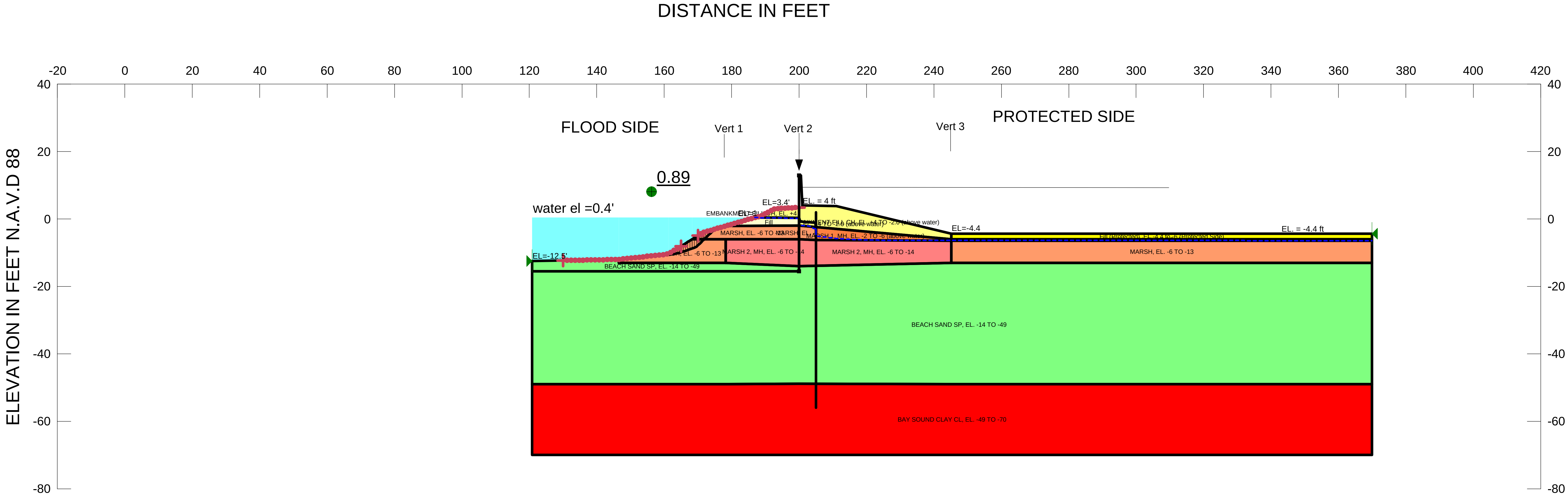



Name: EMBANKMENT FILL CH, EL. +4 TO -2.0 (above water) Model: Spatial Mohr-Coulomb Unit Weight: 109 pcf Cohesion: 75 psf Phi: 26 °
Name: MARSH 1, MH, EL. -2 TO -6 (above water) Model: Spatial Mohr-Coulomb Unit Weight: 75 pcf Cohesion: 75 psf Phi: 24 °
Name: BEACH SAND SP, EL. -14 TO -49 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 34 °
Name: BAY SOUND CLAY CL, EL. -49 TO -70 Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion: 0 psf Phi: 26 °
Name: MARSH 2, MH, EL. -6 TO -14 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion: 0 psf Phi: 24 °
Name: Fill (Protected) ,EL -4.4 to -6 (Protected Side) Model: Spatial Mohr-Coulomb Unit Weight: 109 pcf Cohesion: 75 psf Phi: 26 °
Name: MARSH, EL. -6 TO -13 Model: Spatial Mohr-Coulomb Unit Weight: 75 pcf Cohesion: 0 psf Phi: 24 °
Name: Fill Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion: 0 psf Phi: 26 °

US Army Corps of Engineers®
New Orleans District

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVELS

LONDON AVE CANAL,
OUTFALL CANAL REEVALUATION REPORT
REACH 13, STA. 93+00 TO 96+00
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Slope Stability (Entry/Exit) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Slope Stability (Entry/Exit) in front
File Name: Reach 13-Scase FS GCAT seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Edited By: Middleton, Mark C MVN

# Slope Stability (Entry/Exit) in front



## File Information

Created By: Liljegren, James
Revision Number: 393
Last Edited By: Middleton, Mark C MVN
Date: 12/19/2012
Time: 3:21:41 PM
File Name: Reach 13-Scase FS GCAT seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Solved Date: 12/19/2012
Last Solved Time: 3:22:48 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Slope Stability (Entry/Exit) in front

Kind: SLOPE/W
Parent: Gap Stability (Seepage)
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 9.807 pcf

FOS Distribution
- FOS Calculation Option: Constant

Advanced





- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 3 ft
- Optimization Maximum Iterations: 2000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL CH, EL. +4 TO -2.0 (above water)

Model: Spatial Mohr-Coulomb
Unit Weight: 109 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### MARSH 1, MH, EL. -2 TO -6 (above water)

Model: Spatial Mohr-Coulomb
Unit Weight: 75 pcf
Cohesion: 75 psf
Phi: 24 °
Phi-B: 0 °

### BEACH SAND SP, EL. -14 TO -49

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 34 °
Phi-B: 0 °

### BAY SOUND CLAY CL, EL. -49 TO -70

Model: Mohr-Coulomb
Unit Weight: 108 pcf
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### MARSH 2, MH, EL. -6 TO -14

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### Fill (Protected) ,EL -4.4 to -6 (Protected Side)





Model: Spatial Mohr-Coulomb
Unit Weight: 109 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### MARSH, EL. -6 TO -13

Model: Spatial Mohr-Coulomb
Unit Weight: 75 pcf
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### Fill

Model: Mohr-Coulomb
Unit Weight: 109 pcf
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (130, -12.32101) ft
Left-Zone Right Coordinate: (165, -8.07843) ft
Left-Zone Increment: 30
Right Projection: Range
Right-Zone Left Coordinate: (170, -4.94118) ft
Right-Zone Right Coordinate: (200, 3.4) ft
Right-Zone Increment: 30
Radius Increments: 20

## Slip Surface Limits

Left Coordinate: (120.8, -12.5) ft
Right Coordinate: (370, -4.4) ft

## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -15.5) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 28.4 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No





Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | MARSH, EL. -6 TO -13 | 23,2,11,12,42,39 | 109.0625 |
| Region 2 | MARSH, EL. -6 TO -13 | 11,51,49,12 | 19.375 |
| Region 3 | BEACH SAND SP, EL. -14 TO -49 | 7,1,34,35,31,40,30,14,41,32,33 | 206.375 |
| Region 4 | BAY SOUND CLAY CL, EL. -49 TO -70 | 9,38,37,36,10,17,18 | 5236.55 |
| Region 5 | Fill (Protected) ,EL -4.4 to -6 (Protected Side) | 24,19,6,15 | 199.68 |
| Region 6 | BEACH SAND SP, EL. -14 TO -49 | 14,16,8,10,36,37,38,9,7,33,32,41 | 8747.25 |
| Region 7 | EMBANKMENT FILL CH, EL. +4 TO -2.0 (above water) | 45,22,3,27,4,46 | 27.845 |
| Region 8 | EMBANKMENT FILL CH, EL. +4 TO -2.0 (above water) | 4,20,25,5,24,15,51,48,47,46 | 206.5725 |
| Region 9 | MARSH 2, MH, EL. -6 TO -14 | 12,49,52,16,14,21,13 | 326.44 |
| Region 10 | | 20,4,28,29,25 | 7.275 |
| Region 11 | MARSH, EL. -6 TO -13 | 30,40,31,35,26,39,42 | 129.5125 |
| Region 12 | MARSH 2, MH, EL. -6 TO -14 | 30,42,12,13,21,14 | 163.5 |
| Region 13 | MARSH 1, MH, EL. -2 TO -6 (above water) | 52,15,6,50 | 49.92 |
| Region 14 | EMBANKMENT FILL CH, EL. +4 TO -2.0 (above water) | 46,47,48,51,11 | 6.5375 |
| Region 15 | MARSH 1, MH, EL. -2 TO -6 (above water) | 51,15,52,49 | 83.415 |
| Region 16 | MARSH, EL. -6 TO -13 | 16,52,50,8 | 823.68 |
| Region 17 | Fill | 2,11,46,45 | 41.88 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 120.8 | -13 |
| Point 2 | 178.2 | -2.1 |
| Point 3 | 192.7 | 3 |
| Point 4 | 200 | 3.4 |

| | | |
|---|---|---|
| Point 5 | 211 | 3.8 |
| Point 6 | 370 | -6 |
| Point 7 | 120.8 | -15.5 |
| Point 8 | 370 | -13 |
| Point 9 | 120.8 | -49 |
| Point 10 | 370 | -49 |
| Point 11 | 200 | -2 |
| Point 12 | 200 | -6 |
| Point 13 | 200 | -7.9 |
| Point 14 | 200 | -14 |
| Point 15 | 245.2 | -6 |
| Point 16 | 245.2 | -13 |
| Point 17 | 370 | -70 |
| Point 18 | 120.8 | -70 |
| Point 19 | 370 | -4.4 |
| Point 20 | 201 | 3.4 |
| Point 21 | 200 | -10.7 |
| Point 22 | 189 | 1 |
| Point 23 | 171.5 | -4 |
| Point 24 | 245.2 | -4.4 |
| Point 25 | 201 | 4 |
| Point 26 | 161.3 | -10.4 |
| Point 27 | 199 | 3.4 |
| Point 28 | 200 | 12.9 |
| Point 29 | 200.5 | 12.9 |
| Point 30 | 178.2 | -13 |
| Point 31 | 146.5 | -13 |
| Point 32 | 151.7 | -15.5 |
| Point 33 | 138.6 | -15.5 |
| Point 34 | 120.8 | -12.5 |
| Point 35 | 146.5 | -12 |
| Point 36 | 245.2 | -49 |
| Point 37 | 199.9 | -48.9 |
| Point 38 | 178.2 | -49 |
| Point 39 | 168.3125 | -6 |
| Point 40 | 154.61111 | -13 |
| Point 41 | 200 | -15.5 |
| Point 42 | 178.2 | -6 |
| Point 43 | 205 | 2 |
| Point 44 | 205 | -56 |
| Point 45 | 186.9 | 0.4 |
| Point 46 | 200 | 0.3 |
| Point 47 | 200.3 | -0.8 |
| Point 48 | 204.8 | -1.05 |





| | | |
|---|---|---|
| | 205 | -6.2 |
| Point 50 | 370 | -6.4 |
| Point 51 | 205 | -2.45 |
| Point 52 | 245.2 | -6.4 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 0.89 | (161.144, 5.537) | 9.817358 | (175.183, -2.95544) | (160.275, -10.5108) |
| 2 | 16390 | 0.92 | (161.144, 5.537) | 16.171 | (174.845, -3.05126) | (159.718, -10.5711) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 160.53155 | -10.521965 | 681.52811 | 683.02966 | 0.66853305 | 0 |
| 2 | Optimized | 161.04385 | -10.54436 | 682.93216 | 685.42824 | 1.1113277 | 0 |
| 3 | Optimized | 161.4248 | -10.561015 | 683.94739 | 691.3916 | 3.3143787 | 0 |
| 4 | Optimized | 161.84525 | -10.535165 | 682.32901 | 691.09148 | 3.9013031 | 0 |
| 5 | Optimized | 162.43655 | -10.47255 | 678.4271 | 690.75511 | 5.4887815 | 0 |
| 6 | Optimized | 163.03535 | -10.37605 | 672.39312 | 686.56523 | 6.3098286 | 0 |
| 7 | Optimized | 163.6417 | -10.245675 | 664.25101 | 681.16403 | 7.5301595 | 0 |
| 8 | Optimized | 164.2453 | -10.09938 | 655.11506 | 673.80509 | 8.3213347 | 0 |
| 9 | Optimized | 164.84605 | -9.93716 | 644.99063 | 665.96267 | 9.3373532 | 0 |
| 10 | Optimized | 165.42805 | -9.762655 | 634.10769 | 656.18032 | 9.8273648 | 0 |
| 11 | Optimized | 165.9914 | -9.575865 | 622.44796 | 646.23921 | 10.592549 | 0 |
| 12 | Optimized | 166.63555 | -9.356635 | 608.76366 | 634.22872 | 11.337778 | 0 |
| 13 | Optimized | 167.30775 | -9.114245 | 593.62677 | 620.47042 | 11.951561 | 0 |
| 14 | Optimized | 167.9273 | -8.881135 | 579.07954 | 607.49423 | 12.651034 | 0 |
| 15 | Optimized | 168.2748 | -8.7490465 | 570.83563 | 599.5209 | 12.771505 | 0 |
| 16 | Optimized | 168.62285 | -8.6056225 | 561.88629 | 591.3197 | 13.104601 | 0 |
| 17 | Optimized | 169.24355 | -8.349841 | 545.93326 | 576.69237 | 13.694839 | 0 |
| 18 | Optimized | 169.81315 | -7.989665 | 523.45815 | 547.3183 | 10.623225 | 0 |
| 19 | Optimized | 170.3316 | -7.525095 | 494.46972 | 517.2094 | 10.124362 | 0 |
| 20 | Optimized | 170.8181 | -7.0662405 | 465.82932 | 486.30088 | 9.1145269 | 0 |
| 21 | Optimized | 171.2727 | -6.613101 | 437.56797 | 456.73084 | 8.5318631 | 0 |
| 22 | Optimized | 171.58415 | -6.3026655 | 418.19697 | 435.62623 | 7.7600057 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 23 | Optimized | 171.77575 | -6.1094 | 406.13 | 422.30347 | 7.2008897 | 0 |
| 24 | Optimized | 172.11505 | -5.76388 | 384.5732 | 398.8049 | 6.3363616 | 0 |
| 25 | Optimized | 172.5937 | -5.28427 | 354.65227 | 366.37739 | 5.2203575 | 0 |
| 26 | Optimized | 173.08415 | -4.811255 | 325.13866 | 334.44541 | 4.1436315 | 0 |
| 27 | Optimized | 173.5714 | -4.352205 | 296.50136 | 303.22374 | 2.9929923 | 0 |
| 28 | Optimized | 174.0248 | -3.934075 | 270.41617 | 274.93552 | 2.0121408 | 0 |
| 29 | Optimized | 174.4718 | -3.5479625 | 246.34376 | 248.88689 | 1.1322759 | 0 |
| 30 | Optimized | 174.9462 | -3.1529475 | 221.70614 | 222.04631 | 0.15145091 | 0 |

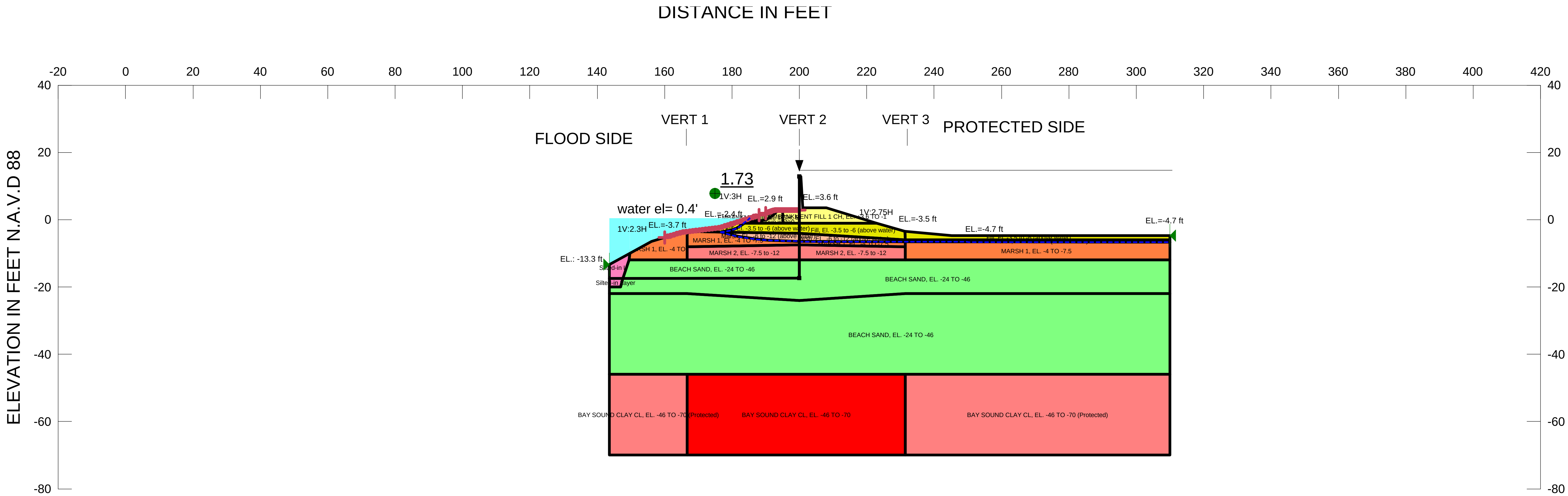
### Slices of Slip Surface: 16390

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 16390 | 159.9814 | -10.59007 | 685.77069 | 687.69956 | 0.8587891 | 0 |
| 2 | 16390 | 160.50885 | -10.61944 | 687.60664 | 690.3726 | 1.2314854 | 0 |
| 3 | 16390 | 161.0363 | -10.631555 | 688.34974 | 691.74342 | 1.5109669 | 0 |
| 4 | 16390 | 161.55045 | -10.62701 | 688.07312 | 696.87461 | 3.9186768 | 0 |
| 5 | 16390 | 162.05135 | -10.60663 | 686.78718 | 698.76683 | 5.3336871 | 0 |
| 6 | 16390 | 162.55225 | -10.57065 | 684.54082 | 699.3975 | 6.6146191 | 0 |
| 7 | 16390 | 163.05315 | -10.518965 | 681.29409 | 698.75961 | 7.7761509 | 0 |
| 8 | 16390 | 163.55405 | -10.451425 | 677.08651 | 696.88702 | 8.8157535 | 0 |
| 9 | 16390 | 164.05495 | -10.367825 | 671.85819 | 693.75466 | 9.7489346 | 0 |
| 10 | 16390 | 164.55585 | -10.267915 | 665.62861 | 689.33903 | 10.55656 | 0 |
| 11 | 16390 | 165.0567 | -10.15138 | 658.35849 | 683.65688 | 11.263566 | 0 |
| 12 | 16390 | 165.55755 | -10.017843 | 650.00952 | 676.64831 | 11.860353 | 0 |
| 13 | 16390 | 166.05845 | -9.866867 | 640.5827 | 668.33241 | 12.354966 | 0 |
| 14 | 16390 | 166.55935 | -9.6979285 | 630.04127 | 658.653 | 12.738764 | 0 |
| 15 | 16390 | 167.06025 | -9.5104235 | 618.34999 | 647.57581 | 13.012174 | 0 |
| 16 | 16390 | 167.56115 | -9.3036465 | 605.4388 | 635.06938 | 13.192386 | 0 |
| 17 | 16390 | 168.06205 | -9.0767785 | 591.27779 | 621.06903 | 13.263918 | 0 |
| 18 | 16390 | 168.57815 | -8.820668 | 575.29721 | 605.00064 | 13.224821 | 0 |
| 19 | 16390 | 169.1094 | -8.5327355 | 557.34266 | 586.67993 | 13.061795 | 0 |
| 20 | 16390 | 169.64065 | -8.218261 | 537.71508 | 566.44489 | 12.791336 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21 | 16390 | 170.1719 | -7.8753725 | 516.32067 | 544.14717 | 12.389159 | 0 |
| 22 | 16390 | 170.70315 | -7.501822 | 493.00441 | 519.64632 | 11.861744 | 0 |
| 23 | 16390 | 171.2344 | -7.09488 | 467.62303 | 492.78667 | 11.203573 | 0 |
| 24 | 16390 | 171.74375 | -6.6710335 | 441.17615 | 463.27833 | 9.8405226 | 0 |
| 25 | 16390 | 172.23125 | -6.2296905 | 413.63307 | 432.51804 | 8.4081298 | 0 |
| 26 | 16390 | 172.71205 | -5.757184 | 384.15358 | 399.6541 | 6.9012762 | 0 |
| 27 | 16390 | 173.18615 | -5.2497085 | 352.48946 | 364.47928 | 5.338212 | 0 |
| 28 | 16390 | 173.66025 | -4.6950585 | 317.88648 | 326.18973 | 3.6968469 | 0 |
| 29 | 16390 | 174.13435 | -4.0850095 | 279.83656 | 284.26805 | 1.9730257 | 0 |
| 30 | 16390 | 174.60845 | -3.408107 | 237.61311 | 238.00993 | 0.17667537 | 0 |




Name: EMBANKMENT FILL 1 CH, EL. +3.6 TO -1 Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 23 °
Name: MARSH 1, EL. -4 TO -7.5 Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion: 0 psf Phi: 23 °
Name: BEACH SAND, EL. -24 TO -46 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 30 °
Name: BAY SOUND CLAY CL, EL. -46 TO -70 Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 23 °
Name: Silted-in Layer Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion: 0 psf Phi: 28 °
Name: MARSH 2, EL. -7.5 to -12 Model: Spatial Mohr-Coulomb Weight Fn: Marsh 2 Cohesion: 0 psf Phi: 23 °
Name: EMBANKMENT FILL 2, EL. -1 TO -4 Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion: 0 psf Phi: 23 °
Name: Fill, El. -3.5 to -6 (above water) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion: 0 psf Phi: 23 °
Name: Marsh, EL. -6 to -12 (above water) Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion: 0 psf Phi: 23 °
Name: BAY SOUND CLAY CL, EL. -46 TO -70 (Protected) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 23 °
Name: Emb Fill 1 CH 3.6 to -1 (above water) Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 23 °

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

LONDON AVE OUTFALL CANAL, REACH 16,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Entry/Exit) (in front)
STA. 104+00 TO 112+50
ORLEANS PARISH, LOUISIANA

Name: Global Stability (Entry/Exit) (in front)
File Name: Reach 16-Scase FS seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Entry/Exit) (in front)



## File Information

Created By: Liljegren, James
Revision Number: 263
Last Edited By: Middleton, Mark C MVN
Date: 1/14/2013
Time: 5:00:23 PM
File Name: Reach 16-Scase FS seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Solved Date: 1/14/2013
Last Solved Time: 5:05:42 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Global Stability (Entry/Exit) (in front)

Kind: SLOPE/W
Parent: Global Stability (Seepage)
Method: Spencer
Settings
  PWP Conditions Source: Parent Analysis
Slip Surface
  Direction of movement: Right to Left
  Use Passive Mode: No
  Slip Surface Option: Entry and Exit
  Critical slip surfaces saved: 1
  Optimize Critical Slip Surface Location: Yes
  Tension Crack
    Tension Crack Option: Search for Tension Crack
    Percentage Wet: 0
    Tension Crack Fluid Unit Weight: 62.4 pcf
FOS Distribution
  FOS Calculation Option: Constant
Advanced





Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 2 ft
Optimization Maximum Iterations: 2000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL 1 CH, EL. +3.6 TO -1

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH 1, EL. -4 TO -7.5

Model: Mohr-Coulomb
Unit Weight: 80 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### BEACH SAND, EL. -24 TO -46

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °

### BAY SOUND CLAY CL, EL. -46 TO -70

Model: Mohr-Coulomb
Unit Weight: 104 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Silted-in Layer

Model: Mohr-Coulomb
Unit Weight: 90 pcf
Cohesion: 0 psf
Phi: 28 °
Phi-B: 0 °

### MARSH 2, EL. -7.5 to -12





Model: Spatial Mohr-Coulomb
Weight Fn: Marsh 2
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### EMBANKMENT FILL 2, EL. -1 TO -4

Model: Mohr-Coulomb
Unit Weight: 90 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Fill, El. -3.5 to -6 (above water)

Model: Mohr-Coulomb
Unit Weight: 90 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Marsh, EL. -6 to -12 (above water)

Model: Mohr-Coulomb
Unit Weight: 80 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### BAY SOUND CLAY CL, EL. -46 TO -70 (Protected)

Model: Mohr-Coulomb
Unit Weight: 104 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Emb Fill 1 CH 3.6 to -1 (above water)

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (160, -5.25543) ft
Left-Zone Right Coordinate: (188, 1.30986) ft
Left-Zone Increment: 30
Right Projection: Range
Right-Zone Left Coordinate: (190, 1.95775) ft
Right-Zone Right Coordinate: (200, 2.9) ft





Right-Zone Increment: 30
Radius Increments: 20

## Slip Surface Limits

Left Coordinate: (143.6, -13.3) ft
Right Coordinate: (310, -4.7) ft

## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -17.4) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 30.3 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No
Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Unit Weight Functions

### Marsh 2

Model: Spline Data Point Function
Function: Unit Weight vs. X
  Curve Fit to Data: 100 %
  Segment Curvature: 0 %
Y-Intercept: 80
Data Points: X (ft), Unit Weight (pcf)
  Data Point: (166.7, 80)
  Data Point: (200, 97)
  Data Point: (231.4, 80)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | EMBANKMENT FILL 1 CH, EL. +3.6 TO -1 | 58,57,30,4,5,33,24,21,59 | 48.755 |
| Region 2 | MARSH 1, EL. -4 TO -7.5 | 25,3,8,28,35,41,42,43 | 100.17577 |
| Region 3 | Fill, El. -3.5 to -6 (above water) | 36,31,32,7,9,18 | 110.58019 |
| Region 4 | MARSH 1, EL. -4 TO -7.5 | 70,19,38,37,69 | 420.51 |

| | | | |
|---|---|---|---|
| Region 5 | Silted-in Layer | 52,20,3,25,51 | 29.215 |
| Region 6 | EMBANKMENT FILL 2, EL. -1 TO -4 | 35,64,63,62,61,60,59,55,29 | 16.397273 |
| Region 7 | EMBANKMENT FILL 1 CH, EL. +3.6 TO -1 | 24,33,34,23,6,56 | 69.275 |
| Region 8 | Fill, El. -3.5 to -6 (above water) | 12,24,56,36,18 | 114.85463 |
| Region 9 | BEACH SAND, EL. -24 TO -46 | 10,26,44,39,40,27,11,47,17,45 | 3928.9 |
| Region 10 | MARSH 1, EL. -4 TO -7.5 | 35,64,65,66,67,68,13,42,41 | 91.854229 |
| Region 11 | MARSH 2, EL. -7.5 to -12 | 42,43,14,54,13 | 141.525 |
| Region 12 | BEACH SAND, EL. -24 TO -46 | 25,43,14,22,51 | 280.301 |
| Region 13 | | 33,49,50,23,34 | 7.675 |
| Region 14 | Marsh, EL. -6 to -12 (above water) | 12,18,69,68 | 47.1 |
| Region 15 | MARSH 2, EL. -7.5 to -12 | 14,54,13,37,38 | 133.45 |
| Region 16 | BEACH SAND, EL. -24 TO -46 | 39,44,26,1,2,51,22,14,38,19,27,40 | 1411.969 |
| Region 17 | Silted-in Layer | 52,51,2,1 | 9.15 |
| Region 18 | BAY SOUND CLAY CL, EL. -46 TO -70 | 45,17,47,48,53,46 | 1552.8 |
| Region 19 | BAY SOUND CLAY CL, EL. -46 TO -70 (Protected) | 47,48,15,11 | 1886.4 |
| Region 20 | BAY SOUND CLAY CL, EL. -46 TO -70 (Protected) | 10,16,46,45 | 554.4 |
| Region 21 | Emb Fill 1 CH 3.6 to -1 (above water) | 55,58,59 | 2.052274 |
| Region 22 | Fill, El. -3.5 to -6 (above water) | 64,63,62,61,60,59,21,24,12 | 54.345 |
| Region 23 | Marsh, EL. -6 to -12 (above water) | 64,12,68,67,66,65 | 40.56 |
| Region 24 | MARSH 1, EL. -4 TO -7.5 | 68,69,37,13 | 39.25 |
| Region 25 | Marsh, EL. -6 to -12 (above water) | 18,9,70,69 | 51.09 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 143.6 | -20 |
| Point 2 | 146.9 | -20 |
| Point 3 | 149.7 | -10 |
| Point 4 | 195 | 2.8 |
| Point 5 | 199 | 2.9 |





| | | |
|---|---|---|
| Point 6 | 208 | 3.5 |
| Point 7 | 310 | -4.7 |
| Point 8 | 156.1 | -6.4 |
| Point 9 | 310 | -6 |
| Point 10 | 143.6 | -46 |
| Point 11 | 310 | -46 |
| Point 12 | 200 | -4 |
| Point 13 | 200 | -7.5 |
| Point 14 | 200 | -12 |
| Point 15 | 310 | -70 |
| Point 16 | 143.6 | -70 |
| Point 17 | 200 | -46 |
| Point 18 | 231.4 | -6 |
| Point 19 | 310 | -12 |
| Point 20 | 143.6 | -13.3 |
| Point 21 | 195 | -1 |
| Point 22 | 200 | -17.4 |
| Point 23 | 201 | 3.6 |
| Point 24 | 200 | -1 |
| Point 25 | 149.5 | -12 |
| Point 26 | 143.6 | -22 |
| Point 27 | 310 | -22 |
| Point 28 | 165.3 | -3.7 |
| Point 29 | 176.2 | -2.4 |
| Point 30 | 192.6 | 2.8 |
| Point 31 | 231.5 | -3.5 |
| Point 32 | 245.2 | -4.7 |
| Point 33 | 200 | 2.9 |
| Point 34 | 201 | 2.9 |
| Point 35 | 166.66154 | -3.5 |
| Point 36 | 231.35185 | -3.5 |
| Point 37 | 231.4 | -8 |
| Point 38 | 231.4 | -12 |
| Point 39 | 200 | -24 |
| Point 40 | 231.4 | -22 |
| Point 41 | 166.7 | -6 |
| Point 42 | 166.7 | -8 |
| Point 43 | 166.7 | -12 |
| Point 44 | 166.7 | -22 |
| Point 45 | 166.7 | -46 |
| Point 46 | 166.7 | -70 |
| Point 47 | 231.4 | -46 |
| Point 48 | 231.4 | -70 |
| Point 49 | 200 | 12.9 |





| | | |
|---|---|---|
| | 200.5 | 12.9 |
| Point 51 | 147.62 | -17.5 |
| Point 52 | 143.6 | -17.5 |
| Point 53 | 200 | -70 |
| Point 54 | 200 | -11.6 |
| Point 55 | 180.71818 | -1 |
| Point 56 | 222.9 | -1 |
| Point 57 | 185.5 | 0.5 |
| Point 58 | 185.2 | 0.4 |
| Point 59 | 183.65 | -1 |
| Point 60 | 182.3 | -2 |
| Point 61 | 180.8 | -2.8 |
| Point 62 | 179.5 | -3.1 |
| Point 63 | 178.2 | -3.4 |
| Point 64 | 176.7 | -3.7 |
| Point 65 | 181.8 | -5 |
| Point 66 | 187.2 | -5.8 |
| Point 67 | 190.8 | -6.1 |
| Point 68 | 200 | -6.4 |
| Point 69 | 231.4 | -6.6 |
| Point 70 | 310 | -6.7 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 1.73 | (187.427, 7.571) | 4.923927 | (193.798, 2.8) | (184.025, 0.0330702) |
| 2 | 17188 | 1.77 | (187.427, 7.571) | 8.058 | (193.921, 2.8) | (184.336, 0.130061) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 184.1731 | 0.00882268 | 22.892773 | 40.074373 | 7.2931562 | 0 |
| 2 | Optimized | 184.4687 | -0.03967244 | 10.405715 | 53.719625 | 18.385664 | 0 |
| 3 | Optimized | 184.6456 | -0.06919815 | 2.9085586 | 62.573058 | 25.326078 | 0 |
| 4 | Optimized | 184.8846 | -0.11254815 | -8.8823155 | 73.44239 | 31.174445 | 0 |
| 5 | Optimized | 185.14725 | -0.16047465 | -22.082119 | 85.299187 | 36.207357 | 0 |
| 6 | Optimized | 185.35 | -0.1983626 | -48.972113 | 90.591528 | 38.453822 | 0 |
| 7 | Optimized | 185.64085 | -0.25272295 | -81.722013 | 111.55266 | 47.351294 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | Optimized | 185.92 | -0.2913675 | -108.77811 | 122.5163 | 52.005084 | 0 |
| 9 | Optimized | 186.19655 | -0.3160025 | -133.40888 | 137.60526 | 58.409968 | 0 |
| 10 | Optimized | 186.4708 | -0.3319 | -157.85419 | 146.31796 | 62.108289 | 0 |
| 11 | Optimized | 186.7428 | -0.33906 | -178.10049 | 158.47897 | 67.27033 | 0 |
| 12 | Optimized | 187.04525 | -0.3384725 | -193.57117 | 166.30466 | 70.592142 | 0 |
| 13 | Optimized | 187.37815 | -0.3301375 | -210.68781 | 178.66468 | 75.838657 | 0 |
| 14 | Optimized | 187.73285 | -0.31235 | -228.84286 | 186.10373 | 78.996346 | 0 |
| 15 | Optimized | 188.1093 | -0.28511 | -247.65168 | 197.58137 | 83.868318 | 0 |
| 16 | Optimized | 188.4507 | -0.25331665 | -259.18611 | 202.34432 | 85.890069 | 0 |
| 17 | Optimized | 188.7571 | -0.21697 | -269.40461 | 209.79186 | 89.051363 | 0 |
| 18 | Optimized | 189.0635 | -0.18062335 | -279.66847 | 217.23941 | 92.212657 | 0 |
| 19 | Optimized | 189.4181 | -0.13065 | -292.04126 | 220.58827 | 93.634166 | 0 |
| 20 | Optimized | 189.8209 | -0.06705 | -304.20556 | 228.35282 | 96.930022 | 0 |
| 21 | Optimized | 190.207 | 0.065605 | -319.21338 | 191.11467 | 81.123364 | 0 |
| 22 | Optimized | 190.57645 | 0.267315 | -337.62451 | 183.11355 | 77.72709 | 0 |
| 23 | Optimized | 190.93705 | 0.4753475 | -356.12169 | 169.76664 | 72.061661 | 0 |
| 24 | Optimized | 191.2887 | 0.6897025 | -373.895 | 160.21955 | 68.009166 | 0 |
| 25 | Optimized | 191.59325 | 0.88755 | -390.21379 | 145.26 | 61.659214 | 0 |
| 26 | Optimized | 191.8507 | 1.06889 | -404.59911 | 136.2922 | 57.852607 | 0 |
| 27 | Optimized | 192.19175 | 1.32976 | -424.44943 | 118.07819 | 50.121218 | 0 |
| 28 | Optimized | 192.50205 | 1.5903195 | -443.33319 | 99.464818 | 42.220311 | 0 |
| 29 | Optimized | 192.7233 | 1.794427 | -457.71876 | 84.90911 | 36.041779 | 0 |
| 30 | Optimized | 192.9699 | 2.0219225 | -474.05202 | 65.699646 | 27.887845 | 0 |
| 31 | Optimized | 193.26945 | 2.3017525 | -493.90332 | 41.775938 | 17.732834 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 32 | Optimized | 193.62195 | 2.6339175 | -517.10988 | 13.925381 | 5.9109737 | 0 |

