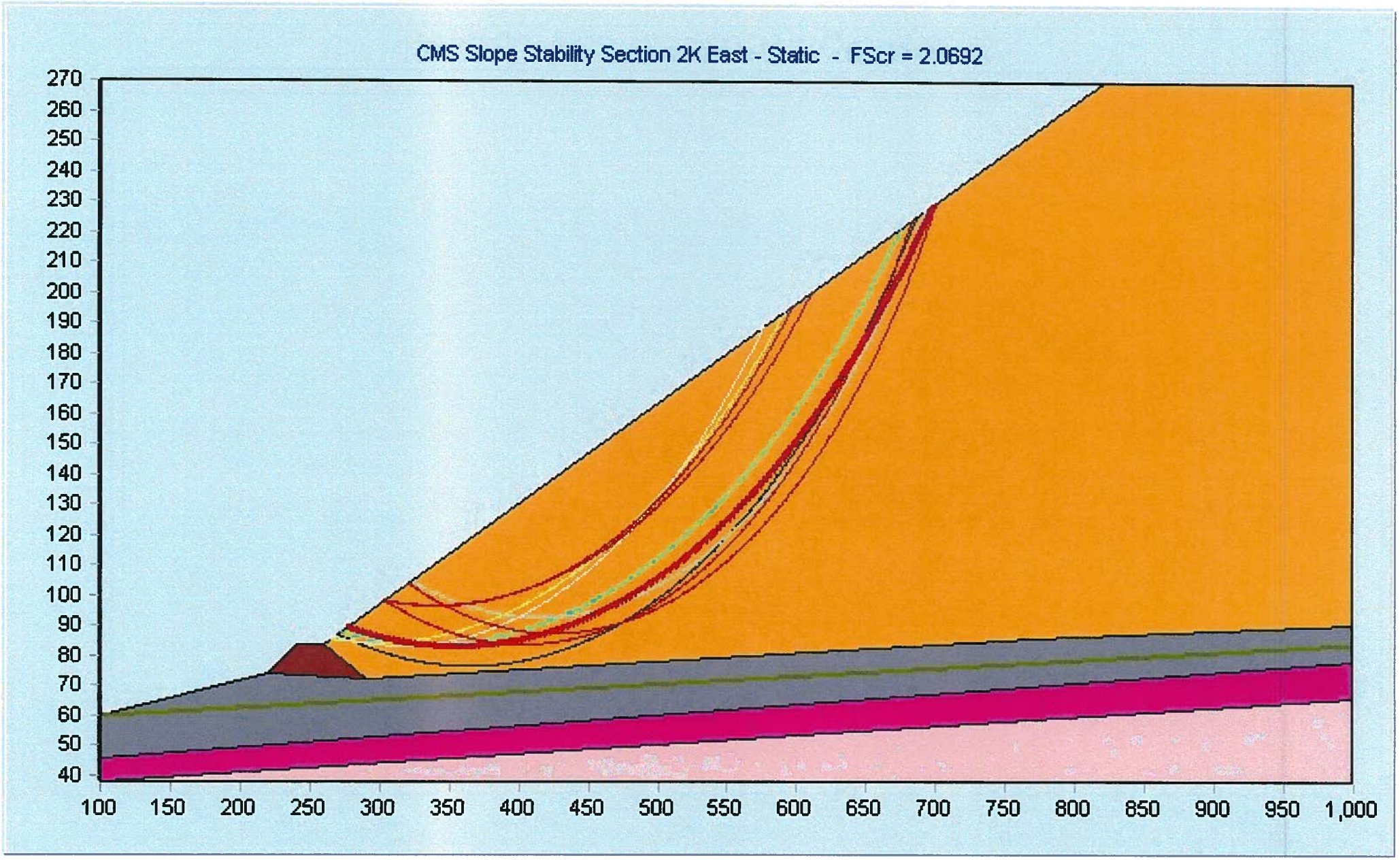
CMS Slope Stability Section 2K East - Static - FScr = 2.0692
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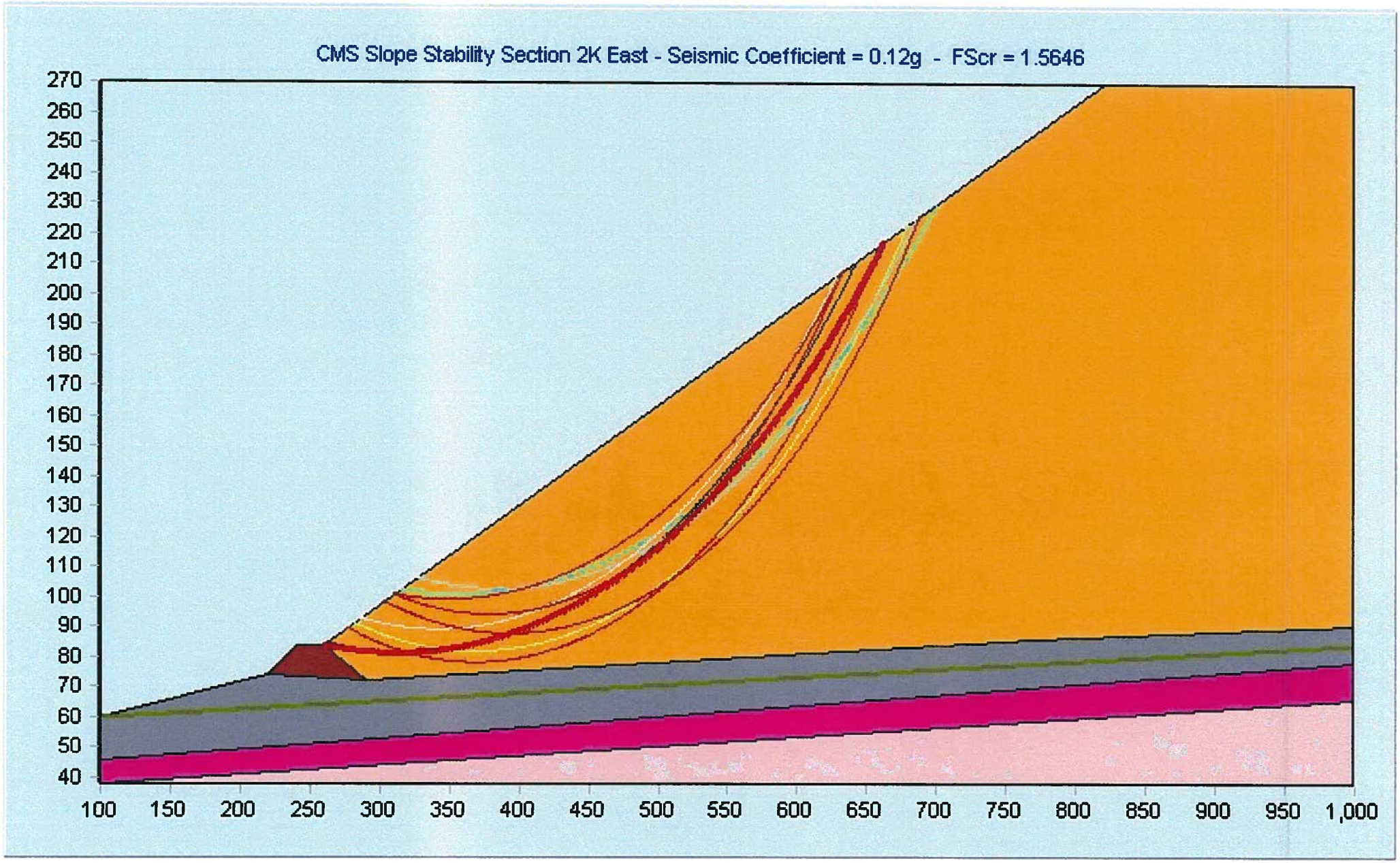
CMS Slope Stability Section 2K East - Seismic Coefficient = 0.12g - FScr = 1.5646
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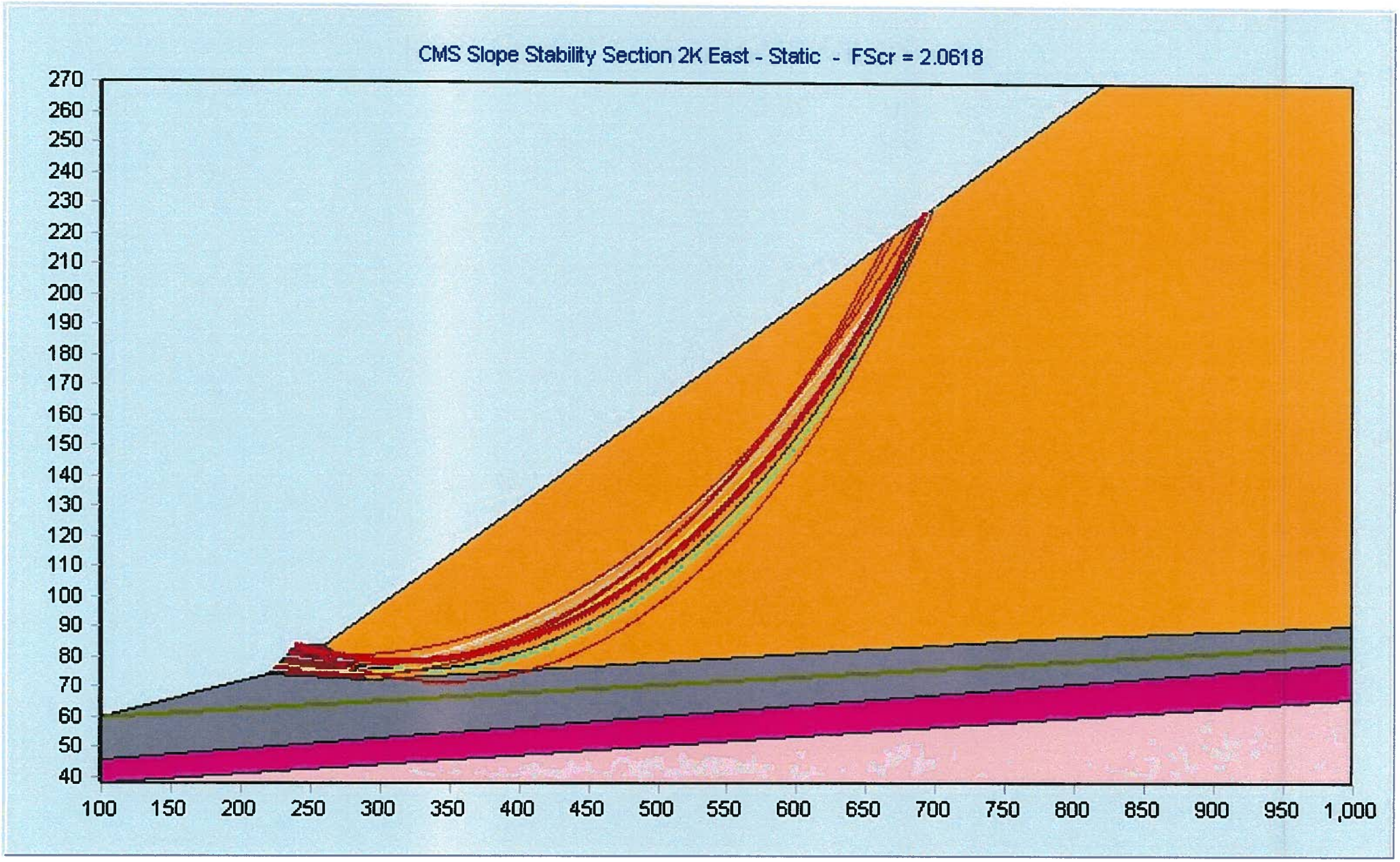
CMS Slope Stability Section 2K East - Static - FScr = 2.0618
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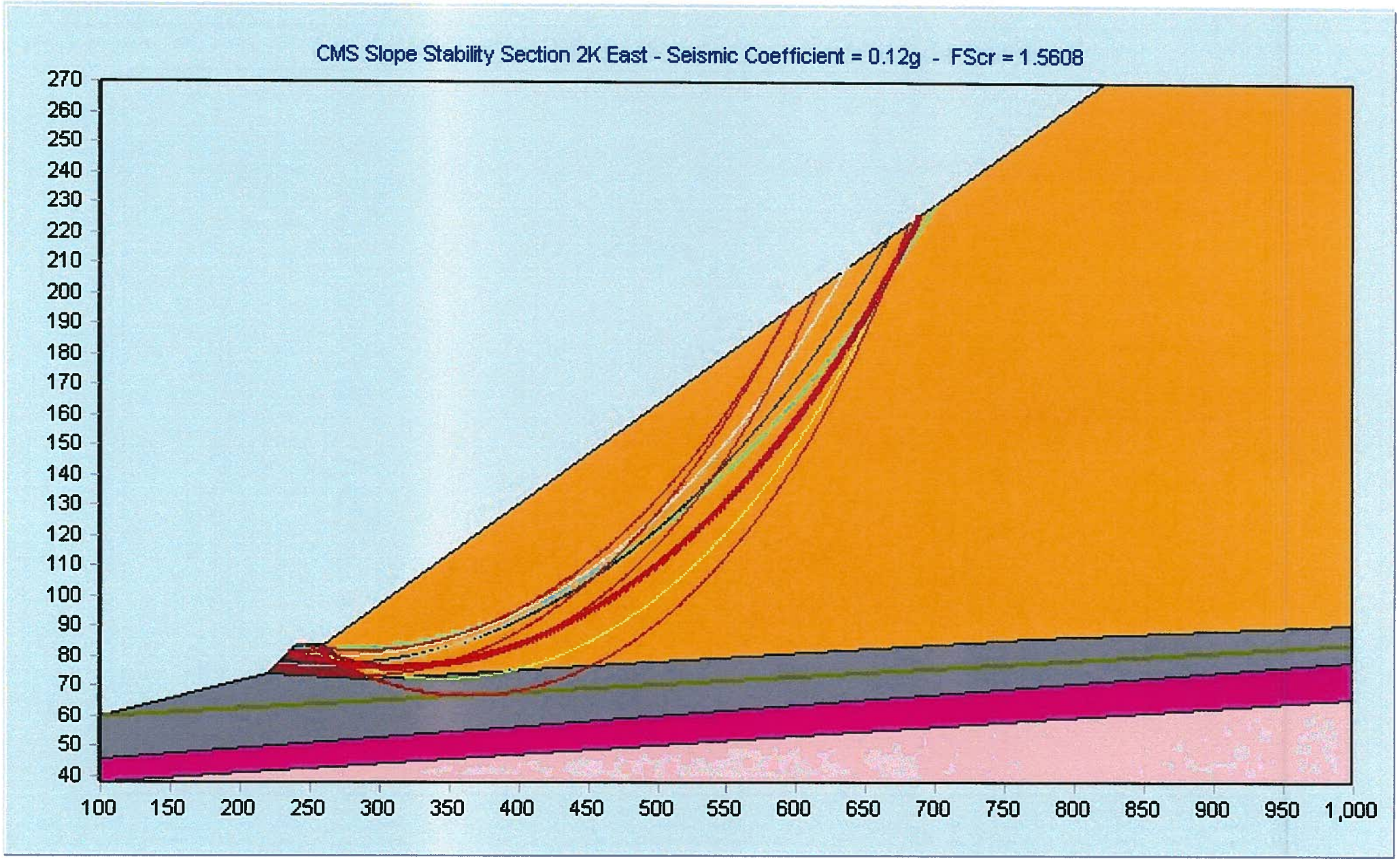
CMS Slope Stability Section 2K East - Seismic Coefficient = 0.12g - FScr = 1.5608
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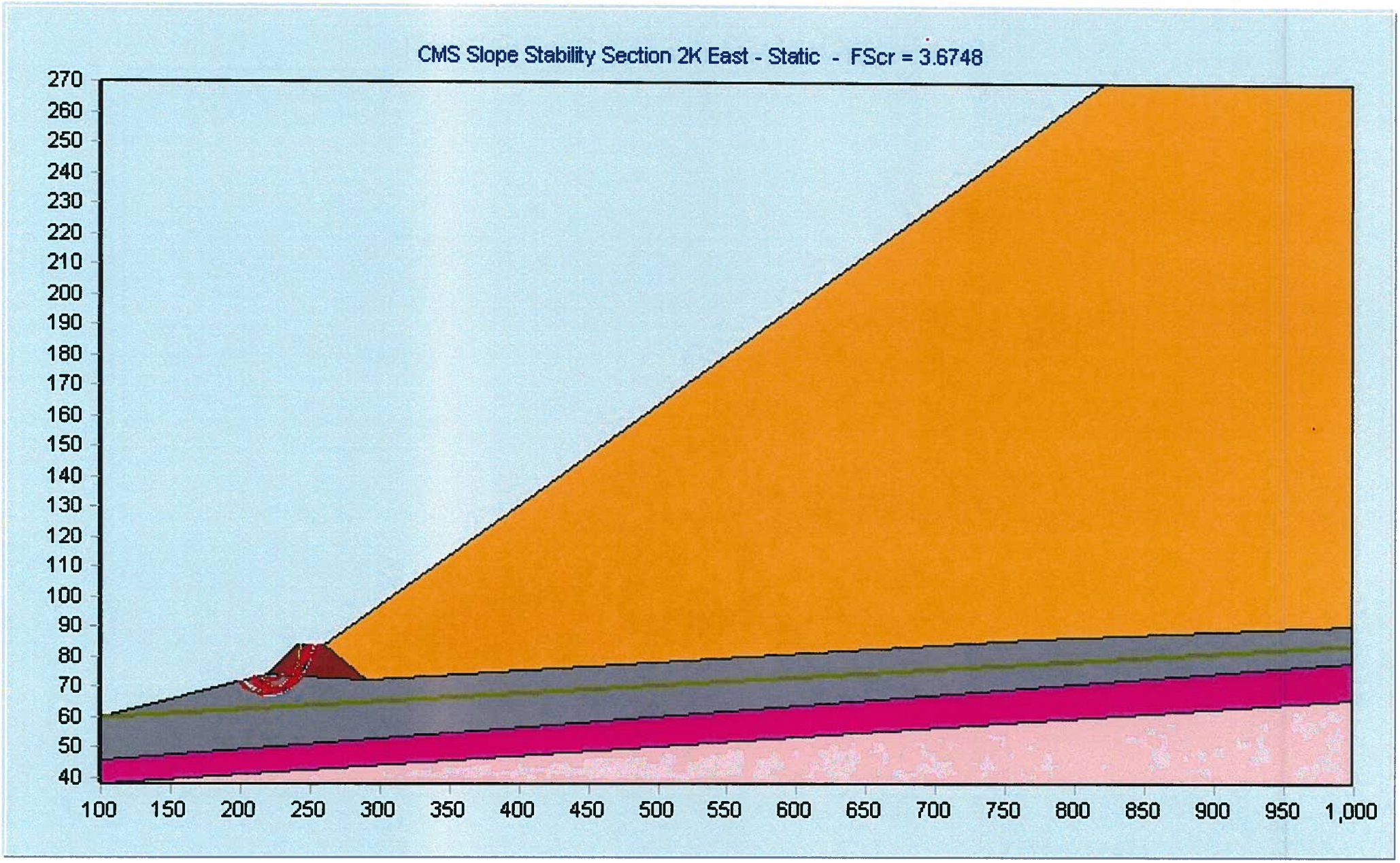
CMS Slope Stability Section 2K East - Static - FScr = 3.6748
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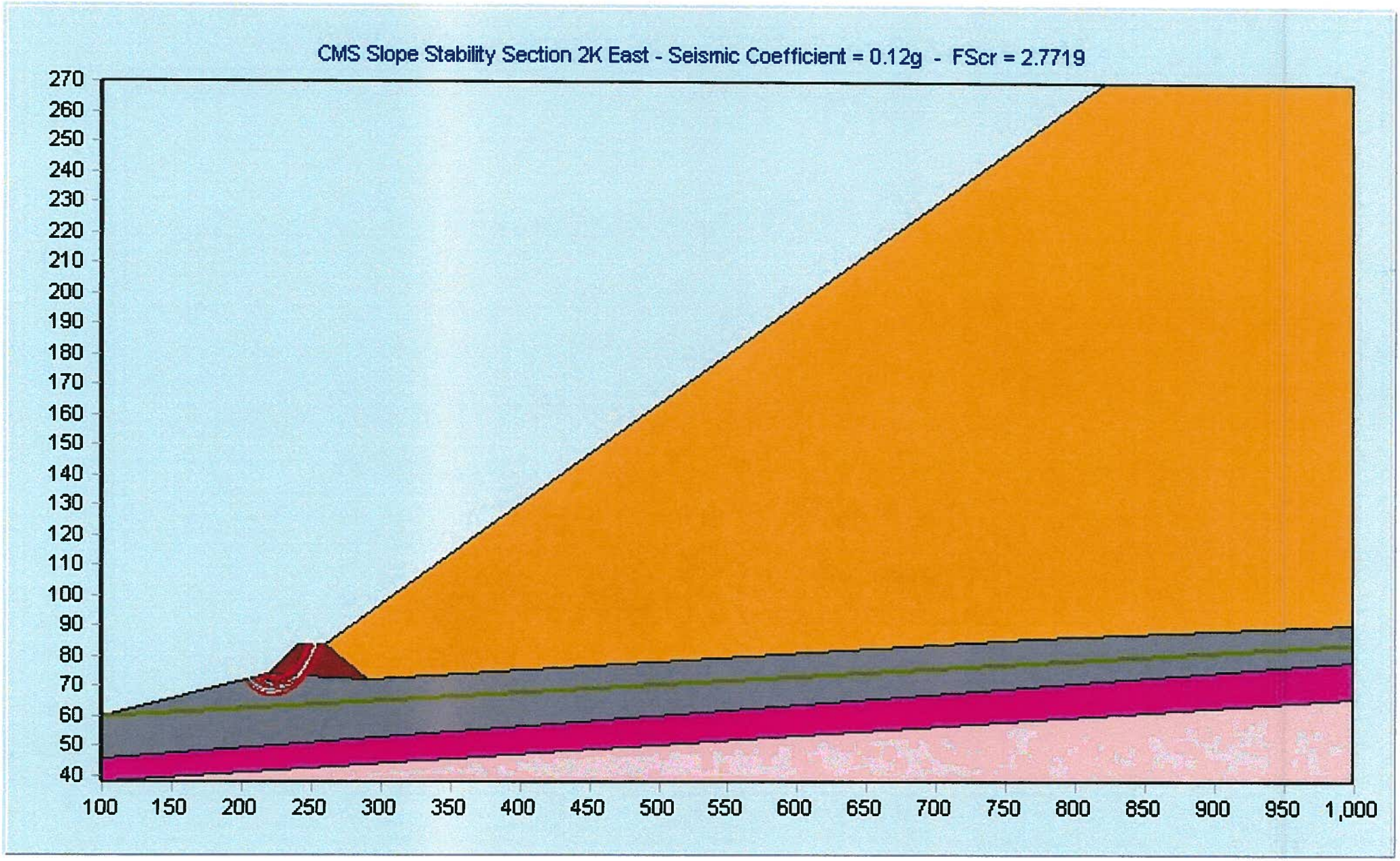
CMS Slope Stability Section 2K East - Seismic Coefficient = 0.12g - FScr = 2.7719
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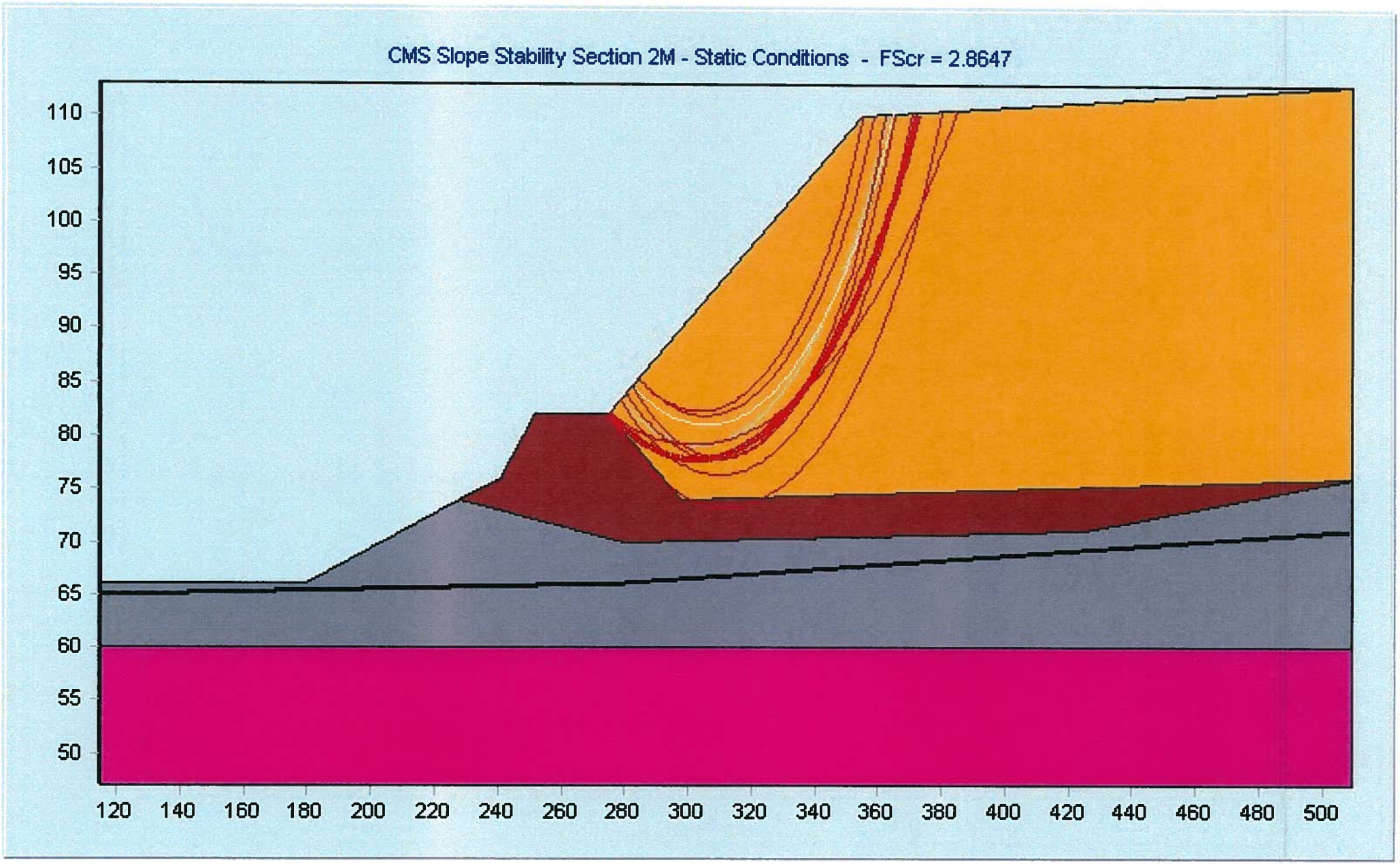
CMS Slope Stability Section 2M - Static Conditions - FScr = 2.8647
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105
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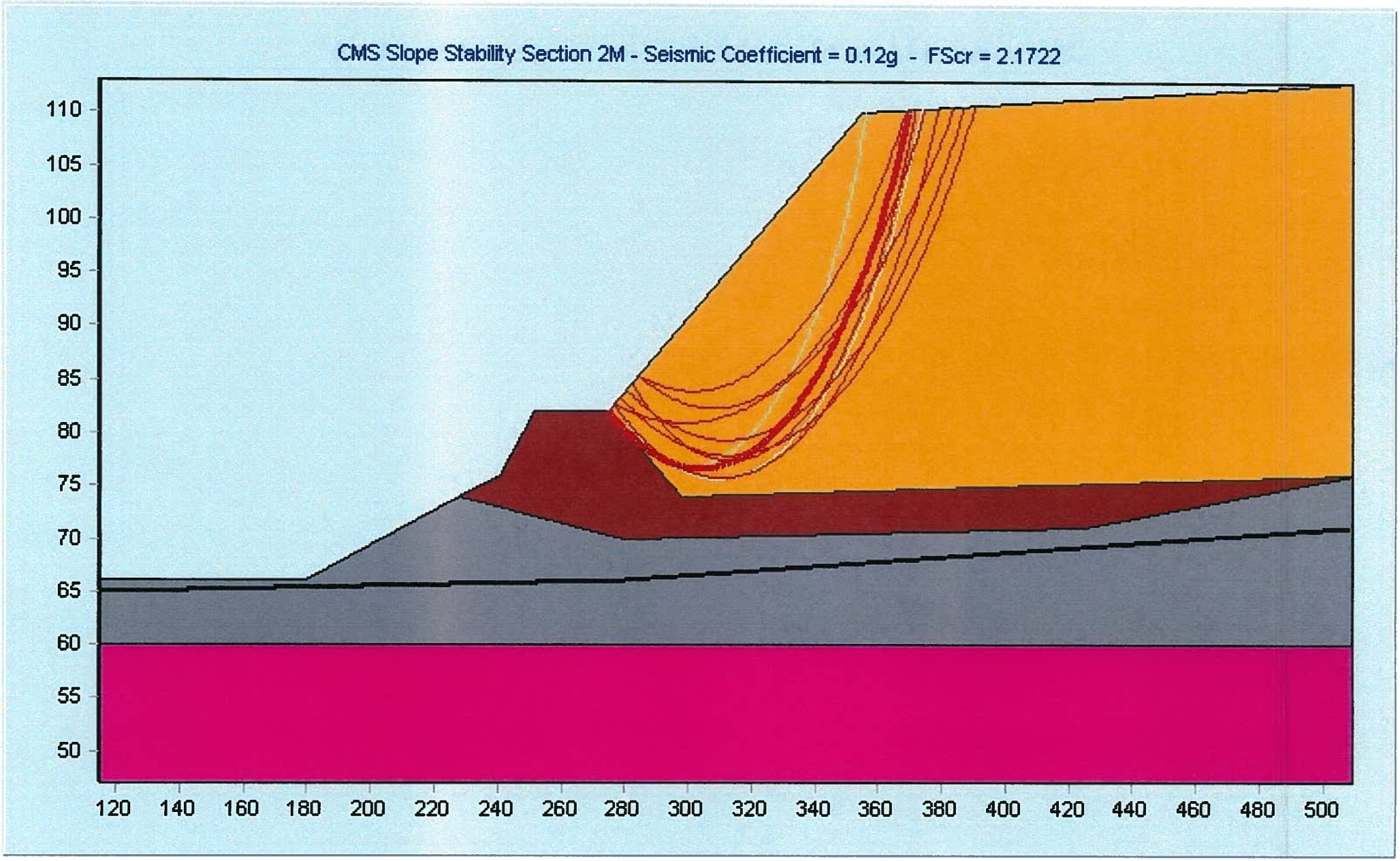
CMS Slope Stability Section 2M - Seismic Coefficient = 0.12g - FScr = 2.1722
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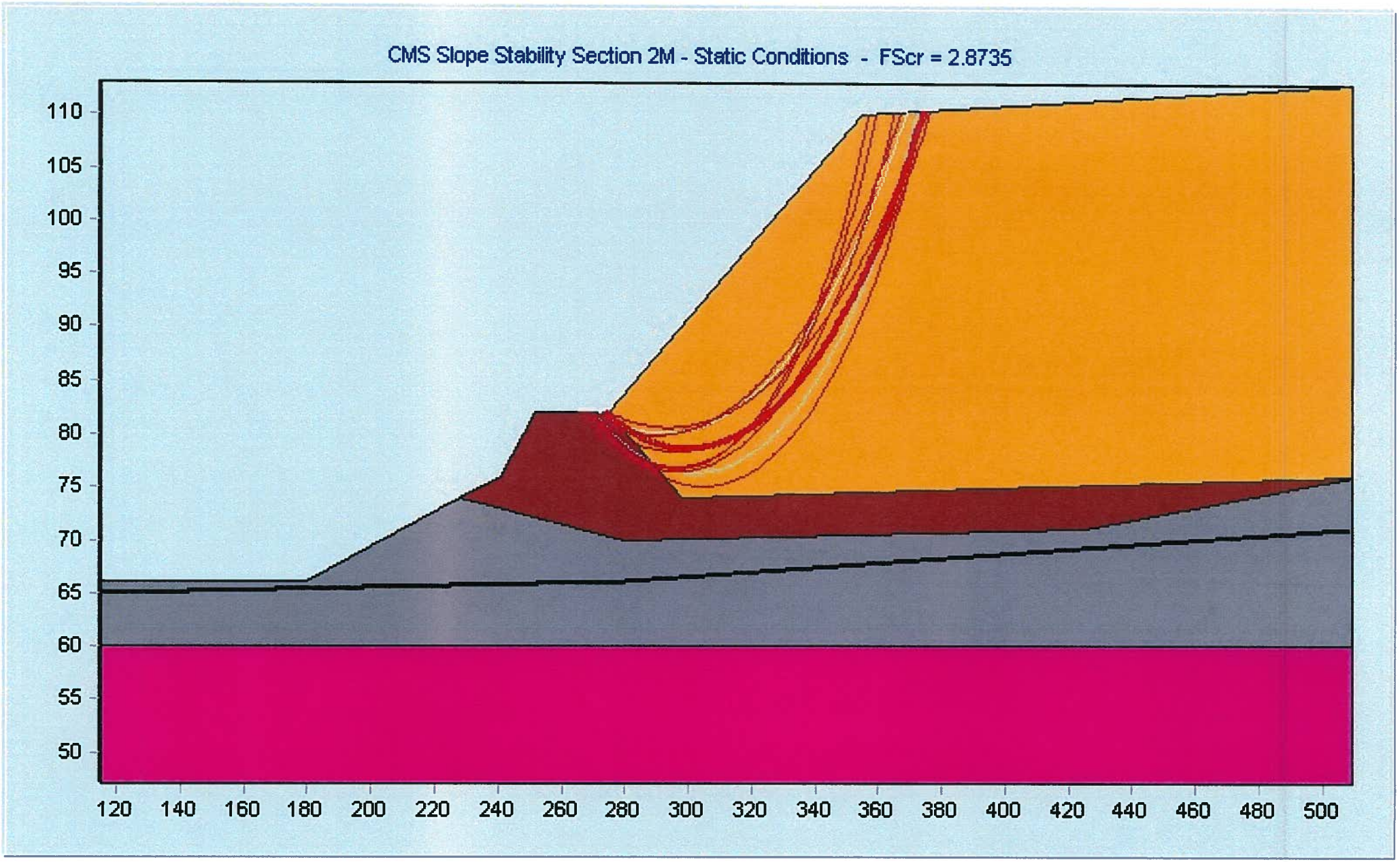
CMS Slope Stability Section 2M - Static Conditions - FScr = 2.8735
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105
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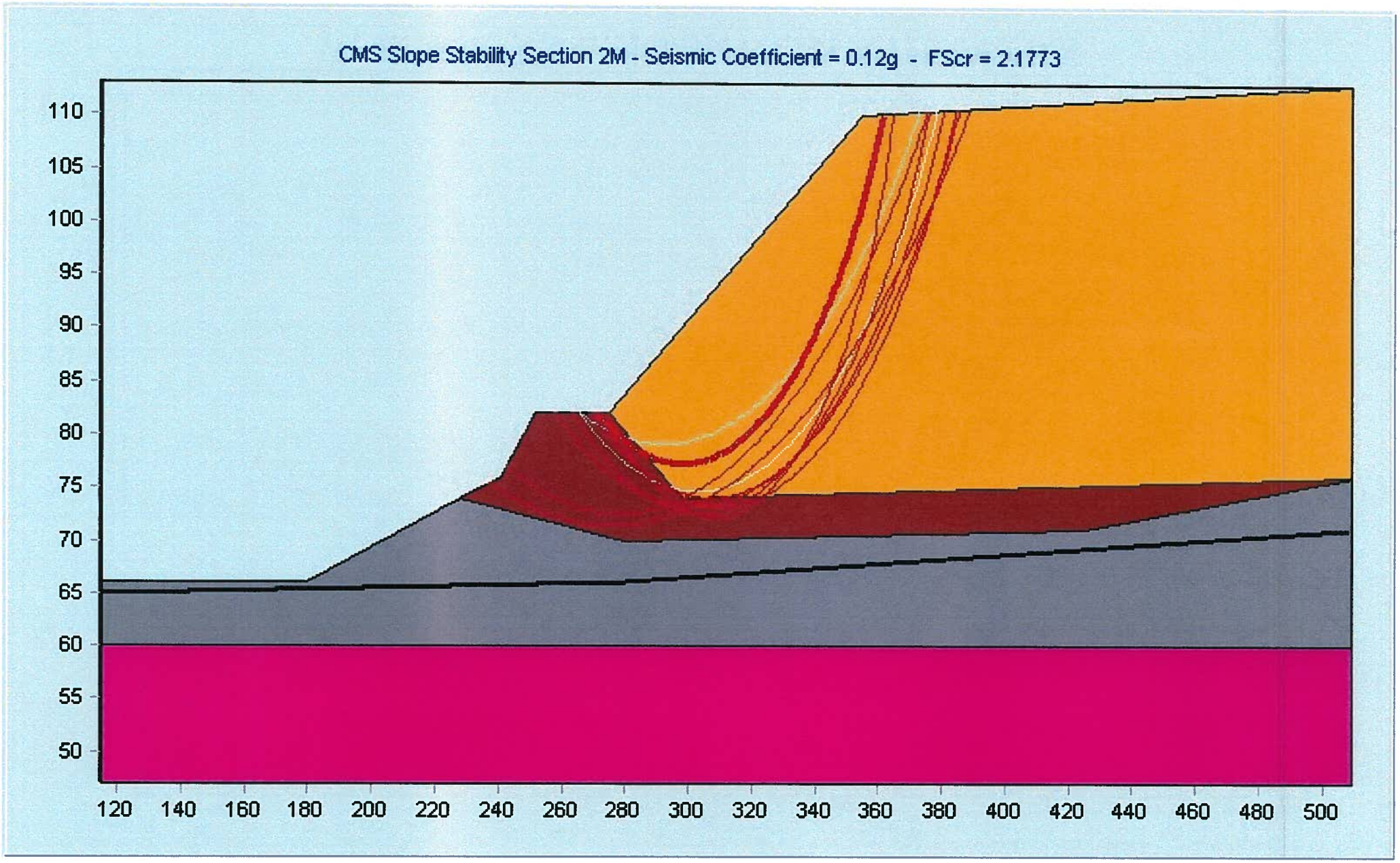
CMS Slope Stability Section 2M - Seismic Coefficient = 0.12g - FScr = 2.1773
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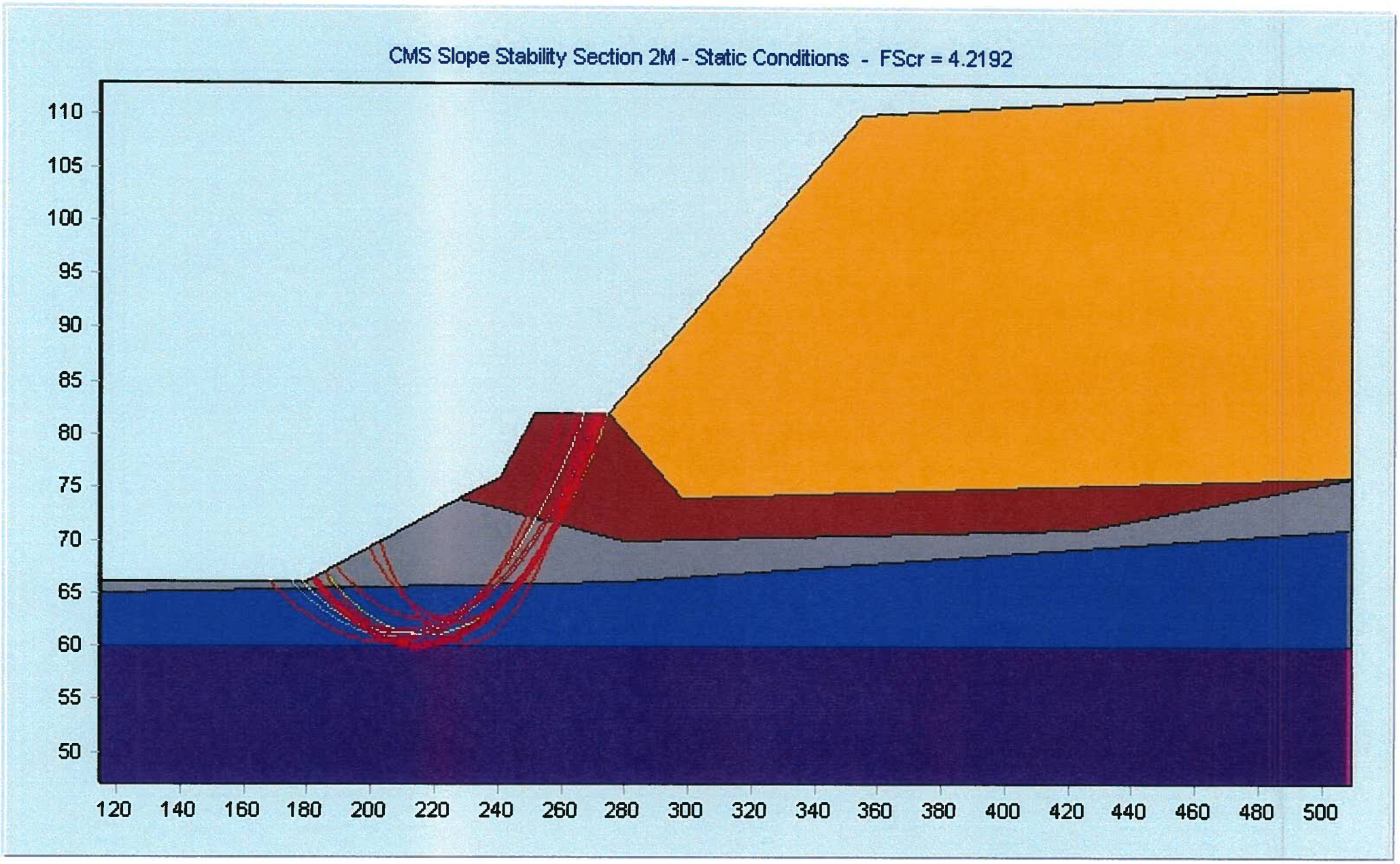
CMS Slope Stability Section 2M - Static Conditions - FScr = 4.2192
110
105
100
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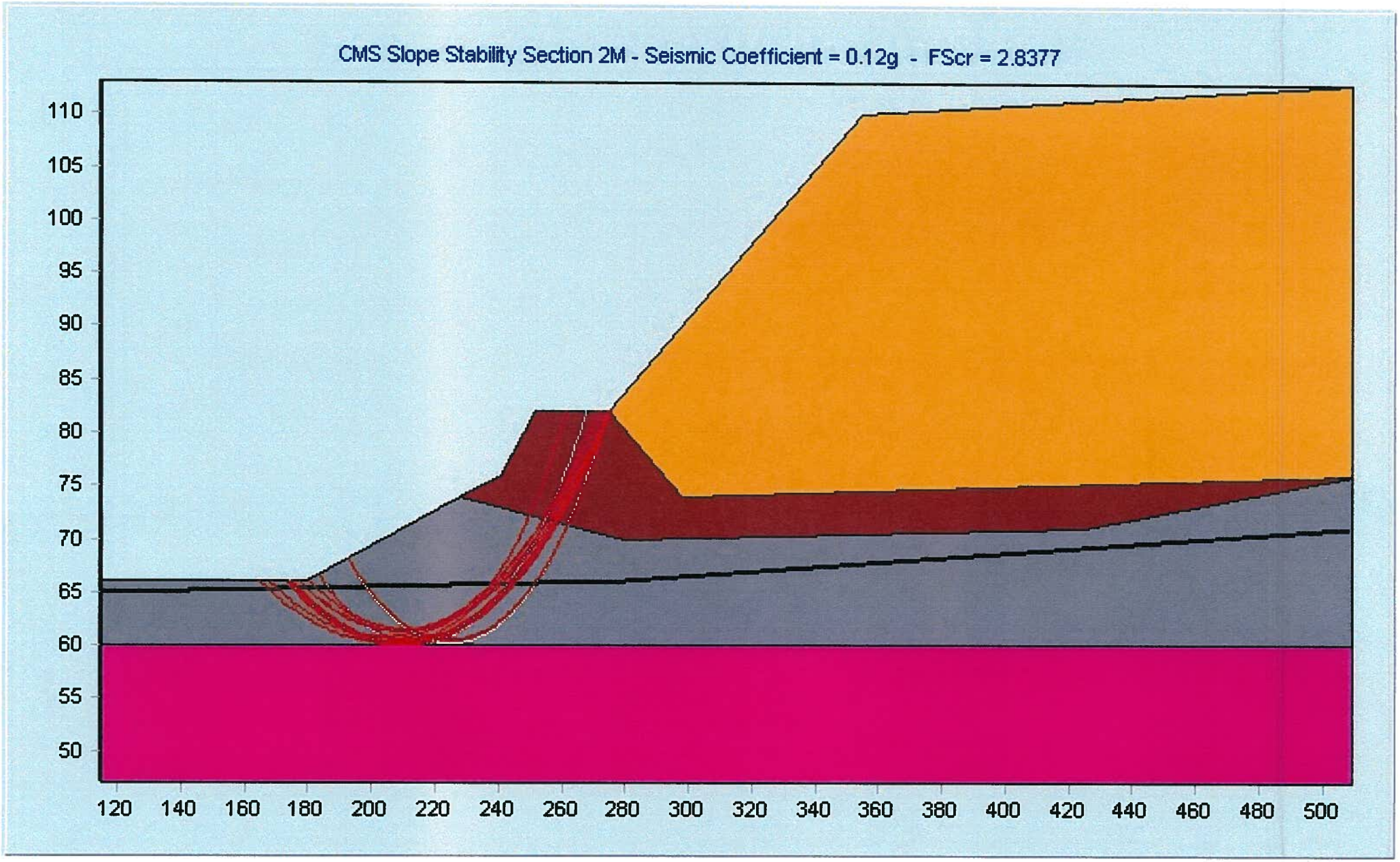
CMS Slope Stability Section 2M - Seismic Coefficient = 0.12g - FScr = 2.8377
110
105
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60
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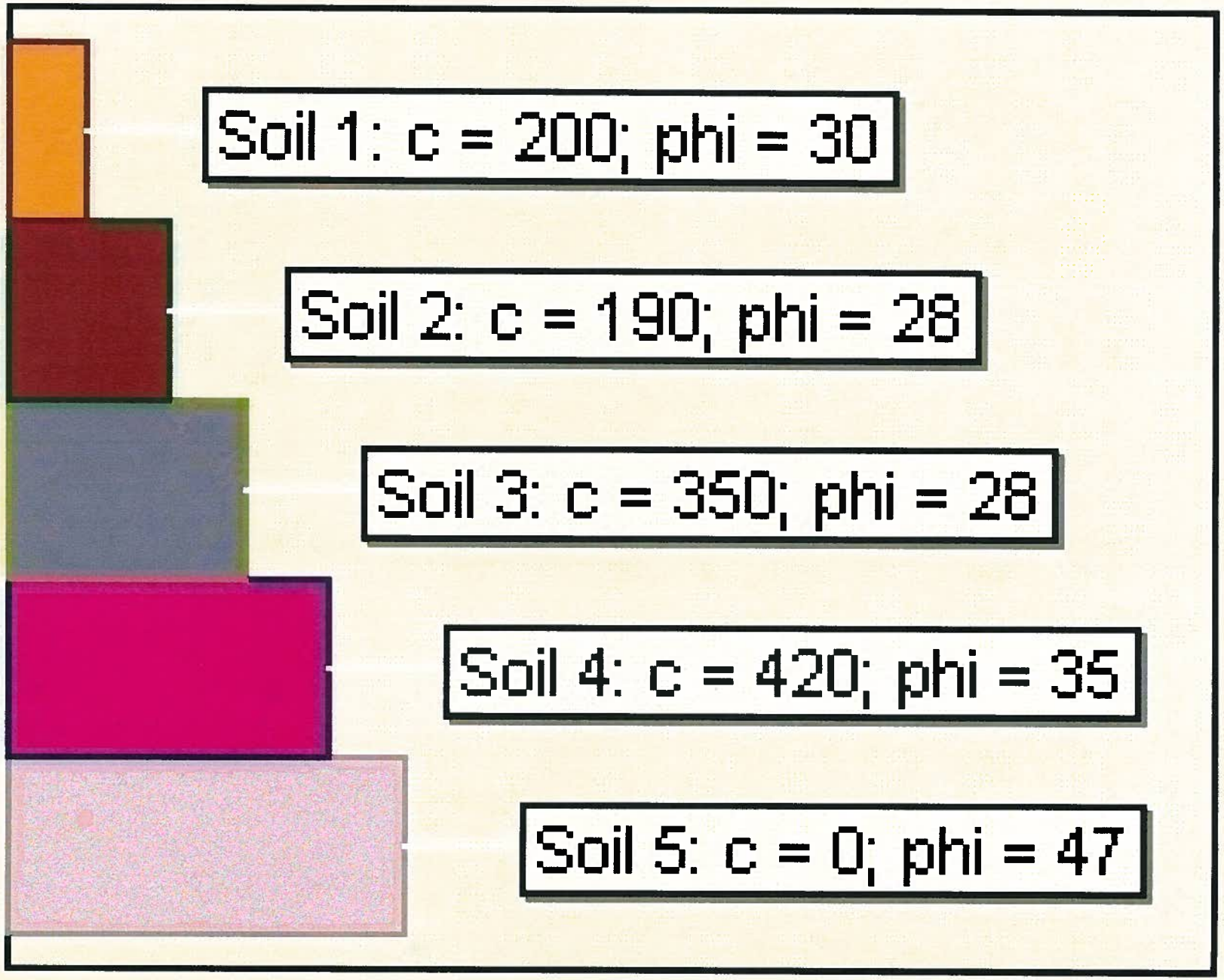
Soil 1: c = 200; phi = 30
Soil 2: c = 190; phi = 28
Soil 3: c = 350; phi = 28
Soil 4: c = 420; phi = 35
Soil 5: c = 0; phi = 47