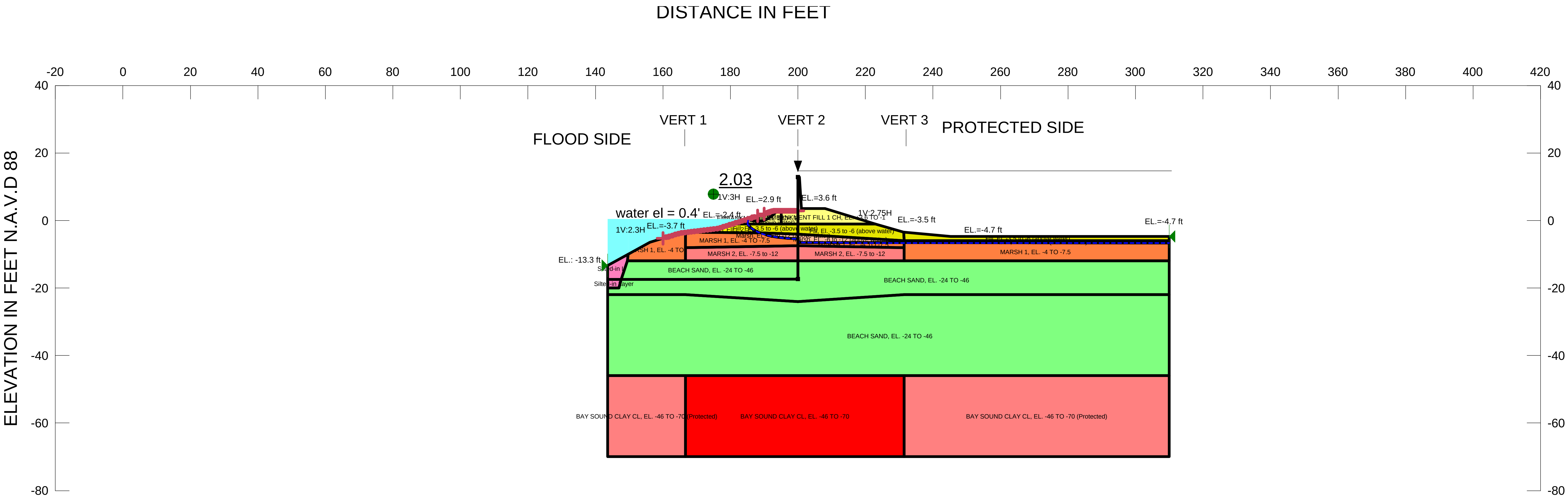
## Slices of Slip Surface: 17188

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 17188 | 184.534 | 0.05377615 | 12.620586 | 46.783025 | 14.501095 | 0 |
| 2 | 17188 | 184.9661 | -0.0975799 | -11.356804 | 78.962699 | 33.517677 | 0 |
| 3 | 17188 | 185.35 | -0.21268615 | -49.349166 | 96.724108 | 41.056948 | 0 |
| 4 | 17188 | 185.66135 | -0.2889792 | -83.398332 | 119.7192 | 50.817787 | 0 |
| 5 | 17188 | 185.9841 | -0.35462375 | -112.19216 | 140.39338 | 59.593456 | 0 |
| 6 | 17188 | 186.30685 | -0.4066776 | -139.0782 | 158.31747 | 67.201781 | 0 |
| 7 | 17188 | 186.62955 | -0.4454059 | -166.07877 | 173.72241 | 73.740789 | 0 |
| 8 | 17188 | 186.95225 | -0.47100155 | -181.47478 | 186.79199 | 79.288494 | 0 |
| 9 | 17188 | 187.275 | -0.48359 | -197.45335 | 197.6857 | 83.912603 | 0 |
| 10 | 17188 | 187.59775 | -0.48323225 | -213.85418 | 206.52455 | 87.664469 | 0 |
| 11 | 17188 | 187.92045 | -0.4699266 | -230.45569 | 213.42064 | 90.591687 | 0 |
| 12 | 17188 | 188.24315 | -0.44360845 | -243.88808 | 218.45301 | 92.727803 | 0 |
| 13 | 17188 | 188.5659 | -0.4041488 | -254.48537 | 221.7 | 94.106066 | 0 |
| 14 | 17188 | 188.88865 | -0.35135095 | -265.85242 | 223.21608 | 94.749605 | 0 |
| 15 | 17188 | 189.21135 | -0.2849454 | -278.04427 | 223.04398 | 94.676552 | 0 |
| 16 | 17188 | 189.5341 | -0.20458295 | -290.80397 | 221.21786 | 93.901409 | 0 |
| 17 | 17188 | 189.85685 | -0.10982471 | -302.52359 | 217.76676 | 92.436506 | 0 |
| 18 | 17188 | 190.17955 | -0.00012898 | -315.008 | 212.70102 | 90.286227 | 0 |
| 19 | 17188 | 190.50225 | 0.12516593 | -328.29854 | 206.02932 | 87.454257 | 0 |
| 20 | 17188 | 190.825 | 0.26686475 | -342.45065 | 197.74706 | 83.938646 | 0 |
| 21 | 17188 | 191.14775 | 0.4259461 | -356.35035 | 187.8466 | 79.736151 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 22 | 17188 | 191.47045 | 0.6036042 | -370.91789 | 176.3066 | 74.837712 | 0 |
| 23 | 17188 | 191.79315 | 0.80130655 | -387.4023 | 163.09853 | 69.231219 | 0 |
| 24 | 17188 | 192.1159 | 1.0208752 | -404.77741 | 148.18406 | 62.900401 | 0 |
| 25 | 17188 | 192.43865 | 1.264605 | -423.10527 | 131.51658 | 55.825474 | 0 |
| 26 | 17188 | 192.7651 | 1.5389155 | -442.45469 | 108.20826 | 45.931683 | 0 |
| 27 | 17188 | 193.09525 | 1.8485135 | -464.19839 | 78.66325 | 33.390569 | 0 |
| 28 | 17188 | 193.4254 | 2.1962615 | -488.52393 | 47.83573 | 20.305063 | 0 |
| 29 | 17188 | 193.7556 | 2.590248 | -515.36794 | 15.807951 | 6.7100771 | 0 |




Name: EMBANKMENT FILL 1 CH, EL. +3.6 TO -1 Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 26 °
Name: MARSH 1, EL. -4 TO -7.5 Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion: 0 psf Phi: 24 °
Name: BEACH SAND, EL. -24 TO -46 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 34 °
Name: BAY SOUND CLAY CL, EL. -46 TO -70 Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 26 °
Name: Silted-in Layer Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion: 0 psf Phi: 34 °
Name: MARSH 2, EL. -7.5 to -12 Model: Spatial Mohr-Coulomb Weight Fn: Marsh 2 Cohesion Fn: Marsh 2 Phi: 24 °
Name: EMBANKMENT FILL 2, EL. -1 TO -4 Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion: 0 psf Phi: 26 °
Name: Fill, El. -3.5 to -6 (above water) Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion: 75 psf Phi: 26 °
Name: Marsh, EL. -6 to -12 (above water) Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion: 75 psf Phi: 24 °
Name: BAY SOUND CLAY CL, EL. -46 TO -70 (Protected) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 26 °
Name: Emb Fill 1 CH 3.6 to -1 (above water) Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 75 psf Phi: 26 °

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

LONDON AVE OUTFALL CANAL, REACH 16,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Entry/Exit) (in front)
STA. 104+00 TO 112+50
ORLEANS PARISH, LOUISIANA

Name: Global Stability (Entry/Exit) (in front)
File Name: Reach 16-Scase FS GCAT seepw - Copy.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Entry/Exit) (in front)



## File Information

- Created By: Liljegren, James
- Revision Number: 265
- Last Edited By: Middleton, Mark C MVN
- Date: 1/25/2013
- Time: 9:09:52 AM
- File Name: Reach 16-Scase FS GCAT seepw - Copy.gsz
- Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
- Last Solved Date: 1/25/2013
- Last Solved Time: 9:14:56 AM

## Project Settings

- Length(L) Units: feet
- Time(t) Units: Seconds
- Force(F) Units: lbf
- Pressure(p) Units: psf
- Strength Units: psf
- Unit Weight of Water: 62.4 pcf
- View: 2D

## Analysis Settings

### Global Stability (Entry/Exit) (in front)

- Kind: SLOPE/W
- Parent: Global Stability (Seepage)
- Method: Spencer
- Settings
  - PWP Conditions Source: Parent Analysis
- Slip Surface
  - Direction of movement: Right to Left
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: Yes
  - Tension Crack
    - Tension Crack Option: Search for Tension Crack
    - Percentage Wet: 0
    - Tension Crack Fluid Unit Weight: 62.4 pcf
- FOS Distribution
  - FOS Calculation Option: Constant
- Advanced





  - Number of Slices: 30
  - Optimization Tolerance: 0.01
  - Minimum Slip Surface Depth: 2 ft
  - Optimization Maximum Iterations: 2000
  - Optimization Convergence Tolerance: 1e-007
  - Starting Optimization Points: 8
  - Ending Optimization Points: 16
  - Complete Passes per Insertion: 1
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL 1 CH, EL. +3.6 TO -1

- Model: Mohr-Coulomb
- Unit Weight: 118 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### MARSH 1, EL. -4 TO -7.5

- Model: Mohr-Coulomb
- Unit Weight: 80 pcf
- Cohesion: 0 psf
- Phi: 24 °
- Phi-B: 0 °

### BEACH SAND, EL. -24 TO -46

- Model: Mohr-Coulomb
- Unit Weight: 122 pcf
- Cohesion: 0 psf
- Phi: 34 °
- Phi-B: 0 °

### BAY SOUND CLAY CL, EL. -46 TO -70

- Model: Mohr-Coulomb
- Unit Weight: 104 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### Silted-in Layer

- Model: Mohr-Coulomb
- Unit Weight: 90 pcf
- Cohesion: 0 psf
- Phi: 34 °
- Phi-B: 0 °

### MARSH 2, EL. -7.5 to -12





- Model: Spatial Mohr-Coulomb
- Weight Fn: Marsh 2
- Cohesion Fn: Marsh 2
- Phi: 24 °
- Phi-B: 0 °

### EMBANKMENT FILL 2, EL. -1 TO -4

- Model: Mohr-Coulomb
- Unit Weight: 90 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### Fill, El. -3.5 to -6 (above water)

- Model: Mohr-Coulomb
- Unit Weight: 90 pcf
- Cohesion: 75 psf
- Phi: 26 °
- Phi-B: 0 °

### Marsh, EL. -6 to -12 (above water)

- Model: Mohr-Coulomb
- Unit Weight: 80 pcf
- Cohesion: 75 psf
- Phi: 24 °
- Phi-B: 0 °

### BAY SOUND CLAY CL, EL. -46 TO -70 (Protected)

- Model: Mohr-Coulomb
- Unit Weight: 104 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### Emb Fill 1 CH 3.6 to -1 (above water)

- Model: Mohr-Coulomb
- Unit Weight: 118 pcf
- Cohesion: 75 psf
- Phi: 26 °
- Phi-B: 0 °

## Slip Surface Entry and Exit

- Left Projection: Range
- Left-Zone Left Coordinate: (160, -5.25543) ft
- Left-Zone Right Coordinate: (188, 1.30986) ft
- Left-Zone Increment: 30
- Right Projection: Range
- Right-Zone Left Coordinate: (190, 1.95775) ft
- Right-Zone Right Coordinate: (200, 2.9) ft





- Right-Zone Increment: 30
- Radius Increments: 20

## Slip Surface Limits

- Left Coordinate: (143.6, -13.3) ft
- Right Coordinate: (310, -4.7) ft

## Reinforcements

### Reinforcement 1

- Type: Pile
- Outside Point: (200, 12.9) ft
- Inside Point: (200, -17.4) ft
- Slip Surface Intersection: (0, 0) ft
- Total Length: 30.3 ft
- Reinforcement Direction: 90 °
- Applied Load Option: Variable
- F of S Dependent: No
- Pile Spacing: 1 ft
- Shear Capacity: 99999 lbs
- Shear Safety Factor: 1
- Shear Load Used: 99999 lbs
- Shear Option: Parallel to Slip
- Resisting Force Used: 0 lbs/ft

## Cohesion Functions

### Marsh 2

- Model: Spline Data Point Function
- Function: Cohesion vs. X
  - Curve Fit to Data: 100 %
  - Segment Curvature: 0 %
- Y-Intercept: 200
- Data Points: X (ft), Cohesion (psf)
  - Data Point: (166.6, 200)
  - Data Point: (200, 250)
  - Data Point: (231.4, 200)

## Unit Weight Functions

### Marsh 2

- Model: Spline Data Point Function
- Function: Unit Weight vs. X
  - Curve Fit to Data: 100 %
  - Segment Curvature: 0 %

Y-Intercept: 80
Data Points: X (ft), Unit Weight (pcf)
Data Point: (166.7, 80)
Data Point: (200, 97)
Data Point: (231.4, 80)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | EMBANKMENT FILL 1 CH, EL. +3.6 TO -1 | 58,57,30,4,5,33,24,21,59 | 47.74 |
| Region 2 | MARSH 1, EL. -4 TO -7.5 | 25,3,8,28,35,41,42,43 | 100.17577 |
| Region 3 | Fill, El. -3.5 to -6 (above water) | 36,31,32,7,9,18 | 110.58019 |
| Region 4 | MARSH 1, EL. -4 TO -7.5 | 69,19,38,37,68 | 420.51 |
| Region 5 | Silted-in Layer | 52,20,3,25,51 | 29.215 |
| Region 6 | EMBANKMENT FILL 2, EL. -1 TO -4 | 35,63,62,61,60,59,55,29 | 29.633773 |
| Region 7 | EMBANKMENT FILL 1 CH, EL. +3.6 TO -1 | 24,33,34,23,6,56 | 69.275 |
| Region 8 | Fill, El. -3.5 to -6 (above water) | 12,24,56,36,18 | 114.85463 |
| Region 9 | BEACH SAND, EL. -24 TO -46 | 10,26,44,39,40,27,11,47,17,45 | 3928.9 |
| Region 10 | MARSH 1, EL. -4 TO -7.5 | 35,63,64,65,66,67,13,42,41 | 123.94923 |
| Region 11 | MARSH 2, EL. -7.5 to -12 | 42,43,14,54,13 | 141.525 |
| Region 12 | BEACH SAND, EL. -24 TO -46 | 25,43,14,22,51 | 280.301 |
| Region 13 | | 33,49,50,23,34 | 7.675 |
| Region 14 | Marsh, EL. -6 to -12 (above water) | 12,18,68,70,67 | 49.124 |
| Region 15 | MARSH 2, EL. -7.5 to -12 | 14,54,13,37,38 | 133.45 |
| Region 16 | BEACH SAND, EL. -24 TO -46 | 39,44,26,1,2,51,22,14,38,19,27,40 | 1411.969 |
| Region 17 | Silted-in Layer | 52,51,2,1 | 9.15 |
| Region 18 | BAY SOUND CLAY CL, EL. -46 TO -70 | 45,17,47,48,53,46 | 1552.8 |
| Region 19 | BAY SOUND CLAY CL, EL. -46 TO -70 (Protected) | 47,48,15,11 | 1886.4 |
| Region 20 | BAY SOUND CLAY CL, EL. -46 TO -70 (Protected) | 10,16,46,45 | 554.4 |
| Region 21 | Emb Fill 1 CH 3.6 to -1 (above water) | 55,58,59 | 3.067274 |
| Region 22 | Fill, El. -3.5 to -6 (above water) | 63,62,61,60,59,21,24,12 | 37.966 |
| Region 23 | Marsh, EL. -6 to -12 (above water) | 63,12,67,66,65,64 | 11.6075 |
| Region 24 | MARSH 1, EL. -4 TO -7.5 | 67,70,68,37,13 | 37.226 |
| Region 25 | Marsh, EL. -6 to -12 (above water) | 18,9,69,68 | 51.09 |





## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 143.6 | -20 |
| Point 2 | 146.9 | -20 |
| Point 3 | 149.7 | -10 |
| Point 4 | 195 | 2.8 |
| Point 5 | 199 | 2.9 |
| Point 6 | 208 | 3.5 |
| Point 7 | 310 | -4.7 |
| Point 8 | 156.1 | -6.4 |
| Point 9 | 310 | -6 |
| Point 10 | 143.6 | -46 |
| Point 11 | 310 | -46 |
| Point 12 | 200 | -4 |
| Point 13 | 200 | -7.5 |
| Point 14 | 200 | -12 |
| Point 15 | 310 | -70 |
| Point 16 | 143.6 | -70 |
| Point 17 | 200 | -46 |
| Point 18 | 231.4 | -6 |
| Point 19 | 310 | -12 |
| Point 20 | 143.6 | -13.3 |
| Point 21 | 195 | -1 |
| Point 22 | 200 | -17.4 |
| Point 23 | 201 | 3.6 |
| Point 24 | 200 | -1 |
| Point 25 | 149.5 | -12 |
| Point 26 | 143.6 | -22 |
| Point 27 | 310 | -22 |
| Point 28 | 165.3 | -3.7 |
| Point 29 | 176.2 | -2.4 |
| Point 30 | 192.6 | 2.8 |
| Point 31 | 231.5 | -3.5 |
| Point 32 | 245.2 | -4.7 |
| Point 33 | 200 | 2.9 |
| Point 34 | 201 | 2.9 |
| Point 35 | 166.66154 | -3.5 |
| Point 36 | 231.35185 | -3.5 |
| Point 37 | 231.4 | -8 |
| Point 38 | 231.4 | -12 |
| Point 39 | 200 | -24 |
| Point 40 | 231.4 | -22 |
| Point 41 | 166.7 | -6 |
| Point 42 | 166.7 | -8 |
| Point 43 | 166.7 | -12 |
| Point 44 | 166.7 | -22 |
| Point 45 | 166.7 | -46 |
| Point 46 | 166.7 | -70 |
| Point 47 | 231.4 | -46 |
| Point 48 | 231.4 | -70 |
| Point 49 | 200 | 12.9 |
| Point 50 | 200.5 | 12.9 |
| Point 51 | 147.62 | -17.5 |
| Point 52 | 143.6 | -17.5 |
| Point 53 | 200 | -70 |
| Point 54 | 200 | -11.6 |
| Point 55 | 180.71818 | -1 |
| Point 56 | 222.9 | -1 |
| Point 57 | 185.5 | 0.5 |
| Point 58 | 185.2 | 0.4 |
| Point 59 | 185.1 | -1 |
| Point 60 | 186 | -2.1 |
| Point 61 | 186.7 | -2.7 |
| Point 62 | 188.5 | -3.6 |
| Point 63 | 189.27 | -3.7 |
| Point 64 | 191.1 | -4.5 |
| Point 65 | 193.8 | -5 |
| Point 66 | 197 | -5.3 |
| Point 67 | 200 | -5.44 |
| Point 68 | 231.4 | -6.6 |
| Point 69 | 310 | -6.7 |
| Point 70 | 200.3 | -6.54 |





## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 2.03 | (188.252, 6.468) | 4.442628 | (193.886, 2.8) | (185.203, 0.400962) |
| 2 | 17840 | 2.08 | (188.252, 6.468) | 6.752 | (193.921, 2.8) | (185.254, 0.418035) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 185.3218 | 0.31131075 | -19.347577 | 27.180833 | 13.256978 | 0 |
| 2 | Optimized | 185.47035 | 0.20991515 | -38.07181 | 44.723919 | 21.813313 | 0 |
| 3 | Optimized | 185.61585 | 0.1523277 | -53.086852 | 61.483775 | 29.987641 | 0 |
| 4 | Optimized | 185.8475 | 0.06064255 | -69.346858 | 88.095436 | 42.967015 | 0 |
| 5 | Optimized | 186.1304 | -0.015906665 | -83.473127 | 100.52798 | 49.030772 | 0 |
| 6 | Optimized | 186.4646 | -0.077320015 | -101.75817 | 124.21642 | 60.584395 | 0 |
| 7 | Optimized | 186.7988 | -0.13873335 | -116.9854 | 147.90191 | 72.136584 | 0 |
| 8 | Optimized | 187.1245 | -0.177885 | -126.29929 | 156.03474 | 76.103226 | 0 |
| 9 | Optimized | 187.44165 | -0.194775 | -136.57841 | 171.53998 | 83.665641 | 0 |
| 10 | Optimized | 187.7786 | -0.2031375 | -147.93822 | 181.41171 | 88.480404 | 0 |
| 11 | Optimized | 188.13535 | -0.2029725 | -160.27808 | 195.9353 | 95.564032 | 0 |
| 12 | Optimized | 188.4569 | -0.1961925 | -169.41432 | 203.17163 | 99.093426 | 0 |
| 13 | Optimized | 188.7433 | -0.1827975 | -177.6627 | 212.91971 | 103.84788 | 0 |
| 14 | Optimized | 189.01595 | -0.16258875 | -185.95218 | 214.83683 | 104.78292 | 0 |
| 15 | Optimized | 189.27485 | -0.13556625 | -194.27409 | 221.61424 | 108.08849 | 0 |
| 16 | Optimized | 189.5337 | -0.10854375 | -202.51148 | 228.39164 | 111.39405 | 0 |
| 17 | Optimized | 189.79255 | -0.08152125 | -209.05452 | 235.16905 | 114.69961 | 0 |
| 18 | Optimized | 190.0915 | 0.01695 | -220.57152 | 195.68619 | 95.442533 | 0 |
| 19 | Optimized | 190.40675 | 0.17866 | -236.08139 | 187.76084 | 91.577079 | 0 |
| 20 | Optimized | 190.70915 | 0.34267 | -251.43336 | 178.9893 | 87.298913 | 0 |
| 21 | Optimized | 191.0224 | 0.51719 | -267.46604 | 171.90023 | 83.841342 | 0 |
| 22 | Optimized | 191.31145 | 0.6872875 | -282.21718 | 159.98164 | 78.02826 | 0 |
| 23 | Optimized | 191.57635 | 0.8529625 | -296.46039 | 152.44394 | 74.351879 | 0 |
| 24 | Optimized | 191.82015 | 1.0154375 | -309.97968 | 139.54856 | 68.062379 | 0 |
| 25 | Optimized | 192.04285 | 1.1747125 | -322.79506 | 131.61244 | 64.191677 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 26 | Optimized | 192.26565 | 1.3478345 | -336.22862 | 116.81862 | 56.976246 | 0 |
| 27 | Optimized | 192.48855 | 1.5348035 | -350.23242 | 106.8434 | 52.111009 | 0 |
| 28 | Optimized | 192.6323 | 1.655404 | -359.08232 | 99.498072 | 48.528452 | 0 |
| 29 | Optimized | 192.79535 | 1.8027625 | -369.90636 | 84.164325 | 41.049684 | 0 |
| 30 | Optimized | 193.0568 | 2.0432475 | -387.6148 | 63.868603 | 31.150799 | 0 |
| 31 | Optimized | 193.36215 | 2.3226175 | -407.98474 | 40.419691 | 19.714001 | 0 |
| 32 | Optimized | 193.71145 | 2.6408725 | -430.83865 | 13.473019 | 6.5712303 | 0 |

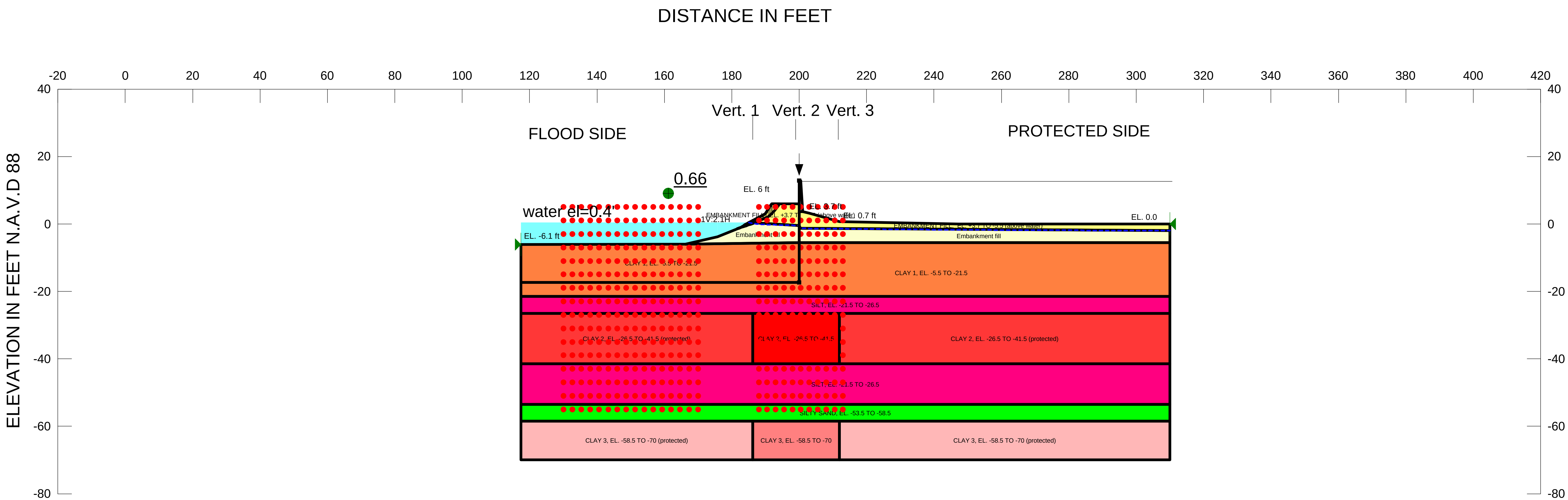
### Slices of Slip Surface: 17840

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 17840 | 185.37705 | 0.3601685 | -31.952112 | 16.401049 | 7.9993261 | 0 |
| 2 | 17840 | 185.642 | 0.24277215 | -63.936368 | 48.602551 | 23.705048 | 0 |
| 3 | 17840 | 185.926 | 0.13112485 | -78.34084 | 78.53256 | 38.302889 | 0 |
| 4 | 17840 | 186.21 | 0.033944975 | -91.39229 | 104.52169 | 50.978634 | 0 |
| 5 | 17840 | 186.494 | -0.04941623 | -105.20887 | 127.0992 | 61.99042 | 0 |
| 6 | 17840 | 186.778 | -0.1194845 | -117.41077 | 146.66983 | 71.535655 | 0 |
| 7 | 17840 | 187.062 | -0.1766813 | -124.13471 | 163.56044 | 79.773756 | 0 |
| 8 | 17840 | 187.346 | -0.2213374 | -131.60167 | 178.01607 | 86.82424 | 0 |
| 9 | 17840 | 187.63 | -0.2537032 | -139.76236 | 190.24398 | 92.78819 | 0 |
| 10 | 17840 | 187.914 | -0.27395605 | -148.56005 | 200.40344 | 97.743287 | 0 |
| 11 | 17840 | 188.198 | -0.28220515 | -157.57951 | 208.63423 | 101.75771 | 0 |
| 12 | 17840 | 188.482 | -0.27849465 | -165.21728 | 215.04041 | 104.88221 | 0 |
| 13 | 17840 | 188.766 | -0.2628047 | -173.56482 | 219.70857 | 107.15903 | 0 |
| 14 | 17840 | 189.05 | -0.23505105 | -182.61505 | 222.71561 | 108.62566 | 0 |
| 15 | 17840 | 189.334 | -0.1950827 | -192.36357 | 224.11657 | 109.30896 | 0 |
| 16 | 17840 | 189.618 | -0.14267765 | -202.1031 | 223.95479 | 109.23005 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17 | 17840 | 189.902 | -0.07753663 | -211.38324 | 222.26464 | 108.40571 | 0 |
| 18 | 17840 | 190.186 | 0.00072598 | -221.41663 | 219.0653 | 106.84528 | 0 |
| 19 | 17840 | 190.47 | 0.09259451 | -232.23061 | 214.37209 | 104.55625 | 0 |
| 20 | 17840 | 190.754 | 0.19866845 | -243.85043 | 208.19101 | 101.54154 | 0 |
| 21 | 17840 | 191.038 | 0.3196849 | -256.00319 | 200.51514 | 97.79777 | 0 |
| 22 | 17840 | 191.322 | 0.4565489 | -268.11941 | 191.3284 | 93.317095 | 0 |
| 23 | 17840 | 191.606 | 0.61037485 | -281.58285 | 180.60525 | 88.087065 | 0 |
| 24 | 17840 | 191.89 | 0.78254455 | -296.35988 | 168.31552 | 82.092962 | 0 |
| 25 | 17840 | 192.174 | 0.97478995 | -312.07382 | 154.41206 | 75.311795 | 0 |
| 26 | 17840 | 192.458 | 1.189316 | -328.75569 | 138.8358 | 67.714744 | 0 |
| 27 | 17840 | 192.73205 | 1.4196595 | -345.66362 | 118.52295 | 57.807504 | 0 |
| 28 | 17840 | 192.9962 | 1.667374 | -363.45266 | 93.877801 | 45.787263 | 0 |
| 29 | 17840 | 193.26035 | 1.944096 | -383.35188 | 68.151163 | 33.239543 | 0 |
| 30 | 17840 | 193.5245 | 2.2556045 | -405.28262 | 41.364822 | 20.174972 | 0 |
| 31 | 17840 | 193.78865 | 2.6104525 | -429.61527 | 13.610039 | 6.6380594 | 0 |




Name: EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water) Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 23 °
Name: CLAY 1, EL. -5.5 TO -21.5 Model: Mohr-Coulomb Unit Weight: 107 pcf Cohesion: 0 psf Phi: 23 °
Name: SILT, EL. -21.5 TO -26.5 Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion: 0 psf Phi: 28 °
Name: CLAY 2, EL. -26.5 TO -41.5 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion: 0 psf Phi: 23 °
Name: SILTY SAND, EL. -53.5 TO -58.5 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 30 °
Name: CLAY 3, EL. -58.5 TO -70 Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 23 °
Name: CLAY 2, EL. -26.5 TO -41.5 (protected) Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion: 0 psf Phi: 23 °
Name: CLAY 3, EL. -58.5 TO -70 (protected) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 23 °
Name: Embankment fill Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 23 °

US Army Corps of Engineers
New Orleans District

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

LONDON AVE CANAL
OUTFALL CANAL REEVALUATION REPORT
REACH 21, STA. 6+30 TO STA. 10+00
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Slope Stability (Block) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Slope Stability (Block) in front
File Name: Reach 21-Scase FS seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Edited By: Middleton, Mark C MVN

# Slope Stability (Block) in front



## File Information

Created By: Liljegren, James
Revision Number: 288
Last Edited By: Middleton, Mark C MVN
Date: 1/16/2013
Time: 3:42:44 PM
File Name: Reach 21-Scase FS seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Solved Date: 1/16/2013
Last Solved Time: 3:44:56 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Slope Stability (Block) in front

Kind: SLOPE/W
Parent: Scase FS Analysis (Seepage)
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 9.807 pcf

FOS Distribution
- FOS Calculation Option: Constant

Restrict Block Crossing: Yes





Advanced
- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 3 ft
- Optimization Maximum Iterations: 2000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water)

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### CLAY 1, EL. -5.5 TO -21.5

Model: Mohr-Coulomb
Unit Weight: 107 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### SILT, EL. -21.5 TO -26.5

Model: Mohr-Coulomb
Unit Weight: 117 pcf
Cohesion: 0 psf
Phi: 28 °
Phi-B: 0 °

### CLAY 2, EL. -26.5 TO -41.5

Model: Mohr-Coulomb
Unit Weight: 99 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### SILTY SAND, EL. -53.5 TO -58.5

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °





### CLAY 3, EL. -58.5 TO -70

Model: Mohr-Coulomb
Unit Weight: 104 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### CLAY 2, EL. -26.5 TO -41.5 (protected)

Model: Mohr-Coulomb
Unit Weight: 99 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### CLAY 3, EL. -58.5 TO -70 (protected)

Model: Mohr-Coulomb
Unit Weight: 104 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Embankment fill

Model: Mohr-Coulomb
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

## Slip Surface Limits

Left Coordinate: (117.4, -6.1) ft
Right Coordinate: (310, 0) ft

## Slip Surface Block

Left Grid
- Upper Left: (130, 5) ft
- Lower Left: (130, -55) ft
- Lower Right: (170, -55) ft
- X Increments: 15
- Y Increments: 15
- Starting Angle: 135 °
- Ending Angle: 155 °
- Angle Increments: 4

Right Grid
- Upper Left: (188, 5) ft
- Lower Left: (188, -55) ft
- Lower Right: (213, -55) ft
- X Increments: 10





- Y Increments: 15
- Starting Angle: 25 °
- Ending Angle: 45 °
- Angle Increments: 4

## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -17.3) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 30.2 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No
Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | CLAY 3, EL. -58.5 TO -70 | 45,12,42,43,13,44 | 295.55 |
| Region 2 | EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water) | 2,3,4,9,25,10,50,49 | 66.2925 |
| Region 3 | EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water) | 10,25,18,1,19,24,5,52,51,50 | 221.6125 |
| Region 4 | CLAY 1, EL. -5.5 TO -21.5 | 17,20,21,11,48,16 | 939.39 |
| Region 5 | | 25,9,26,27,18 | 6.825 |
| Region 6 | SILTY SAND, EL. -53.5 TO -58.5 | 7,32,28,35,8,42,12,45 | 963 |
| Region 7 | SILT, EL. -21.5 TO -26.5 | 32,6,46,29,41,36,35,28 | 2311.2 |
| Region 8 | CLAY 2, EL. -26.5 TO -41.5 | 47,30,40,41,29,46 | 385.5 |
| Region 9 | SILT, EL. -21.5 TO -26.5 | 33,34,31,38,37,40,30,47 | 963 |
| Region 10 | CLAY 1, EL. -5.5 TO -21.5 | 34,17,16,48,11,39,38,31 | 2106.92 |
| Region 11 | CLAY 2, EL. -26.5 TO -41.5 (protected) | 6,46,47,33 | 1032 |
| Region 12 | CLAY 3, EL. -58.5 TO -70 (protected) | 7,15,44,45 | 791.2 |
| Region 13 | CLAY 3, EL. -58.5 TO -70 (protected) | 43,42,8,14 | 1128.15 |
| Region | CLAY 2, EL. -26.5 TO -41.5 (protected) | 41,40,37,36 | 1471.5 |

| | | | |
|---|---|---|---|
| 14 | | | |
| Region 15 | Embankment fill | 21,22,23,49,50,11 | 130.1175 |
| Region 16 | Embankment fill | 52,51,50,11,39 | 423.7325 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 203 | 3.2 |
| Point 2 | 186.2 | 1 |
| Point 3 | 189.9 | 3 |
| Point 4 | 191.8 | 6 |
| Point 5 | 310 | 0 |
| Point 6 | 117.4 | -41.5 |
| Point 7 | 117.4 | -58.5 |
| Point 8 | 310 | -58.5 |
| Point 9 | 200 | 6 |
| Point 10 | 200 | 1 |
| Point 11 | 200 | -5.5 |
| Point 12 | 200 | -58.5 |
| Point 13 | 200 | -70 |
| Point 14 | 310 | -70 |
| Point 15 | 117.4 | -70 |
| Point 16 | 200 | -17.3 |
| Point 17 | 117.4 | -17.3 |
| Point 18 | 201 | 3.7 |
| Point 19 | 211.9 | 0.7 |
| Point 20 | 117.4 | -6.1 |
| Point 21 | 166.2 | -6 |
| Point 22 | 175.7 | -3.8 |
| Point 23 | 182.6 | -1 |
| Point 24 | 247.3 | 0 |
| Point 25 | 200 | 3.7 |
| Point 26 | 200 | 12.8 |
| Point 27 | 200.5 | 12.8 |
| Point 28 | 200 | -53.5 |
| Point 29 | 200 | -41.5 |
| Point 30 | 200 | -26.5 |
| Point 31 | 200 | -21.5 |
| Point 32 | 117.4 | -53.5 |
| Point 33 | 117.4 | -26.5 |
| Point 34 | 117.4 | -21.5 |
| Point 35 | 310 | -53.5 |





| | | |
|---|---|---|
| Point 36 | 310 | -41.5 |
| Point 37 | 310 | -26.5 |
| Point 38 | 310 | -21.5 |
| Point 39 | 310 | -5.5 |
| Point 40 | 211.9 | -26.5 |
| Point 41 | 211.9 | -41.5 |
| Point 42 | 211.9 | -58.5 |
| Point 43 | 211.9 | -70 |
| Point 44 | 186.2 | -70 |
| Point 45 | 186.2 | -58.5 |
| Point 46 | 186.2 | -41.5 |
| Point 47 | 186.2 | -26.5 |
| Point 48 | 200 | -6.9 |
| Point 49 | 185.1 | 0.4 |
| Point 50 | 200 | -0.45 |
| Point 51 | 200.3 | -1.3 |
| Point 52 | 310 | -2 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 0.66 | (188.834, 7.25) | 9.067545 | (194.174, 6) | (181.656, -1.383) |
| 2 | 8260 | 0.90 | (188.834, 7.25) | 6.542 | (195.5, 6) | (186.2, 1) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 181.89215 | -1.307613 | 106.44738 | 112.54323 | 2.5875375 | 0 |
| 2 | Optimized | 182.36405 | -1.1568305 | 96.825209 | 104.35622 | 3.1967226 | 0 |
| 3 | Optimized | 182.80835 | -1.0148745 | 87.474661 | 104.9065 | 7.3993748 | 0 |
| 4 | Optimized | 183.225 | -0.8817451 | 78.478691 | 99.088264 | 8.7482445 | 0 |
| 5 | Optimized | 183.64165 | -0.7486155 | 69.409565 | 93.281462 | 10.133019 | 0 |
| 6 | Optimized | 184.05835 | -0.6154859 | 60.258137 | 87.488378 | 11.558551 | 0 |
| 7 | Optimized | 184.475 | -0.4823563 | 51.003834 | 81.70901 | 13.033574 | 0 |
| 8 | Optimized | 184.89165 | -0.3492267 | 41.61922 | 75.952504 | 14.573615 | 0 |
| 9 | Optimized | 185.2839 | -0.2239014 | 32.638971 | 78.563502 | 19.493807 | 0 |
| 10 | Optimized | 185.6517 | -0.10638045 | 23.496537 | 89.629623 | 28.07183 | 0 |
| 11 | Optimized | 186.0178 | 0.031708 | 10.611376 | 87.561281 | 32.663296 | 0 |
| 12 | Optimized | 186.42965 | 0.21104015 | -5.3247951 | 92.869042 | 39.42057 | 0 |
| 13 | Optimized | 186.8954 | 0.41384825 | -21.83209 | 97.848304 | 41.534141 | 0 |
| 14 | Optimized | 187.3676 | 0.6194561 | -38.078007 | 102.89664 | 43.67703 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 15 | Optimized | 187.91585 | 0.855 | -56.571188 | 110.24874 | 46.797812 | 0 |
| 16 | Optimized | 188.502 | 1.108045 | -75.106844 | 115.12417 | 48.867311 | 0 |
| 17 | Optimized | 188.93245 | 1.2911575 | -88.479358 | 125.04355 | 53.077839 | 0 |
| 18 | Optimized | 189.2454 | 1.4167725 | -97.662661 | 129.63669 | 55.027508 | 0 |
| 19 | Optimized | 189.63145 | 1.571675 | -108.58955 | 135.32097 | 57.440344 | 0 |
| 20 | Optimized | 189.8805 | 1.672765 | -115.71798 | 130.46946 | 55.380998 | 0 |
| 21 | Optimized | 190.0458 | 1.74895 | -121.02751 | 146.77711 | 62.303187 | 0 |
| 22 | Optimized | 190.50435 | 2.00326 | -138.52078 | 169.6492 | 72.011813 | 0 |
| 23 | Optimized | 190.98235 | 2.31639 | -159.30981 | 181.49432 | 77.039767 | 0 |
| 24 | Optimized | 191.31285 | 2.56841 | -175.77254 | 201.95844 | 85.726274 | 0 |
| 25 | Optimized | 191.63905 | 2.847151 | -193.90057 | 192.06181 | 81.525403 | 0 |
| 26 | Optimized | 191.88855 | 3.083891 | -209.24818 | 193.21772 | 82.016054 | 0 |
| 27 | Optimized | 192.22995 | 3.469555 | -233.94095 | 143.74869 | 61.017697 | 0 |
| 28 | Optimized | 192.72445 | 4.069085 | -272.11617 | 107.19878 | 45.503182 | 0 |
| 29 | Optimized | 193.21165 | 4.664825 | -310.00537 | 74.972471 | 31.823926 | 0 |
| 30 | Optimized | 193.60325 | 5.15625 | -341.0689 | 44.475055 | 18.878541 | 0 |
| 31 | Optimized | 193.96145 | 5.674905 | -373.7811 | 15.392502 | 6.5337293 | 0 |

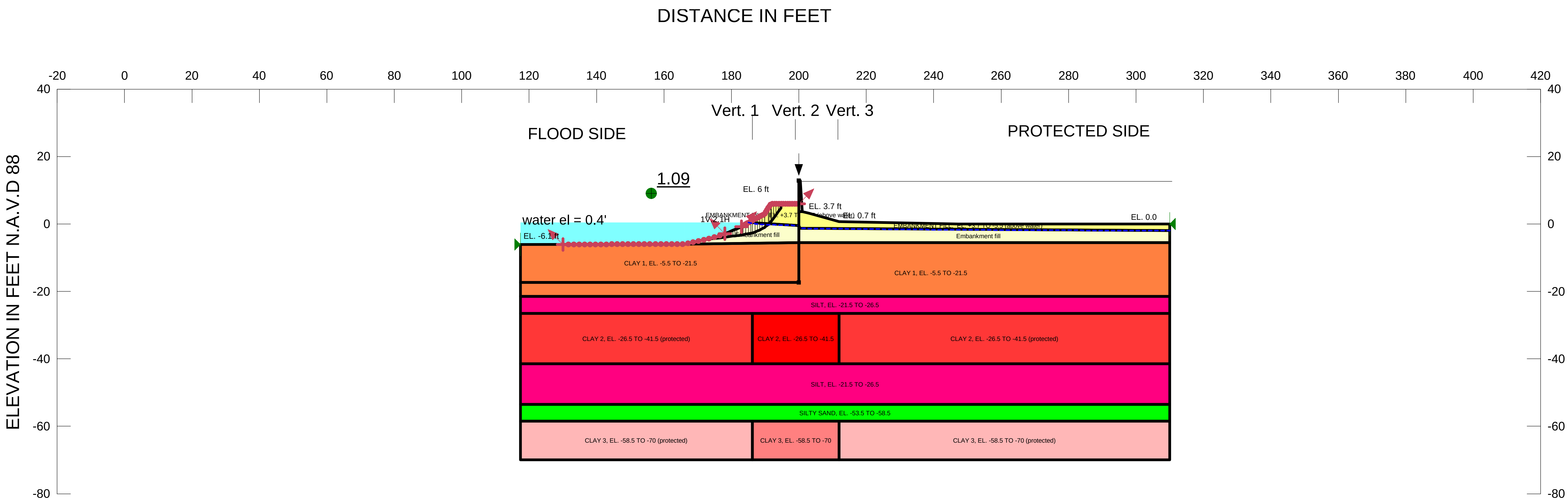
### Slices of Slip Surface: 8260

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 8260 | 186.35415 | 1 | -55.560006 | 13.319353 | 5.6537298 | 0 |
| 2 | 8260 | 186.6625 | 1 | -57.716763 | 39.956761 | 16.960639 | 0 |
| 3 | 8260 | 186.97085 | 1 | -59.828115 | 66.596764 | 28.268649 | 0 |
| 4 | 8260 | 187.27915 | 1 | -61.91352 | 93.233524 | 39.575283 | 0 |
| 5 | 8260 | 187.5875 | 1 | -63.98271 | 119.87353 | 50.883293 | 0 |
| 6 | 8260 | 187.89585 | 1 | -65.675683 | 146.51029 | 62.189927 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 8260 | 188.20415 | 1 | -67.002169 | 173.15029 | 73.497937 | 0 |
| 8 | 8260 | 188.5125 | 1 | -68.280007 | 199.78705 | 84.804571 | 0 |
| 9 | 8260 | 188.82085 | 1 | -69.50271 | 226.42705 | 96.112581 | 0 |
| 10 | 8260 | 189.12915 | 1 | -70.751359 | 253.06381 | 107.41921 | 0 |
| 11 | 8260 | 189.4375 | 1 | -72.003251 | 279.70381 | 118.72723 | 0 |
| 12 | 8260 | 189.74585 | 1 | -72.937305 | 306.34057 | 130.03386 | 0 |
| 13 | 8260 | 190.05 | 1 | -73.86 | 357.5 | 151.74975 | 0 |
| 14 | 8260 | 190.35 | 1 | -74.773333 | 433.23333 | 183.89664 | 0 |
| 15 | 8260 | 190.6625 | 1.1625 | -85.901509 | 203.69897 | 86.465084 | 0 |
| 16 | 8260 | 190.9875 | 1.4875 | -107.17781 | 216.3007 | 91.814202 | 0 |
| 17 | 8260 | 191.3125 | 1.8125 | -128.17562 | 228.90679 | 97.165166 | 0 |
| 18 | 8260 | 191.6375 | 2.1375 | -149.22782 | 241.50417 | 102.51244 | 0 |
| 19 | 8260 | 191.95415 | 2.4541665 | -169.74002 | 237.4732 | 100.80139 | 0 |
| 20 | 8260 | 192.2625 | 2.7625 | -189.6552 | 216.83104 | 92.039314 | 0 |
| 21 | 8260 | 192.57085 | 3.0708335 | -209.3594 | 196.1797 | 83.273341 | 0 |
| 22 | 8260 | 192.87915 | 3.3791665 | -229.07507 | 175.52836 | 74.507367 | 0 |
| 23 | 8260 | 193.1875 | 3.6875 | -248.77927 | 154.87931 | 65.742367 | 0 |
| 24 | 8260 | 193.49585 | 3.9958335 | -268.47888 | 134.22797 | 56.976394 | 0 |
| 25 | 8260 | 193.80415 | 4.3041665 | -288.04089 | 113.57663 | 48.21042 | 0 |
| 26 | 8260 | 194.1125 | 4.6125 | -307.57997 | 92.927587 | 39.44542 | 0 |
| 27 | 8260 | 194.42085 | 4.9208335 | -327.11905 | 72.276248 | 30.679447 | 0 |
| 28 | 8260 | 194.72915 | 5.2291665 | -346.6352 | 51.627202 | 21.914447 | 0 |
| 29 | 8260 | 195.0375 | 5.5375 | -366.12841 | 30.975862 | 13.148473 | 0 |
| 30 | 8260 | 195.34585 | 5.8458335 | -385.62162 | 10.325211 | 4.382792 | 0 |




Name: EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water) Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 75 psf Phi: 26 °
Name: CLAY 1, EL. -5.5 TO -21.5 Model: Mohr-Coulomb Unit Weight: 107 pcf Cohesion: 0 psf Phi: 26 °
Name: SILT, EL. -21.5 TO -26.5 Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion: 0 psf Phi: 34 °
Name: CLAY 2, EL. -26.5 TO -41.5 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion: 0 psf Phi: 26 °
Name: SILTY SAND, EL. -53.5 TO -58.5 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 33 °
Name: CLAY 3, EL. -58.5 TO -70 Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 26 °
Name: CLAY 2, EL. -26.5 TO -41.5 (protected) Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion: 0 psf Phi: 26 °
Name: CLAY 3, EL. -58.5 TO -70 (protected) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion: 0 psf Phi: 26 °
Name: Embankment fill Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion: 0 psf Phi: 26 °

US Army Corps of Engineers®
New Orleans District

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

LONDON AVE CANAL
OUTFALL CANAL REEVALUATION REPORT
REACH 21, STA. 6+30 TO STA. 10+00
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Slope Stability (Entry/Exit) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Slope Stability (Entry/Exit) in front
File Name: Reach 21-Scase FS GCAT seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Edited By: Middleton, Mark C MVN

# Slope Stability (Entry/Exit) in front



## File Information

- Created By: Liljegren, James
- Revision Number: 281
- Last Edited By: Middleton, Mark C MVN
- Date: 1/15/2013
- Time: 1:09:03 PM
- File Name: Reach 21-Scase FS GCAT seepw.gsz
- Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
- Last Solved Date: 1/15/2013
- Last Solved Time: 1:09:46 PM

## Project Settings

- Length(L) Units: feet
- Time(t) Units: Seconds
- Force(F) Units: lbf
- Pressure(p) Units: psf
- Strength Units: psf
- Unit Weight of Water: 62.4 pcf
- View: 2D

## Analysis Settings

### Slope Stability (Entry/Exit) in front

- Kind: SLOPE/W
- Parent: Scase FS Analysis (Seepage)
- Method: Spencer
- Settings
  - PWP Conditions Source: Parent Analysis
- Slip Surface
  - Direction of movement: Right to Left
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: Yes
  - Tension Crack
    - Tension Crack Option: Search for Tension Crack
    - Percentage Wet: 0
    - Tension Crack Fluid Unit Weight: 9.807 pcf
- FOS Distribution
  - FOS Calculation Option: Constant
- Advanced





  - Number of Slices: 30
  - Optimization Tolerance: 0.01
  - Minimum Slip Surface Depth: 3 ft
  - Optimization Maximum Iterations: 2000
  - Optimization Convergence Tolerance: 1e-007
  - Starting Optimization Points: 8
  - Ending Optimization Points: 16
  - Complete Passes per Insertion: 1
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water)

- Model: Mohr-Coulomb
- Unit Weight: 118 pcf
- Cohesion: 75 psf
- Phi: 26 °
- Phi-B: 0 °

### CLAY 1, EL. -5.5 TO -21.5

- Model: Mohr-Coulomb
- Unit Weight: 107 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### SILT, EL. -21.5 TO -26.5

- Model: Mohr-Coulomb
- Unit Weight: 117 pcf
- Cohesion: 0 psf
- Phi: 34 °
- Phi-B: 0 °

### CLAY 2, EL. -26.5 TO -41.5

- Model: Mohr-Coulomb
- Unit Weight: 99 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### SILTY SAND, EL. -53.5 TO -58.5

- Model: Mohr-Coulomb
- Unit Weight: 122 pcf
- Cohesion: 0 psf
- Phi: 33 °
- Phi-B: 0 °

### CLAY 3, EL. -58.5 TO -70





- Model: Mohr-Coulomb
- Unit Weight: 104 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### CLAY 2, EL. -26.5 TO -41.5 (protected)

- Model: Mohr-Coulomb
- Unit Weight: 99 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### CLAY 3, EL. -58.5 TO -70 (protected)

- Model: Mohr-Coulomb
- Unit Weight: 104 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

### Embankment fill

- Model: Mohr-Coulomb
- Unit Weight: 118 pcf
- Cohesion: 0 psf
- Phi: 26 °
- Phi-B: 0 °

## Slip Surface Entry and Exit

- Left Projection: Range
- Left-Zone Left Coordinate: (130, -6.07418) ft
- Left-Zone Right Coordinate: (178, -2.86667) ft
- Left-Zone Increment: 30
- Right Projection: Range
- Right-Zone Left Coordinate: (183, -0.776) ft
- Right-Zone Right Coordinate: (200, 6) ft
- Right-Zone Increment: 30
- Radius Increments: 20
- Left Projection Angle: 135
- Right Projection Angle: 45

## Slip Surface Limits

- Left Coordinate: (117.4, -6.1) ft
- Right Coordinate: (310, 0) ft

## Reinforcements





### Reinforcement 1

- Type: Pile
- Outside Point: (200, 12.9) ft
- Inside Point: (200, -17.3) ft
- Slip Surface Intersection: (0, 0) ft
- Total Length: 30.2 ft
- Reinforcement Direction: 90 °
- Applied Load Option: Variable
- F of S Dependent: No
- Pile Spacing: 1 ft
- Shear Capacity: 99999 lbs
- Shear Safety Factor: 1
- Shear Load Used: 99999 lbs
- Shear Option: Parallel to Slip
- Resisting Force Used: 0 lbs/ft

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | CLAY 3, EL. -58.5 TO -70 | 45,12,42,43,13,44 | 295.55 |
| Region 2 | EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water) | 2,3,4,9,25,10,50,49 | 66.2925 |
| Region 3 | EMBANKMENT FILL, EL. +3.7 TO -5.5 (above water) | 10,25,18,1,19,24,5,52,51,50 | 221.6125 |
| Region 4 | CLAY 1, EL. -5.5 TO -21.5 | 17,20,21,11,48,16 | 939.39 |
| Region 5 | | 25,9,26,27,18 | 6.825 |
| Region 6 | SILTY SAND, EL. -53.5 TO -58.5 | 7,32,28,35,8,42,12,45 | 963 |
| Region 7 | SILT, EL. -21.5 TO -26.5 | 32,6,46,29,41,36,35,28 | 2311.2 |
| Region 8 | CLAY 2, EL. -26.5 TO -41.5 | 47,30,40,41,29,46 | 385.5 |
| Region 9 | SILT, EL. -21.5 TO -26.5 | 33,34,31,38,37,40,30,47 | 963 |
| Region 10 | CLAY 1, EL. -5.5 TO -21.5 | 34,17,16,48,11,39,38,31 | 2106.92 |
| Region 11 | CLAY 2, EL. -26.5 TO -41.5 (protected) | 6,46,47,33 | 1032 |
| Region 12 | CLAY 3, EL. -58.5 TO -70 (protected) | 7,15,44,45 | 791.2 |
| Region 13 | CLAY 3, EL. -58.5 TO -70 (protected) | 43,42,8,14 | 1128.15 |
| Region 14 | CLAY 2, EL. -26.5 TO -41.5 (protected) | 41,40,37,36 | 1471.5 |
| Region 15 | Embankment fill | 21,22,23,49,50,11 | 130.1175 |
| Region 16 | Embankment fill | 52,51,50,11,39 | 423.7325 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 203 | 3.2 |
| Point 2 | 186.2 | 1 |
| Point 3 | 189.9 | 3 |
| Point 4 | 191.8 | 6 |
| Point 5 | 310 | 0 |
| Point 6 | 117.4 | -41.5 |
| Point 7 | 117.4 | -58.5 |
| Point 8 | 310 | -58.5 |
| Point 9 | 200 | 6 |
| Point 10 | 200 | 1 |
| Point 11 | 200 | -5.5 |
| Point 12 | 200 | -58.5 |
| Point 13 | 200 | -70 |
| Point 14 | 310 | -70 |
| Point 15 | 117.4 | -70 |
| Point 16 | 200 | -17.3 |
| Point 17 | 117.4 | -17.3 |
| Point 18 | 201 | 3.7 |
| Point 19 | 211.9 | 0.7 |
| Point 20 | 117.4 | -6.1 |
| Point 21 | 166.2 | -6 |
| Point 22 | 175.7 | -3.8 |
| Point 23 | 182.6 | -1 |
| Point 24 | 247.3 | 0 |
| Point 25 | 200 | 3.7 |
| Point 26 | 200 | 12.8 |
| Point 27 | 200.5 | 12.8 |
| Point 28 | 200 | -53.5 |
| Point 29 | 200 | -41.5 |
| Point 30 | 200 | -26.5 |
| Point 31 | 200 | -21.5 |
| Point 32 | 117.4 | -53.5 |
| Point 33 | 117.4 | -26.5 |
| Point 34 | 117.4 | -21.5 |
| Point 35 | 310 | -53.5 |
| Point 36 | 310 | -41.5 |
| Point 37 | 310 | -26.5 |
| Point 38 | 310 | -21.5 |
| Point 39 | 310 | -5.5 |
| Point 40 | 211.9 | -26.5 |





| | | |
|---|---|---|
| Point 41 | 211.9 | -41.5 |
| Point 42 | 211.9 | -58.5 |
| Point 43 | 211.9 | -70 |
| Point 44 | 186.2 | -70 |
| Point 45 | 186.2 | -58.5 |
| Point 46 | 186.2 | -41.5 |
| Point 47 | 186.2 | -26.5 |
| Point 48 | 200 | -6.9 |
| Point 49 | 185.1 | 0.4 |
| Point 50 | 200 | -0.45 |
| Point 51 | 200.3 | -1.3 |
| Point 52 | 310 | -2 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 1.09 | (179.724, 13.722) | 13.08701 | (194.739, 6) | (172.602, -4.51749) |
| 2 | 19374 | 1.15 | (179.724, 13.722) | 17.495 | (196.08, 6) | (176.504, -3.47373) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 172.989 | -4.4791415 | 304.19223 | 317.81067 | 6.6421562 | 0 |
| 2 | Optimized | 173.7636 | -4.4024365 | 298.84764 | 318.4659 | 9.5684646 | 0 |
| 3 | Optimized | 174.53815 | -4.325732 | 293.50304 | 319.13397 | 12.501039 | 0 |
| 4 | Optimized | 175.3127 | -4.2490275 | 288.13275 | 319.80204 | 15.446146 | 0 |
| 5 | Optimized | 176.10975 | -4.1700975 | 282.21931 | 335.84353 | 26.154279 | 0 |
| 6 | Optimized | 176.928 | -4.0760725 | 275.1496 | 338.11168 | 30.708655 | 0 |
| 7 | Optimized | 177.74505 | -3.9691775 | 267.3825 | 342.34718 | 36.562715 | 0 |
| 8 | Optimized | 178.53975 | -3.8639535 | 259.78529 | 345.90132 | 42.001595 | 0 |
| 9 | Optimized | 179.3121 | -3.7604 | 252.25286 | 349.58413 | 47.471629 | 0 |
| 10 | Optimized | 180.0845 | -3.6568465 | 244.64344 | 353.27976 | 52.985472 | 0 |
| 11 | Optimized | 180.7485 | -3.5633275 | 237.84989 | 353.60635 | 56.458198 | 0 |
| 12 | Optimized | 181.30405 | -3.4798425 | 231.85113 | 355.15499 | 60.139311 | 0 |
| | | | - | | | | |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13 | Optimized | 182.0909 | 3.3676005 | 223.70505 | 359.81539 | 66.38545 | 0 |
| 14 | Optimized | 183.02775 | -3.2378705 | 213.27835 | 369.95729 | 76.417425 | 0 |
| 15 | Optimized | 183.8666 | -3.1059535 | 202.79593 | 370.53909 | 81.813805 | 0 |
| 16 | Optimized | 184.68885 | -2.9605805 | 191.25139 | 375.29343 | 89.763301 | 0 |
| 17 | Optimized | 185.40985 | -2.833112 | 180.6494 | 391.17133 | 102.67841 | 0 |
| 18 | Optimized | 185.95985 | -2.703889 | 170.60077 | 386.06476 | 105.08881 | 0 |
| 19 | Optimized | 186.5787 | -2.512054 | 156.46693 | 401.09864 | 119.31485 | 0 |
| 20 | Optimized | 187.30885 | -2.24956 | 137.49583 | 394.87973 | 125.53451 | 0 |
| 21 | Optimized | 188.01175 | -1.95936 | 116.81491 | 402.62504 | 139.39891 | 0 |
| 22 | Optimized | 188.7329 | -1.61694 | 93.336872 | 382.8073 | 141.18416 | 0 |
| 23 | Optimized | 189.47225 | -1.2223 | 66.110087 | 380.55212 | 153.36363 | 0 |
| 24 | Optimized | 189.87095 | -1.0027407 | 51.113255 | 339.37485 | 140.59457 | 0 |
| 25 | Optimized | 190.39725 | -0.5998807 | 24.651939 | 368.16223 | 167.54116 | 0 |
| 26 | Optimized | 191.01525 | -0.0817969 | -9.1837398 | 339.83281 | 165.74754 | 0 |
| 27 | Optimized | 191.4539 | 0.4177081 | -41.359522 | 317.13879 | 154.67892 | 75 |
| 28 | Optimized | 191.7859 | 0.7987189 | -65.875517 | 293.27387 | 143.03923 | 75 |
| 29 | Optimized | 192.14105 | 1.2770184 | -96.397293 | 263.82095 | 128.67408 | 75 |
| 30 | Optimized | 192.8232 | 2.1956795 | -155.03097 | 204.48811 | 99.735516 | 75 |
| 31 | Optimized | 193.5427 | 3.155975 | -215.98983 | 144.60909 | 70.530568 | 75 |
| 32 | Optimized | 194.3299 | 4.18492 | -281.11388 | 79.76949 | 38.90618 | 75 |