# APPENDIX B

## Calculations for Settlement and Groundwater and Bedrock Separation

**Project:** CMS Landfill Phase 3 Permit Modification
**Subject:** Landfill Subgrade and Soil Liner Settlement Calculations
Summary of Soil Liner and Groundwater/Bedrock Separation
**Date:** July 20, 2010
**Calc'd by:** ADG **Checked by:** CDH

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**Objective:** Estimate the primary consolidation settlement of the proposed landfill bottom liner system subgrade and low permeability clay soil liner. Also, calculate the strain exerted on the bottom liner system geomembrane liner due to differential settlement and the landfill bottom liner system slope due to differential settlement. In addition, estimate the separation distance between the bottom of the soil liner after settlement and seasonal high groundwater and bedrock elevations.

**Reference:**

1. "Geotechnical Aspects of Landfill Design and Construction". Xuede Qian, R.M. Koerner and D.H. Gray; (2002).

2. "Essentials of Soil Mechanics and Foundations, Basic Geotechnics, Sixth Edition." David F. McCarthy; (2002).

3. Boring logs and soils laboratory testing data from the Design Hydrogeologic Report for CMS Landfill Dated August 2008 prepared by David Garrett and Associates.

3. Soil liner laboratory testing data for Cell 2H Construction; Final Certification Report – Construction Quality Assurance Services Dated August 2009 prepared by ACC of North Carolina, PLLC.

4. Figure 3 and 4 - Settlement Evaluation (attached).

**Method:** Primary consolidation settlement calculations were performed for subgrade materials and a 2-foot clay soil liner. Due to the fact that all subgrade and liner soils will be inorganic and compacted or re-compacted to at least 95% of the Standard Proctor Maximum Dry Density, it is assumed that secondary consolidation settlement will be negligible.

Soil parameters used for existing (in-situ) soils, as well as, added structural fill were supplied by boring logs and corresponding soils laboratory testing results within the landfill footprint from the Design Hydrogeologic Report for CMS Landfill (Ref: 3) and for the low permeability clay soil liner from the Cell 2H Construction; Final Certification Report – Construction Quality Assurance Services (Ref: 4).

| Definition of Terms | |
|---|---|
| $Z_c$ | primary consolidation settlement, ft |
| $\Delta Z_c$ | differential settlement between two points, ft |
| $L_{INT}$ | geomembrane initial length, ft |
| $L_{FNL}$ | geomembrane final length, ft |
| $\varepsilon$ | geomembrane strain, % |
| $C_c$ | compression index |
| C' | bearing capacity index |
| $H_o$ | initial thickness of compressible layer, ft |
| N | SPT blow count |
| N' | corrected SPT blow count |
| $e_o$ | initial void ratio of compressible layer |
| $\sigma_o$ | initial vertical stress, lb/ft$^2$ (at center of soil stratum) |
| $\Delta\sigma$ | increase in vertical stress due to additional loadings, lb/ft$^2$ |
| $\gamma_o$ | overburden soil density, lb/ft$^3$ |
| $\gamma_s$ | subgrade soil density, lb/ft$^3$ |
| $h_o$ | height of overburden, ft |
| $\gamma_{waste}$ | waste density, lb/ft$^3$ |
| $h_{waste}$ | final height of waste, ft |

The following equation (one-dimensional compression theory) was used to determine primary consolidation settlement of the subgrade and clay liner soils:

$$Z_c = C_c \frac{H_o}{1+e_o} * \log \frac{\sigma_o + \Delta\sigma}{\sigma_o}$$

$$Z_c = \frac{H_o}{C'} * \log \frac{\sigma_o + \Delta\sigma}{\sigma_o}$$

where: $C_c$ = compression index;

C' = bearing capacity index;

$H_o$ = initial thickness of compressible layer (feet);

$e_o$ = initial void ratio of compressible layer;

$\sigma_o$ = initial vertical stress at the center soil stratum (lb/ft$^2$); and

$\Delta\sigma$ = increase in stress due to additional loadings (lb/ft$^2$).

**Assumptions:** Values for $C_c$ and $e_o$ for the soil liner were obtained from laboratory testing data (Ref: 4).

Bearing capacity index and soil classification was determined from soil borings SPT data (Ref: 3).

Subgrade settlement was calculated throughout the full depth to a confining layer, no stress distribution or reduction was estimated throughout the depth.

Clay soil liner settlement was estimated for a 2 foot thickness plus variable thicknesses of soil underlying the clay soil liner.

**Results:** Calculation inputs and results for the landfill subgrade and clay soil liner settlement are attached. The following tables summarize the expected settlement at locations in the landfill footprint, expected changes in the soil liner bottom (subgrade) elevations and the expected separation distance between the bottom of the soil liner (subgrade) and seasonal high groundwater and bedrock elevations.

**Table 1: Groundwater and Bottom of Soil Liner Separation**

| Location | Elevation at Bottom of Soil Liner (feet.) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Seasonal High Groundwater (feet) | Separation (feet) |
|---|---|---|---|---|---|
| CELL 2I EAST | | | | | |
| Bottom of Sump | 570 | 0.114 | 569.89 | 565 | 4.89 |
| Top of Sump | 572 | 0.128 | 571.87 | 565 | 6.87 |
| Sta. 8+00 | 594 | 0.806 | 593.19 | 587 | 6.19 |
| CELL 2I WEST | | | | | |
| Bottom of Sump | 580 | 0.292 | 579.71 | 575 | 4.71 |
| Top of Sump | 582 | 0.307 | 581.69 | 575 | 6.69 |
| Sta. 5+00 | 590 | 0.647 | 589.35 | 580 | 9.35 |
| CELL 2J EAST | | | | | |
| Bottom of Sump | 570 | 0.268 | 569.73 | 565 | 4.73 |
| Top of Sump | 572 | 0.278 | 571.72 | 565 | 6.72 |
| Sta. 7+00 | 588.80 | 0.240 | 588.56 | 577 | 11.56 |
| CELL 2J WEST | | | | | |

| Location | Elevation at Bottom of Soil Liner (feet.) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Seasonal High Groundwater (feet) | Separation (feet) |
|---|---|---|---|---|---|
| Bottom of Sump | 580 | 0.242 | 579.76 | 574 | 5.76 |
| Top of Sump | 582 | 0.257 | 581.74 | 574 | 7.74 |
| Sta. 6+00 | 590.50 | 0.264 | 590.24 | 577 | 13.00 |
| CELL 2K EAST | | | | | |
| Bottom of Sump | 572 | 0.228 | 571.77 | 567 | 4.77 |
| Top of Sump | 574 | 0.265 | 573.74 | 567 | 6.74 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 580 | 8.47 |
| CELL 2K WEST | | | | | |
| Bottom of Sump | 576 | 0.261 | 575.74 | 571 | 4.74 |
| Top of Sump | 578 | 0.317 | 577.68 | 571 | 6.68 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 579 | 9.47 |
| CELL 2M EAST | | | | | |
| Bottom of Sump | 574 | 0.353 | 573.65 | 567 | 6.65 |
| Top of Sump | 576 | 0.366 | 575.63 | 567 | 8.63 |
| Sta. 5+00 | 586 | 0.300 | 585.70 | 577 | 8.70 |
| CELL 2M WEST | | | | | |
| Bottom of Sump | 575 | 0.296 | 574.70 | 570 | 4.70 |
| Top of Sump | 577 | 0.328 | 576.67 | 570 | 6.67 |
| Sta. 3+50 | 582 | 0.391 | 581.61 | 574 | 7.61 |

Reference: Groundwater elevations from Design Hydrogeologic Report for CMS Landfill dated August 2008 prepared by David Garrett and Associates.

**Table 2: Bedrock and Bottom of Soil Liner Separation**

| Location | Elevation at Bottom of Soil Liner (feet) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Bedrock (feet) | Separation (feet) |
|---|---|---|---|---|---|
| CELL 2I EAST | | | | | |
| Bottom of Sump | 570 | 0.114 | 569.89 | 551 | 18.89 |
| Top of Sump | 572 | 0.128 | 571.87 | 551 | 20.87 |
| Sta. 8+00 | 594 | 0.806 | 593.19 | 562 | 31.19 |
| CELL 2I WEST | | | | | |
| Bottom of Sump | 580 | 0.292 | 579.71 | 555 | 24.71 |
| Top of Sump | 582 | 0.307 | 581.69 | 555 | 26.69 |
| Sta. 5+00 | 590 | 0.647 | 589.35 | 564 | 25.35 |
| CELL 2J EAST | | | | | |
| Bottom of Sump | 570 | 0.268 | 569.73 | 555 | 14.89 |
| Top of Sump | 572 | 0.278 | 571.72 | 555 | 16.87 |
| Sta. 7+00 | 588.80 | 0.240 | 588.56 | 565 | 23.56 |
| CELL 2J WEST | | | | | |
| Bottom of Sump | 580 | 0.242 | 579.76 | 550 | 29.76 |
| Top of Sump | 582 | 0.257 | 581.74 | 550 | 31.74 |
| Sta. 6+00 | 590.50 | 0.264 | 590.24 | 564 | 26.24 |
| CELL 2K EAST | | | | | |
| Bottom of Sump | 572 | 0.228 | 571.77 | 545 | 26.77 |
| Top of Sump | 574 | 0.265 | 573.74 | 545 | 28.74 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 557 | 31.47 |
| CELL 2K WEST | | | | | |
| Bottom of Sump | 576 | 0.261 | 575.74 | 552 | 23.74 |
| Top of Sump | 578 | 0.317 | 577.68 | 552 | 25.68 |
| Sta. 7+00 | 589 | 0.529 | 588.47 | 556 | 32.47 |

| Location | Elevation at Bottom of Soil Liner (feet) | Total Settlement at Location (feet) | Elevation at Bottom of Soil Liner with Settlement (feet) | Elevation of Bedrock (feet) | Separation (feet) |
|---|---|---|---|---|---|
| CELL 2M EAST | | | | | |
| Bottom of Sump | 574 | 0.353 | 573.65 | 543 | 30.65 |
| Top of Sump | 576 | 0.366 | 575.63 | 543 | 32.63 |
| Sta. 5+00 | 586 | 0.300 | 585.70 | 560 | 25.70 |
| CELL 2M WEST | | | | | |
| Bottom of Sump | 575 | 0.296 | 574.70 | 552 | 22.70 |
| Top of Sump | 577 | 0.328 | 576.67 | 552 | 24.67 |
| Sta. 3+50 | 582 | 0.391 | 581.61 | 560 | 21.69 |
| Reference: Bedrock elevations from Design Hydrogeologic Report for CMS Landfill dated August 2008 prepared by David Garrett and Associates. | | | | | |

# SETTLEMENT CALCULATIONS

**Project: Phase 3 Landfill Permit Modification**
**Landfill Subgrade and Soil Liner Settlement Calculations**
**Location: Charlotte Motor Speedway Landfill**
**Prepared by: SCS ENGINEERS, PC**
**Date: July 20, 2010**

| | | | |
|---|---|---|---|
| Calc'd by: | ADG | Date: | 7/20/2010 |
| Chk'd by: | CDH | Date: | 7/27/2010 |

| Common Parameters for all Locations: | | |
|---|---|---|
| Low Perm Bottom Liner Soil Depth ($h_{clay}$) = | 2 | ft |
| Low Perm Bottom Liner Soil Density ($\gamma_{clay}$) = | 110 | pcf |
| Protective Cover Depth ($h_{pc}$) = | 2 | ft |
| Protective Cover Density ($\gamma_{pc}$) = | 100 | pcf |
| Low Perm Cap Soil Depth ($h_{lpc}$) = | 1.5 | ft |
| Low Perm Cap Soil Density ($\gamma_{lpc}$) = | 110 | pcf |
| Cap Cover Soil Depth ($h_{ccs}$) = | 2 | ft |
| Cap Cover Soil Density ($\gamma_{ccs}$) = | 110 | pcf |
| $\Delta\sigma_{(soil\ liner+soil\ cap+protective\ cover)}$ = | 805 | psf |
| Added Soil Structural Fill ($\gamma_{sf}$) = | 110 | pcf |

**Cell 2I East Sump (Bottom of Sump) - Subgrade Elevation 570' - (Use Boring P-8)**

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 1 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 25 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1875 | psf |
| $\Delta\sigma_{(total)}$ = | 2680 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 570-569 | 1 | NA | 110 | 55 | NA | NA | NA | 100 | 1 | 0.017 |
| 569-561 | 8 | 52 | 80 | 320 | 0.16 | 1.42 | 73.8 | 240 | 8 | 0.032 |
| 561-556 | 5 | 34 | 120 | 300 | 0.15 | 1.43 | 48.5 | 115 | 5 | 0.043 |
| 556-550 | 6 | 120 | 80 | 240 | 0.12 | 1.44 | 172.8 | 300 | 6 | 0.022 |
| 550 | Auger Refusal | | | | | | | | | |

Subgrade Total ΔZ: 0.114 feet

$Zc_{(soil\ liner)}$: 0.29 feet

Total Zc: 0.40 feet

**Cell 2I East Sump (Top of Sump) - Subgrade Elevation 572' - (Use Boring P-8)**

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 2 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 23 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1725 | psf |
| $\Delta\sigma_{(total)}$ = | 2530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 572-570 | 2 | NA | 110 | 110 | NA | NA | NA | 100 | 2 | 0.028 |
| 570-561 | 9 | 52 | 80 | 360 | 0.18 | 1.41 | 73.3 | 240 | 9 | 0.035 |
| 561-556 | 5 | 34 | 120 | 300 | 0.15 | 1.43 | 48.5 | 115 | 5 | 0.043 |
| 556-550 | 6 | 120 | 80 | 240 | 0.12 | 1.44 | 172.8 | 300 | 6 | 0.022 |
| 550 | Auger Refusal | | | | | | | | | |

Subgrade Total ΔZ: 0.128

$Zc_{(soil\ liner)}$: 0.28 feet

Total Zc: 0.41 feet

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.01 | 6.3271 | 0.0397% |

## Cell 2I East Sump (Station 8+00) - Subgrade Elevation 594' - (Use Boring P-78)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 4 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 119 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 8925 | psf |
| $\Delta\sigma_{(total)}$ = | 9730 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 594-590 | 4 | NA | 110 | 220 | NA | NA | NA | 100 | 4 | 0.045 |
| 590-577 | 13 | 2 | 90 | 585 | 0.29 | 1.35 | 2.7 | 30 | 13 | 0.324 |
| 577-572 | 5 | 4 | 110 | 275 | 0.14 | 1.43 | 5.7 | 30 | 5 | 0.172 |
| 572-567 | 5 | 16 | 115 | 287.5 | 0.14 | 1.43 | 22.9 | 60 | 5 | 0.084 |
| 567-562 | 5 | 6 | 115 | 287.5 | 0.14 | 1.43 | 8.6 | 40 | 5 | 0.127 |
| 562-560 | 2 | 10 | 120 | 120 | 0.06 | 1.47 | 14.7 | 50 | 2 | 0.055 |
| | | | | | | | | | Subgrade Total ΔZ | 0.806 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.41 | feet | Total Zc | 1.22 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 8+00 | 760.3184 | 0.81 | 760.3421 | 0.0031% |

## Cell 2I West Sump (Bottom of Sump) - Subgrade Elevation 580' - (Use Boring P-10)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 3 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 25 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1875 | psf |
| $\Delta\sigma_{(total)}$ = | 2680 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 580-577 | 3 | NA | 110 | 165 | NA | NA | NA | 100 | 3 | 0.037 |
| 577-570 | 7 | 4 | 110 | 385 | 0.19 | 1.40 | 5.6 | 30 | 7 | 0.210 |
| 570-565 | 5 | 64 | 110 | 275 | 0.14 | 1.43 | 91.6 | 170 | 5 | 0.030 |
| 565-563 | 2 | 120 | 115 | 115 | 0.06 | 1.47 | 176.6 | 190 | 2 | 0.015 |
| 563 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.292 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.29 | feet | Total Zc | 0.58 feet |

## Cell 2I West Sump (Top of Sump) - Subgrade Elevation 582' - (Use Boring P-10)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 5 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 23 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1725 | psf |
| $\Delta\sigma_{(total)}$ = | 2530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 582-577 | 5 | NA | 110 | 275 | NA | NA | NA | 100 | 5 | 0.052 |
| 577-570 | 7 | 4 | 110 | 385 | 0.19 | 1.40 | 5.6 | 30 | 7 | 0.210 |
| 570-565 | 5 | 64 | 110 | 275 | 0.14 | 1.43 | 91.6 | 170 | 5 | 0.030 |
| 565-563 | 2 | 120 | 115 | 115 | 0.06 | 1.47 | 176.6 | 190 | 2 | 0.015 |
| 563 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.307 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.28 | feet | Total Zc | 0.59 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.01 | 6.3274 | 0.0447% |

## Cell 2I West Sump (Station 5+00) - Subgrade Elevation 590 - (Use Boring P-78)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 10 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 158 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 11850 | psf |
| $\Delta\sigma_{(total)}$ = | 12655 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 590-580 | 10 | NA | 110 | 550 | NA | NA | NA | 100 | 10 | 0.077 |
| 580-577 | 3 | 2 | 90 | 135 | 0.07 | 1.47 | 2.9 | 30 | 3 | 0.132 |
| 577-572 | 5 | 4 | 110 | 275 | 0.14 | 1.43 | 5.7 | 30 | 5 | 0.172 |
| 572-567 | 5 | 16 | 115 | 287.5 | 0.14 | 1.43 | 22.9 | 60 | 5 | 0.084 |
| 567-562 | 5 | 6 | 115 | 287.5 | 0.14 | 1.43 | 8.6 | 40 | 5 | 0.127 |
| 562-560 | 2 | 10 | 120 | 120 | 0.06 | 1.47 | 14.7 | 50 | 2 | 0.055 |
| | | | | | | | | | Subgrade Total ΔZ | 0.647 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.44 | feet | Total Zc | 1.08 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 5+00 | 616.0519 | 0.49 | 616.0585 | 0.0011% |

## Cell 2J East Sump (Bottom of Sump) - Subgrade Elevation 570' - (Use Boring P-8)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 1 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 25 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1875 | psf |
| $\Delta\sigma_{(total)}$ = | 2680 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 570-569 | 1 | NA | 110 | 55 | NA | NA | NA | 100 | 1 | 0.017 |
| 569-561 | 8 | 52 | 80 | 320 | 0.16 | 1.42 | 73.8 | 240 | 8 | 0.032 |
| 561-556 | 5 | 34 | 120 | 300 | 0.15 | 1.43 | 48.5 | 115 | 5 | 0.043 |
| 556-550 | 6 | 120 | 80 | 240 | 0.12 | 1.44 | 172.8 | 300 | 6 | 0.022 |
| 550 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.114 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.29 | feet | Total Zc | 0.40 feet |

## Cell 2J East Sump (Top of Sump) - Subgrade Elevation 572' - (Use Boring P-8)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 2 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 23 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1725 | psf |
| $\Delta\sigma_{(total)}$ = | 2530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 572-570 | 2 | NA | 110 | 110 | NA | NA | NA | 100 | 2 | 0.028 |
| 570-561 | 9 | 52 | 80 | 360 | 0.18 | 1.41 | 73.3 | 240 | 9 | 0.035 |
| 561-556 | 5 | 34 | 120 | 300 | 0.15 | 1.43 | 48.5 | 115 | 5 | 0.043 |
| 556-550 | 6 | 120 | 80 | 240 | 0.12 | 1.44 | 172.8 | 300 | 6 | 0.022 |
| 550 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.128 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.28 | feet | Total Zc | 0.41 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.01 | 6.3271 | 0.0397% |

## Cell 2J East Sump (Station 7+00) - Subgrade Elevation 588.80' - (Use Boring P-70)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 11.8 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 177.2 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 13290 | psf |
| $\Delta\sigma_{(total)}$ = | 14095 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 588.80-577 | 11.8 | NA | 110 | 649 | NA | NA | NA | 100 | 11.8 | 0.084 |
| 577-569 | 8 | 12 | 110 | 440 | 0.22 | 1.39 | 16.7 | 45 | 8 | 0.151 |
| 569-568 | 1 | 600 | 140 | 70 | 0.04 | 1.48 | 889.5 | 300 | 1 | 0.005 |
| 568 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.240 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.45 | feet | Total Zc | 0.69 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 7+00 | 655.2154 | 0.27 | 655.2225 | 0.0011% |

## Cell 2J West Sump (Bottom of Sump) - Subgrade Elevation 580' - (Use Boring P-73)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 7 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 25 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1875 | psf |
| $\Delta\sigma_{(total)}$ = | 2680 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 580-573 | 7 | NA | 110 | 385 | NA | NA | NA | 100 | 7 | 0.063 |
| 573-556 | 17 | 8 | 110 | 935 | 0.47 | 1.27 | 10.1 | 55 | 17 | 0.182 |
| 556-546 | 10 | 80 | 130 | 650 | 0.33 | 1.34 | 107.0 | 300 | 10 | 0.024 |
| 546 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.268 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.29 | feet | Total Zc | 0.56 feet |