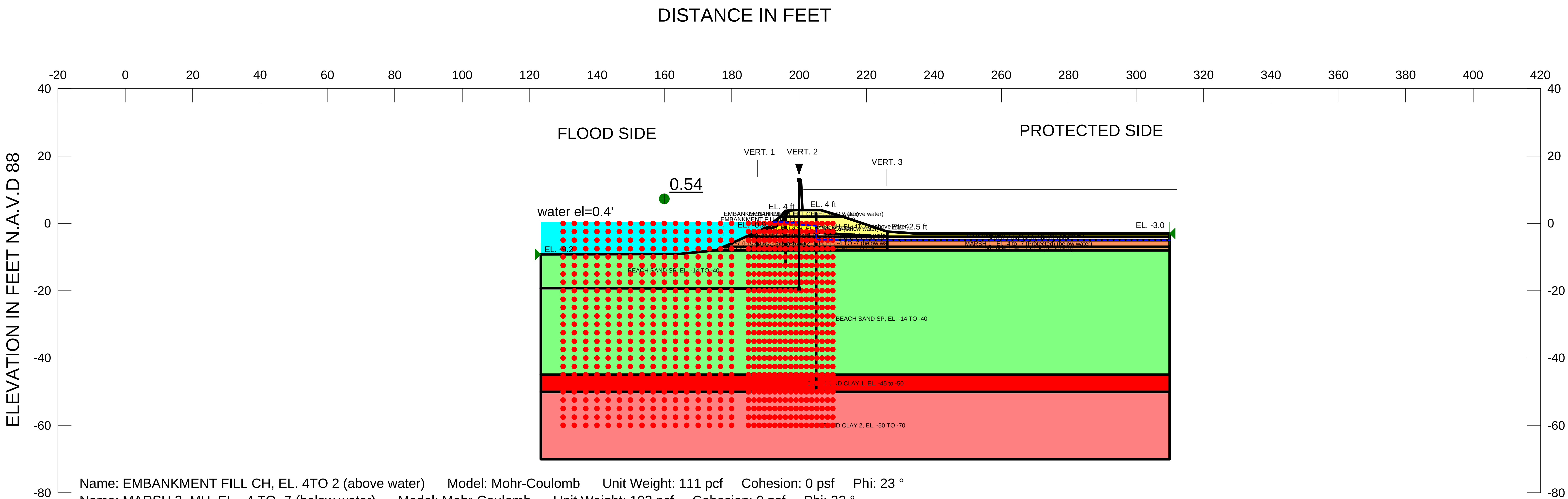
### Slices of Slip Surface: 19374

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 19374 | 176.8427 | -3.530293 | 244.20686 | 293.6744 | 24.126933 | 0 |
| 2 | 19374 | 177.52005 | -3.629877 | 248.45721 | 319.76929 | 34.781226 | 0 |
| 3 | 19374 | 178.19735 | -3.702573 | 251.23319 | 341.08119 | 43.821797 | 0 |
| 4 | 19374 | 178.87465 | -3.748717 | 252.53237 | 357.99873 | 51.439382 | 0 |
| 5 | 19374 | 179.552 | -3.76852 | 252.19841 | 370.79057 | 57.841261 | 0 |
| 6 | 19374 | 180.22935 | -3.7620715 | 250.34931 | 379.7004 | 63.088738 | 0 |
| 7 | 19374 | 180.90665 | -3.729342 | 246.99378 | 384.92613 | 67.274105 | 0 |
| 8 | 19374 | 181.584 | -3.670183 | 242.11977 | 386.61652 | 70.475773 | 0 |
| 9 | 19374 | 182.26135 | -3.5843235 | 235.52014 | 384.89861 | 72.856745 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | 19374 | 182.9125 | -3.4767485 | 227.31145 | 384.89874 | 76.860458 | 0 |
| 11 | 19374 | 183.5375 | -3.3490165 | 217.90997 | 381.30731 | 79.694208 | 0 |
| 12 | 19374 | 184.1625 | -3.1972405 | 206.95052 | 374.80763 | 81.869384 | 0 |
| 13 | 19374 | 184.7875 | -3.020766 | 194.31726 | 365.4016 | 83.443409 | 0 |
| 14 | 19374 | 185.375 | -2.832397 | 180.75992 | 363.08568 | 88.926214 | 0 |
| 15 | 19374 | 185.925 | -2.634279 | 166.60467 | 367.63331 | 98.048218 | 0 |
| 16 | 19374 | 186.50835 | -2.4002885 | 150.11182 | 368.93458 | 106.72699 | 0 |
| 17 | 19374 | 187.125 | -2.1265715 | 130.99474 | 366.55252 | 114.88921 | 0 |
| 18 | 19374 | 187.74165 | -1.8235805 | 109.98005 | 360.29713 | 122.08779 | 0 |
| 19 | 19374 | 188.35835 | -1.489562 | 87.064391 | 350.10505 | 128.2935 | 0 |
| 20 | 19374 | 188.975 | -1.1224157 | 61.947222 | 335.82328 | 133.57828 | 0 |
| 21 | 19374 | 189.59165 | -0.71960825 | 34.563414 | 317.30215 | 137.9009 | 0 |
| 22 | 19374 | 190.28955 | -0.21360702 | 1.1474775 | 325.10669 | 158.00547 | 0 |
| 23 | 19374 | 190.95935 | 0.31657288 | -33.825041 | 328.21258 | 160.07997 | 75 |
| 24 | 19374 | 191.5198 | 0.8073463 | -65.829406 | 345.70155 | 168.60991 | 75 |
| 25 | 19374 | 191.9476 | 1.2074145 | -91.674053 | 337.24262 | 164.48422 | 75 |
| 26 | 19374 | 192.4272 | 1.683586 | -122.35819 | 296.62623 | 144.67428 | 75 |
| 27 | 19374 | 193.09125 | 2.3476495 | -164.91895 | 245.83443 | 119.90146 | 75 |
| 28 | 19374 | 193.7553 | 3.011713 | -207.2348 | 195.05328 | 95.133843 | 75 |
| 29 | 19374 | 194.41935 | 3.675777 | -249.44417 | 144.27213 | 70.366221 | 75 |
| 30 | 19374 | 195.08345 | 4.339841 | -291.50446 | 93.489918 | 45.59808 | 75 |
| 31 | 19374 | 195.7475 | 5.0039045 | -333.45827 | 42.707703 | 20.829939 | 75 |




Name: EMBANKMENT FILL CH, EL. 4TO 2 (above water) Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 0 psf Phi: 23 °
Name: MARSH 2, MH, EL. -4 TO -7 (below water) Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 0 psf Phi: 23 °
Name: BEACH SAND SP, EL. -14 TO -40 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 28 °
Name: Fill (Protected), El., -2.5 TO -4 (above water) Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion: 0 psf Phi: 23 °
Name: MARSH 2, El, -7 to -8 (Protected) Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion: 0 psf Phi: 23 °
Name: EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water) Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 0 psf Phi: 23 °
Name: Marsh1, El., -2.5 TO -4 (above water) Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 0 psf Phi: 23 °
Name: BAY SOUND CLAY 1, EL. -45 to -50 Model: Spatial Mohr-Coulomb Weight Fn: Bay Sound 1 Cohesion: 0 psf Phi: 23 °
Name: BAY SOUND CLAY 2, EL. -50 TO -70 Model: Spatial Mohr-Coulomb Weight Fn: Bay Sound 2 Cohesion: 0 psf Phi: 23 °
Name: MARSH 1 , El, -4 to -7 (Protected) (below water) Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion: 0 psf Phi: 23 °
Name: MARSH 2, EL. -7 TO -8 Model: Spatial Mohr-Coulomb Weight Fn: Marsh2 Cohesion: 0 psf Phi: 23 °
Name: Marsh 1 (prtected) above water Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion: 0 psf Phi: 23 °

US Army Corps of Engineers
New Orleans District

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEENT HE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

LONDON AVE CANAL
OUTFALL CANAL REEVALUATION REPORT
REACH 27, STA. 48+50 TO 58+50
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Block) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Global Stability (Block) in front
File Name: Reach 27-Scase FS seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Block) in front

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## File Information

Created By: Liljegren, James
Revision Number: 322
Last Edited By: Middleton, Mark C MVN
Date: 1/15/2013
Time: 10:27:33 AM
File Name: Reach 27-Scase FS seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Solved Date: 1/15/2013
Last Solved Time: 10:39:26 AM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Global Stability (Block) in front

Kind: SLOPE/W
Parent: Scaes FS Analysis (Seepage)
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution
- FOS Calculation Option: Constant

Restrict Block Crossing: Yes





Advanced
- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 2 ft
- Optimization Maximum Iterations: 4000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL CH, EL. 4TO 2 (above water)

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH 2, MH, EL. -4 TO -7 (below water)

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### BEACH SAND SP, EL. -14 TO -40

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 28 °
Phi-B: 0 °

### Fill (Protected), El., -2.5 TO -4 (above water)

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH 2, El, -7 to -8 (Protected)

Model: Mohr-Coulomb
Unit Weight: 99 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °





### EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water)

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Marsh1, El., -2.5 TO -4 (above water)

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### BAY SOUND CLAY 1, EL. -45 to -50

Model: Spatial Mohr-Coulomb
Weight Fn: Bay Sound 1
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### BAY SOUND CLAY 2, EL. -50 TO -70

Model: Spatial Mohr-Coulomb
Weight Fn: Bay Sound 2
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH 1 , El, -4 to -7 (Protected) (below water)

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH 2, EL. -7 TO -8

Model: Spatial Mohr-Coulomb
Weight Fn: Marsh2
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Marsh 1 (prtected) above water

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °





## Slip Surface Limits

Left Coordinate: (123.3, -9.2) ft
Right Coordinate: (310, -3) ft

## Slip Surface Block

Left Grid
- Upper Left: (130, 0) ft
- Lower Left: (130, -60) ft
- Lower Right: (180, -60) ft
- X Increments: 15
- Y Increments: 24
- Starting Angle: 135 °
- Ending Angle: 155 °
- Angle Increments: 6

Right Grid
- Upper Left: (185, 0) ft
- Lower Left: (185, -60) ft
- Lower Right: (210, -60) ft
- X Increments: 16
- Y Increments: 24
- Starting Angle: 30 °
- Ending Angle: 45 °
- Angle Increments: 6

## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -19.3) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 32.2 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No
Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Unit Weight Functions

### Marsh2

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99
Data Points: X (ft), Unit Weight (pcf)
Data Point: (187.56, 99)
Data Point: (200, 103)
Data Point: (226.1, 99)

### Bay Sound 1

Model: Spline Data Point Function
Function: Unit Weight vs. Y
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 107
Data Points: Y (ft), Unit Weight (pcf)
Data Point: (191.1, 107)
Data Point: (200, 110)
Data Point: (238.5, 107)

### Bay Sound 2

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 112
Data Points: X (ft), Unit Weight (pcf)
Data Point: (191.1, 112)
Data Point: (200, 110)
Data Point: (226.1, 112)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | MARSH 2, MH, EL. -4 TO -7 (below water) | 5,26,16,20,27,50,4 | 21.15 |
| Region 2 | MARSH 2, MH, EL. -4 TO -7 (below water) | 16,61,62,19,20 | 7.05 |
| Region 3 | BEACH SAND SP, EL. -14 TO -40 | 28,17,18,23,1,24,2,25,51 | 809.5 |
| Region 4 | BEACH SAND SP, EL. -14 TO -40 | 23,18,17,14,22,11,13,12 | 6045.025 |
| Region 5 | MARSH 2, MH, EL. -4 TO -7 (below water) | 50,27,20,42,41,52 | 37.32 |
| Region 6 | | 15,30,31,32 | 6.675 |
| Region 7 | MARSH 2, MH, EL. -4 TO -7 (below water) | 20,19,62,60,63,33,34,42 | 58.5175 |
| Region 8 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 6,53,15,38,39,37 | 8.876 |
| Region 9 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 15,32,7,36,38 | 19.4 |
| Region 10 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 37,47,56,57,38,39 | 10.729 |
| Region 11 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 38,57,58,59,61,21,8,36 | 96.239 |





| | | | |
|---|---|---|---|
| Region 12 | Fill (Protected), El., -2.5 TO -4 (above water) | 21,8,43,9,10 | 86.025 |
| Region 13 | MARSH 2, El, -7 to -8 (Protected) | 35,33,22,11 | 83.9 |
| Region 14 | BAY SOUND CLAY 1, EL. -45 to -50 | 12,13,49,48 | 933.5 |
| Region 15 | BAY SOUND CLAY 2, EL. -50 TO -70 | 48,49,45,44 | 3734 |
| Region 16 | MARSH 1 , El, -4 to -7 (Protected) (below water) | 33,63,64,35 | 167.8 |
| Region 17 | MARSH 1 , El, -4 to -7 (Protected) (below water) | 40,3,4,50,52 | 19.905 |
| Region 18 | MARSH 2, El, -7 to -8 (Protected) | 25,51,52,40 | 11.055 |
| Region 19 | MARSH 2, EL. -7 TO -8 | 17,28,51,52,41,42 | 12.44 |
| Region 20 | MARSH 2, EL. -7 TO -8 | 17,42,34,33,22,14 | 26.1 |
| Region 21 | EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water) | 5,46,56,57,16,26 | 27.507 |
| Region 22 | EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water) | 57,58,59,61,16 | 11.326 |
| Region 23 | Marsh1, El., -2.5 TO -4 (above water) | 61,62,21 | 12.51 |
| Region 24 | Marsh1, El., -2.5 TO -4 (above water) | 62,60,63,21 | 19.7825 |
| Region 25 | Marsh 1 (prtected) above water | 21,10,64,63 | 83.9 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 123.3 | -11.2 |
| Point 2 | 164.5 | -9.1 |
| Point 3 | 179.82 | -6 |
| Point 4 | 184.24 | -4 |
| Point 5 | 187.56 | -2.5 |
| Point 6 | 196 | 3.7 |
| Point 7 | 206.4 | 4 |
| Point 8 | 226.1 | -2.5 |
| Point 9 | 310 | -3 |
| Point 10 | 310 | -4 |
| Point 11 | 310 | -8 |
| Point 12 | 123.3 | -45 |
| Point 13 | 310 | -45 |
| Point 14 | 202 | -8 |
| Point 15 | 200 | 4 |
| Point 16 | 200 | -2.5 |
| Point 17 | 200 | -8 |
| Point 18 | 200 | -19.3 |
| Point 19 | 202 | -4 |
| Point 20 | 200 | -4 |
| Point 21 | 226.1 | -4 |
| Point 22 | 226.1 | -8 |
| Point 23 | 123.3 | -19.2 |
| Point 24 | 123.3 | -9.2 |
| Point 25 | 175.4 | -8 |
| Point 26 | 196 | -2.5 |





| | | |
|---|---|---|
| Point 27 | 196 | -4 |
| Point 28 | 196 | -8 |
| Point 29 | 196 | -13 |
| Point 30 | 200 | 12.9 |
| Point 31 | 200.5 | 12.9 |
| Point 32 | 201 | 4 |
| Point 33 | 226.1 | -7 |
| Point 34 | 202 | -7 |
| Point 35 | 310 | -7 |
| Point 36 | 213 | 2 |
| Point 37 | 194.44 | 2 |
| Point 38 | 200 | 2 |
| Point 39 | 196 | 2 |
| Point 40 | 177.61 | -7 |
| Point 41 | 196 | -7 |
| Point 42 | 200 | -7 |
| Point 43 | 234.6 | -3 |
| Point 44 | 123.3 | -70 |
| Point 45 | 310 | -70 |
| Point 46 | 191.1 | -0.9 |
| Point 47 | 193.4 | 1.2 |
| Point 48 | 123.3 | -50 |
| Point 49 | 310 | -50 |
| Point 50 | 187.56 | -4 |
| Point 51 | 187.56 | -8 |
| Point 52 | 187.56 | -7 |
| Point 53 | 199 | 4 |
| Point 54 | 205 | 3 |
| Point 55 | 205 | -49 |
| Point 56 | 192.5 | 0.4 |
| Point 57 | 200 | 0.34 |
| Point 58 | 200.3 | -0.4 |
| Point 59 | 205 | -0.5 |
| Point 60 | 205.3 | -4.9 |
| Point 61 | 205.2 | -2.8 |
| Point 62 | 205.25 | -4 |
| Point 63 | 226.1 | -5 |
| Point 64 | 310 | -5 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 0.54 | (190.507, 5.624) | 9.638605 | (196.967, 3.79674) | (184.134, -4.0481) |
| 2 | 20739 | 0.72 | (190.507, 5.624) | 8.043 | (198.996, 3.99959) | (187.56, -2.5) |





### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 184.18685 | -4.026809 | 276.2361 | 280.9339 | 1.9940994 | 0 |
| 2 | Optimized | 184.46475 | -3.915469 | 269.28659 | 274.1598 | 2.0685583 | 0 |
| 3 | Optimized | 184.9074 | -3.738135 | 258.21811 | 263.50091 | 2.2424152 | 0 |
| 4 | Optimized | 185.3432 | -3.5635585 | 247.33299 | 252.99921 | 2.4051711 | 0 |
| 5 | Optimized | 185.779 | -3.3889815 | 236.42656 | 242.49752 | 2.5769691 | 0 |
| 6 | Optimized | 186.2148 | -3.214405 | 225.54144 | 231.99583 | 2.739725 | 0 |
| 7 | Optimized | 186.6506 | -3.0398285 | 214.63502 | 221.49413 | 2.9115229 | 0 |
| 8 | Optimized | 187.04135 | -2.892474 | 205.44785 | 217.0228 | 4.9132747 | 0 |
| 9 | Optimized | 187.3871 | -2.7723425 | 197.95159 | 210.23682 | 5.2147738 | 0 |
| 10 | Optimized | 187.8655 | -2.6061385 | 187.57871 | 201.84848 | 6.0571591 | 0 |
| 11 | Optimized | 188.2367 | -2.47717 | 179.51672 | 195.58813 | 6.8219063 | 0 |
| 12 | Optimized | 188.5411 | -2.379735 | 173.42546 | 193.43763 | 8.4946615 | 0 |
| 13 | Optimized | 189.0185 | -2.230525 | 164.09818 | 186.0138 | 9.3026261 | 0 |
| 14 | Optimized | 189.47815 | -2.092975 | 155.4984 | 181.79131 | 11.16068 | 0 |
| 15 | Optimized | 189.92005 | -1.967085 | 147.63076 | 176.14359 | 12.102977 | 0 |
| 16 | Optimized | 190.38075 | -1.844251 | 139.95319 | 174.25106 | 14.558582 | 0 |
| 17 | Optimized | 190.86025 | -1.7244725 | 132.46723 | 169.88088 | 15.881153 | 0 |
| 18 | Optimized | 191.10405 | -1.6635665 | 128.66359 | 182.31017 | 22.771622 | 0 |
| 19 | Optimized | 191.1158 | -1.660825 | 128.48752 | 185.24014 | 24.090057 | 0 |
| 20 | Optimized | 191.35295 | -1.577363 | 123.27655 | 168.79105 | 19.319757 | 0 |
| 21 | Optimized | 191.8118 | -1.413889 | 113.03584 | 162.81251 | 21.128942 | 0 |
| 22 | Optimized | 192.2706 | -1.2504145 | 102.79718 | 156.83397 | 22.937255 | 0 |
| 23 | Optimized | 192.66815 | -1.1087635 | 93.927918 | 163.17998 | 29.395755 | 0 |
| 24 | Optimized | 193.06595 | -0.9285 | 82.649219 | 162.04485 | 33.701446 | 0 |
| 25 | Optimized | 193.3478 | -0.77397955 | 72.973506 | 156.9178 | 35.632237 | 0 |
| 26 | Optimized | 193.67735 | -0.55830955 | 59.468121 | 158.25682 | 41.933317 | 0 |
| 27 | Optimized | 194.19735 | -0.1349053 | 32.953353 | 124.7403 | 38.961249 | 0 |
| 28 | Optimized | 194.49325 | 0.1601047 | 14.477764 | 116.92556 | 43.486508 | 0 |
| 29 | Optimized | 194.6153 | 0.29786875 | 5.8486905 | 100.31893 | 40.100238 | 0 |
| 30 | Optimized | 194.88215 | 0.6263956 | -14.728067 | 96.526169 | 40.972928 | 0 |
| 31 | Optimized | 195.2783 | 1.1141319 | -45.281504 | 93.610634 | 39.735357 | 0 |
| 32 | Optimized | 195.643 | 1.598225 | -75.611887 | 79.930465 | 33.928469 | 0 |
| 33 | Optimized | 195.85925 | 1.919225 | -95.723681 | 69.639756 | 29.560323 | 0 |
| 34 | Optimized | 195.95445 | 2.0741335 | - | 67.44911 | 28.630449 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | 105.43161 | | | |
| 35 | Optimized | 196.08045 | 2.2791335 | -122.03113 | 61.147397 | 25.95553 | 0 |
| 36 | Optimized | 196.3197 | 2.67601 | -157.40379 | 44.240968 | 18.779177 | 0 |
| 37 | Optimized | 196.72295 | 3.369379 | -201.49067 | 16.353852 | 6.9417982 | 0 |

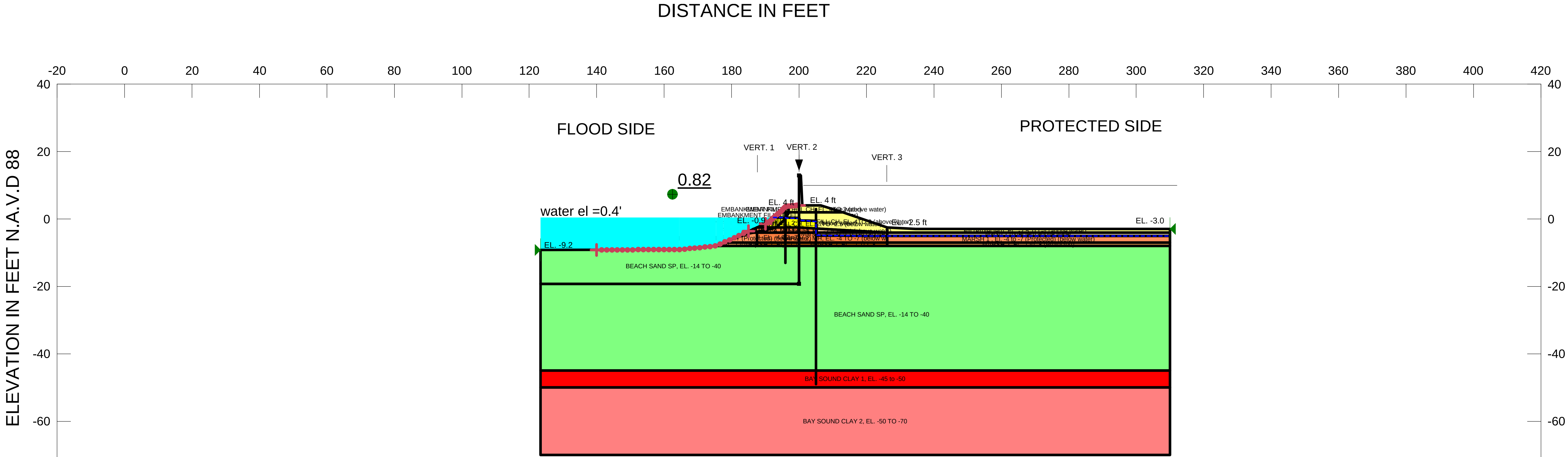
## Slices of Slip Surface: 20739

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 20739 | 187.75665 | -2.5 | 180.95341 | 219.01019 | 16.154146 | 0 |
| 2 | 20739 | 188.15 | -2.5 | 180.94324 | 227.65934 | 19.82981 | 0 |
| 3 | 20739 | 188.54335 | -2.5 | 180.93307 | 236.30595 | 23.504396 | 0 |
| 4 | 20739 | 188.93665 | -2.5 | 180.92035 | 244.95511 | 27.181139 | 0 |
| 5 | 20739 | 189.33 | -2.5 | 180.91273 | 253.60172 | 30.854645 | 0 |
| 6 | 20739 | 189.72335 | -2.5 | 180.90764 | 262.24578 | 34.525993 | 0 |
| 7 | 20739 | 190.11665 | -2.5 | 180.90002 | 270.88985 | 38.19842 | 0 |
| 8 | 20739 | 190.51 | -2.5 | 180.89493 | 279.53392 | 41.869768 | 0 |
| 9 | 20739 | 190.90335 | -2.5 | 180.88985 | 288.17799 | 45.541115 | 0 |
| 10 | 20739 | 191.175 | -2.5 | 180.88667 | 310.95333 | 55.210024 | 0 |
| 11 | 20739 | 191.45835 | -2.3251875 | 169.96627 | 205.87598 | 15.242769 | 0 |
| 12 | 20739 | 191.875 | -1.9755625 | 148.11561 | 184.29191 | 15.355927 | 0 |
| 13 | 20739 | 192.29165 | -1.6259375 | 126.25577 | 162.69681 | 15.468304 | 0 |
| 14 | 20739 | 192.725 | -1.262328 | 103.51984 | 150.73711 | 20.042544 | 0 |
| 15 | 20739 | 193.175 | -0.8847334 | 79.906944 | 147.85679 | 28.842997 | 0 |
| 16 | 20739 | 193.57335 | -0.55049185 | 58.986894 | 143.84105 | 36.018451 | 0 |
| 17 | 20739 | 193.92 | -0.25960395 | 40.774188 | 138.69676 | 41.565667 | 0 |
| 18 | 20739 | 194.26665 | 0.0312839 | 22.554852 | 133.54806 | 47.113822 | 0 |
| 19 | 20739 | 194.56265 | 0.2796229 | 6.9954119 | 131.92142 | 53.027946 | 0 |
| 20 | 20739 | 194.9044 | 0.56638555 | -10.976864 | 136.63484 | 57.998049 | 0 |
| 21 | 20739 | 195.34265 | 0.93412055 | -34.027613 | 144.37308 | 61.282735 | 0 |
| 22 | 20739 | 195.7809 | 1.3018555 | -57.0885 | 152.11131 | 64.567422 | 0 |
| 23 | 20739 | 196.1532 | 1.6142925 | -83.437428 | 148.00157 | 62.822939 | 0 |
| 24 | 20739 | 196.45965 | 1.871431 | -106.51283 | 132.04802 | 56.051058 | 0 |
| 25 | 20739 | 196.8115 | 2.1666325 | -125.49651 | 113.73109 | 48.275984 | 0 |
| 26 | 20739 | 197.20865 | 2.4998975 | -146.80928 | 93.052887 | 39.498607 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27 | 20739 | 197.6058 | 2.833163 | -168.35542 | 72.374682 | 30.72123 | 0 |
| 28 | 20739 | 198.003 | 3.1664285 | -190.16195 | 51.696477 | 21.943853 | 0 |
| 29 | 20739 | 198.40015 | 3.4996935 | -212.00898 | 31.018272 | 13.166475 | 0 |
| 30 | 20739 | 198.7973 | 3.8329585 | -233.7075 | 10.339103 | 4.3886886 | 0 |




Name: EMBANKMENT FILL CH, EL. 4TO 2 (above water) Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 75 psf Phi: 26 °
Name: MARSH 2, MH, EL. -4 TO -7 (below water) Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 0 psf Phi: 24 °
Name: BEACH SAND SP, EL. -14 TO -40 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 34 °
Name: Fill (Protected), El., -2.5 TO -4 (above water) Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion: 75 psf Phi: 26 °
Name: MARSH 2, El, -7 to -8 (Protected) Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion: 0 psf Phi: 24 °
Name: EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water) Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 0 psf Phi: 26 °
Name: Marsh1, El., -2.5 TO -4 (above water) Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 75 psf Phi: 24 °
Name: BAY SOUND CLAY 1, EL. -45 to -50 Model: Spatial Mohr-Coulomb Weight Fn: Bay Sound 1 Cohesion: 0 psf Phi: 26 °
Name: BAY SOUND CLAY 2, EL. -50 TO -70 Model: Spatial Mohr-Coulomb Weight Fn: Bay Sound 2 Cohesion: 0 psf Phi: 26 °
Name: MARSH 1 , El, -4 to -7 (Protected) (below water) Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion: 0 psf Phi: 24 °
Name: MARSH 2, EL. -7 TO -8 Model: Spatial Mohr-Coulomb Weight Fn: Marsh2 Cohesion: 0 psf Phi: 24 °
Name: Marsh 1 (prtected) above water Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion: 75 psf Phi: 24 °

US Army Corps of Engineers®
New Orleans District

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEENT HE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

LONDON AVE CANAL
OUTFALL CANAL REEVALUATION REPORT
REACH 27, STA. 48+50 TO 58+50
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Entry/Exit) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Global Stability (Entry/Exit) in front
File Name: Reach 27-Scase FS GCAT seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Entry/Exit) in front



## File Information

Created By: Liljegren, James
Revision Number: 313
Last Edited By: Middleton, Mark C MVN
Date: 12/11/2012
Time: 4:26:36 PM
File Name: Reach 27-Scase FS GCAT seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Solved Date: 12/11/2012
Last Solved Time: 4:34:56 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Global Stability (Entry/Exit) in front

Kind: SLOPE/W
Parent: Scaes FS Analysis (Seepage)
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution
- FOS Calculation Option: Constant

Advanced





- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 2 ft
- Optimization Maximum Iterations: 4000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL CH, EL. 4TO 2 (above water)

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### MARSH 2, MH, EL. -4 TO -7 (below water)

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### BEACH SAND SP, EL. -14 TO -40

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 34 °
Phi-B: 0 °

### Fill (Protected), El., -2.5 TO -4 (above water)

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### MARSH 2, El, -7 to -8 (Protected)

Model: Mohr-Coulomb
Unit Weight: 99 pcf
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water)





Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### Marsh1, El., -2.5 TO -4 (above water)

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 75 psf
Phi: 24 °
Phi-B: 0 °

### BAY SOUND CLAY 1, EL. -45 to -50

Model: Spatial Mohr-Coulomb
Weight Fn: Bay Sound 1
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### BAY SOUND CLAY 2, EL. -50 TO -70

Model: Spatial Mohr-Coulomb
Weight Fn: Bay Sound 2
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### MARSH 1 , El, -4 to -7 (Protected) (below water)

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### MARSH 2, EL. -7 TO -8

Model: Spatial Mohr-Coulomb
Weight Fn: Marsh2
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### Marsh 1 (prtected) above water

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 75 psf
Phi: 24 °
Phi-B: 0 °

## Slip Surface Entry and Exit





Left Projection: Range
Left-Zone Left Coordinate: (140, -9.15947) ft
Left-Zone Right Coordinate: (185, -3.65663) ft
Left-Zone Increment: 30
Right Projection: Range
Right-Zone Left Coordinate: (190, -1.39718) ft
Right-Zone Right Coordinate: (200, 4) ft
Right-Zone Increment: 30
Radius Increments: 200

## Slip Surface Limits

Left Coordinate: (123.3, -9.2) ft
Right Coordinate: (310, -3) ft

## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -19.3) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 32.2 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No
Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Unit Weight Functions

### Marsh2

Model: Spline Data Point Function
Function: Unit Weight vs. X
- Curve Fit to Data: 100 %
- Segment Curvature: 0 %

Y-Intercept: 99
Data Points: X (ft), Unit Weight (pcf)
- Data Point: (187.56, 99)
- Data Point: (200, 103)
- Data Point: (226.1, 99)

### Bay Sound 1

Model: Spline Data Point Function
Function: Unit Weight vs. Y
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 107
Data Points: Y (ft), Unit Weight (pcf)
Data Point: (191.1, 107)
Data Point: (200, 110)
Data Point: (238.5, 107)

### Bay Sound 2

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 112
Data Points: X (ft), Unit Weight (pcf)
Data Point: (191.1, 112)
Data Point: (200, 110)
Data Point: (226.1, 112)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | MARSH 2, MH, EL. -4 TO -7 (below water) | 5,26,16,20,27,50,4 | 21.15 |
| Region 2 | MARSH 2, MH, EL. -4 TO -7 (below water) | 16,61,62,19,20 | 7.05 |
| Region 3 | BEACH SAND SP, EL. -14 TO -40 | 28,17,18,23,1,24,2,25,51 | 809.5 |
| Region 4 | BEACH SAND SP, EL. -14 TO -40 | 23,18,17,14,22,11,13,12 | 6045.025 |
| Region 5 | MARSH 2, MH, EL. -4 TO -7 (below water) | 50,27,20,42,41,52 | 37.32 |
| Region 6 | | 15,30,31,32 | 6.675 |
| Region 7 | MARSH 2, MH, EL. -4 TO -7 (below water) | 20,19,62,60,63,33,34,42 | 58.5175 |
| Region 8 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 6,53,15,38,39,37 | 8.876 |
| Region 9 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 15,32,7,36,38 | 19.4 |
| Region 10 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 37,47,56,57,38,39 | 10.729 |
| Region 11 | EMBANKMENT FILL CH, EL. 4TO 2 (above water) | 38,57,58,59,61,21,8,36 | 96.239 |
| Region 12 | Fill (Protected), El., -2.5 TO -4 (above water) | 21,8,43,9,10 | 86.025 |
| Region 13 | MARSH 2, El, -7 to -8 (Protected) | 35,33,22,11 | 83.9 |
| Region 14 | BAY SOUND CLAY 1, EL. -45 to -50 | 12,13,49,48 | 933.5 |
| Region 15 | BAY SOUND CLAY 2, EL. -50 TO -70 | 48,49,45,44 | 3734 |
| Region 16 | MARSH 1 , El, -4 to -7 (Protected) (below water) | 33,63,64,35 | 167.8 |
| Region 17 | MARSH 1 , El, -4 to -7 (Protected) (below water) | 40,3,4,50,52 | 19.905 |
| Region 18 | MARSH 2, El, -7 to -8 (Protected) | 25,51,52,40 | 11.055 |
| Region 19 | MARSH 2, EL. -7 TO -8 | 17,28,51,52,41,42 | 12.44 |
| Region 20 | MARSH 2, EL. -7 TO -8 | 17,42,34,33,22,14 | 26.1 |
| Region 21 | EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water) | 5,46,56,57,16,26 | 27.507 |
| Region 22 | EMBANKMENT FILL CH, EL. 2 TO -2.5 (below water) | 57,58,59,61,16 | 11.326 |
| Region 23 | Marsh1, El., -2.5 TO -4 (above water) | 61,62,21 | 12.51 |
| Region 24 | Marsh1, El., -2.5 TO -4 (above water) | 62,60,63,21 | 19.7825 |
| Region 25 | Marsh 1 (prtected) above water | 21,10,64,63 | 83.9 |





## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 123.3 | -11.2 |
| Point 2 | 164.5 | -9.1 |
| Point 3 | 179.82 | -6 |
| Point 4 | 184.24 | -4 |
| Point 5 | 187.56 | -2.5 |
| Point 6 | 196 | 3.7 |
| Point 7 | 206.4 | 4 |
| Point 8 | 226.1 | -2.5 |
| Point 9 | 310 | -3 |
| Point 10 | 310 | -4 |
| Point 11 | 310 | -8 |
| Point 12 | 123.3 | -45 |
| Point 13 | 310 | -45 |
| Point 14 | 202 | -8 |
| Point 15 | 200 | 4 |
| Point 16 | 200 | -2.5 |
| Point 17 | 200 | -8 |
| Point 18 | 200 | -19.3 |
| Point 19 | 202 | -4 |
| Point 20 | 200 | -4 |
| Point 21 | 226.1 | -4 |
| Point 22 | 226.1 | -8 |
| Point 23 | 123.3 | -19.2 |
| Point 24 | 123.3 | -9.2 |
| Point 25 | 175.4 | -8 |
| Point 26 | 196 | -2.5 |
| Point 27 | 196 | -4 |
| Point 28 | 196 | -8 |
| Point 29 | 196 | -13 |
| Point 30 | 200 | 12.9 |
| Point 31 | 200.5 | 12.9 |
| Point 32 | 201 | 4 |
| Point 33 | 226.1 | -7 |
| Point 34 | 202 | -7 |
| Point 35 | 310 | -7 |
| Point 36 | 213 | 2 |
| Point 37 | 194.44 | 2 |
| Point 38 | 200 | 2 |
| Point 39 | 196 | 2 |
| Point 40 | 177.61 | -7 |
| Point 41 | 196 | -7 |
| Point 42 | 200 | -7 |
| Point 43 | 234.6 | -3 |
| Point 44 | 123.3 | -70 |
| Point 45 | 310 | -70 |
| Point 46 | 191.1 | -0.9 |
| Point 47 | 193.4 | 1.2 |
| Point 48 | 123.3 | -50 |
| Point 49 | 310 | -50 |
| Point 50 | 187.56 | -4 |
| Point 51 | 187.56 | -8 |
| Point 52 | 187.56 | -7 |
| Point 53 | 199 | 4 |
| Point 54 | 205 | 3 |
| Point 55 | 205 | -49 |
| Point 56 | 192.5 | 0.4 |
| Point 57 | 200 | 0.34 |
| Point 58 | 200.3 | -0.4 |
| Point 59 | 205 | -0.5 |
| Point 60 | 205.3 | -4.9 |
| Point 61 | 205.2 | -2.8 |
| Point 62 | 205.25 | -4 |
| Point 63 | 226.1 | -5 |
| Point 64 | 310 | -5 |





## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 0.82 | (187.519, 6.46) | 10.86653 | (196.953, 3.79526) | (179.03, -6.35765) |
| 2 | 191905 | 0.88 | (187.519, 6.46) | 10.425 | (196.943, 3.79425) | (185, -3.65663) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 179.4248 | -6.225215 | 413.4072 | 419.98102 | 2.9268553 | 0 |
| 2 | Optimized | 180.1357 | -5.986981 | 398.5499 | 407.75494 | 4.0983499 | 0 |
| 3 | Optimized | 180.76715 | -5.775385 | 385.33548 | 396.8981 | 5.1480088 | 0 |
| 4 | Optimized | 181.3986 | -5.5637885 | 372.13607 | 386.05626 | 6.1976678 | 0 |
| 5 | Optimized | 182.03 | -5.352192 | 358.93667 | 375.19942 | 7.240641 | 0 |
| 6 | Optimized | 182.6614 | -5.140596 | 345.72225 | 364.34257 | 8.2902999 | 0 |
| 7 | Optimized | 183.29285 | -4.9289995 | 332.52285 | 353.48572 | 9.3332731 | 0 |
| 8 | Optimized | 183.9243 | -4.717403 | 319.32345 | 342.62888 | 10.376246 | 0 |
| 9 | Optimized | 184.49485 | -4.5261965 | 307.38479 | 332.60801 | 11.230103 | 0 |
| 10 | Optimized | 185.0046 | -4.355379 | 296.7263 | 323.43762 | 11.892646 | 0 |
| 11 | Optimized | 185.58695 | -4.189155 | 286.3537 | 320.06504 | 15.009257 | 0 |
| 12 | Optimized | 186.19195 | -4.05417 | 277.92565 | 318.73051 | 18.167494 | 0 |
| 13 | Optimized | 186.67395 | -3.9601 | 272.04784 | 316.90909 | 19.973516 | 0 |
| 14 | Optimized | 187.2192 | -3.856196 | 265.5711 | 315.65138 | 22.297175 | 0 |
| 15 | Optimized | 187.9055 | -3.727301 | 257.51605 | 314.90461 | 25.551033 | 0 |
| 16 | Optimized | 188.6968 | -3.57734 | 248.14954 | 315.01242 | 29.769273 | 0 |
| 17 | Optimized | 189.46885 | -3.427713 | 238.80056 | 314.45657 | 33.684226 | 0 |
| 18 | Optimized | 190.1213 | -3.2985985 | 230.74181 | 314.14083 | 37.131638 | 0 |
| 19 | Optimized | 190.77375 | -3.169484 | 222.66803 | 313.81006 | 40.579049 | 0 |
| 20 | Optimized | 191.1031 | -3.1043185 | 218.59043 | 318.01206 | 44.265365 | 0 |
| 21 | Optimized | 191.506 | -3.00265 | 212.25327 | 317.5918 | 46.899737 | 0 |
| 22 | Optimized | 192.2029 | -2.7989605 | 199.52866 | 313.72001 | 50.841264 | 0 |
| 23 | Optimized | 192.7015 | -2.6267255 | 188.7727 | 324.54176 | 60.448281 | 0 |
| 24 | Optimized | 192.94935 | -2.52856 | 182.63959 | 311.25527 | 57.26339 | 0 |
| 25 | Optimized | 193.19785 | -2.3753945 | 173.06835 | 312.39387 | 67.953596 | 0 |
| 26 | Optimized | 193.4704 | -2.2073895 | 162.56624 | 315.43001 | 74.556642 | 0 |
| 27 | Optimized | 193.7656 | -1.9811955 | 148.4165 | 294.83808 | 71.414576 | 0 |
| 28 | Optimized | 194.2152 | -1.615607 | 125.54218 | 287.08963 | 78.791958 | 0 |
| 29 | Optimized | 194.52825 | -1.3610515 | 109.60994 | 283.78138 | 84.949088 | 0 |
| 30 | Optimized | 194.96955 | -0.900105 | 80.750093 | 252.00089 | 83.524593 | 0 |
| 31 | Optimized | 195.6556 | -0.048675 | 27.427701 | 205.33038 | 86.768932 | 0 |
| 32 | Optimized | 195.9943 | 0.42164715 | -2.0381768 | 124.91382 | 60.924539 | 75 |
| 33 | Optimized | 196.23815 | 0.76807565 | -32.952929 | 106.88886 | 52.133183 | 75 |
| 34 | Optimized | 196.71445 | 1.4447785 | -79.219232 | 71.053809 | 34.655258 | 75 |

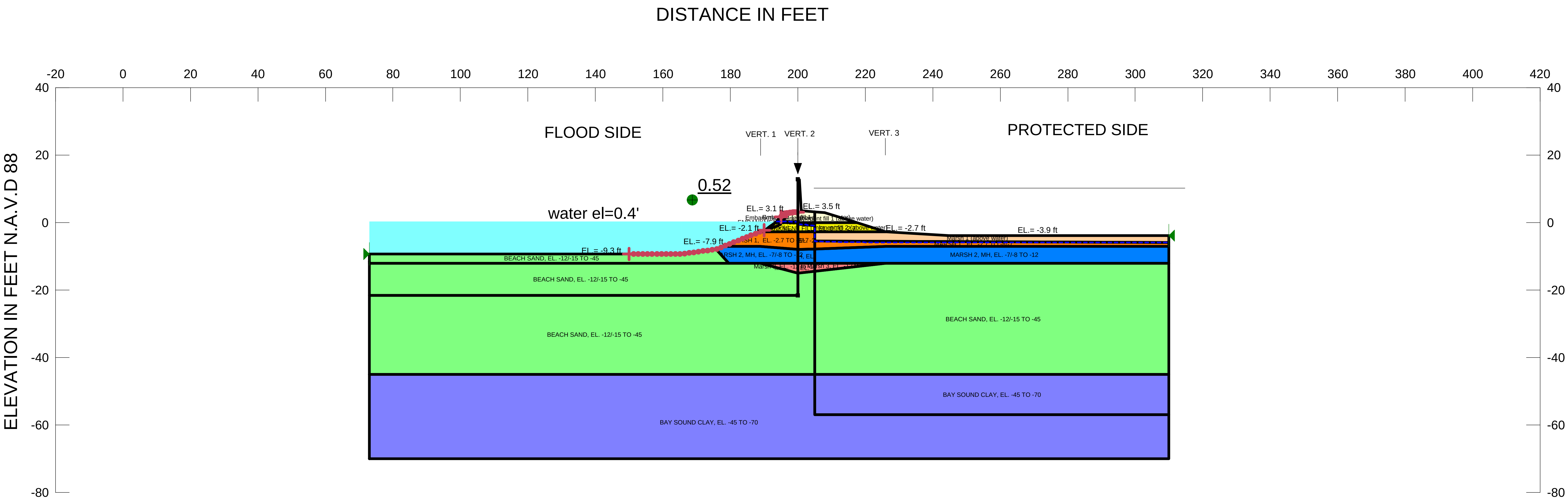




### Slices of Slip Surface: 191905

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 191905 | 185.21335 | -3.70502 | 256.15602 | 291.51547 | 15.743042 | 0 |
| 2 | 191905 | 185.64 | -3.792515 | 261.61046 | 307.23322 | 20.312562 | 0 |
| 3 | 191905 | 186.06665 | -3.8616385 | 265.92652 | 320.21192 | 24.169418 | 0 |
| 4 | 191905 | 186.49335 | -3.912758 | 269.10888 | 330.68345 | 27.414767 | 0 |
| 5 | 191905 | 186.92 | -3.94614 | 271.19129 | 338.81363 | 30.107403 | 0 |
| 6 | 191905 | 187.34665 | -3.961955 | 272.16572 | 344.71825 | 32.302467 | 0 |
| 7 | 191905 | 187.75665 | -3.961004 | 272.09034 | 349.20591 | 34.334061 | 0 |
| 8 | 191905 | 188.15 | -3.944598 | 271.0785 | 352.4122 | 36.212096 | 0 |
| 9 | 191905 | 188.54335 | -3.9132565 | 269.12367 | 353.88105 | 37.736419 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | 191905 | 188.93665 | -3.866844 | 266.20725 | 353.65843 | 38.935775 | 0 |
| 11 | 191905 | 189.33 | -3.8051555 | 262.36422 | 351.74682 | 39.795697 | 0 |
| 12 | 191905 | 189.72335 | -3.7279125 | 257.5331 | 348.18158 | 40.3593 | 0 |
| 13 | 191905 | 190.11665 | -3.6347585 | 251.70751 | 342.95549 | 40.626216 | 0 |
| 14 | 191905 | 190.51 | -3.525247 | 244.86201 | 336.09467 | 40.619395 | 0 |
| 15 | 191905 | 190.90335 | -3.398831 | 236.98034 | 327.56098 | 40.329098 | 0 |
| 16 | 191905 | 191.275 | -3.263727 | 228.54374 | 324.89192 | 42.896972 | 0 |
| 17 | 191905 | 191.625 | -3.1211385 | 219.6417 | 319.44636 | 44.4359 | 0 |
| 18 | 191905 | 191.975 | -2.963396 | 209.79156 | 312.35495 | 45.664162 | 0 |
| 19 | 191905 | 192.325 | -2.7897225 | 198.9491 | 303.63379 | 46.60863 | 0 |
| 20 | 191905 | 192.67465 | -2.599399 | 187.06728 | 301.66524 | 51.022299 | 0 |
| 21 | 191905 | 193.12465 | -2.3243 | 169.87704 | 301.88115 | 64.38271 | 0 |
| 22 | 191905 | 193.57335 | -2.024922 | 151.15517 | 297.7925 | 71.519805 | 0 |
| 23 | 191905 | 193.92 | -1.7663745 | 134.97906 | 289.15466 | 75.196464 | 0 |
| 24 | 191905 | 194.26665 | -1.4842825 | 117.32806 | 277.55071 | 78.145811 | 0 |
| 25 | 191905 | 194.63285 | -1.1569744 | 96.840154 | 266.14413 | 82.575067 | 0 |
| 26 | 191905 | 195.0185 | -0.77707415 | 73.051043 | 253.56293 | 88.041528 | 0 |
| 27 | 191905 | 195.40415 | -0.3541292 | 46.560788 | 235.29627 | 92.052446 | 0 |
| 28 | 191905 | 195.7985 | 0.13269835 | 16.064287 | 209.71104 | 94.447831 | 0 |
| 29 | 191905 | 196.23565 | 0.7565148 | -32.111466 | 106.70129 | 52.041697 | 75 |
| 30 | 191905 | 196.7069 | 1.558317 | -86.514884 | 44.046484 | 21.482905 | 75 |




Name: EMBANKMENT FILL, EL. 3.9 TO 0 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 0 psf Phi: 23 °
Name: MARSH 1, EL. -2.7 TO -8/-7 Model: Spatial Mohr-Coulomb Weight Fn: Marsh 1 Cohesion: 0 psf Phi: 23 °
Name: BEACH SAND, EL. -12/-15 TO -45 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 30 °
Name: BAY SOUND CLAY, EL. -45 TO -70 Model: Spatial Mohr-Coulomb Weight Fn: Clay Cohesion: 0 psf Phi: 23 °
Name: EMBANKMENT FILL, EL. 0 TO -2.7 Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 0 psf Phi: 23 °
Name: MARSH 2, MH, EL. -7/-8 TO -12 Model: Spatial Mohr-Coulomb Weight Fn: Marsh 2 Cohesion: 0 psf Phi: 23 °
Name: Marsh 3, EL. -12 to -15 Model: Mohr-Coulomb Unit Weight: 89 pcf Cohesion: 0 psf Phi: 23 °
Name: Embankment fill 1 (above water) Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 0 psf Phi: 23 °
Name: Embankment fill 2 (above water) Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 0 psf Phi: 23 °
Name: Marsh 1 (above water) Model: Spatial Mohr-Coulomb Weight Fn: Marsh 1 Cohesion: 0 psf Phi: 23 °

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw = CANAL WATER LEVEL

US Army Corps of Engineers
New Orleans District

LONDON AVE CANAL
OUTFALL CANAL REEVALUATION REPORT
REACH 28, STA. 58+50 TO STA 68+12
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Entry/Exit) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Global Stability (Entry/Exit) in front
File Name: Reach 28-Scase FS seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Entry/Exit) in front



## File Information

Created By: Liljegren, James
Revision Number: 278
Last Edited By: Middleton, Mark C MVN
Date: 1/16/2013
Time: 1:54:06 PM
File Name: Reach 28-Scase FS seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Solved Date: 1/16/2013
Last Solved Time: 1:55:14 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Global Stability (Entry/Exit) in front

Kind: SLOPE/W
Parent: Scase FS Stability (Seepage) OPEN
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution
- FOS Calculation Option: Constant

Advanced





- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 2 ft
- Optimization Maximum Iterations: 4000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL, EL. 3.9 TO 0

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH 1, EL. -2.7 TO -8/-7

Model: Spatial Mohr-Coulomb
Weight Fn: Marsh 1
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### BEACH SAND, EL. -12/-15 TO -45

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °

### BAY SOUND CLAY, EL. -45 TO -70

Model: Spatial Mohr-Coulomb
Weight Fn: Clay
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### EMBANKMENT FILL, EL. 0 TO -2.7

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH 2, MH, EL. -7/-8 TO -12





Model: Spatial Mohr-Coulomb
Weight Fn: Marsh 2
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Marsh 3, EL. -12 to -15

Model: Mohr-Coulomb
Unit Weight: 89 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Embankment fill 1 (above water)

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Embankment fill 2 (above water)

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Marsh 1 (above water)

Model: Spatial Mohr-Coulomb
Weight Fn: Marsh 1
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (150, -9.3) ft
Left-Zone Right Coordinate: (190, -2.2589) ft
Left-Zone Increment: 30
Right Projection: Range
Right-Zone Left Coordinate: (195, 1.7) ft
Right-Zone Right Coordinate: (200, 3.1) ft
Right-Zone Increment: 30
Radius Increments: 25

## Slip Surface Limits

Left Coordinate: (73, -9.3) ft
Right Coordinate: (310, -3.9) ft





## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -21.6) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 34.5 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No
Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Unit Weight Functions

### Clay

Model: Spline Data Point Function
Function: Unit Weight vs. X
- Curve Fit to Data: 100 %
- Segment Curvature: 0 %

Y-Intercept: 112
Data Points: X (ft), Unit Weight (pcf)
- Data Point: (73, 112)
- Data Point: (188.9, 112)
- Data Point: (200, 106)
- Data Point: (226.1, 112)
- Data Point: (310, 112)

### Marsh 2

Model: Spline Data Point Function
Function: Unit Weight vs. X
- Curve Fit to Data: 100 %
- Segment Curvature: 0 %

Y-Intercept: 100
Data Points: X (ft), Unit Weight (pcf)
- Data Point: (73, 100)
- Data Point: (188.9, 100)
- Data Point: (200, 97)
- Data Point: (226.1, 100)
- Data Point: (310, 100)

### Marsh 1

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100
Data Points: X (ft), Unit Weight (pcf)
Data Point: (73, 100)
Data Point: (188.9, 100)
Data Point: (200, 86)
Data Point: (226.1, 100)
Data Point: (310, 100)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | BEACH SAND, EL. -12/-15 TO -45 | 26,11,15,27,40,30 | 1202.55 |
| Region 2 | BEACH SAND, EL. -12/-15 TO -45 | 9,15,11,26,53,54 | 3123.25 |
| Region 3 | BAY SOUND CLAY, EL. -45 TO -70 | 16,9,54,42,55,17 | 4665 |
| Region 4 | | 5,19,6,20,21 | 7.375 |
| Region 5 | Embankment fill 1 (above water) | 5,19,6,41,46,22,44 | 16.52858 |
| Region 6 | Embankment fill 2 (above water) | 22,46,50,45 | 3.25 |
| Region 7 | MARSH 1, EL. -2.7 TO -8/-7 | 24,23,47,48,51 | 26 |
| Region 8 | MARSH 2, MH, EL. -7/-8 TO -12 | 24,51,52,25,36 | 20.5 |
| Region 9 | Marsh 3, EL. -12 to -15 | 26,53,52,25 | 13.55 |
| Region 10 | Embankment fill 1 (above water) | 5,39,12,43,44 | 13.475 |
| Region 11 | EMBANKMENT FILL, EL. 0 TO -2.7 | 22,4,3,37,23,45 | 23.328102 |
| Region 12 | Marsh 3, EL. -12 to -15 | 26,25,30 | 16.65 |
| Region 13 | MARSH 2, MH, EL. -7/-8 TO -12 | 25,36,24,32,35,2,40,30 | 106.64052 |
| Region 14 | MARSH 1, EL. -2.7 TO -8/-7 | 24,23,37,35,32 | 76.596363 |
| Region 15 | BEACH SAND, EL. -12/-15 TO -45 | 38,1,14,2,40,27 | 292.49 |
| Region 16 | EMBANKMENT FILL, EL. 3.9 TO 0 | 43,44,22,4 | 1.97 |
| Region 17 | Embankment fill 2 (above water) | 46,29,13,47,50 | 45.395532 |
| Region 18 | Marsh 1 (above water) | 47,13,7,8,49,48 | 225.54 |
| Region 19 | EMBANKMENT FILL, EL. 0 TO -2.7 | 45,50,47,23 | 10.25 |
| Region 20 | Embankment fill 1 (above water) | 41,18,29,46 | 23.610915 |
| Region 21 | MARSH 1, EL. -2.7 TO -8/-7 | 48,51,33,34,49 | 144.94 |
| Region 22 | MARSH 2, MH, EL. -7/-8 TO -12 | 51,33,34,28,31,52 | 516.56 |
| Region 23 | Marsh 3, EL. -12 to -15 | 52,31,53 | 25.531 |
| Region 24 | BEACH SAND, EL. -12/-15 TO -45 | 53,31,28,10,54 | 3439.469 |
| Region 25 | BAY SOUND CLAY, EL. -45 TO -70 | 54,10,55,42 | 1260 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 73 | -9.3 |





| | | |
|---|---|---|
| Point 2 | 175.8 | -7.9 |
| Point 3 | 190.4 | -2.1 |
| Point 4 | 193.3 | 0 |
| Point 5 | 200 | 3.1 |
| Point 6 | 201 | 3.5 |
| Point 7 | 244.8 | -3.9 |
| Point 8 | 310 | -3.9 |
| Point 9 | 73 | -45 |
| Point 10 | 310 | -45 |
| Point 11 | 200 | -21.6 |
| Point 12 | 196 | 2.7 |
| Point 13 | 226.1 | -2.7 |
| Point 14 | 165.6 | -9.3 |
| Point 15 | 73 | -21.6 |
| Point 16 | 73 | -70 |
| Point 17 | 310 | -70 |
| Point 18 | 208 | 3 |
| Point 19 | 201 | 3.1 |
| Point 20 | 200.5 | 12.8 |
| Point 21 | 200 | 12.8 |
| Point 22 | 200 | 0 |
| Point 23 | 200 | -2.7 |
| Point 24 | 200 | -8 |
| Point 25 | 200 | -12 |
| Point 26 | 200 | -15 |
| Point 27 | 73 | -12 |
| Point 28 | 310 | -12 |
| Point 29 | 217.52632 | 0 |
| Point 30 | 188.9 | -12 |
| Point 31 | 226.1 | -12 |
| Point 32 | 188.9 | -7 |
| Point 33 | 226.1 | -7 |
| Point 34 | 310 | -7 |
| Point 35 | 178.06552 | -7 |
| Point 36 | 200 | -11.9 |
| Point 37 | 188.88966 | -2.7 |
| Point 38 | 73 | -11.6 |
| Point 39 | 199 | 3.1 |
| Point 40 | 179.6 | -12 |
| Point 41 | 205 | 3.21429 |
| Point 42 | 205 | -57 |
| Point 43 | 193.7 | 0.4 |
| Point 44 | 200 | 0.2 |
| Point 45 | 200 | -0.4 |





| | | |
|---|---|---|
| | 205 | 0 |
| Point 47 | 205 | -2.7 |
| Point 48 | 205 | -5.5 |
| Point 49 | 310 | -5.9 |
| Point 50 | 205 | -0.9 |
| Point 51 | 205 | -7.8 |
| Point 52 | 205 | -12 |
| Point 53 | 205 | -14.42 |
| Point 54 | 205 | -45 |
| Point 55 | 310 | -57 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 0.52 | (189.349, 6.681) | 7.004305 | (196.914, 2.82184) | (188.438, -2.87932) |
| 2 | 24610 | 0.56 | (189.349, 6.681) | 8.964 | (197.475, 2.8966) | (190, -2.2589) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 188.55115 | -2.843465 | 202.38923 | 207.7266 | 2.2655778 | 0 |
| 2 | Optimized | 188.77685 | -2.771747 | 197.91328 | 203.61801 | 2.4215155 | 0 |
| 3 | Optimized | 188.94615 | -2.717944 | 194.54531 | 200.59558 | 2.5681874 | 0 |
| 4 | Optimized | 189.14235 | -2.655597 | 190.63958 | 197.1187 | 2.7502233 | 0 |
| 5 | Optimized | 189.42185 | -2.5667905 | 185.088 | 192.09227 | 2.9731361 | 0 |
| 6 | Optimized | 189.7013 | -2.477984 | 179.53642 | 187.06584 | 3.1960489 | 0 |
| 7 | Optimized | 189.98075 | -2.389178 | 173.98142 | 182.0394 | 3.4204093 | 0 |
| 8 | Optimized | 190.26025 | -2.3003715 | 168.42984 | 177.01297 | 3.6433221 | 0 |
| 9 | Optimized | 190.4038 | -2.254759 | 165.57399 | 190.59606 | 10.62124 | 0 |
| 10 | Optimized | 190.5628 | -2.19524 | 161.85995 | 183.38779 | 9.1380274 | 0 |
| 11 | Optimized | 190.8732 | -2.07862 | 154.54627 | 177.69368 | 9.8254918 | 0 |
| 12 | Optimized | 191.1995 | -1.9577225 | 146.96249 | 172.55531 | 10.863507 | 0 |
| 13 | Optimized | 191.5417 | -1.8325475 | 139.10572 | 166.58109 | 11.662603 | 0 |
| 14 | Optimized | 191.88815 | -1.709815 | 131.40162 | 162.51419 | 13.2065 | 0 |
| 15 | Optimized | 192.23885 | -1.589525 | 123.84602 | 157.11656 | 14.122505 | 0 |
| 16 | Optimized | 192.6256 | -1.45836 | 115.60812 | 151.82603 | 15.373592 | 0 |
| 17 | Optimized | 192.95275 | -1.348655 | 108.71533 | 147.151 | 16.314972 | 0 |
| 18 | Optimized | 193.18425 | -1.271285 | 103.85659 | 143.77528 | 16.944478 | 0 |
| 19 | Optimized | 193.5 | -1.165761 | 97.229046 | 142.93661 | 19.401709 | 0 |
| 20 | Optimized | 193.74335 | -1.084431 | 92.119385 | 144.64982 | 22.297847 | 0 |



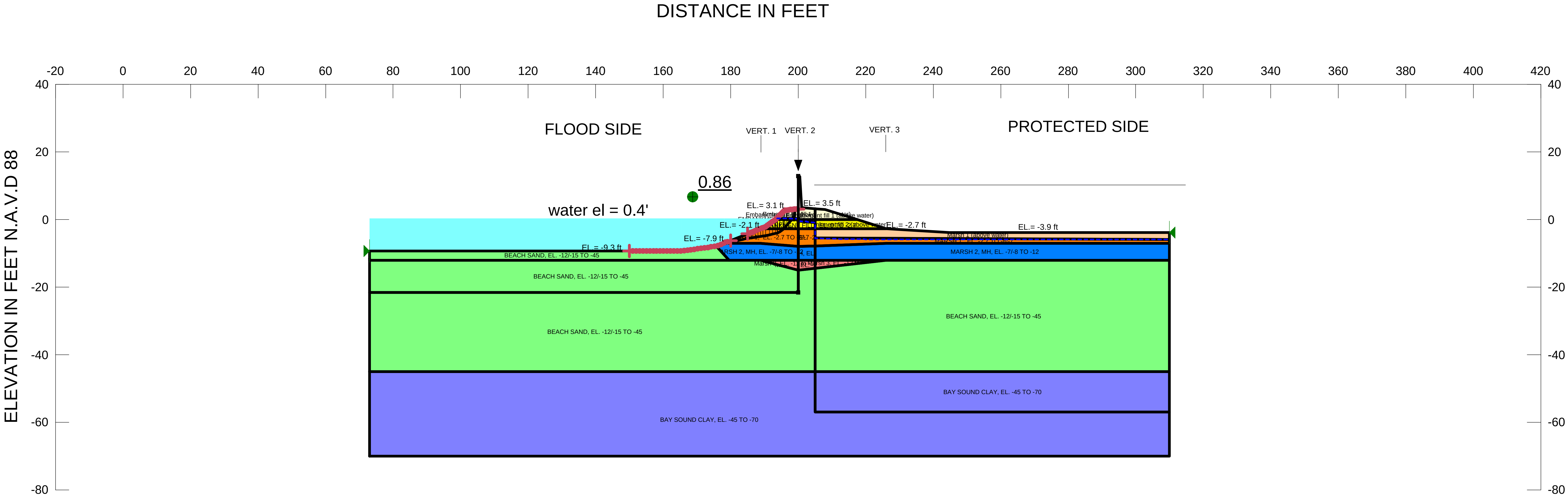


| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21 | Optimized | 193.9602 | -0.989085 | 85.944632 | 145.75037 | 25.386031 | 0 |
| 22 | Optimized | 194.25335 | -0.831455 | 75.747528 | 143.26668 | 28.660178 | 0 |
| 23 | Optimized | 194.4926 | -0.677905 | 65.827037 | 148.94106 | 35.279809 | 0 |
| 24 | Optimized | 194.72855 | -0.5065575 | 54.754777 | 139.27578 | 35.877035 | 0 |
| 25 | Optimized | 194.9613 | -0.3174125 | 42.525555 | 140.27598 | 41.492596 | 0 |
| 26 | Optimized | 195.1575 | -0.11142 | 29.241857 | 103.60983 | 31.567333 | 0 |
| 27 | Optimized | 195.32545 | 0.123085 | 14.258659 | 95.32636 | 34.411197 | 0 |
| 28 | Optimized | 195.4445 | 0.294904 | 3.3535587 | 81.732543 | 33.269905 | 0 |
| 29 | Optimized | 195.64955 | 0.618124 | -17.411238 | 75.271305 | 31.950773 | 0 |
| 30 | Optimized | 195.91185 | 1.045199 | -44.902903 | 63.598968 | 26.99616 | 0 |
| 31 | Optimized | 196.12795 | 1.419344 | -68.965975 | 52.679601 | 22.361164 | 0 |
| 32 | Optimized | 196.3829 | 1.86483 | -97.618041 | 35.487758 | 15.06366 | 0 |
| 33 | Optimized | 196.61655 | 2.280775 | -124.36923 | 19.774425 | 8.3937456 | 0 |
| 34 | Optimized | 196.8185 | 2.6473135 | -147.94172 | 6.2989397 | 2.6737413 | 0 |