## Cell 2J West Sump (Top of Sump) - Subgrade Elevation 582' - (Use Boring P-73)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 9 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 23 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1725 | psf |
| $\Delta\sigma_{(total)}$ = | 2530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 582-573 | 9 | NA | 110 | 495 | NA | NA | NA | 100 | 9 | 0.073 |
| 573-556 | 17 | 8 | 110 | 935 | 0.47 | 1.27 | 10.1 | 55 | 17 | 0.182 |
| 556-546 | 10 | 80 | 130 | 650 | 0.33 | 1.34 | 107.0 | 300 | 10 | 0.024 |
| 546 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.278 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.28 | feet | Total Zc | 0.56 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.00 | 6.3258 | 0.0202% |

## Cell 2J West Sump (Station 6+00) - Subgrade Elevation 590.50' - (Use Boring P-70)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 10.5 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 176.5 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 13237.5 | psf |
| $\Delta\sigma_{(total)}$ = | 14043 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 590.50-580 | 10.5 | NA | 110 | 577.5 | NA | NA | NA | 100 | 10.5 | 0.079 |
| 580-569 | 11 | 12 | 110 | 605 | 0.30 | 1.35 | 16.2 | 45 | 11 | 0.180 |
| 569-568 | 1 | 600 | 140 | 70 | 0.04 | 1.48 | 889.5 | 300 | 1 | 0.005 |
| 568 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.264 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.45 | feet | Total Zc | 0.71 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 6+00 | 562.1390 | 0.15 | 562.1423 | 0.0006% |

## Cell 2K East Sump (Bottom of Sump) - Subgrade Elevation 572' - (Use Boring P-58)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 0 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 25 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1875 | psf |
| $\Delta\sigma_{(total)}$ = | 2680 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 572-569 | 3 | 8 | 110 | 165 | 0.08 | 1.46 | 11.7 | 40 | 3 | 0.093 |
| 569-564 | 5 | 8 | 110 | 275 | 0.14 | 1.43 | 11.5 | 45 | 5 | 0.115 |
| 564-557 | 7 | 96 | 110 | 385 | 0.19 | 1.40 | 134.8 | 300 | 7 | 0.021 |
| | | | | | | | | | Subgrade Total ΔZ | 0.228 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.29 | feet | Total Zc | 0.52 feet |

## Cell 2K East Sump (Top of Sump) - Subgrade Elevation 574' - (Use Boring P-58)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 0 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 23 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1725 | psf |
| $\Delta\sigma_{(total)}$ = | 2530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 574-569 | 5 | 8 | 110 | 275 | 0.14 | 1.43 | 11.5 | 40 | 5 | 0.129 |
| 569-564 | 5 | 8 | 110 | 275 | 0.14 | 1.43 | 11.5 | 45 | 5 | 0.115 |
| 564-557 | 7 | 96 | 110 | 385 | 0.19 | 1.40 | 134.8 | 300 | 7 | 0.021 |
| | | | | | | | | | Subgrade Total ΔZ | 0.265 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.28 | feet | Total Zc | 0.55 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.03 | 6.3343 | 0.1541% |

## Cell 2K East Sump (Station 7+00) - Subgrade Elevation 589' - (Use Boring P-27)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 3 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 153 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 11475 | psf |
| $\Delta\sigma_{(total)}$ = | 12280 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 589-586 | 3 | NA | 110 | 165 | NA | NA | NA | 100 | 3 | 0.037 |
| 586-574 | 12 | 4 | 110 | 660 | 0.33 | 1.34 | 5.3 | 30 | 12 | 0.282 |
| 574-558 | 16 | 10 | 115 | 920 | 0.46 | 1.27 | 12.7 | 45 | 16 | 0.211 |
| 558 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.529 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.43 | feet | Total Zc | 0.96 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 7+00 | 654.1720 | 0.41 | 654.1816 | 0.0015% |

## Cell 2K West Sump (Bottom of Sump) - Subgrade Elevation 576' - (Use Boring P-84)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 0 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 25 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1875 | psf |
| $\Delta\sigma_{(total)}$ = | 2680 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 576-574 | 2 | 2 | 110 | 110 | 0.06 | 1.47 | 2.9 | 30 | 2 | 0.094 |
| 574-559 | 15 | 14 | 115 | 862.5 | 0.43 | 1.28 | 18.0 | 55 | 15 | 0.167 |
| | | | | | | | | | Subgrade Total ΔZ | 0.261 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.29 | feet | Total Zc | 0.55 feet |

## Cell 2K West Sump (Top of Sump) - Subgrade Elevation 578' - (Use Boring P-84)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 0 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 23 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1725 | psf |
| $\Delta\sigma_{(total)}$ = | 2530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 578-574 | 4 | 2 | 110 | 220 | 0.11 | 1.45 | 2.9 | 30 | 4 | 0.149 |
| 574-559 | 15 | 14 | 115 | 862.5 | 0.43 | 1.28 | 18.0 | 55 | 15 | 0.167 |
| | | | | | | | | | Subgrade Total ΔZ | 0.317 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.28 | feet | Total Zc | 0.60 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.05 | 6.3406 | 0.2537% |

## Cell 2K West Sump (Station 7+00) - Subgrade Elevation 589' - (Use Boring P-27)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 0 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 124 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 9300 | psf |
| $\Delta\sigma_{(total)}$ = | 10105 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 589-586 | 3 | NA | 110 | 165 | NA | NA | NA | 100 | 3 | 0.037 |
| 586-574 | 12 | 4 | 110 | 660 | 0.33 | 1.34 | 5.3 | 30 | 12 | 0.282 |
| 574-558 | 16 | 10 | 115 | 920 | 0.46 | 1.27 | 12.7 | 45 | 16 | 0.211 |
| 558 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.529 |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.42 | feet | Total Zc | 0.94 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 7+00 | 662.0914 | 0.34 | 662.0972 | 0.0009% |

## Cell 2M East Sump (Bottom of Sump) - Subgrade Elevation 574' - (Use Boring P-60)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 4 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 17 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1275 | psf |
| $\Delta\sigma_{(total)}$ = | 2080 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 574-570 | 4 | NA | 110 | 220 | NA | NA | NA | 100 | 4 | 0.045 |
| 570-561 | 9 | 16 | 115 | 517.5 | 0.26 | 1.37 | 21.9 | 30 | 9 | 0.237 |
| 561-558 | 3 | 174 | 115 | 172.5 | 0.09 | 1.46 | 253.5 | 300 | 3 | 0.012 |
| 558-554 | 4 | 16 | 115 | 230 | 0.12 | 1.44 | 23.1 | 75 | 4 | 0.059 |
| | | | | | | | | | Subgrade Total ΔZ | 0.353 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.27 | feet | Total Zc | 0.62 feet |

## Cell 2M East Sump (Top of Sump) - Subgrade Elevation 576' - (Use Boring P-60)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 6 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 15 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1125 | psf |
| $\Delta\sigma_{(total)}$ = | 1930 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 576-570 | 6 | NA | 110 | 330 | NA | NA | NA | 100 | 6 | 0.058 |
| 570-561 | 9 | 16 | 115 | 517.5 | 0.26 | 1.37 | 21.9 | 30 | 9 | 0.237 |
| 561-558 | 3 | 174 | 115 | 172.5 | 0.09 | 1.46 | 253.5 | 300 | 3 | 0.012 |
| 558-554 | 4 | 16 | 115 | 230 | 0.12 | 1.44 | 23.1 | 75 | 4 | 0.059 |
| | | | | | | | | | Subgrade Total ΔZ | 0.366 feet |

| | | | | |
|---|---|---|---|---|
| $Zc_{(soil\ liner)}$ | 0.26 | feet | Total Zc | 0.62 feet |

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.01 | 6.3263 | 0.0276% |

## Cell 2M East Sump (Station 5+00) - Subgrade Elevation 586' - (Use Boring P-61)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 2 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 103 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 7725 | psf |
| $\Delta\sigma_{(total)}$ = | 8530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 586-584 | 2 | NA | 110 | 110 | NA | NA | NA | 100 | 2 | 0.028 |
| 584-581 | 3 | 4 | 110 | 165 | 0.08 | 1.46 | 5.8 | 40 | 3 | 0.093 |
| 581-576 | 5 | 2 | 110 | 275 | 0.14 | 1.43 | 2.9 | 35 | 5 | 0.147 |
| 576-565 | 11 | 60 | 115 | 632.5 | 0.32 | 1.34 | 80.5 | 250 | 11 | 0.032 |
| 565 | Auger Refusal | | | | | | | | | |

Subgrade Total ΔZ: 0.300

$Zc_{(soil\ liner)}$: 0.40 feet

Total Zc: 0.70 feet

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 7+00 | 454.1101 | 0.08 | 454.1118 | 0.0004% |

## Cell 2M West Sump (Bottom of Sump) - Subgrade Elevation 575' - (Use Boring P-63)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 0 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 25 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1875 | psf |
| $\Delta\sigma_{(total)}$ = | 2680 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 575-566 | 9 | 4 | 90 | 405 | 0.20 | 1.40 | 5.6 | 30 | 9 | 0.265 |
| 566-550 | 16 | 220 | 115 | 920 | 0.46 | 1.27 | 279.4 | 300 | 16 | 0.032 |
| 550 | Auger Refusal | | | | | | | | | |

Subgrade Total ΔZ: 0.296 feet

$Zc_{(soil\ liner)}$: 0.29 feet

Total Zc: 0.59 feet

## Cell 2M West Sump (Top of Sump) - Subgrade Elevation 577' - (Use Boring P-63)

| | | |
|---|---|---|
| Soil Fill Height ($h_{fill}$) = | 0 | ft |
| Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf |
| Final Waste Height ($h_{waste}$) = | 23 | ft |
| Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf |
| $\Delta\sigma_{(waste)}$ = | 1725 | psf |
| $\Delta\sigma_{(total)}$ = | 2530 | psf |

| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 577-566 | 11 | 4 | 90 | 495 | 0.25 | 1.38 | 5.5 | 30 | 11 | 0.296 |
| 566-550 | 16 | 220 | 115 | 920 | 0.46 | 1.27 | 279.4 | 300 | 16 | 0.032 |
| 550 | Auger Refusal | | | | | | | | | |

Subgrade Total ΔZ: 0.328 feet

$Zc_{(soil\ liner)}$: 0.28 feet

Total Zc: 0.61 feet

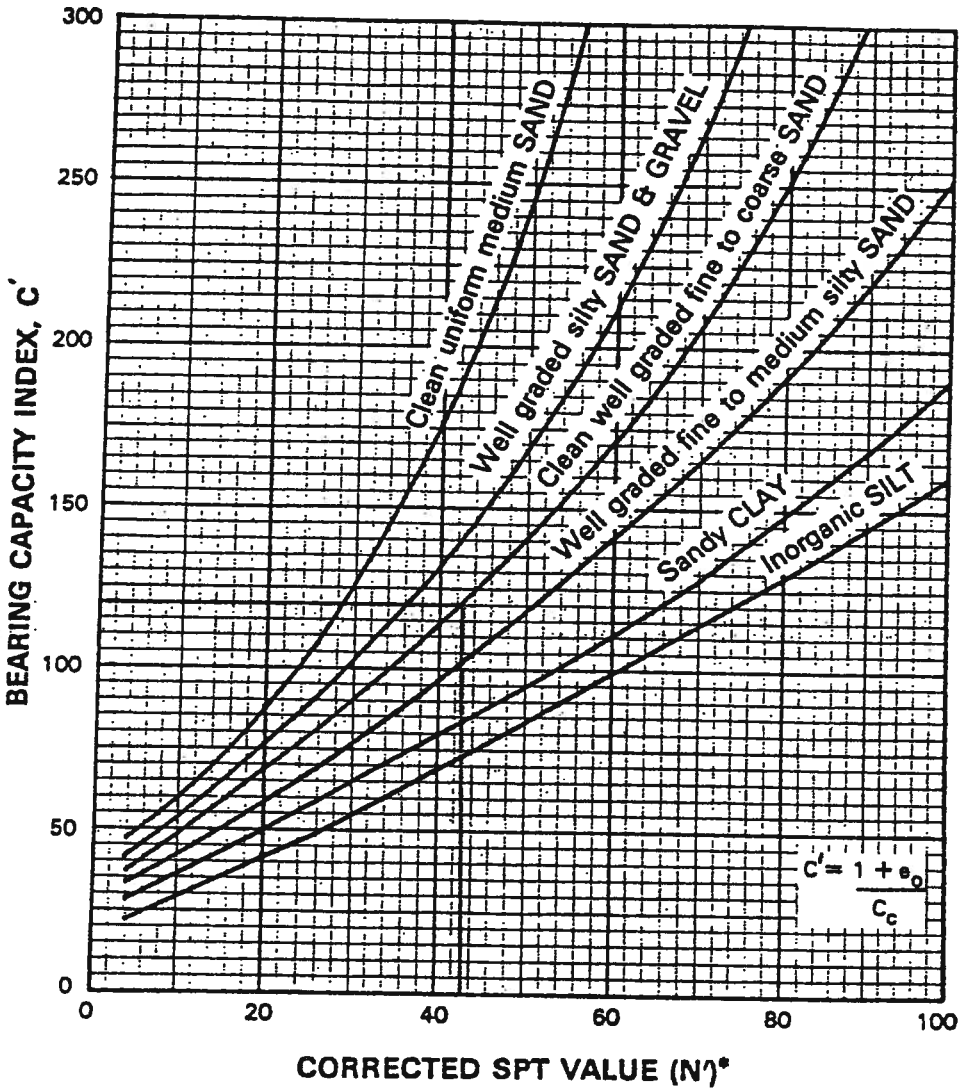
| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Bottom to Top of Sump | 6.3246 | 0.03 | 6.3328 | 0.1301% |

| Cell 2M West Sump (Station 3+50) - Subgrade Elevation 582' - (Use Boring P-63) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Soil Fill Height ($h_{fill}$) = | 3 | ft | | | |
| | | | | | Soil Fill Density ($\gamma_{fill}$) = | 110 | pcf | | | |
| | | | | | Final Waste Height ($h_{waste}$) = | 57 | ft | | | |
| | | | | | Compacted Waste Density ($\gamma_{waste}$) = | 75 | pcf | | | |
| | | | | | $\Delta\sigma_{(waste)}$ = | 4275 | psf | | | |
| | | | | | $\Delta\sigma_{(total)}$ = | 5080 | psf | | | |
| Elevation | Depth | N | $\gamma_s$ | $\sigma_o$ | $\sigma_o$/2000 | N'/N | N' | $C_c$' | $H_o$ | $Z_c$ |
| 582-566 | 16 | 4 | 90 | 720 | 0.36 | 1.32 | 5.3 | 30 | 16 | 0.360 |
| 566-550 | 16 | 220 | 115 | 920 | 0.46 | 1.27 | 279.4 | 300 | 16 | 0.032 |
| 550 | Auger Refusal | | | | | | | | | |
| | | | | | | | | | Subgrade Total ΔZ | 0.391 |

| $Zc_{(soil\ liner)}$ | 0.35 | feet | Total Zc | 0.74 | feet |
|---|---|---|---|---|---|

| Geomembrane Strain | | | | |
|---|---|---|---|---|
| Location | $L_{INT}$ (ft) | Diff. ΔZc (ft) | $L_{FNL}$ (ft) | ε |
| Top of Sump to Station 3+50 | 296.0608 | 0.13 | 296.0635 | 0.0009% |

| Estimated Soil Liner Primary Consolidation Settlement (24" of Clay Soils) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | $C_c$ | $H_o$ | $e_o$ | $\gamma_{clay}$ | $\sigma_o$ | $\Delta\sigma_{(waste)}$ | $\Delta\sigma_{(overburden)}$ | $\Delta\sigma_{(total)}$ | $Zc_{(soil\ liner)}$ |
| | | (feet) | | (pcf) | (psf) | (psf) | (psf) | (psf) | (feet) |
| Cell 2I East Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1875 | 585 | 2460 | 0.29 |
| Cell 2I East Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1725 | 585 | 2310 | 0.28 |
| Cell 2I East Sump Sta. 8+00 | 0.17 | 2 | 0.603 | 110 | 110 | 8925 | 585 | 9510 | 0.41 |
| Cell 2I West Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1875 | 585 | 2460 | 0.29 |
| Cell 2I West Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1725 | 585 | 2310 | 0.28 |
| Cell 2I West Sump Sta. 7+00 | 0.17 | 2 | 0.603 | 110 | 110 | 11850 | 585 | 12435 | 0.44 |
| Cell 2J East Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1875 | 585 | 2460 | 0.29 |
| Cell 2J East Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1725 | 585 | 2310 | 0.28 |
| Cell 2J East Sump Sta. 7+00 | 0.17 | 2 | 0.603 | 110 | 110 | 13290 | 585 | 13875 | 0.45 |
| Cell 2J West Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1875 | 585 | 2460 | 0.29 |
| Cell 2J West Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1725 | 585 | 2310 | 0.28 |
| Cell 2J West Sump Sta. 6+00 | 0.17 | 2 | 0.603 | 110 | 110 | 13237.5 | 585 | 13823 | 0.45 |
| Cell 2K East Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1875 | 585 | 2460 | 0.29 |
| Cell 2K East Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1725 | 585 | 2310 | 0.28 |
| Cell 2K East Sump Sta. 7+00 | 0.17 | 2 | 0.603 | 110 | 110 | 11475 | 585 | 12060 | 0.43 |
| Cell 2K West Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1875 | 585 | 2460 | 0.29 |
| Cell 2K West Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1725 | 585 | 2310 | 0.28 |
| Cell 2K West Sump Sta. 7+00 | 0.17 | 2 | 0.603 | 110 | 110 | 9300 | 585 | 9885 | 0.42 |
| Cell 2M East Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1275 | 585 | 1860 | 0.27 |
| Cell 2M East Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1125 | 585 | 1710 | 0.26 |
| Cell 2M East Sump Sta. 5+00 | 0.17 | 2 | 0.603 | 110 | 110 | 7725 | 585 | 8310 | 0.40 |
| Cell 2M West Bottom of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1875 | 585 | 2460 | 0.29 |
| Cell 2M West Top of Sump | 0.17 | 2 | 0.603 | 110 | 110 | 1725 | 585 | 2310 | 0.28 |
| Cell 2M West Sump Sta. 3+50 | 0.17 | 2 | 0.603 | 110 | 110 | 4275 | 585 | 4860 | 0.35 |



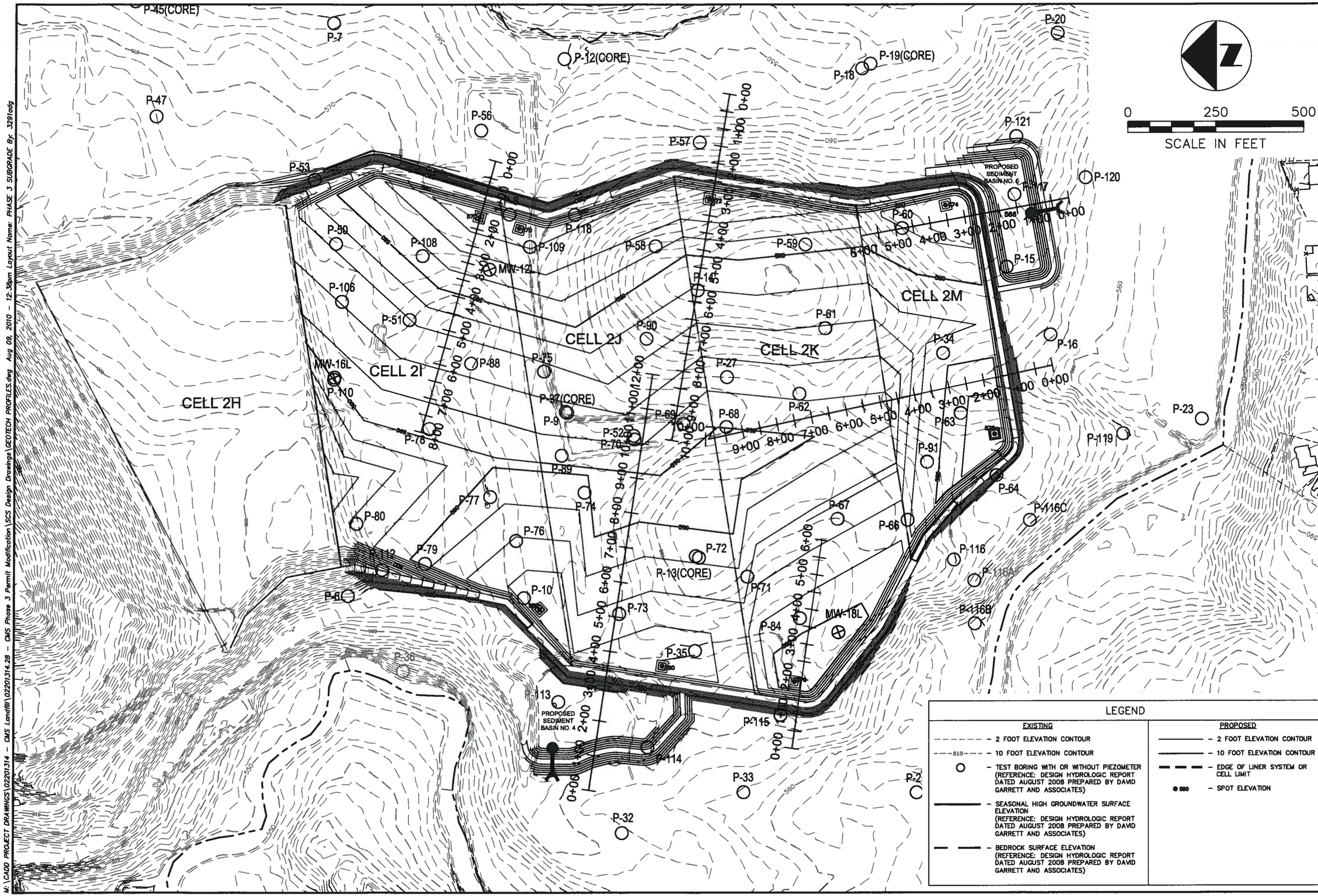

*N'—*SPT (N) Value Corrected for Overburden Pressure.*

Reference: Hough, "Compressibility as a Basis for Soil Bearing Value" ASCE 1959

Bearing capacity index (C') values for granular soils

# APPENDIX C

Figures for Geotechnical Evaluation




## LEGEND

| EXISTING | PROPOSED |
|---|---|
| 2 FOOT ELEVATION CONTOUR | 2 FOOT ELEVATION CONTOUR |
| 610 — 10 FOOT ELEVATION CONTOUR | 10 FOOT ELEVATION CONTOUR |
| TEST BORING WITH OR WITHOUT PIEZOMETER (REFERENCE: DESIGN HYDROLOGIC REPORT DATED AUGUST 2008 PREPARED BY DAVID GARRETT AND ASSOCIATES) | EDGE OF LINER SYSTEM OR CELL LIMIT |
| SEASONAL HIGH GROUNDWATER SURFACE ELEVATION (REFERENCE: DESIGN HYDROLOGIC REPORT DATED AUGUST 2008 PREPARED BY DAVID GARRETT AND ASSOCIATES) | 590 SPOT ELEVATION |
| BEDROCK SURFACE ELEVATION (REFERENCE: DESIGN HYDROLOGIC REPORT DATED AUGUST 2008 PREPARED BY DAVID GARRETT AND ASSOCIATES) | |

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DATE 7/27/2010

FIGURE 1

**SLOPE STABILITY EVALUATION**

**CROSS-SECTIONS - LANDFILL SUBGRADE**

**PHASE 3 PERMIT MODIFICATION**

| | |
|---|---|
| DES BY | CDH |
| CHK BY | CDH |
| APP BY | ADG |
| PROJECT NO. | 02201314.28 |
| SCALE | 1" = 250' |
| CAD FILE | |


SCS ENGINEERS

Environmental Consultants and Contractors

2520 WHITEHALL PARK DRIVE, SUITE 450

CHARLOTTE, NORTH CAROLINA 28273

PHONE: (704) 504-3107 FAX: (704) 504-3174

**SLOPE STABILITY EVALUATION**
**CROSS-SECTIONS - LANDFILL CLOSURE**
**PHASE 3 PERMIT MODIFICATION**

DATE 7/27/2010
FIGURE 2

| | | |
|---|---|---|
| PROJECT NO. 02201314.28 | DES BY CDH | |
| SCALE 1" = 250' | CHK BY CDH | |
| CAD FILE | APP BY ADG | |


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Environmental Consultants and Contractors
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CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174


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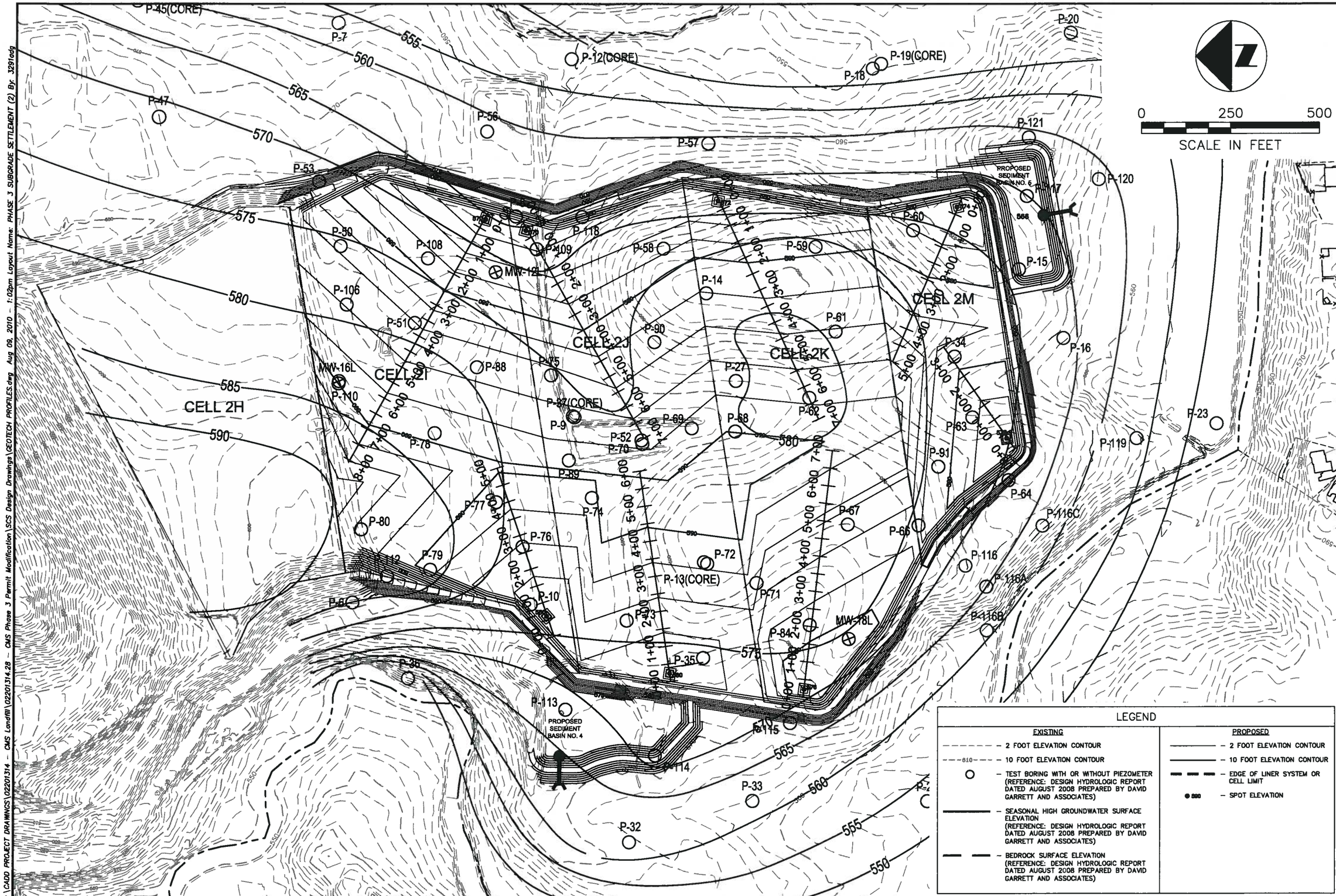


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DATE 7/27/2010

FIGURE 3A

# SETTLEMENT EVALUATION
# PHASE 3 PERMIT MODIFICATION

| | |
|---|---|
| PROJECT NO. 02201314.28 | DES BY CDH |
| SCALE 1" = 250' | CHK BY CDH |
| CAD FILE | APP BY ADG |


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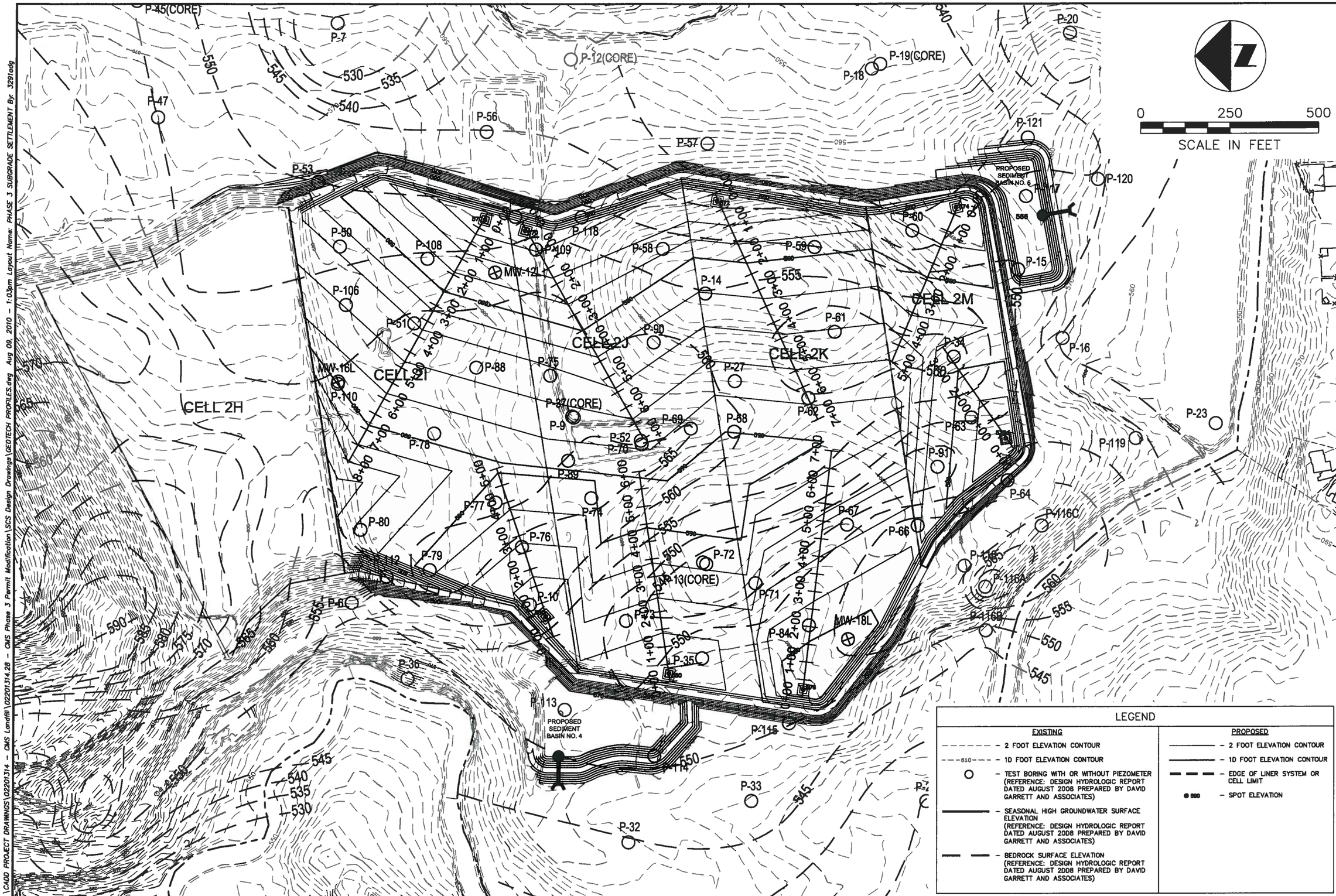


DATE 7/27/2010
FIGURE 3B

SETTLEMENT EVALUATION
PHASE 3 PERMIT MODIFICATION

| | | |
|---|---|---|
| PROJECT NO. 02201314.28 | DES BY CDH | |
| SCALE 1" = 250' | CHK BY CDH | |
| CAD FILE | APP BY ADG | |

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2520 WHITEHALL PARK DRIVE, SUITE 450
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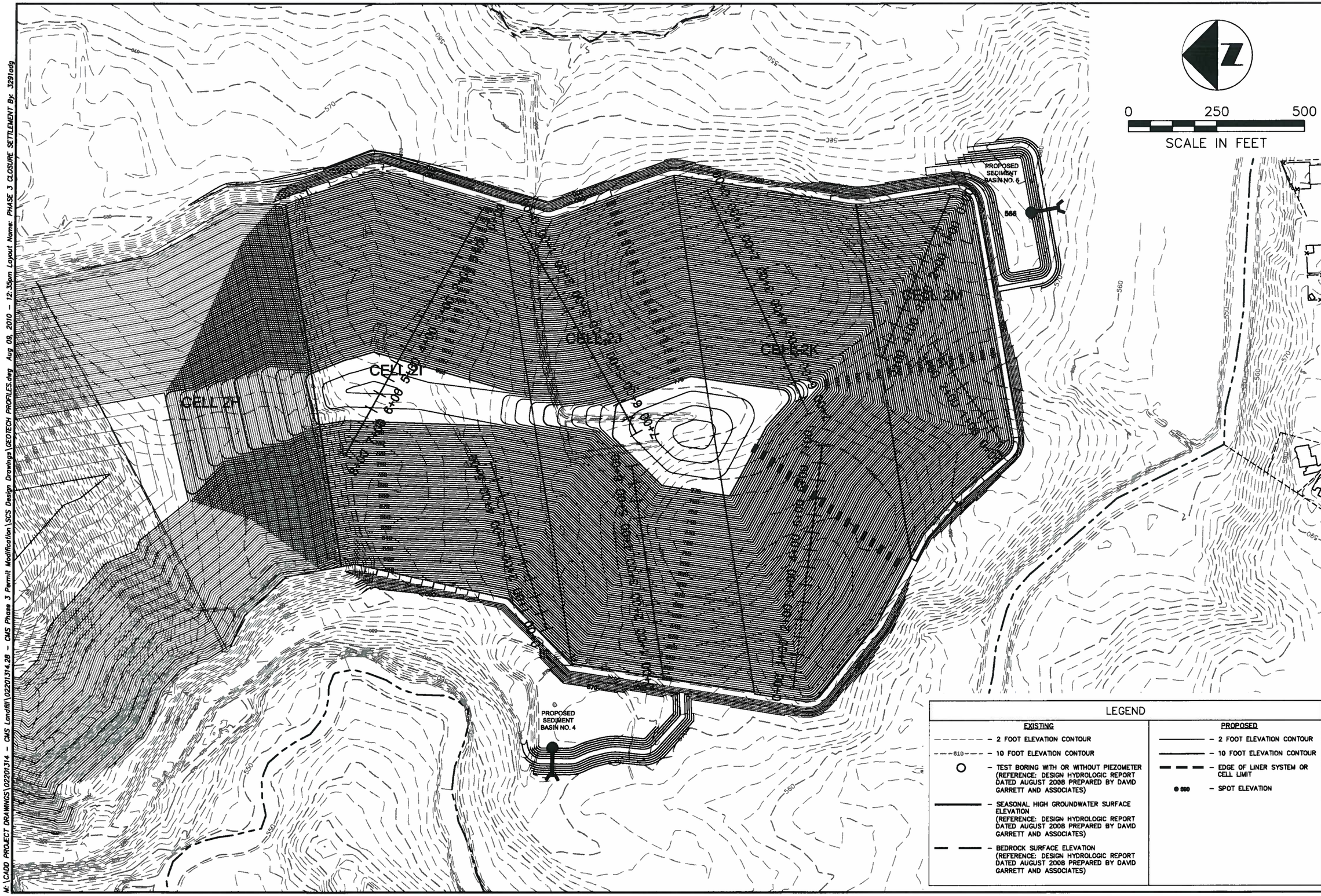


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DATE 7/27/2010

FIGURE 4

SETTLEMENT EVALUATION
PHASE 3 PERMIT MODIFICATION

| | |
|---|---|
| PROJECT NO. 02201314.28 | DES BY CDH |
| SCALE 1" = 250' | CHK BY CDH |
| CAD FILE | APP BY ADG |

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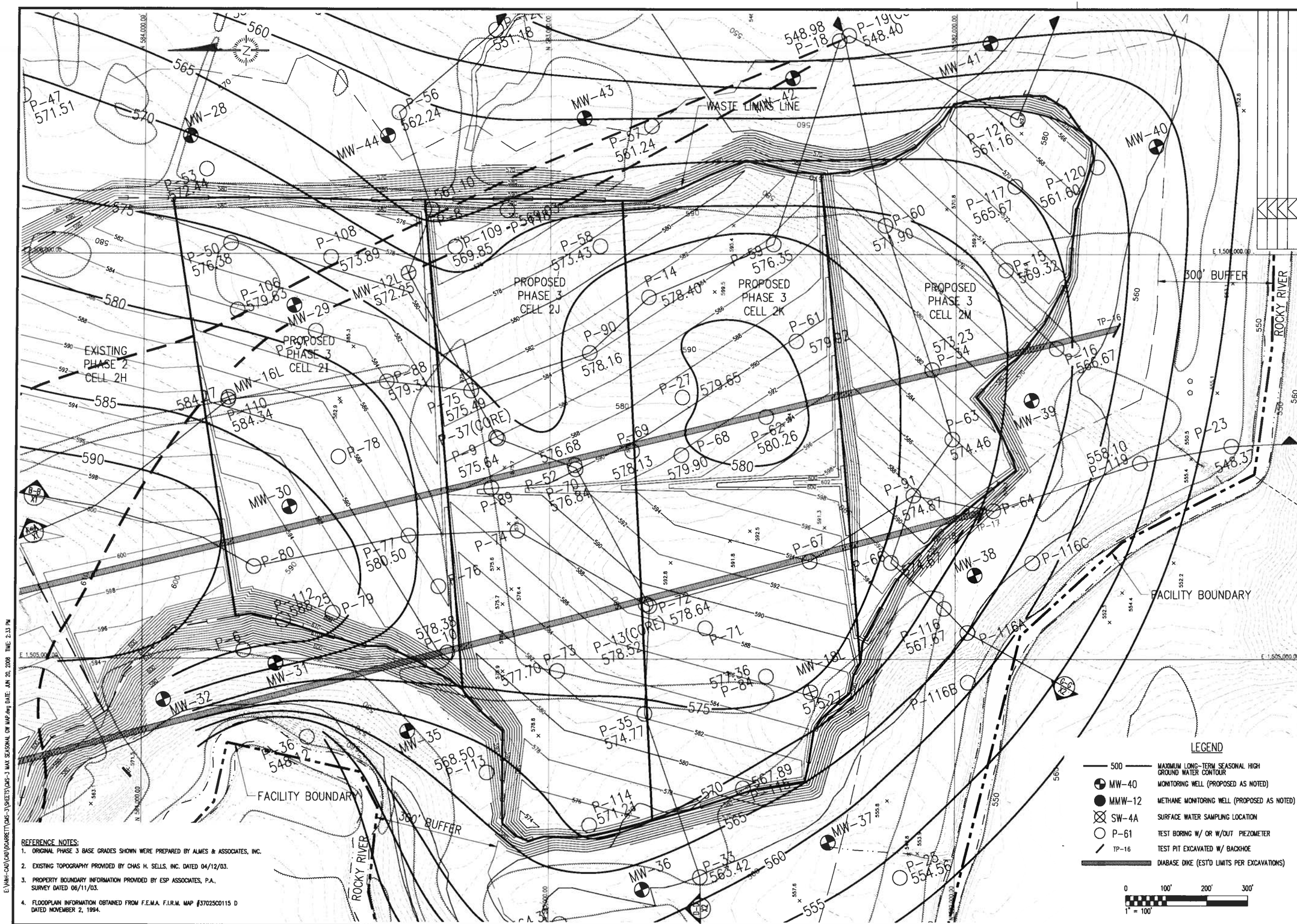



REFERENCE NOTES:

1. ORIGINAL PHASE 3 BASE GRADES SHOWN WERE PREPARED BY ALMES & ASSOCIATES, INC.
2. EXISTING TOPOGRAPHY PROVIDED BY CHAS H. SELLS, INC. DATED 04/12/03.
3. PROPERTY BOUNDARY INFORMATION PROVIDED BY ESP ASSOCIATES, P.A., SURVEY DATED 06/11/03.
4. FLOODPLAIN INFORMATION OBTAINED FROM F.E.M.A. F.I.R.M. MAP #37025C0115 D DATED NOVEMBER 2, 1994.

E:\Mkt-CAD\CAD\GARRETT\CMS-3\SHEETS\CMS-3 MAX SEASONAL GW MAP.dwg DATE: JUN 20, 2008 TIME: 2:13 PM

| NO. | DATE | REVISION |
|---|---|---|


David Garrett & Associates
Engineering and Geology
5105 Harbour Towne Drive, Raleigh, North Carolina 27604
Email: david_garrett_1@mindspring.com 919-231-1818 (Office and Fax) 919-418-4375 (mobile)


SEAL: NORTH CAROLINA PROFESSIONAL GEOLOGIST DAVID GARRETT 6-14-2008

SEAL: NORTH CAROLINA PROFESSIONAL GEOLOGIST DAVID GARRETT 6-14-2008

PROJECT TITLE: CMS V MSWLF PHASE 3 DESIGN HYDROGEOLOGIC REPORT PERMIT #13-04 CABARRUS COUNTY, NORTH CAROLINA

DRAWING TITLE: MAXIMUM LONG-TERM SEASONAL HIGH GROUNDWATER MAP (PHASE 3)

| | |
|---|---|
| DESIGNED BY: G.D.G. | DRAWN BY: A.W.H. |
| CHECKED BY: G.D.G. | PROJECT NO.: CMS-3 |
| SCALE: AS SHOWN | DATE: FEBRUARY 2008 |
| FILE NAME: CMS-3 MAX SEASONAL GW MAP | |
| SHEET NO. 5 | DRAWING NO. S5 |

Environmental Consultants
and Contractors

SCS Engineers, PC
2520 Whitehall Park Drive
Suite 450
Charlotte, NC 28273-3557

704 504-3107
FAX 704 504-3174
www.scsengineers.com

**SCS ENGINEERS, PC**

File No. 02201314.28
July 27, 2010

# MEMORANDUM

Subject: Addendum – Phase 3 Landfill Soil Requirements and Maximum Waste Inventory and Expected Life
Permit Modification for the CMS Landfill Phase 3 Permit to Construct

Prepared by: Albert D. Glenn, PE

Checked by: Christopher D. Hardin, PE

## INTRODUCTION

This memorandum summarizes the Phase 3 Landfill construction and closure soil requirements and Landfill Phase 2, 3, 4 and 5 maximum waste inventory and expected life for the modification to the Permit Application for Phase 3 Permit to Construct for the Charlotte Motor Speedway (CMS) Landfill, dated May 2009 as prepared by Hodges, Harbin, Newberry and Tribble, Inc. (HHNT). The information provided in this memorandum should be considered ***a revision*** to the original design calculations provided in the HHNT Permit Application, dated May 2009.

## PARAMETERS AND ASSUMPTIONS

A summary of the assumptions used to estimate the Landfill maximum waste inventory and expected life and the Phase 3 Landfill construction and closure soil requirements is as follows:

- Waste Stream = 4,000 tons/day
- Estimated Waste In-place Density = 1,600 lbs/cy
- Landfill Operations = 285 days per year
- 7:1 waste to soil ratio for daily and intermediate cover

## RESULTS

### Phase 3 Soil Requirements

A summary of the soil requirements for cell construction is as follows:

- Cell Construction Calculated Cut = 220,035 cy
- Sediment Basins Construction Calculated Cut = 95,238 cy
- Land Stripping Loss = (minus) 50,994 cy
- Calculated Fill including 30% for shrinkage/compaction = (minus) 551,883 cy
- Clay Liner including 30% for shrinkage/compaction = (minus) 234,000 cy
- **Soil Required From Soil Borrow = 521,604 cy**

A summary of the soil requirements for landfill operations is as follows:

- Soil For Daily and Intermediate Cover (7:1 Ratio) = 1,140,979 cy
- Closure Final Cover including 20% for shrinkage/compaction = 270,658 cy
- Drainage Berms = 102,000 cy
- **Soil Required From Soil Borrow = 1,513,637 cy**

A summary of the total soil requirements is as follows:

- **Additional Soil Required For Cell Construction = 521,604 cy**
- **Additional Soil Required For Landfill Operations = 1,513,637 cy**
- **Net Soil Required From Soil Borrow = 2,035,241 cy**
- Soil Available From Off-Site Borrow Area
  Morehead Road Property Owned by the Landfill = 1,917,000 cy
- **Net Soil Required = 118,241 cy**

The Phase 3 Landfill has a soil deficit of 118,241 cubic yards which will come from the recently acquired property to be partially used as a soil borrow.

## Maximum Waste Inventory and Expected Life

A summary of the Landfill Phase 2, 3, 4 and 5 maximum waste inventories is outlined in Table 1:

**Table 1 – Maximum Waste Inventory**
**CMS Landfill Phase 3 - Permit Modification**

| Designation | Area (acres) | Gross Airspace (cubic yards) | Closure Final Cover (cubic yards) | Net Airspace (cubic yards) |
|---|---|---|---|---|
| **Phase 2 Expansion** | **41.7** | **6,029,397** | **235,465** | **5,793,932** |
| **Phase 3** | **54.25** | **8,375,397** | **225,548** | **8,149,849** |
| Cell No. 2I | 16.27 | 2,319,470 | 56,551 | 2,262,919 |
| Cell No. 2J | 15.87 | 2,582,733 | 52,991 | 2,529,742 |
| Cell No. 2K | 15.46 | 2,287,700 | 56,797 | 2,230,903 |
| Cell No. 2M | 6.65 | 1,185,494 | 59,209 | 1,126,285 |
| **Phase 4** | **6.8** | **3,275,000** | **169,400** | **3,105,600** |
| **Phase 5** | **19.0** | **3,836,000** | **112,930** | **3,723,070** |

A summary of the Landfill Phase 2, 3, 4 and 5 expected life is outlined in Table 2:

**Table 2 – Landfill Expected Life**
**CMS Landfill Phase 3 - Permit Modification**

| Designation | Net Airspace (cubic yards) | Years[(1)] |
|---|---|---|
| **Phase 2 Expansion** | **5,827,535** | **4.1** |
| **Phase 3** | **8,149,849** | **5.8** |
| Cell No. 2I | 2,262,919 | 1.6 |
| Cell No. 2J | 2,529,742 | 1.8 |
| Cell No. 2K | 2,230,903 | 1.6 |
| Cell No. 2M | 1,126,285 | 0.8 |
| **Phase 4** | **3,105,600** | **1.3** |
| **Phase 5** | **3,723,070** | **1.6** |

Notes:
(1) Years = (Net Airspace / (4,000 tons per day / (1,600 lbs per cy / 2,000 lbs per ton))) / 285 operating days per year

# PHASE 3 PERMIT MODIFICATION

## MODIFIED ENGINEERING PLANS FOR PERMIT TO CONSTRUCT APPLICATION

## CHARLOTTE MOTOR SPEEDWAY LANDFILL V #13-04


**REPUBLIC SERVICES, INC.**
5105 MOREHEAD ROAD
CONCORD, NC 28027
OWNER CONTACT: MIKE GURLEY
(704) 782-2004 ext. 391

**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
CONTACT: ALBERT GLENN
(704) 504-3107


**SCS JOB NO. 02201314.28**
**JULY 2010**

7000 0 14000 21000 28000
(feet)

LOCATION MAP

| BENCHMARK | | | |
|---|---|---|---|
| NORTHING | EASTING | ELEVATION | DESCRIPTION |
| 585073.90 | 1505958.83 | 592.79 | NAIL IN PAD |

REFERENCES:

1. EXISTING TOPOGRAPHY AND PHYSICAL FEATURES INFORMATION PROVIDED BY IMC, INC. DATED FEBRUARY 11, 2010.
2. PERMIT TO CONSTRUCT APPLICATION DATED MAY 2009 PREPARED BY HODGES, HARBIN, NEWBERRY AND TRIBBLE, INC.
3. DESIGN HYDROGEOLOGIC REPORT FOR CMS LANDFILL DATED AUGUST 2008 PREPARED BY DAVID GARRETT AND ASSOCIATES.