### Slices of Slip Surface: 24610

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 24610 | 190.1 | -2.250495 | 165.37696 | 181.06167 | 6.6577617 | 0 |
| 2 | 24610 | 190.3 | -2.2314145 | 164.15367 | 180.64511 | 7.0001992 | 0 |
| 3 | 24610 | 190.52085 | -2.204807 | 162.46354 | 194.06029 | 13.412022 | 0 |
| 4 | 24610 | 190.7625 | -2.169572 | 160.21764 | 193.70358 | 14.213937 | 0 |
| 5 | 24610 | 191.00415 | -2.127567 | 157.55009 | 192.56484 | 14.862878 | 0 |
| 6 | 24610 | 191.24585 | -2.078695 | 154.45185 | 190.65953 | 15.369247 | 0 |
| 7 | 24610 | 191.4875 | -2.0228395 | 150.92353 | 188.01348 | 15.743748 | 0 |
| 8 | 24610 | 191.72915 | -1.9598655 | 146.95545 | 184.64278 | 15.997322 | 0 |
| 9 | 24610 | 191.97085 | -1.889616 | 142.53211 | 180.55808 | 16.141068 | 0 |
| 10 | 24610 | 192.2125 | -1.8119095 | 137.64842 | 175.76494 | 16.179501 | 0 |
| 11 | 24610 | 192.45415 | -1.7265395 | 132.29031 | 170.2722 | 16.122354 | 0 |
| 12 | 24610 | 192.69585 | -1.63327 | 126.43938 | 164.08061 | 15.977755 | 0 |
| 13 | 24610 | 192.9375 | -1.5318315 | 120.0853 | 157.18775 | 15.749057 | 0 |
| 14 | 24610 | 193.17915 | -1.4219165 | 113.20368 | 149.59271 | 15.446229 | 0 |
| 15 | 24610 | 193.4 | -1.31413 | 106.45904 | 144.26317 | 16.046902 | 0 |
| 16 | 24610 | 193.6 | -1.209586 | 99.921471 | 138.59152 | 16.414462 | 0 |
| 17 | 24610 | 193.81605 | -1.088991 | 92.339607 | 138.2853 | 19.502791 | 0 |
| 18 | 24610 | 194.04815 | -0.95081305 | 83.452138 | 142.6431 | 25.125072 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 19 | 24610 | 194.28025 | -0.80288565 | 73.923827 | 145.41207 | 30.344958 | 0 |
| 20 | 24610 | 194.51235 | -0.6446177 | 63.711943 | 146.57761 | 35.17439 | 0 |
| 21 | 24610 | 194.74445 | -0.4753217 | 52.765656 | 146.09461 | 39.61579 | 0 |
| 22 | 24610 | 194.97655 | -0.2941929 | 41.039112 | 143.91353 | 43.667598 | 0 |
| 23 | 24610 | 195.20865 | -0.1002808 | 28.463617 | 139.97581 | 47.334118 | 0 |
| 24 | 24610 | 195.5031 | 0.1685483 | 11.130965 | 131.35236 | 51.030954 | 0 |
| 25 | 24610 | 195.84075 | 0.50449805 | -10.579721 | 120.7757 | 51.266241 | 0 |
| 26 | 24610 | 196.12285 | 0.81375995 | -30.653934 | 106.86517 | 45.361571 | 0 |
| 27 | 24610 | 196.3686 | 1.1104572 | -49.864203 | 87.316108 | 37.063489 | 0 |
| 28 | 24610 | 196.61435 | 1.4354805 | -70.869109 | 67.63436 | 28.709083 | 0 |
| 29 | 24610 | 196.8601 | 1.794539 | -94.025189 | 47.904649 | 20.334317 | 0 |
| 30 | 24610 | 197.10585 | 2.195917 | -119.86276 | 28.26387 | 11.997301 | 0 |
| 31 | 24610 | 197.3516 | 2.65251 | -149.20247 | 8.9429999 | 3.7960782 | 0 |




Name: EMBANKMENT FILL, EL. 3.9 TO 0 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 0 psf Phi: 26 °
Name: MARSH 1, EL. -2.7 TO -8/-7 Model: Spatial Mohr-Coulomb Weight Fn: Marsh 1 Cohesion: 0 psf Phi: 24 °
Name: BEACH SAND, EL. -12/-15 TO -45 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 34 °
Name: BAY SOUND CLAY, EL. -45 TO -70 Model: Spatial Mohr-Coulomb Weight Fn: Clay Cohesion: 0 psf Phi: 26 °
Name: EMBANKMENT FILL, EL. 0 TO -2.7 Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 0 psf Phi: 26 °
Name: MARSH 2, MH, EL. -7/-8 TO -12 Model: Spatial Mohr-Coulomb Weight Fn: Marsh 2 Cohesion: 0 psf Phi: 24 °
Name: Marsh 3, EL. -12 to -15 Model: Mohr-Coulomb Unit Weight: 89 pcf Cohesion: 0 psf Phi: 24 °
Name: Embankment fill 1 (above water) Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion: 75 psf Phi: 26 °
Name: Embankment fill 2 (above water) Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion: 75 psf Phi: 26 °
Name: Marsh 1 (above water) Model: Spatial Mohr-Coulomb Weight Fn: Marsh 1 Cohesion: 75 psf Phi: 24 °

## GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw = CANAL WATER LEVEL

US Army Corps of Engineers
New Orleans District

LONDON AVE CANAL
OUTFALL CANAL REEVALUATION REPORT
REACH 28, STA. 58+50 TO STA 68+12
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Entry/Exit) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Global Stability (Entry/Exit) in front
File Name: Reach 28-Scase FS GCAT seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Entry/Exit) in front



## File Information

Created By: Liljegren, James
Revision Number: 275
Last Edited By: Middleton, Mark C MVN
Date: 1/15/2013
Time: 12:44:34 PM
File Name: Reach 28-Scase FS GCAT seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Solved Date: 1/15/2013
Last Solved Time: 12:45:48 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Global Stability (Entry/Exit) in front

Kind: SLOPE/W
Parent: Scase FS Stability (Seepage) OPEN
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution
- FOS Calculation Option: Constant

Advanced





- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 2 ft
- Optimization Maximum Iterations: 4000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL, EL. 3.9 TO 0

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### MARSH 1, EL. -2.7 TO -8/-7

Model: Spatial Mohr-Coulomb
Weight Fn: Marsh 1
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### BEACH SAND, EL. -12/-15 TO -45

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 34 °
Phi-B: 0 °

### BAY SOUND CLAY, EL. -45 TO -70

Model: Spatial Mohr-Coulomb
Weight Fn: Clay
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### EMBANKMENT FILL, EL. 0 TO -2.7

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### MARSH 2, MH, EL. -7/-8 TO -12





Model: Spatial Mohr-Coulomb
Weight Fn: Marsh 2
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### Marsh 3, EL. -12 to -15

Model: Mohr-Coulomb
Unit Weight: 89 pcf
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### Embankment fill 1 (above water)

Model: Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### Embankment fill 2 (above water)

Model: Mohr-Coulomb
Unit Weight: 103 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### Marsh 1 (above water)

Model: Spatial Mohr-Coulomb
Weight Fn: Marsh 1
Cohesion: 75 psf
Phi: 24 °
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (150, -9.3) ft
Left-Zone Right Coordinate: (180, -6.23151) ft
Left-Zone Increment: 30
Right Projection: Range
Right-Zone Left Coordinate: (185, -4.24521) ft
Right-Zone Right Coordinate: (200, 3.1) ft
Right-Zone Increment: 30
Radius Increments: 25

## Slip Surface Limits

Left Coordinate: (73, -9.3) ft
Right Coordinate: (310, -3.9) ft





## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -21.6) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 34.5 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No
Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Unit Weight Functions

### Clay

Model: Spline Data Point Function
Function: Unit Weight vs. X
- Curve Fit to Data: 100 %
- Segment Curvature: 0 %

Y-Intercept: 112
Data Points: X (ft), Unit Weight (pcf)
- Data Point: (73, 112)
- Data Point: (188.9, 112)
- Data Point: (200, 106)
- Data Point: (226.1, 112)
- Data Point: (310, 112)

### Marsh 2

Model: Spline Data Point Function
Function: Unit Weight vs. X
- Curve Fit to Data: 100 %
- Segment Curvature: 0 %

Y-Intercept: 100
Data Points: X (ft), Unit Weight (pcf)
- Data Point: (73, 100)
- Data Point: (188.9, 100)
- Data Point: (200, 97)
- Data Point: (226.1, 100)
- Data Point: (310, 100)

### Marsh 1

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100
Data Points: X (ft), Unit Weight (pcf)
Data Point: (73, 100)
Data Point: (188.9, 100)
Data Point: (200, 86)
Data Point: (226.1, 100)
Data Point: (310, 100)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | BEACH SAND, EL. -12/-15 TO -45 | 26,11,15,27,40,30 | 1202.55 |
| Region 2 | BEACH SAND, EL. -12/-15 TO -45 | 9,15,11,26,53,54 | 3123.25 |
| Region 3 | BAY SOUND CLAY, EL. -45 TO -70 | 16,9,54,42,55,17 | 4665 |
| Region 4 | | 5,19,6,20,21 | 7.375 |
| Region 5 | Embankment fill 1 (above water) | 5,19,6,41,46,22,44 | 16.52858 |
| Region 6 | Embankment fill 2 (above water) | 22,46,50,45 | 3.25 |
| Region 7 | MARSH 1, EL. -2.7 TO -8/-7 | 24,23,47,48,51 | 26 |
| Region 8 | MARSH 2, MH, EL. -7/-8 TO -12 | 24,51,52,25,36 | 20.5 |
| Region 9 | Marsh 3, EL. -12 to -15 | 26,53,52,25 | 13.55 |
| Region 10 | Embankment fill 1 (above water) | 5,39,12,43,44 | 13.475 |
| Region 11 | EMBANKMENT FILL, EL. 0 TO -2.7 | 22,4,3,37,23,45 | 23.328102 |
| Region 12 | Marsh 3, EL. -12 to -15 | 26,25,30 | 16.65 |
| Region 13 | MARSH 2, MH, EL. -7/-8 TO -12 | 25,36,24,32,35,2,40,30 | 106.64052 |
| Region 14 | MARSH 1, EL. -2.7 TO -8/-7 | 24,23,37,35,32 | 76.596363 |
| Region 15 | BEACH SAND, EL. -12/-15 TO -45 | 38,1,14,2,40,27 | 292.49 |
| Region 16 | EMBANKMENT FILL, EL. 3.9 TO 0 | 43,44,22,4 | 1.97 |
| Region 17 | Embankment fill 2 (above water) | 46,29,13,47,50 | 45.395532 |
| Region 18 | Marsh 1 (above water) | 47,13,7,8,49,48 | 225.54 |
| Region 19 | EMBANKMENT FILL, EL. 0 TO -2.7 | 45,50,47,23 | 10.25 |
| Region 20 | Embankment fill 1 (above water) | 41,18,29,46 | 23.610915 |
| Region 21 | MARSH 1, EL. -2.7 TO -8/-7 | 48,51,33,34,49 | 144.94 |
| Region 22 | MARSH 2, MH, EL. -7/-8 TO -12 | 51,33,34,28,31,52 | 516.56 |
| Region 23 | Marsh 3, EL. -12 to -15 | 52,31,53 | 25.531 |
| Region 24 | BEACH SAND, EL. -12/-15 TO -45 | 53,31,28,10,54 | 3439.469 |
| Region 25 | BAY SOUND CLAY, EL. -45 TO -70 | 54,10,55,42 | 1260 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 73 | -9.3 |





| | | |
|---|---|---|
| Point 2 | 175.8 | -7.9 |
| Point 3 | 190.4 | -2.1 |
| Point 4 | 193.3 | 0 |
| Point 5 | 200 | 3.1 |
| Point 6 | 201 | 3.5 |
| Point 7 | 244.8 | -3.9 |
| Point 8 | 310 | -3.9 |
| Point 9 | 73 | -45 |
| Point 10 | 310 | -45 |
| Point 11 | 200 | -21.6 |
| Point 12 | 196 | 2.7 |
| Point 13 | 226.1 | -2.7 |
| Point 14 | 165.6 | -9.3 |
| Point 15 | 73 | -21.6 |
| Point 16 | 73 | -70 |
| Point 17 | 310 | -70 |
| Point 18 | 208 | 3 |
| Point 19 | 201 | 3.1 |
| Point 20 | 200.5 | 12.8 |
| Point 21 | 200 | 12.8 |
| Point 22 | 200 | 0 |
| Point 23 | 200 | -2.7 |
| Point 24 | 200 | -8 |
| Point 25 | 200 | -12 |
| Point 26 | 200 | -15 |
| Point 27 | 73 | -12 |
| Point 28 | 310 | -12 |
| Point 29 | 217.52632 | 0 |
| Point 30 | 188.9 | -12 |
| Point 31 | 226.1 | -12 |
| Point 32 | 188.9 | -7 |
| Point 33 | 226.1 | -7 |
| Point 34 | 310 | -7 |
| Point 35 | 178.06552 | -7 |
| Point 36 | 200 | -11.9 |
| Point 37 | 188.88966 | -2.7 |
| Point 38 | 73 | -11.6 |
| Point 39 | 199 | 3.1 |
| Point 40 | 179.6 | -12 |
| Point 41 | 205 | 3.21429 |
| Point 42 | 205 | -57 |
| Point 43 | 193.7 | 0.4 |
| Point 44 | 200 | 0.2 |
| Point 45 | 200 | -0.4 |





| | | |
|---|---|---|
| | 205 | 0 |
| Point 47 | 205 | -2.7 |
| Point 48 | 205 | -5.5 |
| Point 49 | 310 | -5.9 |
| Point 50 | 205 | -0.9 |
| Point 51 | 205 | -7.8 |
| Point 52 | 205 | -12 |
| Point 53 | 205 | -14.42 |
| Point 54 | 205 | -45 |
| Point 55 | 310 | -57 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 0.86 | (183.117, 13.186) | 12.32891 | (199, 3.1) | (176.86, -7.47881) |
| 2 | 24973 | 0.94 | (183.117, 13.186) | 19.666 | (199, 3.1) | (180, -6.23151) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 177.16155 | -7.4019745 | 486.84742 | 494.74233 | 3.5150404 | 0 |
| 2 | Optimized | 177.7642 | -7.2483095 | 477.24811 | 487.74786 | 4.6747889 | 0 |
| 3 | Optimized | 178.40175 | -7.0857385 | 467.1125 | 480.3256 | 5.8828496 | 0 |
| 4 | Optimized | 179.09305 | -6.9094685 | 456.10887 | 472.2932 | 7.2057289 | 0 |
| 5 | Optimized | 179.80315 | -6.728405 | 444.80986 | 464.05093 | 8.5666761 | 0 |
| 6 | Optimized | 180.51325 | -6.5473415 | 433.51085 | 455.79501 | 9.9215475 | 0 |
| 7 | Optimized | 181.4103 | -6.334005 | 420.19566 | 448.40964 | 12.56167 | 0 |
| 8 | Optimized | 182.47585 | -6.104285 | 405.85758 | 441.39609 | 15.822762 | 0 |
| 9 | Optimized | 183.3394 | -5.92957 | 394.95349 | 436.08426 | 18.3126 | 0 |
| 10 | Optimized | 184.0194 | -5.79397 | 386.47351 | 431.84428 | 20.200365 | 0 |
| 11 | Optimized | 184.8638 | -5.630975 | 376.2947 | 427.83431 | 22.946914 | 0 |
| 12 | Optimized | 185.6788 | -5.4811835 | 366.93582 | 424.91561 | 25.814267 | 0 |
| 13 | Optimized | 186.3 | -5.37199 | 360.10255 | 422.52159 | 27.790749 | 0 |
| 14 | Optimized | 186.9212 | -5.2627965 | 353.26927 | 420.11171 | 29.760172 | 0 |
| 15 | Optimized | 187.64625 | -5.1450235 | 345.87183 | 420.06474 | 33.032813 | 0 |
| 16 | Optimized | 188.4752 | -5.0186705 | 337.9409 | 418.81249 | 36.00635 | 0 |
| 17 | Optimized | 189.2131 | -4.906192 | 330.85145 | 417.2283 | 38.457451 | 0 |
| 18 | Optimized | 189.96825 | -4.7893625 | 323.4557 | 414.55742 | 40.561096 | 0 |
| 19 | Optimized | 190.9492 | -4.6359375 | 313.74976 | 422.51874 | 48.427071 | 0 |
| 20 | Optimized | 191.9488 | -4.444356 | 301.63663 | 419.23277 | 52.357173 | 0 |
| 21 | Optimized | 192.8496 | -4.2329875 | 288.25698 | 419.61103 | 58.482592 | 0 |
| 22 | Optimized | 193.5 | -4.080375 | 278.58387 | 423.76584 | 64.639176 | 0 |
| 23 | Optimized | 193.8018 | -4.0095585 | 274.09502 | 434.96991 | 71.626117 | 0 |



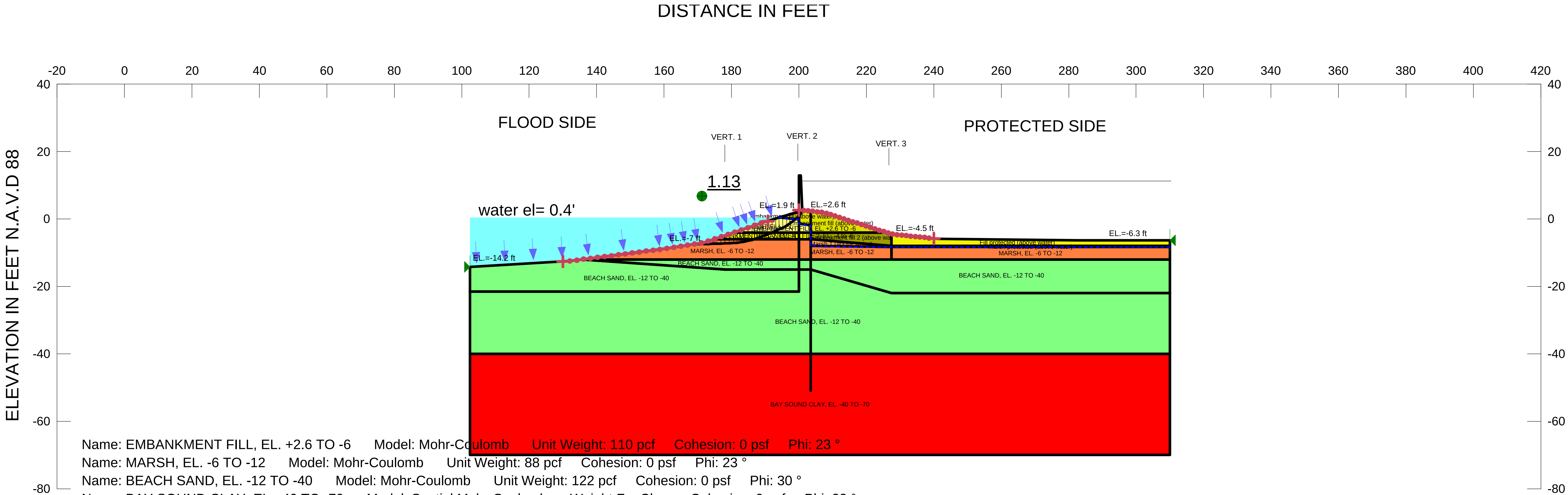


| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | Optimized | 194.22375 | -3.82432 | 262.42469 | 428.34572 | 73.8728 | 0 |
| 25 | Optimized | 195.0309 | -3.292085 | 228.96511 | 424.21396 | 86.930389 | 0 |
| 26 | Optimized | 195.6181 | -2.8106 | 198.70545 | 396.6604 | 88.135222 | 0 |
| 27 | Optimized | 195.85915 | -2.544513 | 181.95416 | 385.53366 | 99.292358 | 0 |
| 28 | Optimized | 196.32565 | -2.029522 | 149.24298 | 355.13624 | 100.42085 | 0 |
| 29 | Optimized | 196.977 | -1.310514 | 103.04764 | 301.28961 | 96.689067 | 0 |
| 30 | Optimized | 197.69275 | -0.50143 | 50.114376 | 236.4377 | 90.875957 | 0 |
| 31 | Optimized | 198.1026 | -0.025925 | 18.966793 | 190.00501 | 83.420912 | 0 |
| 32 | Optimized | 198.2193 | 0.12672765 | 8.982279 | 178.01882 | 82.44463 | 0 |
| 33 | Optimized | 198.65415 | 0.69554265 | -27.985631 | 85.611934 | 41.75573 | 75 |
| 34 | Optimized | 198.99605 | 1.1453015 | -57.190283 | 24.466224 | 11.932975 | 75 |

### Slices of Slip Surface: 24973

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 24973 | 180.3175 | -6.277175 | 416.65712 | 445.27706 | 12.74242 | 0 |
| 2 | 24973 | 180.9525 | -6.358005 | 421.68975 | 461.8395 | 17.87582 | 0 |
| 3 | 24973 | 181.58745 | -6.41794 | 425.4319 | 475.76902 | 22.411531 | 0 |
| 4 | 24973 | 182.2224 | -6.457172 | 427.87201 | 487.16714 | 26.399892 | 0 |
| 5 | 24973 | 182.8574 | -6.475825 | 429.03411 | 496.11743 | 29.867422 | 0 |
| 6 | 24973 | 183.4924 | -6.473957 | 428.91464 | 502.6993 | 32.851045 | 0 |
| 7 | 24973 | 184.12735 | -6.451563 | 427.49823 | 506.9867 | 35.390546 | 0 |
| 8 | 24973 | 184.7623 | -6.4085725 | 424.80494 | 509.01579 | 37.493083 | 0 |
| 9 | 24973 | 185.3973 | -6.344849 | 420.81157 | 508.8313 | 39.188908 | 0 |
| 10 | 24973 | 186.0323 | -6.2601885 | 415.5148 | 506.45489 | 40.489141 | 0 |
| 11 | 24973 | 186.66725 | -6.1543155 | 408.88509 | 501.90153 | 41.413587 | 0 |
| 12 | 24973 | 187.3022 | -6.0268795 | 400.89828 | 495.1947 | 41.983471 | 0 |
| 13 | 24973 | 187.9372 | -5.8774475 | 391.53644 | 486.33638 | 42.207654 | 0 |
| 14 | 24973 | 188.5722 | -5.7054965 | 380.77347 | 475.30866 | 42.089779 | 0 |
| 15 | 24973 | 189.26725 | -5.489476 | 367.22811 | 459.8747 | 41.248916 | 0 |
| 16 | 24973 | 190.0224 | -5.223503 | 350.54409 | 439.85081 | 39.761916 | 0 |
| 17 | 24973 | 190.69 | -4.960855 | 334.06187 | 426.49175 | 41.152435 | 0 |
| 18 | 24973 | 191.27 | -4.707705 | 318.18488 | 412.82448 | 42.136267 | 0 |
| 19 | 24973 | 191.85 | -4.4318265 | 300.87604 | 397.34731 | 42.951776 | 0 |
| 20 | 24973 | 192.43 | -4.1321325 | 282.04727 | 380.02126 | 43.620833 | 0 |
| 21 | 24973 | 193.01 | -3.807361 | 261.65057 | 360.81255 | 44.149762 | 0 |
| 22 | 24973 | 193.5 | -3.514193 | 243.22511 | 346.21787 | 45.855329 | 0 |
| 23 | 24973 | 193.95245 | -3.2231445 | 224.94844 | 346.96697 | 54.326153 | 0 |
| 24 | 24973 | 194.4574 | -2.8782195 | 203.28107 | 356.82591 | 68.362567 | 0 |
| 25 | 24973 | 195.0324 | -2.454284 | 176.64648 | 358.37348 | 88.634179 | 0 |
| 26 | 24973 | 195.67745 | -1.9407565 | 144.07383 | 356.7497 | 103.72895 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27 | 24973 | 196.28465 | -1.4162875 | 110.46111 | 331.25288 | 107.68734 | 0 |
| 28 | 24973 | 196.8539 | -0.8817024 | 75.894574 | 283.83796 | 101.42077 | 0 |
| 29 | 24973 | 197.42315 | -0.3018874 | 37.848113 | 232.67786 | 95.024818 | 0 |
| 30 | 24973 | 197.8255 | 0.1326474 | 9.3361668 | 194.01669 | 90.074709 | 0 |
| 31 | 24973 | 198.2074 | 0.58159115 | -19.899529 | 107.00638 | 52.190497 | 75 |
| 32 | 24973 | 198.7358 | 1.2434003 | -62.869743 | 60.223443 | 29.372936 | 75 |




Name: EMBANKMENT FILL, EL. +2.6 TO -6 Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 23 °
Name: MARSH, EL. -6 TO -12 Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 0 psf Phi: 23 °
Name: BEACH SAND, EL. -12 TO -40 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 30 °
Name: BAY SOUND CLAY, EL. -40 TO -70 Model: Spatial Mohr-Coulomb Weight Fn: Clay Cohesion: 0 psf Phi: 23 °
Name: EMBANKMENT FILL 2, EL. -4 to -6 Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 0 psf Phi: 23 °
Name: Embankment fill (above water) Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 23 °
Name: Embankment fill 2 (above water) Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 0 psf Phi: 23 °
Name: Fill protected (above water) Model: Mohr-Coulomb Unit Weight: 96 pcf Cohesion: 0 psf Phi: 23 °
Name: Marsh 1 (above water) Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 0 psf Phi: 23 °
Name: Marsh protected (above water) Model: Mohr-Coulomb Unit Weight: 96 pcf Cohesion: 0 psf Phi: 23 °

**US Army Corps of Engineers®**
New Orleans District

LONDON AVE CANAL,
OUTFALL CANAL REEVALUATION REPORT
REACH 35A, STA. 102+42 TO 103+50 EAST
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Entry/Exit) through
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

## GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

Name: Global Stability (Entry/Exit) through
File Name: Reach 35A-Scase FS seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Entry/Exit) through



## File Information

Created By: Liljegren, James
Revision Number: 403
Last Edited By: Middleton, Mark C MVN
Date: 1/16/2013
Time: 1:08:27 PM
File Name: Reach 35A-Scase FS seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\original phi23 seepw parent\
Last Solved Date: 1/16/2013
Last Solved Time: 1:19:38 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Global Stability (Entry/Exit) through

Kind: SLOPE/W
Parent: Global Analysis (Seepage)
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 9.807 pcf

FOS Distribution
- FOS Calculation Option: Constant

Advanced





Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 4000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL, EL. +2.6 TO -6

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### MARSH, EL. -6 TO -12

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### BEACH SAND, EL. -12 TO -40

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °

### BAY SOUND CLAY, EL. -40 TO -70

Model: Spatial Mohr-Coulomb
Weight Fn: Clay
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### EMBANKMENT FILL 2, EL. -4 to -6

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Embankment fill (above water)





Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Embankment fill 2 (above water)

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Fill protected (above water)

Model: Mohr-Coulomb
Unit Weight: 96 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Marsh 1 (above water)

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

### Marsh protected (above water)

Model: Mohr-Coulomb
Unit Weight: 96 pcf
Cohesion: 0 psf
Phi: 23 °
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (130, -12.60408) ft
Left-Zone Right Coordinate: (190.78638, -0.61437) ft
Left-Zone Increment: 30
Right Projection: Range
Right-Zone Left Coordinate: (200, 2.6) ft
Right-Zone Right Coordinate: (240, -5.77826) ft
Right-Zone Increment: 30
Radius Increments: 20

## Slip Surface Limits

Left Coordinate: (102.4, -14.2) ft
Right Coordinate: (310, -6.3) ft





## Unit Weight Functions

### Clay

Model: Spline Data Point Function
Function: Unit Weight vs. X
- Curve Fit to Data: 100 %
- Segment Curvature: 0 %

Y-Intercept: 107
Data Points: X (ft), Unit Weight (pcf)
- Data Point: (103, 107)
- Data Point: (174.8, 107)
- Data Point: (200, 108)
- Data Point: (227.4, 107)
- Data Point: (310, 107)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | EMBANKMENT FILL, EL. +2.6 TO -6 | 2,48,49,36,41 | 54.699916 |
| Region 2 | Embankment fill 2 (above water) | 40,4,25,53,52 | 71.161327 |
| Region 3 | BEACH SAND, EL. -12 TO -40 | 1,28,29,44,45,18,9,12 | 757.09176 |
| Region 4 | BEACH SAND, EL. -12 TO -40 | 12,9,18,22,16,20,6,5 | 3893.75 |
| Region 5 | BAY SOUND CLAY, EL. -40 TO -70 | 5,6,8,7 | 6228 |
| Region 6 | BEACH SAND, EL. -12 TO -40 | 18,17,21,15,19,20,16,22 | 991.85 |
| Region 7 | MARSH, EL. -6 TO -12 | 44,43,30,42,14,24,34,17 | 253.04524 |
| Region 8 | MARSH, EL. -6 TO -12 | 17,34,24,14,11,53,54,55,15,21 | 113.18 |
| Region 9 | BEACH SAND, EL. -12 TO -40 | 44,17,18,45 | 129.44189 |
| Region 10 | MARSH, EL. -6 TO -12 | 15,55,56,19 | 305.62 |
| Region 11 | Fill protected (above water) | 4,25,26,27,38,39 | 163.94 |
| Region 12 | | 13,32,33,23 | 7.725 |
| Region 13 | EMBANKMENT FILL 2, EL. -4 to -6 | 42,41,36,14 | 44.47119 |
| Region 14 | Embankment fill (above water) | 49,31,13,23,46,3,40,52,51,50 | 92.976167 |
| Region 15 | Embankment fill (above water) | 35,31,49,48 | 6.65 |
| Region 16 | EMBANKMENT FILL, EL. +2.6 TO -6 | 49,50,51,52,37,36 | 8.3675 |
| Region 17 | EMBANKMENT FILL 2, EL. -4 to -6 | 36,37,52,53,11,14 | 7.1 |
| Region 18 | Marsh 1 (above water) | 53,25,55,54 | 27.37 |
| Region 19 | Marsh protected (above water) | 25,55,56,26 | 24.78 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 102.4 | -15 |
| Point 2 | 189.2 | -1.1 |

| | | |
|---|---|---|
| Point 3 | 207.5 | 1.9 |
| Point 4 | 227.4 | -4.5 |
| Point 5 | 102.4 | -40 |
| Point 6 | 310 | -40 |
| Point 7 | 102.4 | -70 |
| Point 8 | 310 | -70 |
| Point 9 | 200 | -21.5 |
| Point 10 | 203.5 | -21.5 |
| Point 11 | 203.5 | -6 |
| Point 12 | 102.4 | -21.5 |
| Point 13 | 200 | 2.6 |
| Point 14 | 200 | -6 |
| Point 15 | 227.4 | -12 |
| Point 16 | 227.4 | -22 |
| Point 17 | 200 | -12 |
| Point 18 | 200 | -15 |
| Point 19 | 310 | -12 |
| Point 20 | 310 | -22 |
| Point 21 | 203.5 | -12 |
| Point 22 | 203.5 | -15 |
| Point 23 | 201 | 2.6 |
| Point 24 | 200 | -7 |
| Point 25 | 227.4 | -8 |
| Point 26 | 310 | -8 |
| Point 27 | 310 | -6.3 |
| Point 28 | 102.4 | -14.2 |
| Point 29 | 131.8 | -12.5 |
| Point 30 | 171.9 | -7 |
| Point 31 | 200 | 1.9 |
| Point 32 | 200 | 12.9 |
| Point 33 | 200.5 | 12.9 |
| Point 34 | 200 | -10 |
| Point 35 | 199 | 1.9 |
| Point 36 | 200 | -4 |
| Point 37 | 203.5 | -4 |
| Point 38 | 282.9 | -6.3 |
| Point 39 | 241.2 | -5.9 |
| Point 40 | 225.84531 | -4 |
| Point 41 | 180.69661 | -4 |
| Point 42 | 174.8322 | -6 |
| Point 43 | 160.7 | -8.8 |
| Point 44 | 135.70541 | -12 |
| Point 45 | 178 | -15 |
| Point 46 | 203.5 | 2.33077 |





| | | |
|---|---|---|
| | 203.5 | -51 |
| Point 48 | 194.1 | 0.4 |
| Point 49 | 200 | -0.1 |
| Point 50 | 200.1 | -1.4 |
| Point 51 | 203.5 | -1.9 |
| Point 52 | 203.55 | -4 |
| Point 53 | 203.55 | -6 |
| Point 54 | 203.6 | -8 |
| Point 55 | 227.4 | -8.3 |
| Point 56 | 310 | -8.3 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 1.13 | (176.434, 28.341) | 16.30946 | (201.253, 2.57272) | (169.096, -7.45064) |
| 2 | 13048 | 1.15 | (176.434, 28.341) | 35.866 | (201.368, 2.56036) | (171.108, -7.12735) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 169.56335 | -7.4452445 | 489.54317 | 496.89289 | 3.119774 | 0 |
| 2 | Optimized | 170.498 | -7.434448 | 488.86918 | 499.76004 | 4.6228966 | 0 |
| 3 | Optimized | 171.43265 | -7.4236515 | 488.18448 | 502.62718 | 6.1305603 | 0 |
| 4 | Optimized | 171.90795 | -7.4181615 | 487.84255 | 510.48291 | 9.6102597 | 0 |
| 5 | Optimized | 172.5596 | -7.4050325 | 487.01828 | 514.34535 | 11.599654 | 0 |
| 6 | Optimized | 173.84705 | -7.3789575 | 485.38751 | 522.78654 | 15.874946 | 0 |
| 7 | Optimized | 174.6615 | -7.3601845 | 484.20238 | 527.17754 | 18.241872 | 0 |
| 8 | Optimized | 175.1777 | -7.3428395 | 483.11373 | 529.93245 | 19.873371 | 0 |
| 9 | Optimized | 176.14735 | -7.308635 | 480.96752 | 534.79707 | 22.849289 | 0 |
| 10 | Optimized | 177.39565 | -7.263445 | 478.13355 | 541.15351 | 26.750387 | 0 |
| 11 | Optimized | 178.689 | -7.2078105 | 474.6404 | 546.0719 | 30.320874 | 0 |
| 12 | Optimized | 180.0274 | -7.141732 | 470.49868 | 551.28822 | 34.293124 | 0 |
| 13 | Optimized | 181.15285 | -7.0861665 | 467.02126 | 559.11427 | 39.091165 | 0 |
| 14 | Optimized | 182.13535 | -6.9886475 | 460.91732 | 558.70163 | 41.506976 | 0 |
| 15 | Optimized | 183.1878 | -6.8386625 | 451.52927 | 561.6742 | 46.753746 | 0 |
| 16 | Optimized | 184.3123 | -6.62383 | 438.10423 | 552.71638 | 48.649973 | 0 |
| 17 | Optimized | 185.5089 | -6.34415 | 420.60805 | 546.32824 | 53.365055 | 0 |
| 18 | Optimized | 186.41995 | -6.102155 | 405.46673 | 531.49407 | 53.495434 | 0 |
| 19 | Optimized | 187.1609 | -5.8601325 | 390.34045 | 521.57866 | 55.707316 | 0 |
| 20 | Optimized | 188.0173 | -5.5803975 | 372.82574 | 510.11308 | 58.275017 | 0 |
| 21 | Optimized | 188.82275 | -5.292506 | 354.77974 | 492.05731 | 58.270873 | 0 |
| 22 | Optimized | 189.8979 | -4.870636 | 328.30706 | 470.51832 | 60.365099 | 0 |
| 23 | Optimized | 191.29205 | -4.298395 | 291.92821 | 437.31147 | 61.711532 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | Optimized | 192.54125 | -3.76304 | 257.66598 | 403.63791 | 61.961409 | 0 |
| 25 | Optimized | 193.5971 | -3.312502 | 228.63433 | 370.86621 | 60.37385 | 0 |
| 26 | Optimized | 194.65325 | -2.863977 | 198.63043 | 347.19149 | 63.060427 | 0 |
| 27 | Optimized | 195.81675 | -2.284375 | 159.21043 | 311.90718 | 64.815926 | 0 |
| 28 | Optimized | 196.8457 | -1.64249 | 114.77475 | 266.82428 | 64.541196 | 0 |
| 29 | Optimized | 197.6831 | -1.04803 | 73.149309 | 230.33824 | 66.722742 | 0 |
| 30 | Optimized | 198.5509 | -0.37510447 | 25.44219 | 179.84761 | 65.541211 | 0 |
| 31 | Optimized | 199.5 | 0.41886708 | -30.983202 | 120.88779 | 51.313824 | 0 |
| 32 | Optimized | 200.00185 | 0.83868655 | -64.542802 | 143.75225 | 61.01921 | 0 |
| 33 | Optimized | 200.25185 | 1.1842685 | -183.38158 | 97.653817 | 41.451586 | 0 |
| 34 | Optimized | 200.75 | 1.8749035 | -232.72422 | 50.015058 | 21.230132 | 0 |
| 35 | Optimized | 201.12665 | 2.397109 | -269.669 | 13.053938 | 5.5410679 | 0 |