INDEX OF SHEETS


| SHEET NO. | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | SUBGRADE PLAN |
| 3 | TOP OF SUBGRADE – VERTICAL SEPARATION FROM SEASONAL HIGH GROUNDWATER |
| 4 | TOP OF SUBGRADE – VERTICAL SEPARATION FROM BEDROCK |
| 5 | LEACHATE COLLECTION PLAN |
| 6 | FINAL CLOSURE GRADING PLAN |
| 7 | BOTTOM LINER SYSTEM PROFILES CELLS 2I AND 2J |
| 8 | BOTTOM LINER SYSTEM PROFILES CELLS 2K AND 2M |
| 9 | SEQUENCE OF FILL – CELL 2I |
| 10 | SEQUENCE OF FILL – CELL 2J |
| 11 | SEQUENCE OF FILL – CELL 2K |
| 12 | SEQUENCE OF FILL – CELL 2M |
| 13 | MODIFIED DETAILS |


NORTH CAROLINA PROFESSIONAL SEAL 031802 ENGINEER ALBERT D. GLENN
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |

SHEET TITLE: TITLE SHEET
PROJECT TITLE: CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION

CLIENT: REPUBLIC SERVICES, INC. CHARLOTTE MOTOR SPEEDWAY LANDFILL 5105 MOREHEAD ROAD CONCORD, NORTH CAROLINA 28027

SCS ENGINEERS, PC
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

PROJ. NO. 02201314.28 | DWN. BY: SRN | Q/A RVW BY: CDH
DSN. BY: ADG | CHK. BY: ADG | APP. BY: CDH

CADD FILE: TITLE SHEET
DATE: JULY 2010
SCALE: AS SHOWN
DRAWING NO. 1 of 13

EXISTING SEDIMENT BASIN NO. 3

300 FOOT PROPERTY BOUNDARY BUFFER

LIMITS OF 100 YEAR FLOODPLAIN

500 FOOT RESIDENCE BUFFER

N

OVERFLOW STRUCTURE NO. 5

HEADWALL NO. 500

500

300 FOOT PROPERTY BOUNDARY BUFFER

PROPOSED SEDIMENT BASIN NO. 5 (SEE NOTE 1)

MODIFIED PROPOSED CELL 2M PHASE 3

PERMITTED CELL NO. 2H PHASE 2

MODIFIED PROPOSED CELL 2I PHASE 3

MODIFIED PROPOSED CELL 2J PHASE 3

MODIFIED PROPOSED CELL 2K PHASE 3

500 FOOT RESIDENCE BUFFER

LIMITS OF 100 YEAR FLOODPLAIN

ROCKY RIVER

WSACC 54" ROCKY RIVER INTERCEPTOR W/ 100' WIDE RIGHT OF WAY

ROCKY RIVER

OVERFLOW STRUCTURE NO. 4

PROPOSED SEDIMENT BASIN NO. 4 (SEE NOTE 1)

400

HEADWALL NO. 400

LIMITS OF 100 YEAR FLOODPLAIN

PROPERTY BOUNDARY BUFFER

JURISDICTIONAL WETLANDS (TYP.)

## LEGEND

| EXISTING | PROPOSED |
|---|---|
| 2 FOOT ELEVATION CONTOUR | 2 FOOT ELEVATION CONTOUR |
| 610 — 10 FOOT ELEVATION CONTOUR | 10 FOOT ELEVATION CONTOUR |
| × 419.2 — SPOT ELEVATION | LC — LEACHATE COLLECTION PIPE |
| WATER COURSE OR IMPOUNDMENT | FM — LEACHATE FORCEMAIN |
| TREE LINE | EDGE OF LINER OR CELL LIMIT |
| PROPERTY BOUNDARY | 580 — SPOT ELEVATION |
| PAVED ROAD | |
| ACCESS ROAD | |
| EDGE OF LINER OR CELL LIMIT | |
| FENCE | |
| FM — LEACHATE FORCEMAIN | |

NOTES

1. BUFFERS, PROPERTY LINES, STORMWATER MANAGEMENT AND EROSION AND SEDIMENTATION CONTROL STRUCTURES SHOWN ON THIS DRAWING REFERENCED FROM PHASE 3 ENGINEERING DRAWINGS – PERMIT TO CONSTRUCT APPLICATION DATED MAY 2009 PREPARED BY HODGES, HARBIN, NEWBERRY AND TRIBBLE, INC.

BASE MAP SOURCE: EXISTING CONTOURS PROVIDED BY INDEPENDENT MAPPING CONSULTANTS (IMC). DATE OF PHOTOGRAPHY FEBRUARY 11, 2010.

0 100 200 300
SCALE IN FEET

## PROPOSED HEADWALLS

| HEADWALL NO. | INVERT |
|---|---|
| 400 | 571.00 |
| 500 | 575.00 |

## PROPOSED PIPES

| PIPE NO. | SIZE | LENGTH | SLOPE | MATERIAL | INLET INV. | OUTLET INV. |
|---|---|---|---|---|---|---|
| 400 | 42" | 78' | 1.28% | HDPE | 572.00 | 571.00 |
| 500 | 48" | 78' | 3.85% | HDPE | 578.00 | 575.00 |

NORTH CAROLINA PROFESSIONAL SEAL 031902 ENGINEER HERBERT D. GREENE
7/27/2010

NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |

SHEET TITLE: SUBGRADE PLAN

PROJECT TITLE: CMS LANDFILL V #13-04
PHASE 3 PERMIT MODIFICATION

CLIENT: REPUBLIC SERVICES, INC.
CHARLOTTE MOTOR SPEEDWAY LANDFILL
5105 MOREHEAD ROAD
CONCORD, NORTH CAROLINA 28027

SCS ENGINEERS, PC
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

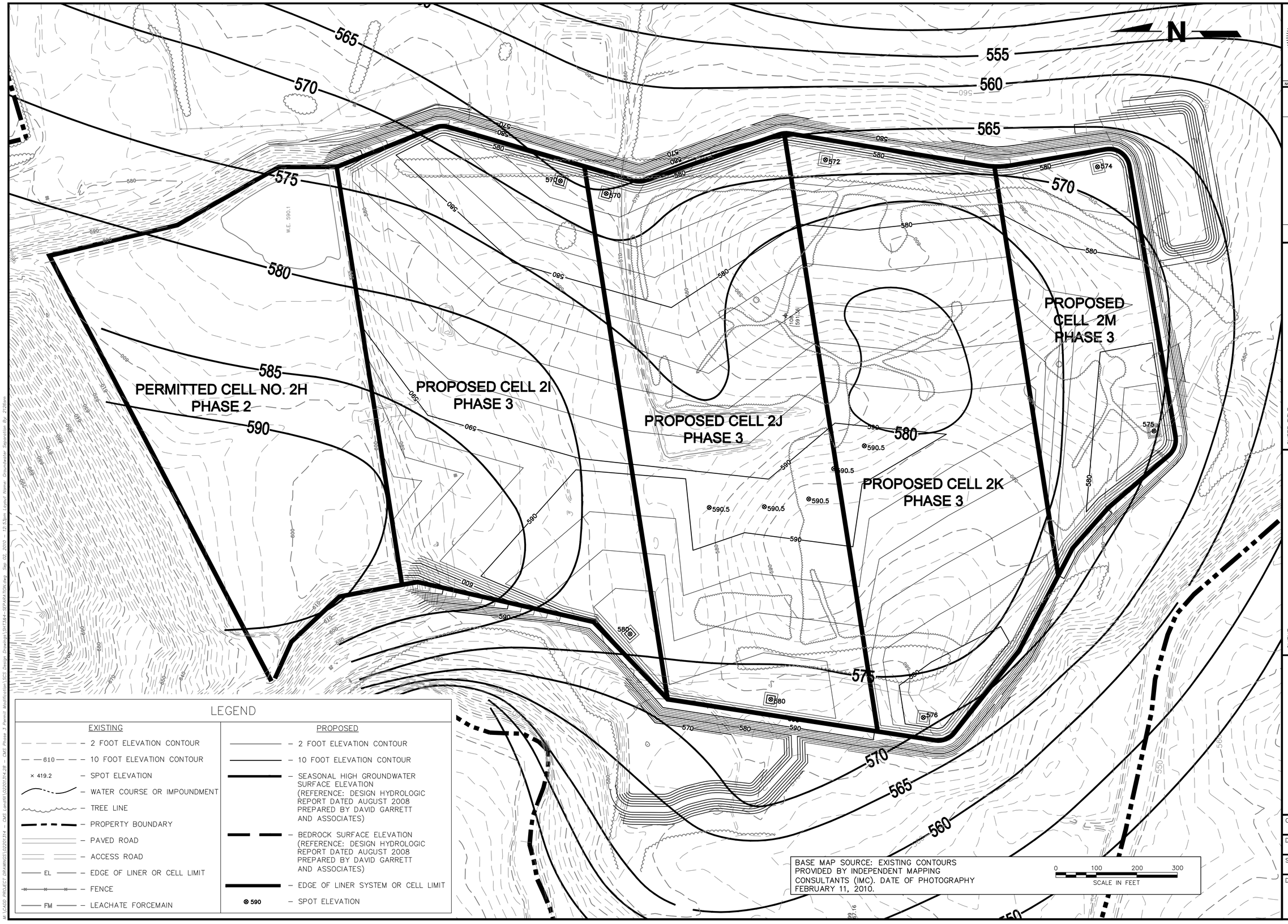
PROJ. NO. 02201314.28 | DWN. BY: SRN | Q/A RVW BY: CDH
DSN. BY: SRN | CHK. BY: ADG | APP. BY: ADG

CADD FILE: SHT2

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. 2 of 13




NORTH CAROLINA PROFESSIONAL SEAL 031902 ENGINEER ALBERT D. GREEN III
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE **TOP OF SUBGRADE - VERTICAL SEPARATION FROM SEASONAL HIGH GROUNDWATER**

PROJECT TITLE **CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION**

CLIENT
**REPUBLIC SERVICES, INC.**
**CHARLOTTE MOTOR SPEEDWAY LANDFILL V**
**5105 MOREHEAD ROAD**
**CONCORD, NORTH CAROLINA 28027**


**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174


PROJ. NO. 02201314.28 | DSN. BY: SRN | Q/A R/W BY: CDH
DSK. BY: SRN | CHK. BY: ADG | APP. BY: ADG

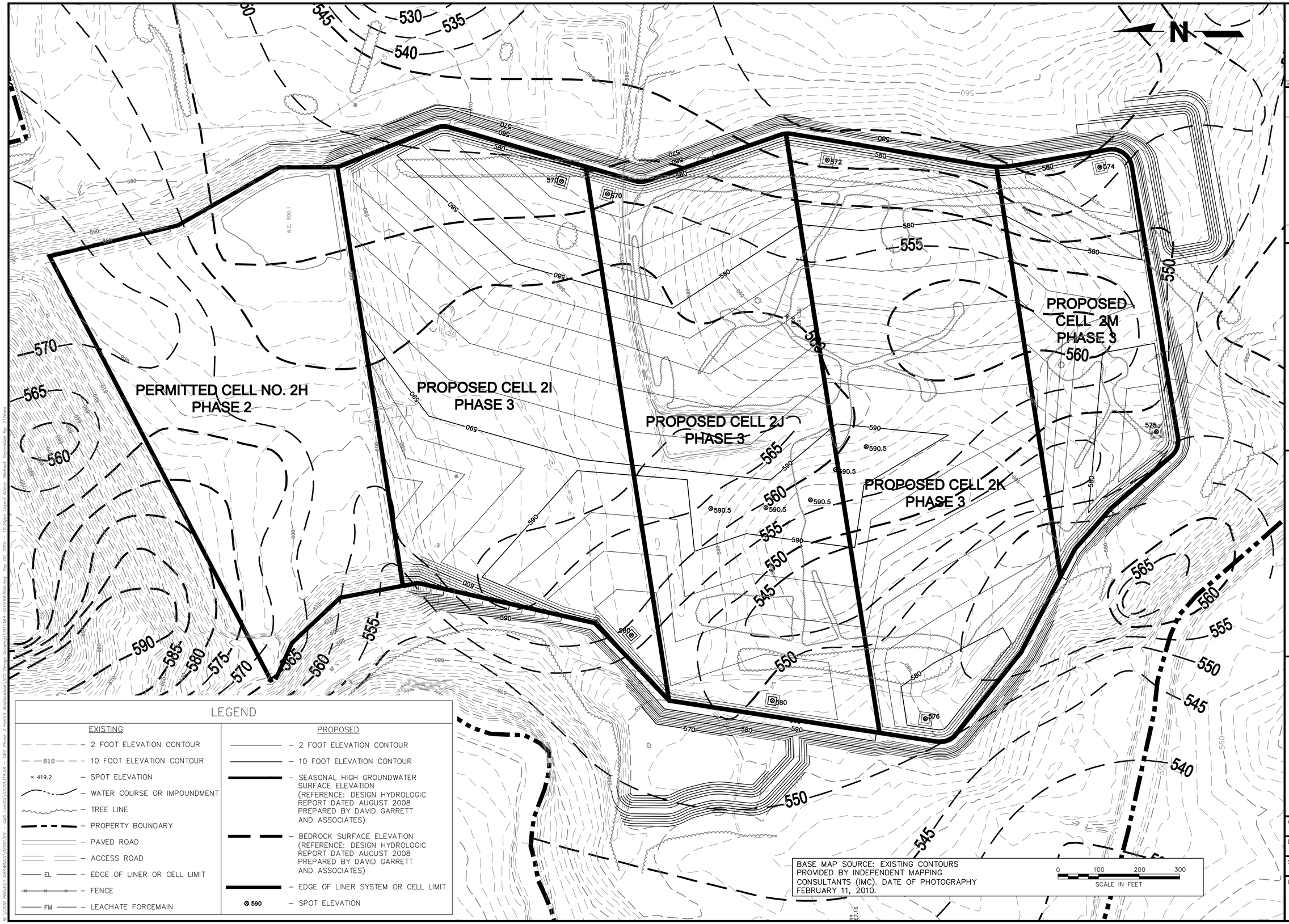
CADD FILE: SHT3&4

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. **3** of **13**

W:\CADD PROJECT DRAWINGS\02201314 - CMS Landfill\02201314.28 - CMS Phase 3 Permit Modification\SCS Design Drawings\SHT3&4 - SEPARATION.dwg Sep 02, 2010 12:53pm Layout Name: Groundwater Separation By: 2128sm




NORTH CAROLINA PROFESSIONAL SEAL 031902 ENGINEER ALBERT D. GLENN
7/27/2010

NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE: **TOP OF SUBGRADE - VERTICAL SEPARATION FROM BEDROCK**

PROJECT TITLE: **CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION**

CLIENT: **REPUBLIC SERVICES, INC.**
**CHARLOTTE MOTOR SPEEDWAY LANDFILL V**
**5105 MOREHEAD ROAD**
**CONCORD, NORTH CAROLINA 28027**

**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

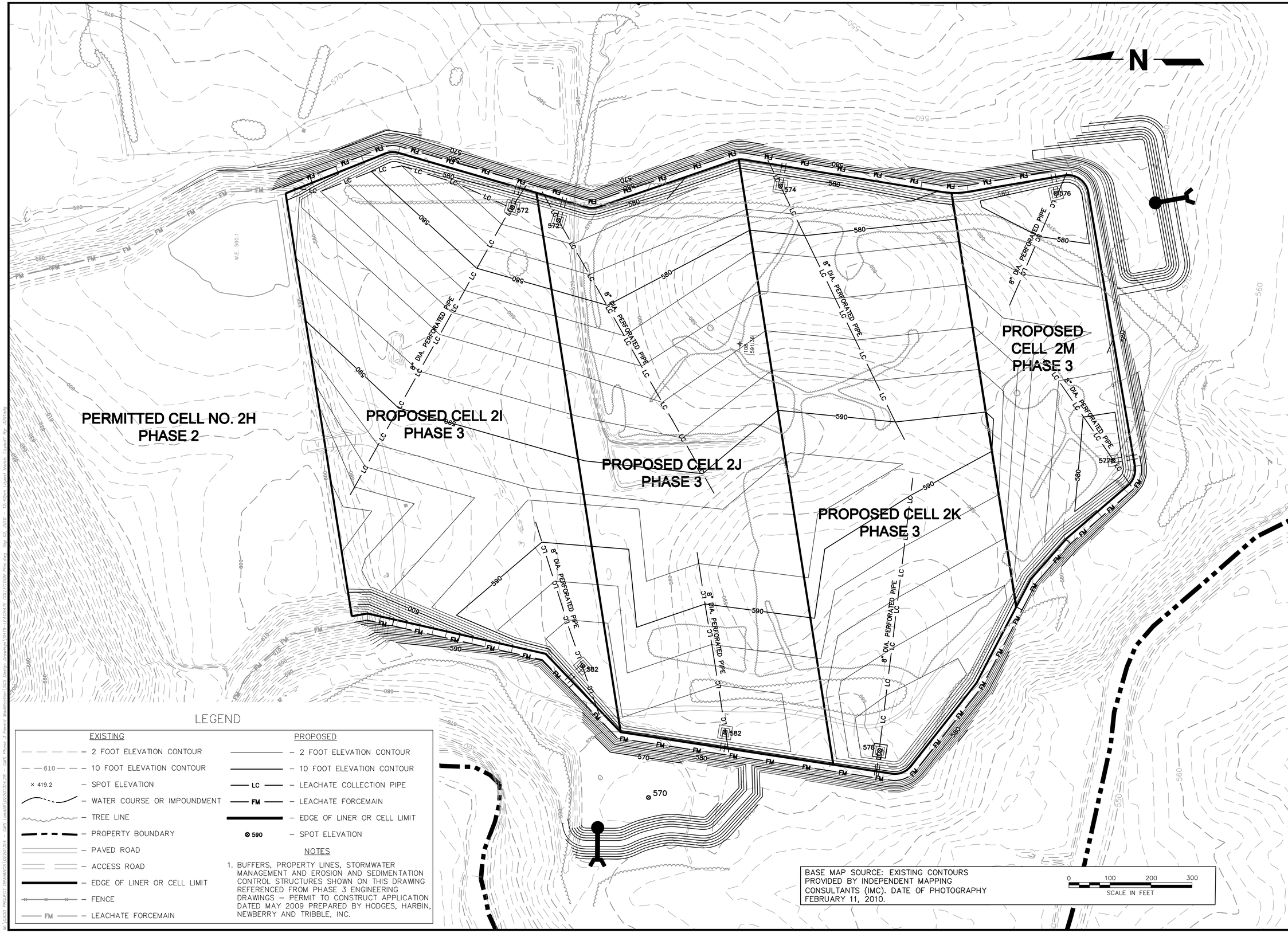
PROJ. NO. 0220.314.28 | DSN. BY: SRN | Q/A RVW BY: CDH
DSK. BY: SRN | CHK. BY: ADG | APP. BY: ADG

CADD FILE: SHT3&4

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. 4 of 13




NORTH CAROLINA PROFESSIONAL SEAL 031802 ENGINEER HERBERT D. GERBER
7/27/2010

NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE
**LEACHATE COLLECTION PLAN**

PROJECT TITLE
**CMS LANDFILL V #13-04**
**PHASE 3 PERMIT MODIFICATION**

CLIENT
**REPUBLIC SERVICES, INC.**
**CHARLOTTE MOTOR SPEEDWAY LANDFILL**
**5105 MOREHEAD ROAD**
**CONCORD, NORTH CAROLINA 28027**


**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

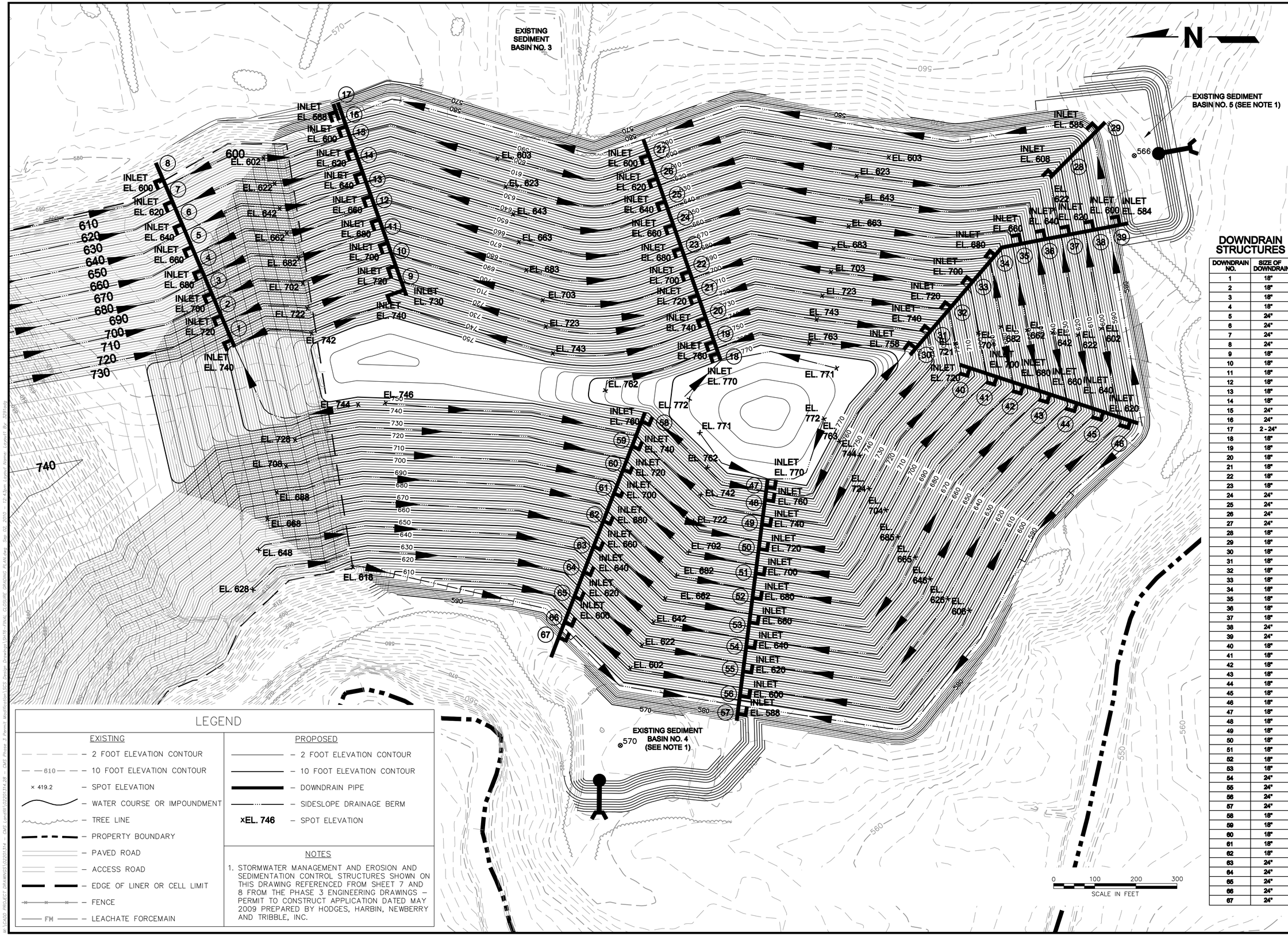

PROJ. NO. 02201314.28
DSN. BY: SRN
DWN. BY: SRN
CHK. BY: ADG
Q/A RVW BY: CDH
APP. BY: ADG

CADD FILE: SHT5

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO.
**5** of **20**




## DOWNDRAIN STRUCTURES

| DOWNDRAIN NO. | SIZE OF DOWNDRAIN |
|---|---|
| 1 | 18" |
| 2 | 18" |
| 3 | 18" |
| 4 | 18" |
| 5 | 24" |
| 6 | 24" |
| 7 | 24" |
| 8 | 24" |
| 9 | 18" |
| 10 | 18" |
| 11 | 18" |
| 12 | 18" |
| 13 | 18" |
| 14 | 18" |
| 15 | 24" |
| 16 | 24" |
| 17 | 2 - 24" |
| 18 | 18" |
| 19 | 18" |
| 20 | 18" |
| 21 | 18" |
| 22 | 18" |
| 23 | 18" |
| 24 | 24" |
| 25 | 24" |
| 26 | 24" |
| 27 | 24" |
| 28 | 18" |
| 29 | 18" |
| 30 | 18" |
| 31 | 18" |
| 32 | 18" |
| 33 | 18" |
| 34 | 18" |
| 35 | 18" |
| 36 | 18" |
| 37 | 18" |
| 38 | 24" |
| 39 | 24" |
| 40 | 18" |
| 41 | 18" |
| 42 | 18" |
| 43 | 18" |
| 44 | 18" |
| 45 | 18" |
| 46 | 18" |
| 47 | 18" |
| 48 | 18" |
| 49 | 18" |
| 50 | 18" |
| 51 | 18" |
| 52 | 18" |
| 53 | 18" |
| 54 | 24" |
| 55 | 24" |
| 56 | 24" |
| 57 | 24" |
| 58 | 18" |
| 59 | 18" |
| 60 | 18" |
| 61 | 18" |
| 62 | 18" |
| 63 | 24" |
| 64 | 24" |
| 65 | 24" |
| 66 | 24" |
| 67 | 24" |

## LEGEND

| EXISTING | PROPOSED |
|---|---|
| 2 FOOT ELEVATION CONTOUR | 2 FOOT ELEVATION CONTOUR |
| 610 — 10 FOOT ELEVATION CONTOUR | 10 FOOT ELEVATION CONTOUR |
| × 419.2 — SPOT ELEVATION | DOWNDRAIN PIPE |
| WATER COURSE OR IMPOUNDMENT | SIDESLOPE DRAINAGE BERM |
| TREE LINE | ×EL. 746 — SPOT ELEVATION |
| PROPERTY BOUNDARY | |
| PAVED ROAD | |
| ACCESS ROAD | |
| EDGE OF LINER OR CELL LIMIT | |
| FENCE | |
| FM — LEACHATE FORCEMAIN | |

### NOTES

1. STORMWATER MANAGEMENT AND EROSION AND SEDIMENTATION CONTROL STRUCTURES SHOWN ON THIS DRAWING REFERENCED FROM SHEET 7 AND 8 FROM THE PHASE 3 ENGINEERING DRAWINGS – PERMIT TO CONSTRUCT APPLICATION DATED MAY 2009 PREPARED BY HODGES, HARBIN, NEWBERRY AND TRIBBLE, INC.

NORTH CAROLINA PROFESSIONAL SEAL 031802 ENGINEER ALBERT D. GLENN
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

SHEET TITLE
# FINAL CLOSURE GRADING PLAN

PROJECT TITLE
# CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION

CLIENT
REPUBLIC SERVICES, INC.
CHARLOTTE MOTOR SPEEDWAY LANDFILL
5105 MOREHEAD ROAD
CONCORD, NORTH CAROLINA 28027


SCS ENGINEERS, PC
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

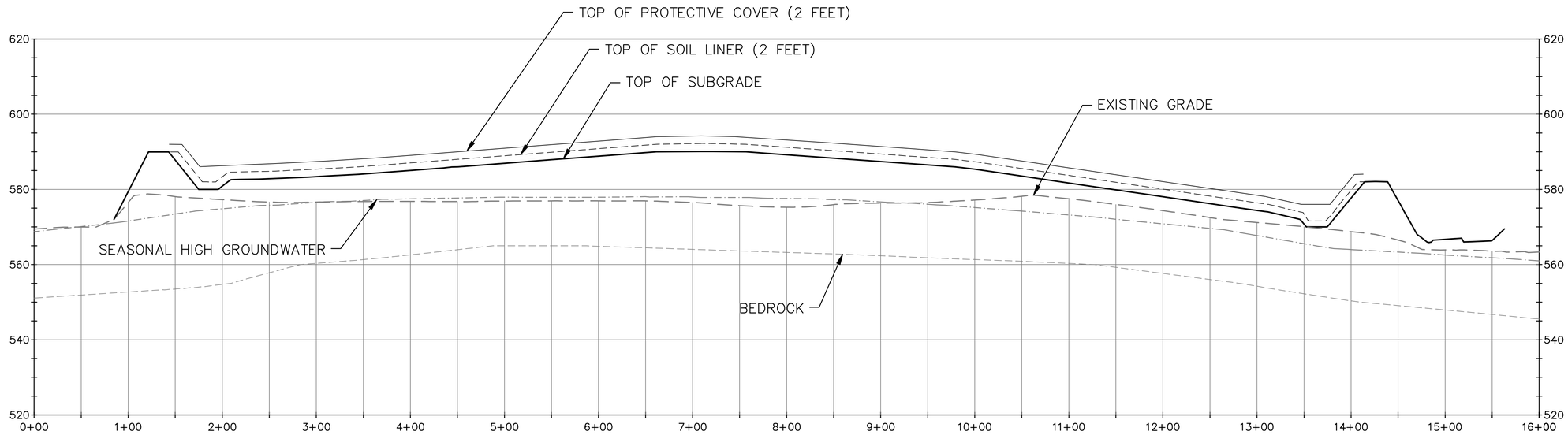

PROJ. NO. 02201314.28 | DSN. BY: SRN | DWN. BY: SRN | CHK. BY: ADG | Q/A RVW. BY: CDH | APP. BY: ADG

CADD FILE: SHT6

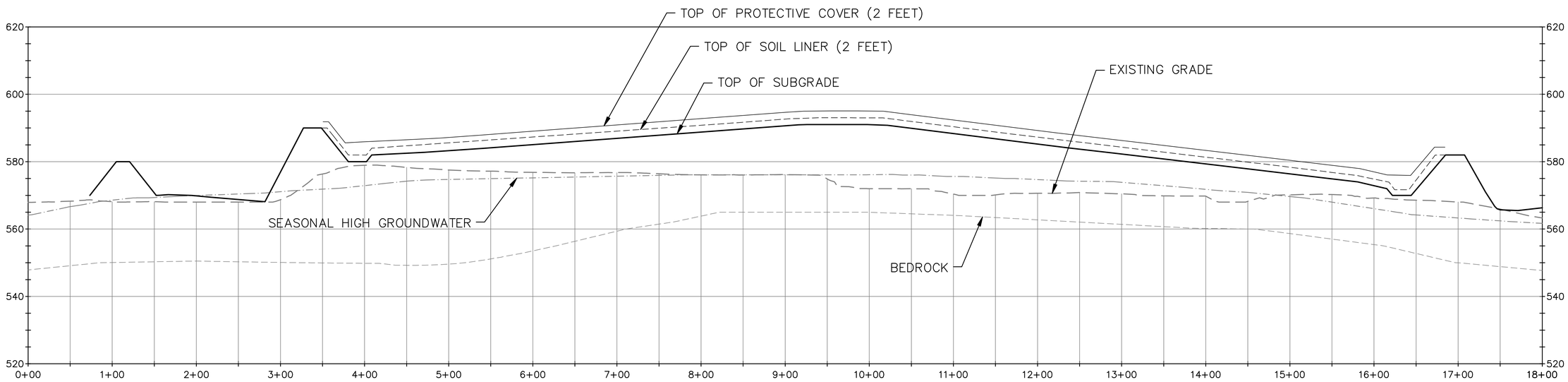
DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO.
6 of 13




Alignment – CELL 2I PROFILE
Horizontal Scale: 1"=60'-0"
Vertical Scale: 1"=15'-0"




Alignment – CELL 2J PROFILE
Horizontal Scale: 1"=60'-0"
Vertical Scale: 1"=15'-0"

NORTH CAROLINA PROFESSIONAL SEAL 031802 ENGINEER ALBERT D. GERLACH
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE **BOTTOM LINER SYSTEM PROFILES CELLS 2I & 2J**

PROJECT TITLE **CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION**

CLIENT **REPUBLIC SERVICES, INC. CHARLOTTE MOTOR SPEEDWAY LANDFILL 5105 MOREHEAD ROAD CONCORD, NORTH CAROLINA 28027**

**SCS ENGINEERS, PC**
2820 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

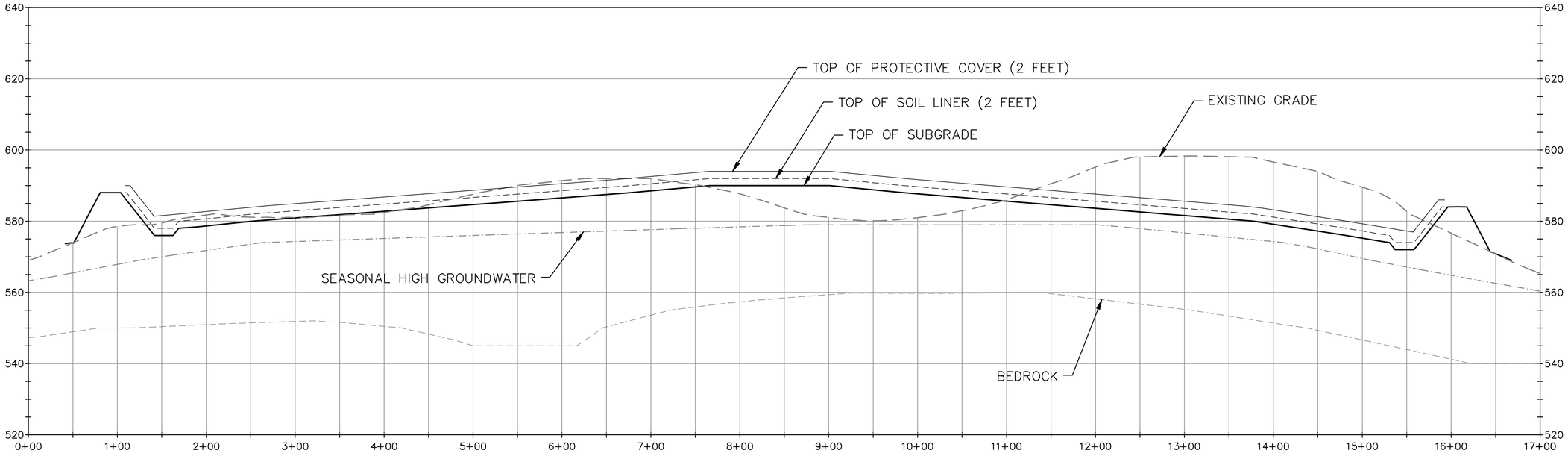
PROJ. NO. 02201314.28 | DSN. BY: SRN | DWN. BY: SRN | CHK. BY: ADG | Q/A RVW BY: CDH | APP. BY: ADG

CADD FILE: SHT7&8

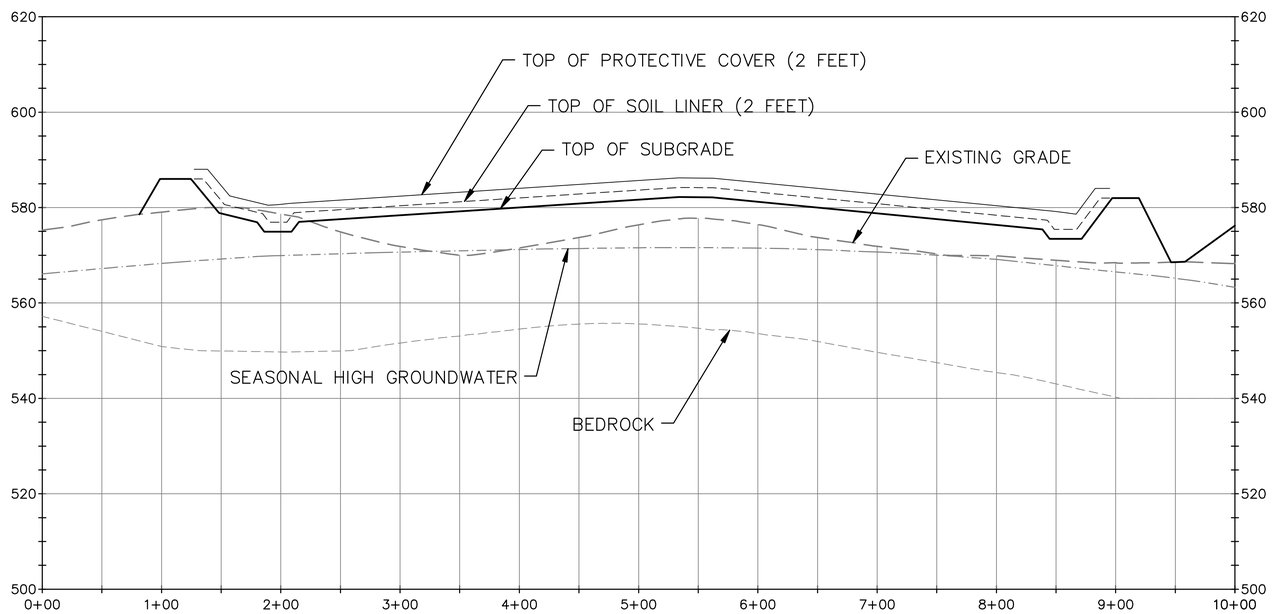
DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. 7 of 13




Alignment – CELL 2K PROFILE
Horizontal Scale: 1"=60'–0"
Vertical Scale: 1"=15'–0"




Alignment – CELL 2M PROFILE
Horizontal Scale: 1"=60'–0"
Vertical Scale: 1"=15'–0"

NORTH CAROLINA PROFESSIONAL SEAL 031802 ENGINEER ALBERTO D. GIL
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

SHEET TITLE **BOTTOM LINER SYSTEM PROFILES CELLS 2K & 2M**

PROJECT TITLE **CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION**

CLIENT **REPUBLIC SERVICES, INC.**
**CHARLOTTE MOTOR SPEEDWAY LANDFILL**
**5105 MOREHEAD ROAD**
**CONCORD, NORTH CAROLINA 28027**

**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

PROJ. NO. 02201314.28 | DWN. BY: DMC | Q/A RVW BY: SRN
DSN. BY: JLM | CHK. BY: JLM | APP. BY: SCL

CADD FILE: SHT7&8

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. **8** of **13**

## LEGEND

| EXISTING | PROPOSED |
|---|---|
| 2 FOOT ELEVATION CONTOUR | 2 FOOT ELEVATION CONTOUR |
| 610 — 10 FOOT ELEVATION CONTOUR | 10 FOOT ELEVATION CONTOUR |
| × 419.2 — SPOT ELEVATION | LC — LEACHATE COLLECTION PIPE |
| WATER COURSE OR IMPOUNDMENT | FM — LEACHATE FORCEMAIN |
| TREE LINE | EDGE OF LINER OR CELL LIMIT |
| PROPERTY BOUNDARY | ⊗ 590 — SPOT ELEVATION |
| PAVED ROAD | |
| ACCESS ROAD | |
| EDGE OF LINER OR CELL LIMIT | |
| FENCE | |
| FM — LEACHATE FORCEMAIN | |

NOTES

1. BUFFERS, PROPERTY LINES, STORMWATER MANAGEMENT AND EROSION AND SEDIMENTATION CONTROL STRUCTURES SHOWN ON THIS DRAWING REFERENCED FROM PHASE 3 ENGINEERING DRAWINGS – PERMIT TO CONSTRUCT APPLICATION DATED MAY 2009 PREPARED BY HODGES, HARBIN, NEWBERRY AND TRIBBLE, INC.

BASE MAP SOURCE: EXISTING CONTOURS PROVIDED BY INDEPENDENT MAPPING CONSULTANTS (IMC). DATE OF PHOTOGRAPHY FEBRUARY 11, 2010.

0 100 200 300
SCALE IN FEET

NORTH CAROLINA PROFESSIONAL SEAL 031902 ENGINEER ALBERT D. GEORGE
7/27/2010

NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE: **SEQUENCE OF FILL - CELL 2I**

PROJECT TITLE: **CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION**

CLIENT: **REPUBLIC SERVICES, INC.**
**CHARLOTTE MOTOR SPEEDWAY LANDFILL**
**5105 MOREHEAD ROAD**
**CONCORD, NORTH CAROLINA 28027**

**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

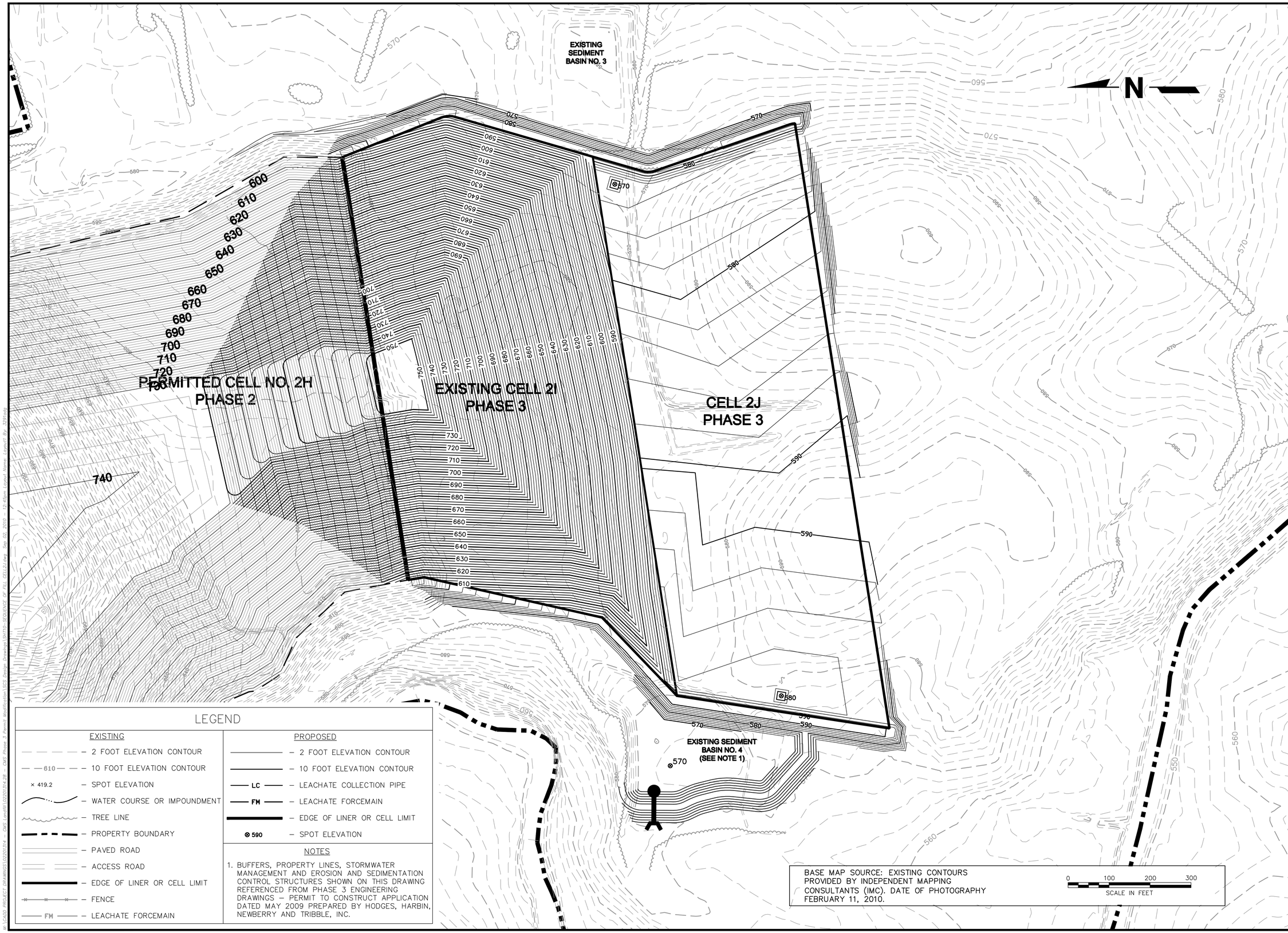
PROJ. NO. 02201314.28 | DSN. BY: SRN | DWN. BY: SRN | CHK. BY: ADG | Q/A R/W BY: CDH | APP. BY: CDH

CADD FILE: SHT9

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. 9 of 13




NORTH CAROLINA PROFESSIONAL SEAL 031902 ENGINEER ALBERT D. GEORGE
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE: **SEQUENCE OF FILL - CELL 2J**

PROJECT TITLE: **CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION**

CLIENT: **REPUBLIC SERVICES, INC. CHARLOTTE MOTOR SPEEDWAY LANDFILL 5105 MOREHEAD ROAD CONCORD, NORTH CAROLINA 28027**

**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

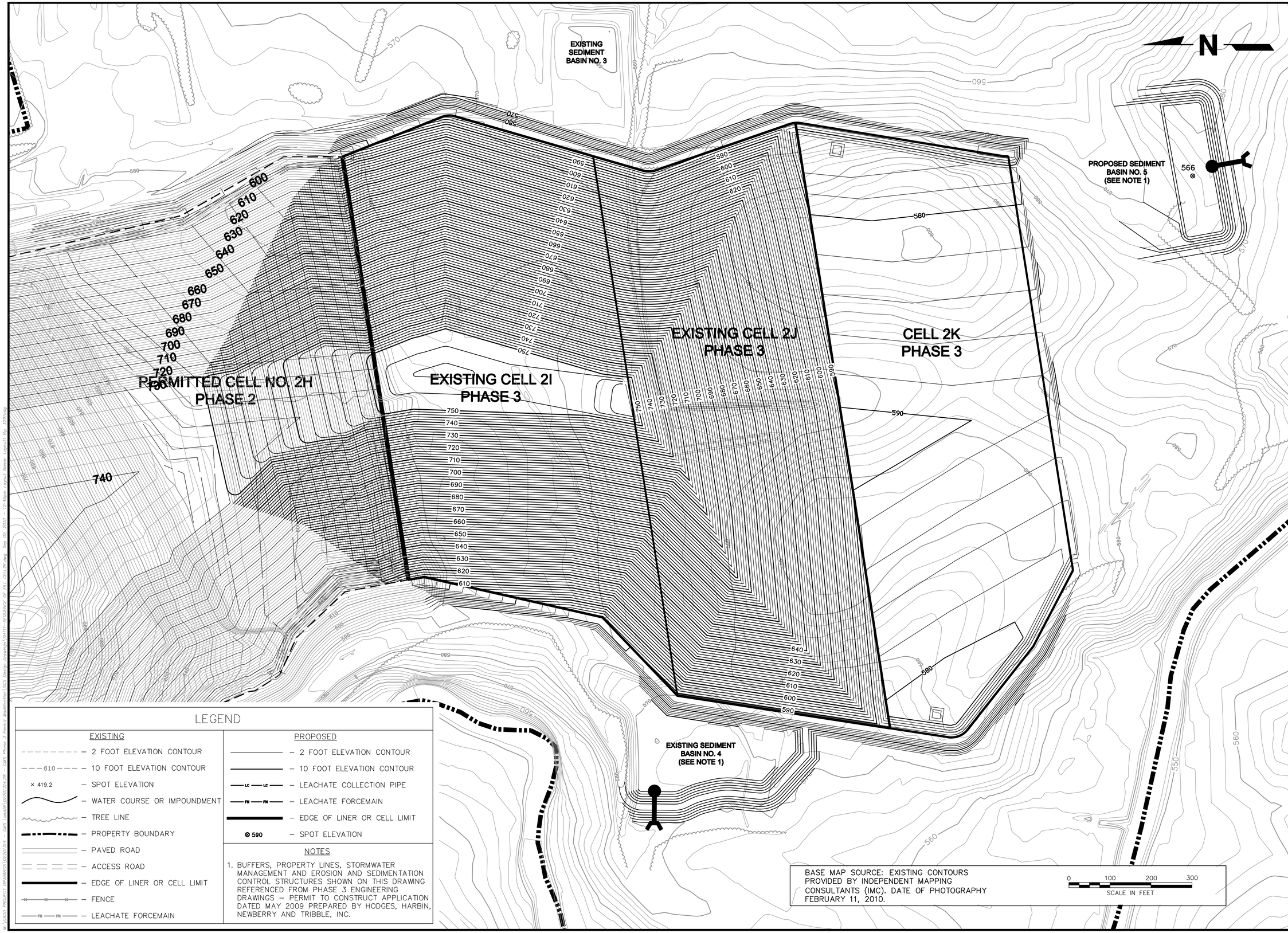
PROJ. NO. 02201314.28 | DSN. BY: SRN | DWN. BY: SRN | CHK. BY: ADG | Q/A RVW. BY: CDH | APP. BY: ADG

CADD FILE: SHT10

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. **10** of **13**




## LEGEND

| EXISTING | PROPOSED |
|---|---|
| 2 FOOT ELEVATION CONTOUR | 2 FOOT ELEVATION CONTOUR |
| 610 — 10 FOOT ELEVATION CONTOUR | 10 FOOT ELEVATION CONTOUR |
| × 419.2 — SPOT ELEVATION | LC — LEACHATE COLLECTION PIPE |
| WATER COURSE OR IMPOUNDMENT | FM — LEACHATE FORCEMAIN |
| TREE LINE | EDGE OF LINER OR CELL LIMIT |
| PROPERTY BOUNDARY | ⊗ 590 — SPOT ELEVATION |
| PAVED ROAD | |
| ACCESS ROAD | |
| EDGE OF LINER OR CELL LIMIT | |
| FENCE | |
| FM — LEACHATE FORCEMAIN | |

NOTES

1. BUFFERS, PROPERTY LINES, STORMWATER MANAGEMENT AND EROSION AND SEDIMENTATION CONTROL STRUCTURES SHOWN ON THIS DRAWING REFERENCED FROM PHASE 3 ENGINEERING DRAWINGS – PERMIT TO CONSTRUCT APPLICATION DATED MAY 2009 PREPARED BY HODGES, HARBIN, NEWBERRY AND TRIBBLE, INC.