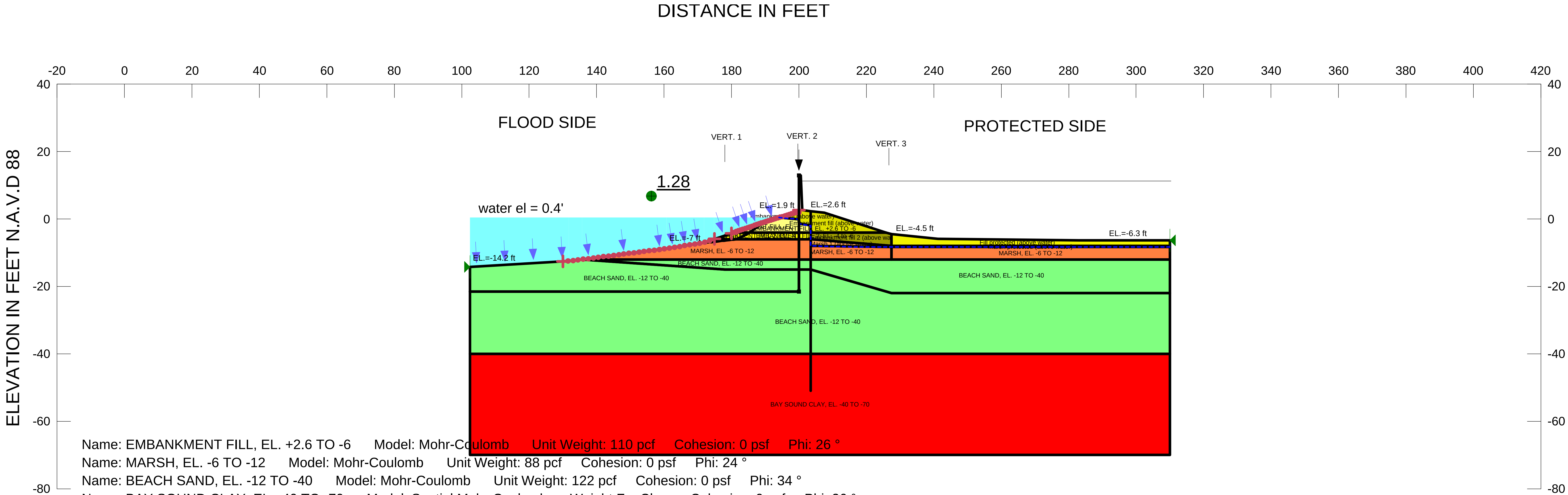
### Slices of Slip Surface: 13048

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | 13048 | 171.5038 | -7.1823335 | 473.13898 | 486.30152 | 5.5871672 | 0 |
| 2 | 13048 | 172.3887 | -7.2927885 | 480.01548 | 507.14839 | 11.517233 | 0 |
| 3 | 13048 | 173.3661 | -7.390215 | 486.0881 | 523.27484 | 15.784832 | 0 |
| 4 | 13048 | 174.3435 | -7.460698 | 490.47861 | 536.71665 | 19.626881 | 0 |
| 5 | 13048 | 175.3209 | -7.5043965 | 493.19318 | 547.53565 | 23.067009 | 0 |
| 6 | 13048 | 176.2983 | -7.521409 | 494.2457 | 555.79621 | 26.126642 | 0 |
| 7 | 13048 | 177.2757 | -7.5117725 | 493.62194 | 561.51797 | 28.820155 | 0 |
| 8 | 13048 | 178.2531 | -7.475466 | 491.34425 | 564.74037 | 31.154804 | 0 |
| 9 | 13048 | 179.2305 | -7.4124085 | 487.39897 | 565.51091 | 33.156554 | 0 |
| 10 | 13048 | 180.2079 | -7.3224575 | 481.77762 | 563.82389 | 34.826573 | 0 |
| 11 | 13048 | 181.2036 | -7.202694 | 474.28408 | 563.25694 | 37.766738 | 0 |
| 12 | 13048 | 182.21765 | -7.0517915 | 464.85441 | 563.5811 | 41.906995 | 0 |
| 13 | 13048 | 183.2317 | -6.8710465 | 453.5534 | 561.11995 | 45.659292 | 0 |
| 14 | 13048 | 184.2457 | -6.6599965 | 440.36374 | 555.86141 | 49.025852 | 0 |
| 15 | 13048 | 185.25975 | -6.4180885 | 425.22971 | 547.78625 | 52.022165 | 0 |
| 16 | 13048 | 186.2738 | -6.1446725 | 408.12553 | 536.878 | 54.652183 | 0 |
| 17 | 13048 | 187.3856 | -5.8060215 | 386.95736 | 521.47729 | 57.100324 | 0 |
| 18 | 13048 | 188.5952 | -5.3940095 | 361.13563 | 500.88466 | 59.319943 | 0 |
| 19 | 13048 | 189.65655 | -4.994878 | 336.10949 | 478.75014 | 60.547362 | 0 |
| 20 | 13048 | 190.56965 | -4.6179625 | 312.22061 | 456.2783 | 61.148861 | 0 |
| 21 | 13048 | 191.4828 | -4.2110725 | 286.3485 | 431.28223 | 61.520719 | 0 |
| 22 | 13048 | 192.47955 | -3.7297415 | 255.63805 | 395.92814 | 59.549607 | 0 |
| 23 | 13048 | 193.55985 | -3.165867 | 219.50049 | 349.36281 | 55.123282 | 0 |





| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | 13048 | 194.6443 | -2.5513985 | 178.99834 | 306.58976 | 54.159343 | 0 |
| 25 | 13048 | 195.7329 | -1.8829945 | 133.9678 | 266.92908 | 56.438716 | 0 |
| 26 | 13048 | 196.82145 | -1.1592808 | 83.921908 | 221.44653 | 58.375737 | 0 |
| 27 | 13048 | 197.91 | -0.37606452 | 28.691319 | 169.81883 | 59.905074 | 0 |
| 28 | 13048 | 198.72715 | 0.24749908 | -15.802208 | 130.67542 | 55.468425 | 0 |
| 29 | 13048 | 199.5 | 0.88405435 | -61.020868 | 83.343223 | 35.377099 | 0 |
| 30 | 13048 | 200.25 | 1.5261445 | -206.65699 | 86.740607 | 36.819203 | 0 |
| 31 | 13048 | 200.75 | 1.978787 | -239.61284 | 49.636714 | 21.069535 | 0 |
| 32 | 13048 | 201.18405 | 2.384873 | -269.54952 | 15.453923 | 6.5598012 | 0 |




Name: EMBANKMENT FILL, EL. +2.6 TO -6 Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 26 °
Name: MARSH, EL. -6 TO -12 Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 0 psf Phi: 24 °
Name: BEACH SAND, EL. -12 TO -40 Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 34 °
Name: BAY SOUND CLAY, EL. -40 TO -70 Model: Spatial Mohr-Coulomb Weight Fn: Clay Cohesion: 0 psf Phi: 26 °
Name: EMBANKMENT FILL 2, EL. -4 to -6 Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 0 psf Phi: 26 °
Name: Embankment fill (above water) Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 75 psf Phi: 26 °
Name: Embankment fill 2 (above water) Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 75 psf Phi: 26 °
Name: Fill protected (above water) Model: Mohr-Coulomb Unit Weight: 96 pcf Cohesion: 75 psf Phi: 26 °
Name: Marsh 1 (above water) Model: Mohr-Coulomb Unit Weight: 88 pcf Cohesion: 75 psf Phi: 24 °
Name: Marsh protected (above water) Model: Mohr-Coulomb Unit Weight: 96 pcf Cohesion: 75 psf Phi: 24 °

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

Hw=CANAL WATER LEVEL

US Army Corps of Engineers
New Orleans District

LONDON AVE CANAL,
OUTFALL CANAL REEVALUATION REPORT
REACH 35A, STA. 102+42 TO 103+50 EAST
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Global Stability (Entry/Exit) in front
MARCH 2012

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

Name: Global Stability (Entry/Exit) in front
File Name: Reach 35A-Scase FS GCAT seepw.gsz Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Edited By: Middleton, Mark C MVN

# Global Stability (Entry/Exit) in front



## File Information

Created By: Liljegren, James
Revision Number: 393
Last Edited By: Middleton, Mark C MVN
Date: 12/12/2012
Time: 3:23:50 PM
File Name: Reach 35A-Scase FS GCAT seepw.gsz
Directory: G:\F&MHOME\Middleton\London Ave Canal\Scase Gcat 7-27-12\12-5-12 flood side\seepw parent\GCAT seepw parent\
Last Solved Date: 12/12/2012
Last Solved Time: 3:34:40 PM

## Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

## Analysis Settings

### Global Stability (Entry/Exit) in front

Kind: SLOPE/W
Parent: Global Analysis (Seepage)
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: Search for Tension Crack
  - Percentage Wet: 0
  - Tension Crack Fluid Unit Weight: 9.807 pcf

FOS Distribution
- FOS Calculation Option: Constant

Advanced





- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 4000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

## Materials

### EMBANKMENT FILL, EL. +2.6 TO -6

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### MARSH, EL. -6 TO -12

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 24 °
Phi-B: 0 °

### BEACH SAND, EL. -12 TO -40

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion: 0 psf
Phi: 34 °
Phi-B: 0 °

### BAY SOUND CLAY, EL. -40 TO -70

Model: Spatial Mohr-Coulomb
Weight Fn: Clay
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### EMBANKMENT FILL 2, EL. -4 to -6

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 26 °
Phi-B: 0 °

### Embankment fill (above water)





Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### Embankment fill 2 (above water)

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### Fill protected (above water)

Model: Mohr-Coulomb
Unit Weight: 96 pcf
Cohesion: 75 psf
Phi: 26 °
Phi-B: 0 °

### Marsh 1 (above water)

Model: Mohr-Coulomb
Unit Weight: 88 pcf
Cohesion: 75 psf
Phi: 24 °
Phi-B: 0 °

### Marsh protected (above water)

Model: Mohr-Coulomb
Unit Weight: 96 pcf
Cohesion: 75 psf
Phi: 24 °
Phi-B: 0 °

## Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (130, -12.60408) ft
Left-Zone Right Coordinate: (175, -5.94277) ft
Left-Zone Increment: 30
Right Projection: Range
Right-Zone Left Coordinate: (180, -4.23757) ft
Right-Zone Right Coordinate: (200, 2.6) ft
Right-Zone Increment: 30
Radius Increments: 20

## Slip Surface Limits

Left Coordinate: (102.4, -14.2) ft
Right Coordinate: (310, -6.3) ft





## Reinforcements

### Reinforcement 1

Type: Pile
Outside Point: (200, 12.9) ft
Inside Point: (200, -21.5) ft
Slip Surface Intersection: (0, 0) ft
Total Length: 34.4 ft
Reinforcement Direction: 90 °
Applied Load Option: Variable
F of S Dependent: No
Pile Spacing: 1 ft
Shear Capacity: 99999 lbs
Shear Safety Factor: 1
Shear Load Used: 99999 lbs
Shear Option: Parallel to Slip
Resisting Force Used: 0 lbs/ft

## Unit Weight Functions

### Clay

Model: Spline Data Point Function
Function: Unit Weight vs. X
- Curve Fit to Data: 100 %
- Segment Curvature: 0 %

Y-Intercept: 107
Data Points: X (ft), Unit Weight (pcf)
- Data Point: (103, 107)
- Data Point: (174.8, 107)
- Data Point: (200, 108)
- Data Point: (227.4, 107)
- Data Point: (310, 107)

## Regions

| | Material | Points | Area (ft²) |
|---|---|---|---|
| Region 1 | EMBANKMENT FILL, EL. +2.6 TO -6 | 2,48,49,36,41 | 54.699916 |
| Region 2 | Embankment fill 2 (above water) | 40,4,25,53,52 | 71.161327 |
| Region 3 | BEACH SAND, EL. -12 TO -40 | 1,28,29,44,45,18,9,12 | 757.09176 |
| Region 4 | BEACH SAND, EL. -12 TO -40 | 12,9,18,22,16,20,6,5 | 3893.75 |
| Region 5 | BAY SOUND CLAY, EL. -40 TO -70 | 5,6,8,7 | 6228 |
| Region 6 | BEACH SAND, EL. -12 TO -40 | 18,17,21,15,19,20,16,22 | 991.85 |
| Region 7 | MARSH, EL. -6 TO -12 | 44,43,30,42,14,24,34,17 | 253.04524 |
| Region 8 | MARSH, EL. -6 TO -12 | 17,34,24,14,11,53,54,55,15,21 | 113.18 |
| Region 9 | BEACH SAND, EL. -12 TO -40 | 44,17,18,45 | 129.44189 |

| | | | |
|---|---|---|---|
| Region 10 | MARSH, EL. -6 TO -12 | 15,55,56,19 | 305.62 |
| Region 11 | Fill protected (above water) | 4,25,26,27,38,39 | 163.94 |
| Region 12 | | 13,32,33,23 | 7.725 |
| Region 13 | EMBANKMENT FILL 2, EL. -4 to -6 | 42,41,36,14 | 44.47119 |
| Region 14 | Embankment fill (above water) | 49,31,13,23,46,3,40,52,51,50 | 92.976167 |
| Region 15 | Embankment fill (above water) | 35,31,49,48 | 6.65 |
| Region 16 | EMBANKMENT FILL, EL. +2.6 TO -6 | 49,50,51,52,37,36 | 8.3675 |
| Region 17 | EMBANKMENT FILL 2, EL. -4 to -6 | 36,37,52,53,11,14 | 7.1 |
| Region 18 | Marsh 1 (above water) | 53,25,55,54 | 27.37 |
| Region 19 | Marsh protected (above water) | 25,55,56,26 | 24.78 |

## Points

| | X (ft) | Y (ft) |
|---|---|---|
| Point 1 | 102.4 | -15 |
| Point 2 | 189.2 | -1.1 |
| Point 3 | 207.5 | 1.9 |
| Point 4 | 227.4 | -4.5 |
| Point 5 | 102.4 | -40 |
| Point 6 | 310 | -40 |
| Point 7 | 102.4 | -70 |
| Point 8 | 310 | -70 |
| Point 9 | 200 | -21.5 |
| Point 10 | 203.5 | -21.5 |
| Point 11 | 203.5 | -6 |
| Point 12 | 102.4 | -21.5 |
| Point 13 | 200 | 2.6 |
| Point 14 | 200 | -6 |
| Point 15 | 227.4 | -12 |
| Point 16 | 227.4 | -22 |
| Point 17 | 200 | -12 |
| Point 18 | 200 | -15 |
| Point 19 | 310 | -12 |
| Point 20 | 310 | -22 |
| Point 21 | 203.5 | -12 |
| Point 22 | 203.5 | -15 |
| Point 23 | 201 | 2.6 |
| Point 24 | 200 | -7 |
| Point 25 | 227.4 | -8 |
| Point 26 | 310 | -8 |
| Point 27 | 310 | -6.3 |
| Point 28 | 102.4 | -14.2 |
| Point 29 | 131.8 | -12.5 |
| Point 30 | 171.9 | -7 |





| | | |
|---|---|---|
| Point 31 | 200 | 1.9 |
| Point 32 | 200 | 12.9 |
| Point 33 | 200.5 | 12.9 |
| Point 34 | 200 | -10 |
| Point 35 | 199 | 1.9 |
| Point 36 | 200 | -4 |
| Point 37 | 203.5 | -4 |
| Point 38 | 282.9 | -6.3 |
| Point 39 | 241.2 | -5.9 |
| Point 40 | 225.84531 | -4 |
| Point 41 | 180.69661 | -4 |
| Point 42 | 174.8322 | -6 |
| Point 43 | 160.7 | -8.8 |
| Point 44 | 135.70541 | -12 |
| Point 45 | 178 | -15 |
| Point 46 | 203.5 | 2.33077 |
| Point 47 | 203.5 | -51 |
| Point 48 | 194.1 | 0.4 |
| Point 49 | 200 | -0.1 |
| Point 50 | 200.1 | -1.4 |
| Point 51 | 203.5 | -1.9 |
| Point 52 | 203.55 | -4 |
| Point 53 | 203.55 | -6 |
| Point 54 | 203.6 | -8 |
| Point 55 | 227.4 | -8.3 |
| Point 56 | 310 | -8.3 |

## Critical Slip Surfaces

| | Slip Surface | FOS | Center (ft) | Radius (ft) | Entry (ft) | Exit (ft) |
|---|---|---|---|---|---|---|
| 1 | Optimized | 1.28 | (173.603, 17.341) | 9.642468 | (189.819, -0.910595) | (171.263, -7.10231) |
| 2 | 18528 | 1.30 | (173.603, 17.341) | 24.309 | (189.575, -0.985259) | (172.125, -6.92314) |

### Slices of Slip Surface: Optimized

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| 1 | Optimized | 171.5817 | -7.081858 | 466.8648 | 468.71451 | 0.82354594 | 0 |
| 2 | Optimized | 172.17895 | -7.043476 | 464.46457 | 470.99373 | 2.9069681 | 0 |
| 3 | Optimized | 172.92125 | -6.981435 | 460.59203 | 471.34494 | 4.787505 | 0 |
| 4 | Optimized | 173.7344 | -6.899695 | 455.48326 | 470.78873 | 6.8144323 | 0 |
| 5 | Optimized | 174.43405 | -6.824445 | 450.79357 | 470.03554 | 8.5670765 | 0 |
| 6 | Optimized | 174.80805 | -6.7839585 | 448.26528 | 469.42926 | 9.422808 | 0 |
| 7 | Optimized | 175.27695 | -6.7284335 | 444.79349 | 468.46044 | 10.537204 | 0 |
| 8 | Optimized | 176.08535 | -6.633025 | 438.82871 | 466.86491 | 12.482522 | 0 |
| 9 | Optimized | 176.81265 | -6.547535 | 433.47547 | 465.44466 | 14.233601 | 0 |
| 10 | Optimized | 177.50365 | -6.4660175 | 428.3778 | 464.03677 | 15.876395 | 0 |
| 11 | Optimized | 178.15835 | -6.3884725 | 423.52418 | 462.70202 | 17.4431 | 0 |
| 12 | Optimized | 178.9431 | -6.29395 | 417.61342 | 460.87655 | 19.261985 | 0 |
| 13 | Optimized | 179.72455 | -6.197827 | 411.60329 | 458.90398 | 21.059624 | 0 |
| 14 | Optimized | 180.3726 | -6.1170815 | 406.56544 | 457.23491 | 22.559501 | 0 |
| 15 | Optimized | 181.01725 | -6.0367595 | 401.54223 | 457.88627 | 25.085985 | 0 |
| 16 | Optimized | 181.59325 | -5.9037625 | 393.23779 | 447.76166 | 26.593069 | 0 |
| 17 | Optimized | 182.104 | -5.7176675 | 381.61192 | 439.263 | 28.118313 | 0 |
| 18 | Optimized | 182.6115 | -5.51096 | 368.71727 | 426.5028 | 28.183888 | 0 |
| 19 | Optimized | 183.1157 | -5.28364 | 354.54209 | 414.4069 | 29.198014 | 0 |
| 20 | Optimized | 183.662 | -5.0056375 | 337.19126 | 395.69453 | 28.533948 | 0 |
| 21 | Optimized | 184.2504 | -4.6769525 | 316.68619 | 376.27257 | 29.06222 | 0 |
| 22 | Optimized | 184.926 | -4.256305 | 290.44666 | 347.5698 | 27.860815 | 0 |
| 23 | Optimized | 185.42715 | -3.919545 | 269.4262 | 324.96899 | 27.090028 | 0 |
| 24 | Optimized | 185.81945 | -3.6503475 | 252.62542 | 302.80361 | 24.473541 | 0 |
| 25 | Optimized | 186.36455 | -3.2728625 | 229.08224 | 272.30758 | 21.082407 | 0 |
| 26 | Optimized | 186.8978 | -2.9037385 | 206.05474 | 242.5027 | 17.776855 | 0 |
| 27 | Optimized | 187.4192 | -2.542975 | 183.5488 | 213.35695 | 14.538406 | 0 |
| 28 | Optimized | 187.9406 | -2.1822115 | 161.04286 | 184.21121 | 11.299957 | 0 |
| 29 | Optimized | 188.451 | -1.8333825 | 139.28954 | 156.26287 | 8.2784456 | 0 |
| 30 | Optimized | 188.95035 | -1.4964875 | 118.28704 | 129.17095 | 5.3084399 | 0 |
| 31 | Optimized | 189.50935 | -1.1193174 | 94.781821 | 98.379198 | 1.7545576 | 0 |





### Slices of Slip Surface: 18528

| | Slip Surface | X (ft) | Y (ft) | PWP (psf) | Base Normal Stress (psf) | Frictional Strength (psf) | Cohesive Strength (psf) |
|---|---|---|---|---|---|---|---|
| | | | - | | | | |
| 1 | 18528 | 172.39605 | 6.9365975 | 457.79492 | 463.82776 | 2.6859943 | 0 |
| 2 | 18528 | 172.9374 | -6.957478 | 459.09345 | 470.17241 | 4.9326688 | 0 |
| 3 | 18528 | 173.4788 | -6.966285 | 459.64774 | 475.36708 | 6.9987041 | 0 |
| 4 | 18528 | 174.02015 | -6.963032 | 459.43843 | 479.44052 | 8.9055013 | 0 |
| 5 | 18528 | 174.5615 | -6.947714 | 458.48445 | 482.36847 | 10.633848 | 0 |
| 6 | 18528 | 175.11035 | -6.9197595 | 456.73086 | 484.17992 | 12.22111 | 0 |
| 7 | 18528 | 175.66665 | -6.8787865 | 454.16861 | 484.86681 | 13.66772 | 0 |
| 8 | 18528 | 176.223 | -6.8249385 | 450.80013 | 484.37872 | 14.95015 | 0 |
| 9 | 18528 | 176.77935 | -6.758129 | 446.61354 | 482.71901 | 16.075188 | 0 |
| 10 | 18528 | 177.33565 | -6.6782505 | 441.61658 | 479.89368 | 17.042066 | 0 |
| 11 | 18528 | 177.89195 | -6.585172 | 435.80066 | 475.87571 | 17.842561 | 0 |
| 12 | 18528 | 178.4483 | -6.4787385 | 429.15922 | 470.67656 | 18.484707 | 0 |
| 13 | 18528 | 179.00465 | -6.3587695 | 421.65275 | 464.3105 | 18.992454 | 0 |
| 14 | 18528 | 179.56095 | -6.2250585 | 413.31416 | 456.72461 | 19.327576 | 0 |
| 15 | 18528 | 180.11725 | -6.07737 | 404.09162 | 447.92277 | 19.514882 | 0 |
| 16 | 18528 | 180.546 | -5.955124 | 396.45554 | 440.08188 | 21.277987 | 0 |
| 17 | 18528 | 180.9808 | -5.8197245 | 388.01164 | 433.3741 | 22.12475 | 0 |
| 18 | 18528 | 181.5492 | -5.630902 | 376.21938 | 424.87002 | 23.7285 | 0 |
| 19 | 18528 | 182.1176 | -5.426326 | 363.46001 | 414.98973 | 25.132722 | 0 |
| 20 | 18528 | 182.686 | -5.2055665 | 349.68795 | 403.65557 | 26.321765 | 0 |
| 21 | 18528 | 183.2544 | -4.968143 | 334.86454 | 390.89597 | 27.328358 | 0 |
| 22 | 18528 | 183.8228 | -4.7135175 | 318.97514 | 376.61798 | 28.114292 | 0 |
| 23 | 18528 | 184.39115 | -4.4410855 | 301.98144 | 360.82004 | 28.697507 | 0 |
| 24 | 18528 | 184.9595 | -4.150169 | 283.82465 | 343.44868 | 29.080578 | 0 |
| 25 | 18528 | 185.5263 | -3.840938 | 264.52408 | 321.61971 | 27.8474 | 0 |
| 26 | 18528 | 186.0915 | -3.5126515 | 244.03095 | 295.20216 | 24.957865 | 0 |
| 27 | 18528 | 186.6567 | -3.163532 | 222.25934 | 266.82763 | 21.737407 | 0 |
| 28 | 18528 | 187.2219 | -2.7924945 | 199.1126 | 236.4114 | 18.191842 | 0 |
| 29 | 18528 | 187.78705 | -2.398301 | 174.50951 | 203.89378 | 14.331666 | 0 |
| 30 | 18528 | 188.3522 | -1.979532 | 148.39001 | 169.14858 | 10.12463 | 0 |
| 31 | 18528 | 188.9174 | -1.534549 | 120.65843 | 132.09717 | 5.5790459 | 0 |
| 32 | 18528 | 189.3874 | -1.1452713 | 96.405284 | 99.355431 | 1.4388828 | 0 |

# APPENDIX L GEOTECHNICAL CRITERIA APPLICATIONS TEAM (GCAT) PAPER

## S-Case Analysis Parameters for Outfall Canals

GCAT March 15, 2011

## Summary

A literature review and analysis was performed to offer some guidance on the selection of drained strength parameters for use in S-case analyses performed on levees, particularly the levee fill materials in the outfall canals.

Based on the review of geotechnical laboratory test results performed by Brandon et al. (2011), drained friction angles are provided as a function of the MVN soil classification type as shown below:

| Soil Type | Design cohesion c' | Design friction angle $\phi'$ |
|---|---|---|
| CH | 0 | 26 |
| CHO | 0 | 24 |
| CL | 0 | 32 |
| ML | 0 | 34 |
| PT | 0 | 30 |
| SC | 0 | 33 |
| SM | 0 | 33 |
| SP | 0 | 34 |

These values represent the mean value from CU (R-bar) triaxial test results minus one standard deviation, or the mean value determined from direct shear tests for cases where no triaxial test results were available. The value of c' = 0 shown in the table above reflects the assumption that the soils are assumed to be normally consolidated.

For cases where the levee fill materials are located above the phreatic surface, theories regarding partially saturated soil mechanics (Fredlund and Rahardjo, 1993) were used to account for a small contribution of the negative pore pressures to the drained shear strength. Slope stability analyses were conducted on hypothetical levee cross sections for levee heights ranging from 5 ft to 15 ft. Based on the analyses, it was determined that using an equivalent c' of 75 psf would conservatively allow for an increased strength to reflect the presence of negative pore water pressures.

The assumed value of the drained friction angle as a function of the soil type and the use of partially saturated soil mechanics should only be used if it is not possible or practical to obtain

soil samples for laboratory testing. It is expected that tests conducted on undisturbed samples of the levee fill material would result in higher strengths than these assumed values.

## Introduction

An analysis case for levees and I-walls required by the Hurricane and Storm Damage Risk Reduction System Design Guidelines (HSDRRSDG) is a "Low Water (non-hurricane) S-case" analysis. A minimum factor of safety of 1.4 must be obtained using Spencer's method. According to the HSDRRSD guidelines, this analysis applies to flood side and protected side and represents a long-term water level drawdown where steady state conditions prevail.

## Undrained Strength Values

The HSDRRSD guidelines recommend strength parameters for cases where no laboratory tests are available. These values, along with the table numbers from the guidelines, are shown in the two tables below.

**Table 3.3 – Typical values for embankment fill.**

| Soil Type | Unit Weight (pcf) | Cohesion (psf) | Friction Angle (deg) |
|---|---|---|---|
| Compacted Clay (90%) | 110 | 400 | 0 |
| Compacted Clay from Bonnet Carrie (from dry borrow pit placed on land) | 115 | 600 | 0 |
| Uncompacted Clay (from dry borrow pit placed on land) | 100 | 200 | 0 |

The properties given in the table above are presumed to be undrained strength parameters to be incorporated as a $S_u = c$, $\phi = 0$, strength model. Although these values may be appropriate for a saturated soil, they would not be appropriate for a partially saturated levee fill. UU or Q triaxial tests conducted on a partially saturated soil should result in a $c - \phi$ strength envelope (Duncan and Wright 2005). The strengths listed above would probably be conservative if they are viewed as unconfined compressive strengths since they would represent the lowest strengths on the $c - \phi$ strength envelope. In New Orleans area projects, UU triaxial tests are not often conducted on levee fill materials.

## Drained Strength Values

The strength parameters listed in Table 3.4 are presumed to be drained or effective strength parameters. The strength parameters listed for silt ($c'$ = 200 psf $\phi'$ = 15 degrees) are not reasonable. In order for a fine-grained soil to have an effective stress cohesion intercept, it would have to be overconsolidated (Lambe and Whitman 1969). In addition, non-plastic silts often do not have a memory for their preconsolidation pressure, and the presence of a cohesion intercept would not be likely (Brandon et al. 2006). Also, non-plastic silts are often very dilative soils, and the volume change response during shear results in very high friction angles being measured (Penman 1953).