BASE MAP SOURCE: EXISTING CONTOURS PROVIDED BY INDEPENDENT MAPPING CONSULTANTS (IMC). DATE OF PHOTOGRAPHY FEBRUARY 11, 2010.

0 100 200 300
SCALE IN FEET

NORTH CAROLINA PROFESSIONAL SEAL 031802 ENGINEER ALBERT D. GLENN
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE: SEQUENCE OF FILL - CELL 2K

PROJECT TITLE: CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION

CLIENT: REPUBLIC SERVICES, INC. CHARLOTTE MOTOR SPEEDWAY LANDFILL 5105 MOREHEAD ROAD CONCORD, NORTH CAROLINA 28027

SCS ENGINEERS, PC
2920 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

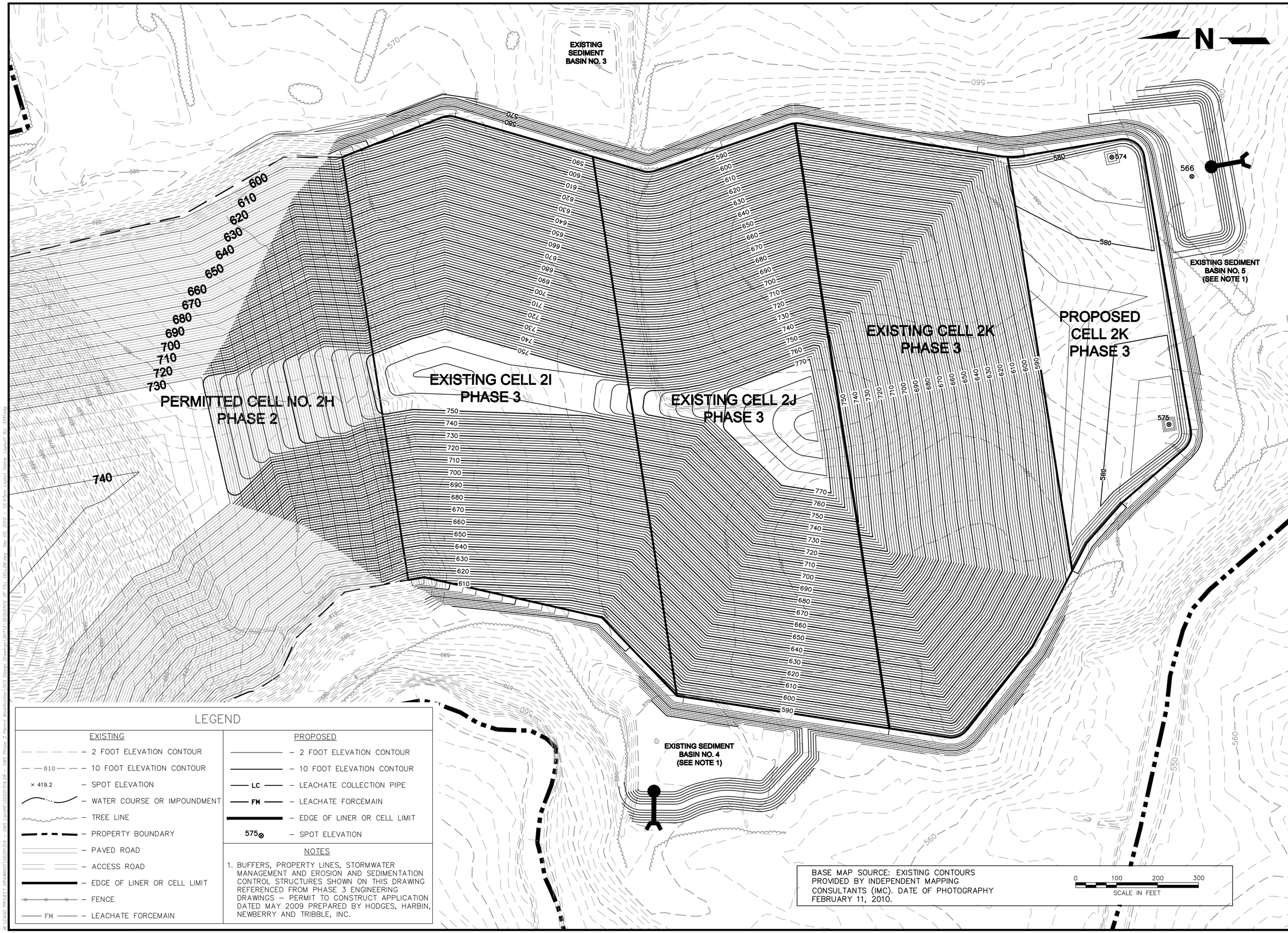
PROJ. NO. 02201314.28 | DSN. BY: SRN | DWN. BY: SRN | CHK. BY: ADG | Q/A RVW. BY: CDH | APP. BY: ADG

CADD FILE: SHT11

DATE: JULY 2010

SCALE: AS SHOWN

DRAWING NO. 11 of 13




## LEGEND

| EXISTING | PROPOSED |
|---|---|
| 2 FOOT ELEVATION CONTOUR | 2 FOOT ELEVATION CONTOUR |
| 610 — 10 FOOT ELEVATION CONTOUR | 10 FOOT ELEVATION CONTOUR |
| × 419.2 — SPOT ELEVATION | LC — LEACHATE COLLECTION PIPE |
| WATER COURSE OR IMPOUNDMENT | FM — LEACHATE FORCEMAIN |
| TREE LINE | EDGE OF LINER OR CELL LIMIT |
| PROPERTY BOUNDARY | 575 — SPOT ELEVATION |
| PAVED ROAD | |
| ACCESS ROAD | |
| EDGE OF LINER OR CELL LIMIT | |
| FENCE | |
| FM — LEACHATE FORCEMAIN | |

NOTES

1. BUFFERS, PROPERTY LINES, STORMWATER MANAGEMENT AND EROSION AND SEDIMENTATION CONTROL STRUCTURES SHOWN ON THIS DRAWING REFERENCED FROM PHASE 3 ENGINEERING DRAWINGS – PERMIT TO CONSTRUCT APPLICATION DATED MAY 2009 PREPARED BY HODGES, HARBIN, NEWBERRY AND TRIBBLE, INC.

BASE MAP SOURCE: EXISTING CONTOURS PROVIDED BY INDEPENDENT MAPPING CONSULTANTS (IMC). DATE OF PHOTOGRAPHY FEBRUARY 11, 2010.

0 100 200 300
SCALE IN FEET

NORTH CAROLINA PROFESSIONAL SEAL 031902 ENGINEER ROBERT D. GLENN
7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

| NO. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
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| 3 | | |
| 4 | | |
| 5 | | |

SHEET TITLE: SEQUENCE OF FILL - CELL 2M

PROJECT TITLE: CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION

CLIENT: REPUBLIC SERVICES, INC. CHARLOTTE MOTOR SPEEDWAY LANDFILL 5105 MOREHEAD ROAD CONCORD, NORTH CAROLINA 28027


SCS ENGINEERS, PC
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
PHONE: (704) 504-3107 FAX: (704) 504-3174

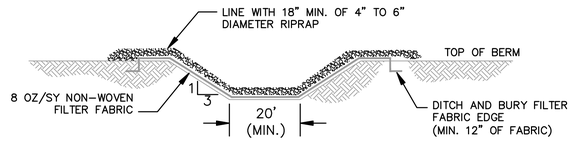

PROJ. NO. 02201314.28 | DSN. BY: SRN | DWN. BY: SRN | CHK. BY: ADG | Q/A RVW. BY: CDH | APP. BY: ADG

CADD FILE: SHT12

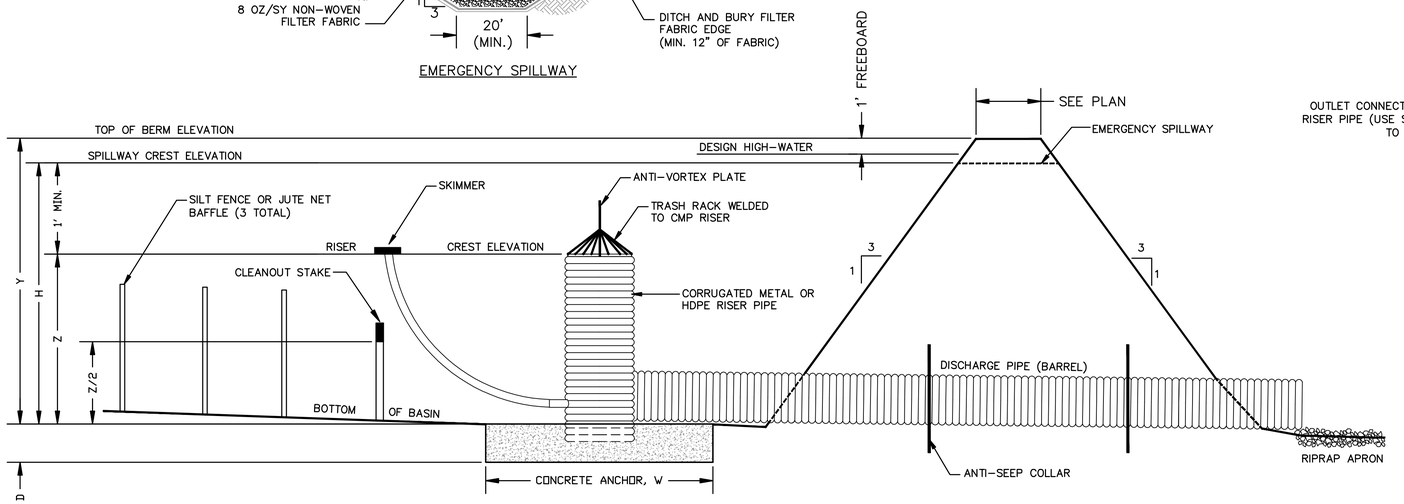
DATE: JULY 2010

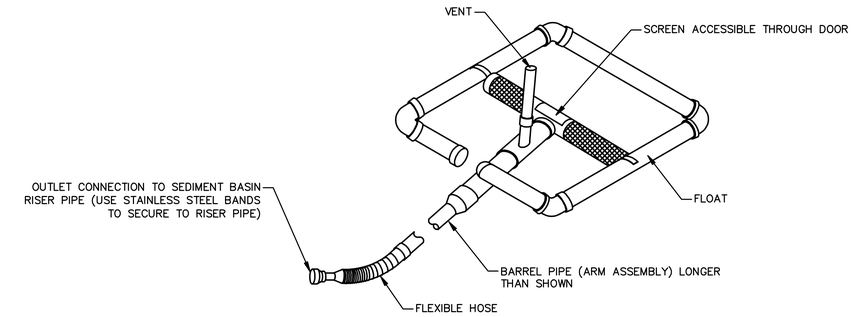
SCALE: AS SHOWN

DRAWING NO. 12 of 13

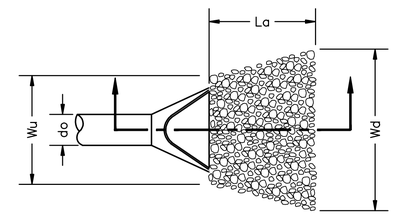



EMERGENCY SPILLWAY

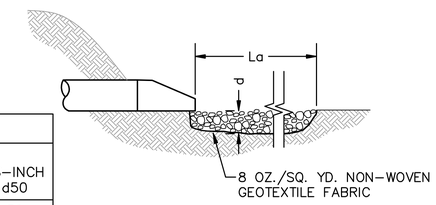



## SKIMMER DETAIL
NTS




PLAN VIEW




CROSS SECTION

| AGGREGATE REQUIRED GRADATION | | |
|---|---|---|
| PERCENT OF AGGREGATE SMALLER THAN SIZE SHOWN | 9-INCH d50 | 18-INCH d50 |
| 100 % | 15 | 30 |
| 50-70 % | 12 | 24 |
| 35-50 % | 9 | 18 |
| 2-10 % | 3 | 6 |

## RIPRAP APRON DETAIL
NTS

SEDIMENT BASIN CONSTRUCTION NOTES

1. AREA UNDER EMBANKMENT SHALL BE CLEARED, GRUBBED, AND STRIPPED OF ANY VEGETATION AND ROOT MAT. THE POOL AREA SHALL BE CLEARED ALSO.
2. PROVIDE RETRIEVAL ROPE FOR FLOATING SKIMMER
3. THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVERSIZED STONES, AND ROCKS. THE EMBANKMENT SHALL BE CONSTRUCTED IN 8 TO 12-INCH COMPACTED LIFTS. SPILLWAYS SHOULD BE GRASS LINED WITH MATTING.
4. SEDIMENT SHALL BE REMOVED AND BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO ONE-HALF THE DESIGN DEPTH OF THE BASIN. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA IN SUCH A MANNER THAT IT WILL NOT ERODE.
5. THE BASIN SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NECESSARY.
6. CONSTRUCTION OPERATION SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED. ALL CUT AND FILL SLOPES SHALL BE 2:1 OR FLATTER.
7. SEDIMENT BASIN EMBANKMENTS SHOULD BE SEEDED AND MULCHED ONCE FINAL GRADES HAVE BEEN REACHED.
8. CLEANOUT STAKES SHALL BE PLACED IN ALL SEDIMENT BASINS AT THE LOW POINT IN THE BASIN. THE STAKES SHALL BE MARKED SHOWING THE HALF FULL, CLEANOUT POINT OF THE BASIN.

SEDIMENT BASIN MAINTENANCE NOTES

INSPECT SEDIMENT BASINS AT LEAST WEEKLY AND AFTER EACH RAINFALL EVENT OF 0.5 INCHES OR GREATER AND REPAIR IMMEDIATELY. REMOVE SEDIMENT AND RESTORE THE BASIN TO ITS ORIGINAL DIMENSIONS WHEN SEDIMENT ACCUMULATES TO THE LEVEL MARKED ON THE CLEANOUT STAKE. EXCAVATE SEDIMENT FROM THE ENTIRE BASIN, NOT JUST IN THE AREA AROUND THE SPILLWAY OR IN THE FIRST CELL. MAKE SURE VEGETATION GROWING IN THE BOTTOM OF THE BASIN DOES NOT HOLD DOWN THE SKIMMER.

IF THE SKIMMER IS CLOGGED WITH TRASH AND WATER IS IN THE BASIN, USUALLY JERKING ON THE ROPE WILL MAKE THE SKIMMER BOB UP AND DOWN AND DISLODGE DEBRIS, RESTORING FLOW. IF THIS DOES NOT WORK, PULL THE SKIMMER OVER TO THE SIDE OF THE BASIN AND REMOVE THE DEBRIS.

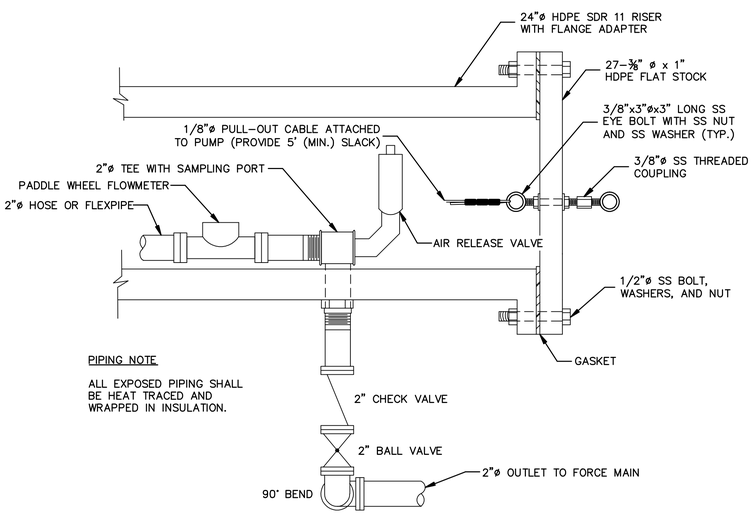
IF THE SKIMMER ARM OR BARREL PIPE IS CLOGGED, THE ORIFICE CAN BE REMOVED AND THE OBSTRUCTION CLEARED WITH A PLUMBER'S SNAKE OR BY FLUSHING WITH WATER. BE SURE AND REPLACE THE ORIFICE BEFORE REPOSITIONING THE SKIMMER.

CHECK THE FABRIC LINED SPILLWAY FOR DAMAGE AND MAKE ANY REQUIRED REPAIRS WITH FABRIC THAT SPANS THE FULL WIDTH OF THE SPILLWAY. CHECK THE EMBANKMENT, SPILLWAYS, AND OUTLET FOR EROSION DAMAGE, AND INSPECT THE EMBANKMENT FOR PIPING AND SETTLEMENT. MAKE ALL NECESSARY REPAIRS IMMEDIATELY. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE SKIMMER AND POOL AREAS.

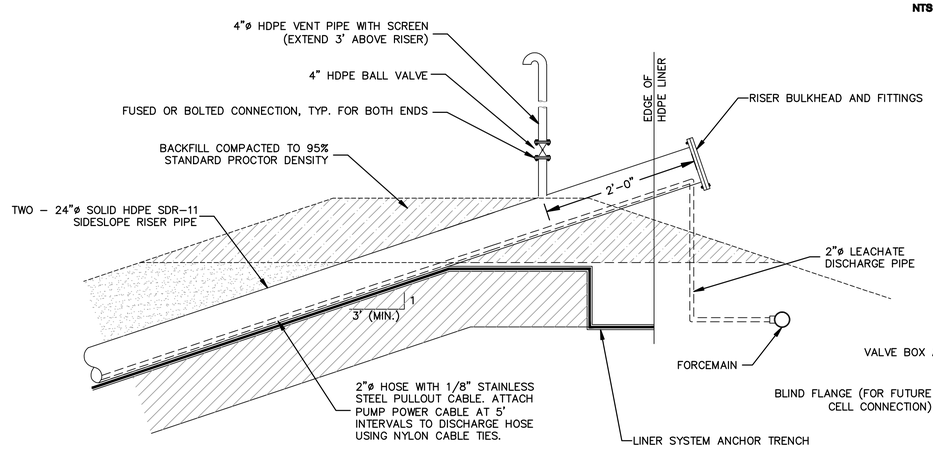
FREEZING WEATHER CAN RESULT IN ICE FORMING IN THE BASIN. SOME SPECIAL PRECAUTIONS SHOULD BE TAKEN IN THE WINTER TO PREVENT THE SKIMMER FROM PLUGGING WITH ICE.

(REF: NC EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL)

## SEDIMENT BASIN DETAIL
NTS



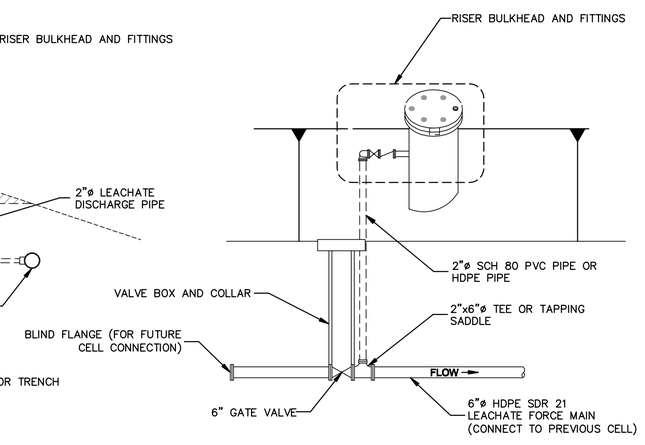

## RISER BULKHEAD AND FITTINGS
NTS




NOTE

1. PLACE "CONFINED SPACE" LABEL ON LID.

## LEACHATE RISER VAULT PROFILE
NTS




## LEACHATE RISER VAULT SECTION
NTS

NORTH CAROLINA PROFESSIONAL SEAL 031902 ENGINEER ROBERT D. GLENN 7/27/2010
NORTH CAROLINA LICENSE NO. C-1837

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| 1 | ISSUED FOR REGULATORY APPROVAL | 7/27/10 |
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SHEET TITLE: **MODIFIED DETAILS**

PROJECT TITLE: **CMS LANDFILL V #13-04 PHASE 3 PERMIT MODIFICATION**

CLIENT: **REPUBLIC SERVICES, INC.**
**CHARLOTTE MOTOR SPEEDWAY LANDFILL**
**5105 MOREHEAD ROAD**
**CONCORD, NORTH CAROLINA 28027**

**SCS ENGINEERS, PC**
2520 WHITEHALL PARK DRIVE, SUITE 450
CHARLOTTE, NORTH CAROLINA 28273
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CADD FILE: SHT13

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SCALE: AS SHOWN

DRAWING NO. **13** of **13**