**Table 3.4 - Typical values for Silts, Sands, and Riprap**

| Soil Type | Unit Weight (pcf) | Cohesion (psf) | Friction Angle (deg) |
|---|---|---|---|
| Silt | 117 | 200 | 15 |
| Silty Sand | 122 | 0 | 30 |
| Poorly graded sand | 122 | 0 | 33 |
| Riprap | 132 | 0 | 40 |

Notes. 1) Weight of riprap may vary based on the filling of the riprap voids over time.
2) Undrained soil parameters for the S-Case are:
Silt: Cohesion = 0 psf, phi = 28
Clay: Cohesion = 0 psf, phi = 23

Below Table 3.4 in Note 2, additional strength parameters are given for silt and clay. First, these parameters are mislabeled as "Undrained soil parameters for the S-Case…" S-case strengths would be drained or effective stress strengths, not undrained strengths. Second, there isn't any logic to giving two different sets of S-case or drained strengths parameters for silt.

## New Drained Strength Correlations

The values given in Table 3.4 appear to be very conservative. Brandon et al. (2011) reviewed pre-Katrina and post-Katrina direct shear data and triaxial data for New Orleans area soils. Based on their assessment, the following results were tabulated:

Table 1 Summary of drained friction angle for all soils for direct shear tests.

| Soil Type | # of test series | Friction Angle (deg) | | | Standard Deviation |
|---|---|---|---|---|---|
| | | Maximum | Minimum | Mean | |
| CH | 148 | 33.26 | 14.79 | 22.66 | 3.24 |
| CL | 50 | 37.04 | 20.00 | 29.45 | 3.70 |
| ML | 42 | 41.03 | 27.29 | 33.24 | 2.25 |
| CHO | 2 | 33.18 | 26.47 | 29.83 | 4.75 |
| SC | 4 | 34.99 | 31.63 | 32.80 | 1.50 |
| SM | 109 | 38.35 | 23.32 | 33.03 | 2.37 |
| SP | 32 | 39.35 | 30.63 | 34.22 | 2.12 |

Brandon et al. also found that the direct shear apparatus consistently produced friction angles 4 to 10 degrees lower for New Orleans area soils than Consolidated Undrained (R-bar) triaxial tests. This is clearly shown in Figure 1 below. This difference in friction angle has been documented in geotechnical literature, and is most often attributed to progressive failure conditions present in the direct shear test (Hvorslev 1960).

Table 2 shows the mean effective stress friction angles obtained from CU triaxial tests. However, no sandy soils were tested in triaxial compression.

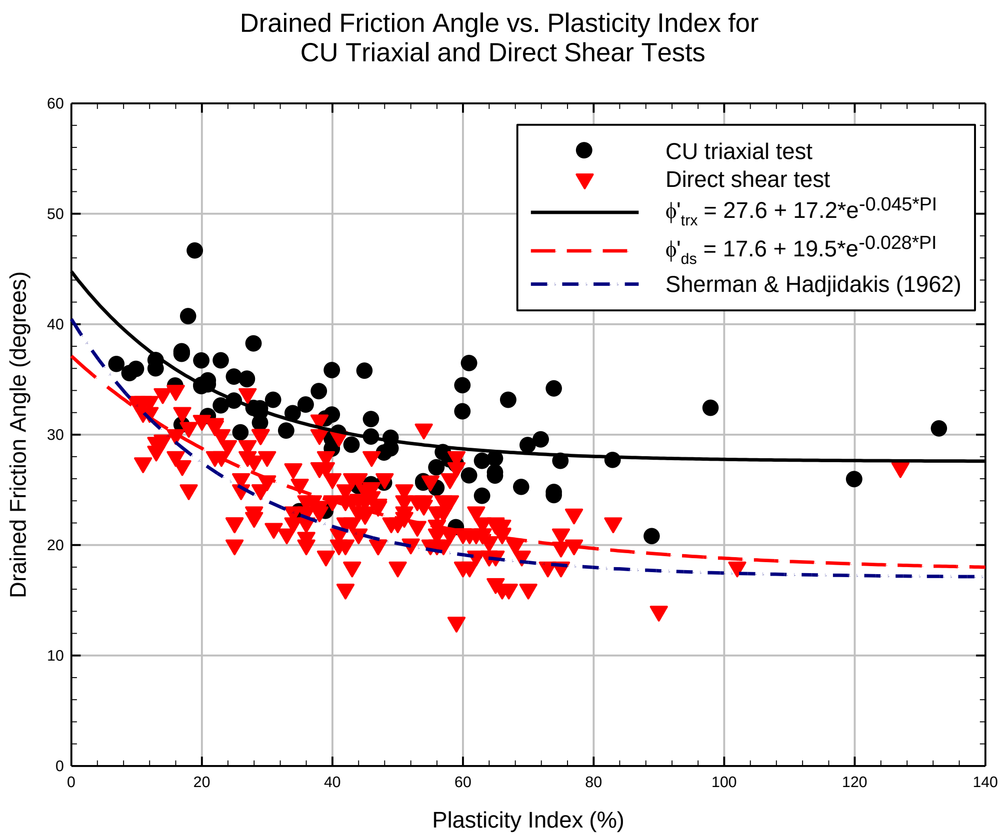



Figure 1 Relationship between drained friction angle with plasticity index for CU triaxial tests and direct shear tests.

Table 2 Summary of drained friction angle for all soils for CU triaxial tests.

| Soil Type | # of test series | Friction Angle (deg) | | | Standard Deviation |
|---|---|---|---|---|---|
| | | Maximum | Minimum | Mean | |
| CH | 83 | 36.42 | 21.55 | 28.86 | 3.20 |
| CHO | 7 | 32.37 | 20.74 | 28.49 | 4.00 |
| CL | 49 | 46.60 | 29.52 | 35.05 | 2.99 |
| ML | 16 | 38.06 | 30.14 | 35.89 | 2.28 |
| PT | 2 | 42.20 | 32.05 | 37.12 | 7.18 |

For cases where no shear strength parameters are available, it is conservative to use the mean friction angles listed in Table 2 less one standard deviation. By using this value, there is only a 16% probability that the actual value realized in the field will be lower. It would also be appropriate to use the mean values given in Table 1. Since the results from direct shear tests are much less than triaxial tests, it is not necessary to further reduce the friction angle by subtracting the standard deviation.

Based on this procedure, the following drained or effective stress strength parameters are recommended in Table 3. The effective stress cohesion, c′, should be set to zero. This would be consistent in assuming that the fine-grained soils are normally consolidated (Lambe and Whitman 1969).

Table 3 Recommended S-case design friction angles for cases where no laboratory test data are available.

| Soil Type | Design cohesion c′ | Design friction angle $\phi'$ |
|---|---|---|
| CH | 0 | 26 |
| CHO | 0 | 24 |
| CL | 0 | 32 |
| ML | 0 | 34 |
| PT | 0 | 30 |
| SC | 0 | 33 |
| SM | 0 | 33 |
| SP | 0 | 34 |

## Strength Parameters for Partially Saturated Levee Fill Materials

The strength parameters given in Table 3 would be most appropriate for saturated, normally consolidated soils beneath the phreatic surface. If these strength parameters are applied to partially saturated levee fill materials, in combination with an assumption that the pore pressures above the water table are zero, they would prove to be too conservative. This is because of several reasons:

(1) The partially saturated levee fill material would likely be overconsolidated, and have an effective stress cohesion value greater than zero. The overconsolidation would be the result of the initial compaction, weathering, repeated wetting and drying, fluctuations in the phreatic surface, etc.

(2) The pore pressures in the levee fill above the phreatic surface would not be equal to zero, but would be negative. This would result in a higher effective stress than that which would be calculated assuming zero pore pressures. The actual magnitude of the pore pressures would depend on the soil moisture retention curve, height above the phreatic surface, and other factors.

(3) The shear strength for partially saturated soils can often be more complex than for saturated soils. Special theories have been developed solely for partially saturated soils.

A thorough evaluation of the existing soils reports shown in the reference list was done, for both pre-Katrina and post-Katrina reports, for effective stress shear strength measured on levee fill materials for the outfall canals. Only one test series was found. A direct shear test was conducted on a CL test specimen obtained from the Orleans Avenue Canal, and resulted in $\phi'$ = 29 degrees and c' = 340 psf.

## Example Analysis Case

In order to demonstrate the importance of both the strength model and the pore pressure assumptions, an example levee was analyzed. The levee was 10 ft high and had a 10 ft wide crest. The protected side and flood side slopes were 2H:1V or 26.6 degrees from the horizontal. The levee fill was assumed to be a CL soil and the foundation material was assumed to be a CH soil. The analyses were conducted using Spencer's method with the computer program SLIDE 6.0.

The unit weight of the levee fill was 105 pcf, and the drained friction angle of 32 degrees was obtained from Table 3. The foundation soil was assumed to have a unit weight of 100 pcf and a friction angle of 26 degrees corresponding to a CH soil. The static phreatic surface is located at the interface between the levee and foundation soil (elevation 0).

A summary of the factor of safety values for the analysis cases is given in Table 4. A description of each analysis case follows.

Table 4 Factors of safety resulting from analysis of hypothetical 10 ft tall levee.

| Case | Foundation $\phi'$ degrees | Levee $\phi'$ degrees | Levee c' psf | Pore pressures | FS |
|---|---|---|---|---|---|
| 1 | 26 | 32 | 0 | u = 0 above phreatic surface | 1.25 |
| 2 | 26 | 32 | 0 | $u = -h \cdot \gamma_w$ above phreatic surface | 1.58 |
| 3 | 26 | 32 | 0 | Fredlund's method with $\phi^b = \phi'/2$ | 1.44 |
| 4 | 26 | 32 | 75 | u = 0 above phreatic surface | 1.44 |

Case 1 Analysis

The first analysis case was performed assuming that the pore pressures above the phreatic surface as equal to zero. This means that for the portion of the failure plane above the phreatic surface, the shear strength is based on the total stress. The factor of safety for this case defaults to the infinite slope failure mechanism, as shown in Figure 2. The resulting factor of safety is equal to:

$$FS = \tan\phi'/\tan\alpha = 1.25$$

where $\alpha$ = slope angle (26.6 degrees)

The infinite slope failure mechanism, often called raveling or sloughing, is normally considered more of a maintenance issue as opposed to a critical stability issue. Slope repairs are often easy to accomplish with regrading.

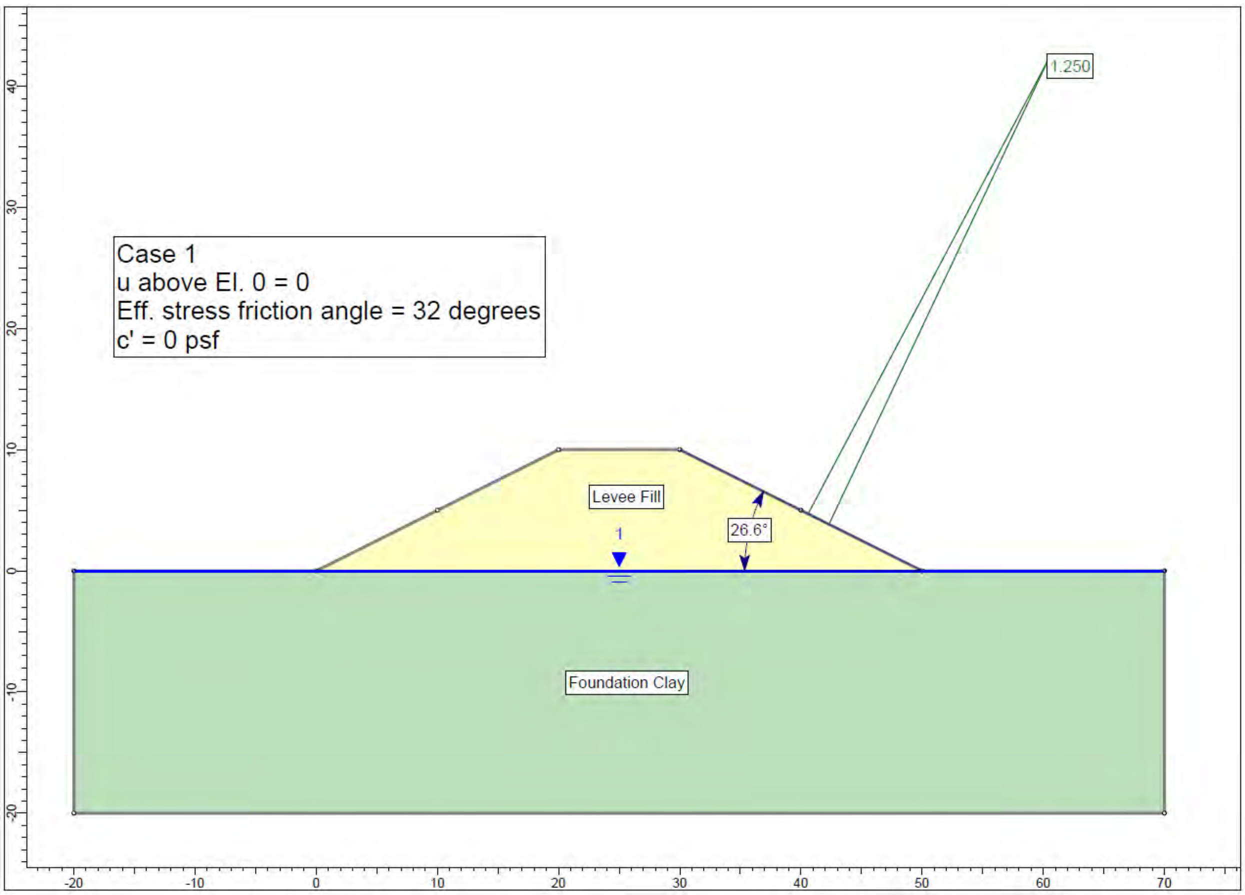



Figure 2 Case 1 results showing an infinite slope failure mechanism.

## Case 2 Analysis

In Case 2, the pore pressures above the phreatic surface can be assumed to be equal to the negative value of the height above the phreatic surface multiplied by the unit weight of water.

While this may be possible for levees of modest height (< 15 ft), it does not incorporate any conservatism into the strength assessment. The critical failure surface for Case 2 is shown in Figure 3. The factor of safety calculated is 1.58.

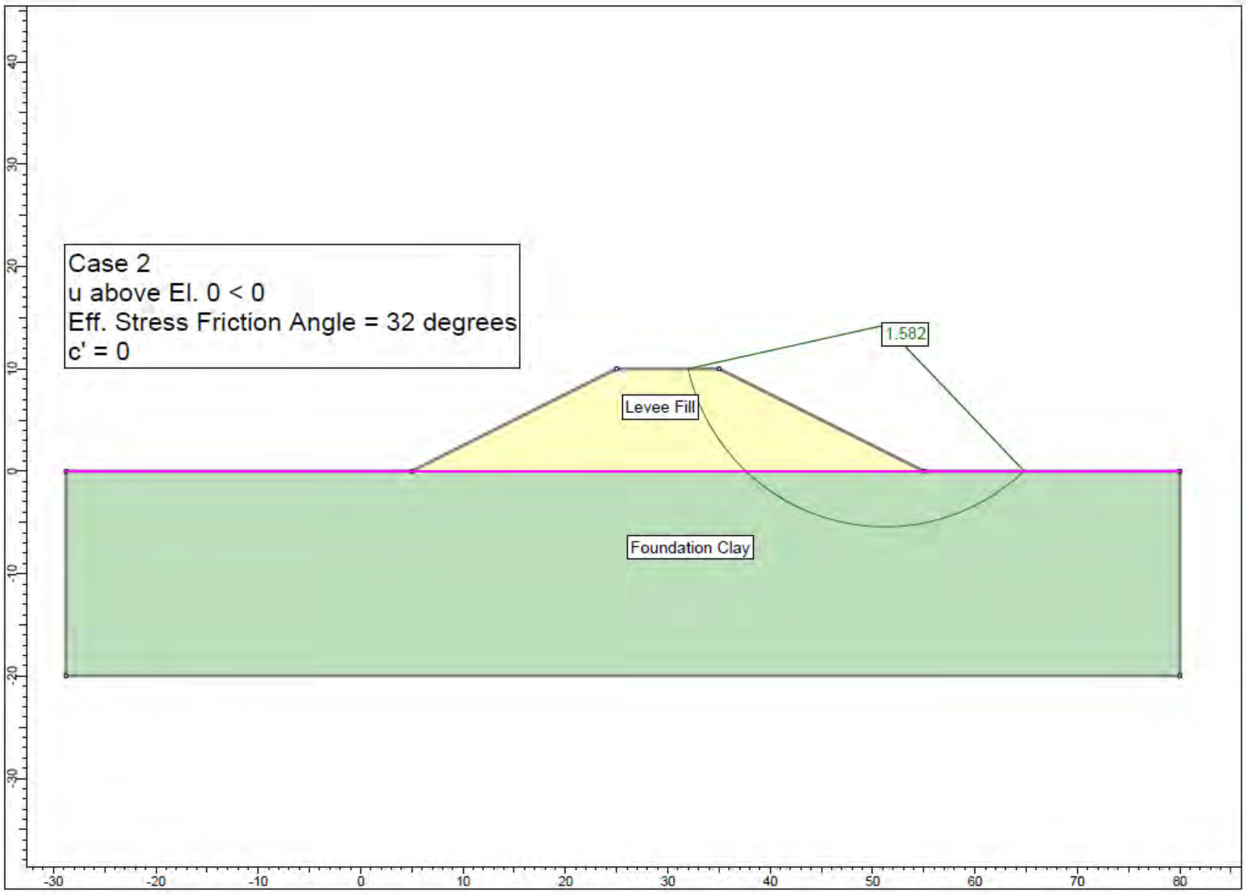



Figure 3 Critical failure surface for Case 2 analysis. Pore pressures above the phreatic surface as considered to be negative.

Case 3 Analysis

Case 3 is similar in many respects to Case 2. For this case, the shear strength model used was that developed by Fredlund et al. (1978). In Fredlund's method, the equation used to calculate shear strength differs from the conventional Mohr-Coulomb equation by the inclusion of an additional friction angle, $\phi^b$.

$$s = c' + (\sigma_n - u_a) tan\varphi' + (u_a - u_w) tan\varphi^b$$

with:

$u_a$ = pore air pressure

$u_w$ = pore water pressure

$\phi^b$ = friction angle related to matric suction

For this example, $\phi^b$ was specified as half of $\phi'$, which is a common assumption (Fredlund and Rahardjo 1993). If $\phi^b$ is equal to $\phi'$, then this case becomes the same as Case 2. If pore water pressures are positive, the Fredlund's equation becomes the conventional Mohr-Coulomb equation.

An additional parameter used in Fredlund's method is the *air entry value* of the soil. The air entry value is the threshold suction where air enters the pores of the soil, and the soil desaturates. At suction values less than the air entry value, the shear strength is consistent with conventional Mohr-Coulomb theory, and the full negative pore pressure is used in calculating the effective stress. At values of suction greater than the air entry value, the equation shown above is applied.

A review of the index test data available for the levee fill materials was performed, and the levee fill was determined to be predominately a CL soil, although scant Atterberg limits tests were available. A literature review was performed to determine measured air entry values for soils with similar Atterberg limits, and the results of that review is shown in Table 5. The AEV is given in the table in units of feet of water. This means that the soil is fully saturated from the phreatic surface upwards until this distance is reached. In this case, $\phi' = \phi^b$. The Case 2 results are equivalent to using an AEV equal to the height of the levee.

For the analyses in this report, the AEV was assumed to be equal to zero. This is a conservative assumption resulting in the use of a shear strength about half of that which would be calculated using full negative pore pressure.

Table 5 Air Entry Values (AEV) measured for soils with similar Atterberg limits as the outfall canal levee fill material.

| LL | PI | AEV ft $H_20$ | Reference |
|---|---|---|---|
| 27 | 15 | 2 - 8 | Tinjum et al. (1997) |
| 32 | 14 | 1 - 8 | Tinjum et al. (1997) |
| 29 | 13 | 13 | Mijares & Khire (2010) |
| 40 | 17 | 5 - 16 | Miller et al. (2002) |
| 26 | 14 | 18 - 24 | Miller et al. (2002) |
| 63 | 29 | 13 | Jeong et al. (2008) |
| 22 | 5.4 | 7 | Vanapalli et al. (1999) |
| 33 | 13.6 | 13 | Vanapalli & Fredlund (2000) |
| 28 | 8 | 10 | Vanapalli & Fredlund (2000) |

Fredlund's method has become popular in geotechnical engineering practice, and is incorporated into the major commercial slope stability programs like SLIDE, SLOPE/W, and SVSLOPE. The net effect of applying Fredlund's equation to this example problem is that negative pore pressures are considered, but not to the full magnitude of $-h \cdot \gamma_w$., thus the factor of safety is an intermediate value of 1.44. The results of this analysis are shown in Figure 4.

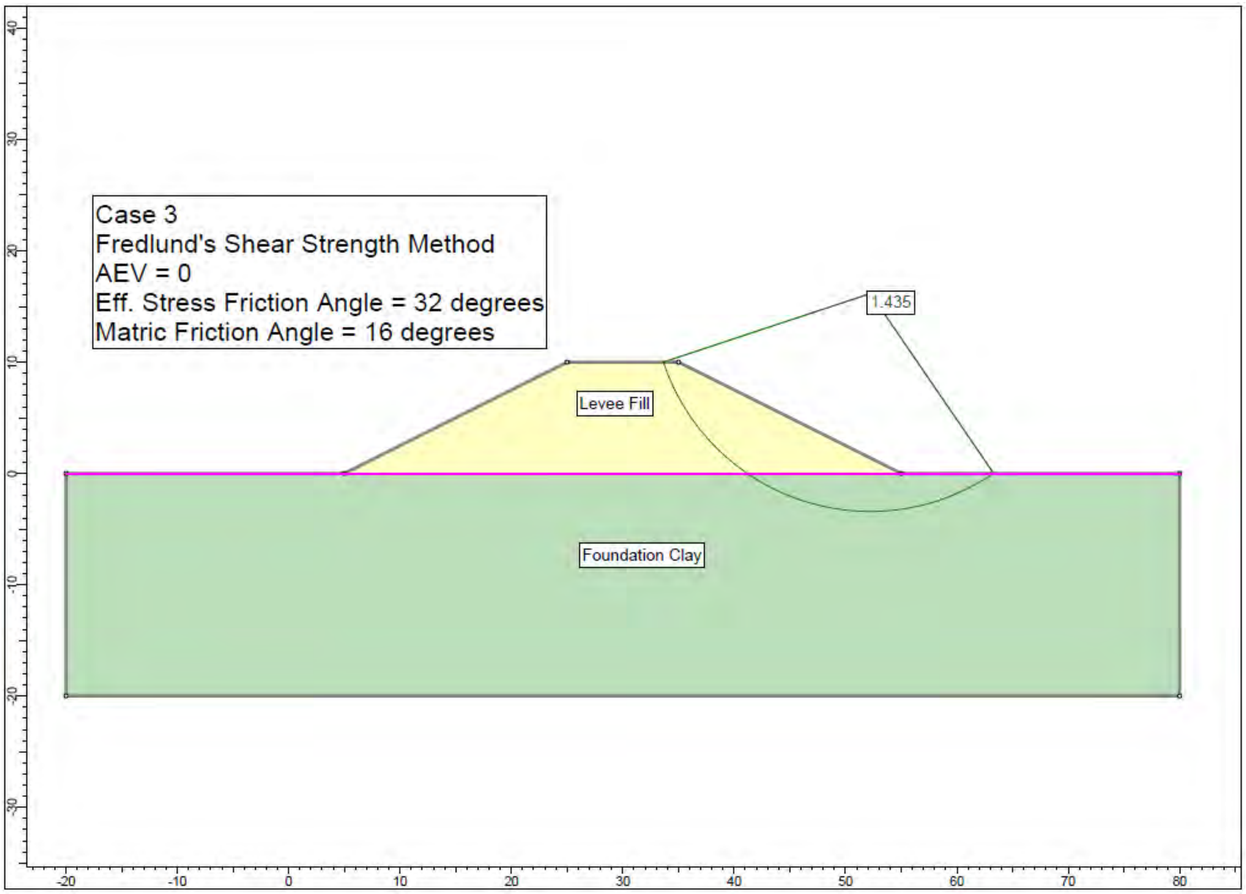



Figure 4 Results of Case 3 analysis using Fredlund's method for characterizing the shear strength of the levee fill.

<u>Case 4 Analysis</u>

Case 4 is identical to Case 1 regarding the assumption about pore pressures, but an effective stress cohesion has been specified such that the final factor of safety is approximately equal to Case 3. The levee fill soils would be expected to have an effective stress cohesion owing to overconsolidation. However, the value of c' = 75 psf is applied to compensate for the negative pore pressures and not the overconsolidation. It can be viewed as the minimum effective stress cohesion that should be available for the levee fill, and the use of this value can be considered to be conservative. The failure surface for Case 4 is shown in Figure 5. The geometry of the slip surface is approximately the same for Case 3 and Case 4.

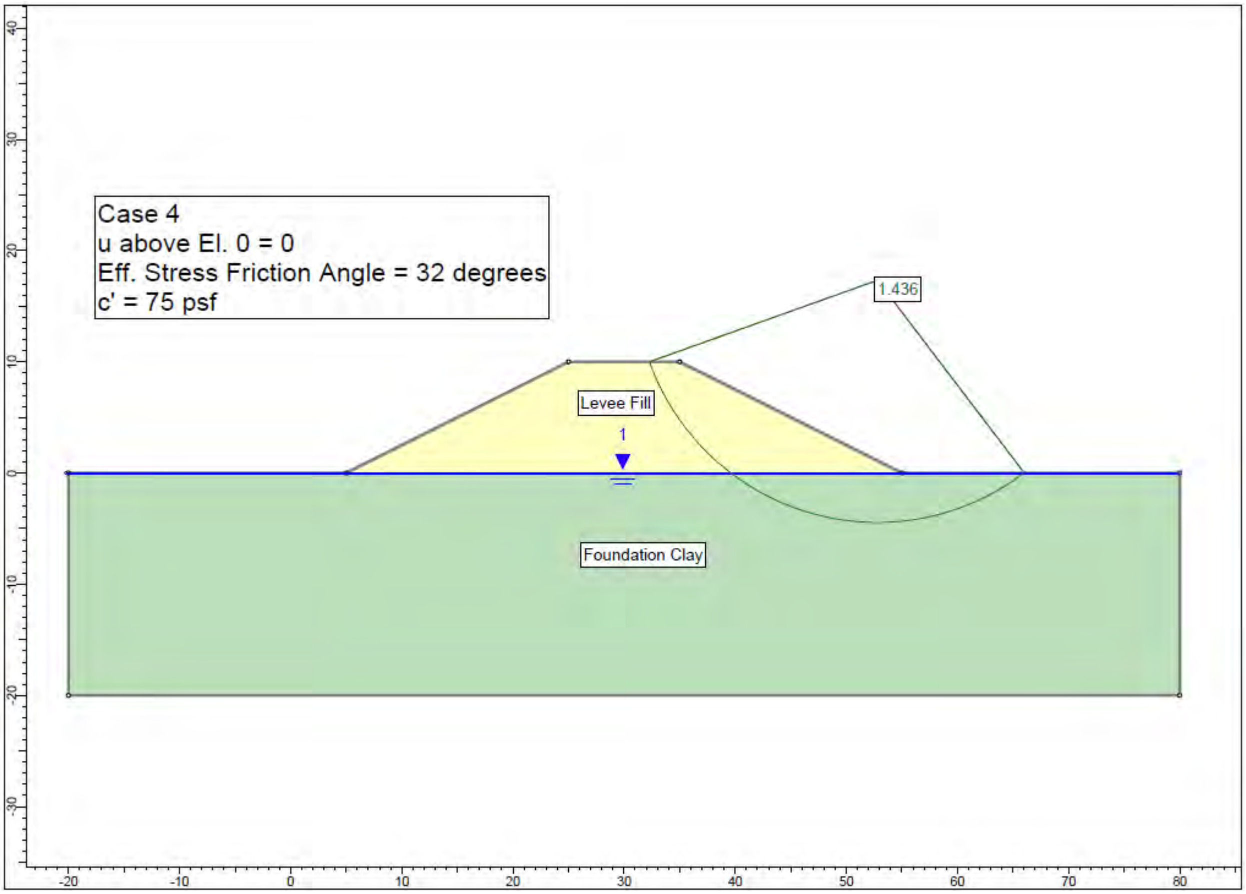



Figure 5 Case 4 results where an effective stress cohesion value of 75 psf is used.

As the levee slopes get flatter than 2H:1V, the equivalent cohesion value calculated for Case 4 increases. This is because the Case 3 factor of safety is much greater. Shown in Table 6 are the factor of safety values for the 10 ft tall levee for slope angles from 2H:1V to 3H:1V. For slope angles of 2.5H:1V and 3H:1V, the infinite slope failure mechanism does not control since the foundation soil friction angle is less than the levee friction angle.

Table 7 shows the calculated equivalent cohesion (Case 4 analysis) for both 10 ft and 15 ft tall levees. For the 10 ft tall levee, the equivalent cohesion ranges from 65 psf to 78 psf, with the value increasing with decreasing slope angle. For the 15 ft tall levee, the cohesion value ranges from 106 psf to 121 psf. Therefore, using a c' value of 75 psf would be conservative for all cases analyzed.

Table 6 Factors of safety for levee slopes ranging from 2H:1V to 3H:1V for 10 ft tall levee.

| Case | Levee ϕ' (degrees) | c' (psf) | Factor of safety (FS) | | |
|---|---|---|---|---|---|
| | | | 2H:1V | 2.5H:1V | 3H:1V |
| 1 | 32 | 0 | 1.25 | 1.41* | 1.57* |
| 2 | 32 | 0 | 1.58 | 1.73 | 1.86 |
| 3 | 32 | 0 | 1.44 | 1.58 | 1.72 |
| 4 | 32 | 75-78 | 1.44 | 1.58 | 1.72 |

*not infinite slope failure mechanism

Table 7 Equivalent cohesions calculated for Case 4 analysis for 10 ft and 15 ft tall levees for slope angles ranging from 2H:1V to 3H:1V.

| Slope | H = 10 ft | H = 15 ft |
|---|---|---|
| | c' (psf) | c' (psf) |
| 2H:1V | 75 | 106 |
| 2.5H:1V | 77 | 115 |
| 3H:1V | 78 | 121 |

Analyses were also conducted for a 5 ft tall levee. For a levee of such modest height, it would be overconservative to assume that AEV = 0. As indicated by Table 5, the air entry values for reported for clayey soils are seldom less than 5 ft. If an AEV = 5 ft $H_20$ is used in the analysis, the equivalent back-calculated c' ranges from 75 psf to 85 psf for levee slopes from 2H:1V to 3H:1V.

## Comparison of Different Cases

A simple cross section can be used to explain the main differences in the shear strength concepts used in the different cases. Shown in Figure 6 is a cross section where the static phreatic surface is located 20 ft below the ground surface. The soil beneath the water table is assumed to be fully saturated. For calculation purposes, the effective stress friction angle is assumed to be 30 degrees and the effective stress cohesion is set equal to zero. The calculated shear strength on a horizontal plane is used to compare the different shear strength concepts and the influence of AEV.  The first plot, using filled circles, shows the shear strengths determined assuming that the pore pressure is equal to zero above the phreatic surface.  In other words, the effective stress is assumed to be equal to the total stress above the phreatic surface.  This is the assumption made in the Case 1 stability analysis.  The second plot, using the inverted triangles, assumed that full negative pore pressure is achieved above the water table. This would imply that the soils are saturated from the elevation of the phreatic surface to the ground surface.  This would also be consistent with an air entry value (AEV) greater than or equal to 20 ft of water.  This is the method used in the Case 2 stability analysis.  Both Case 1 and Case 2 used conventional Mohr-Coulomb shear strength theory, with the only difference being the assumptions regarding the pore pressures.

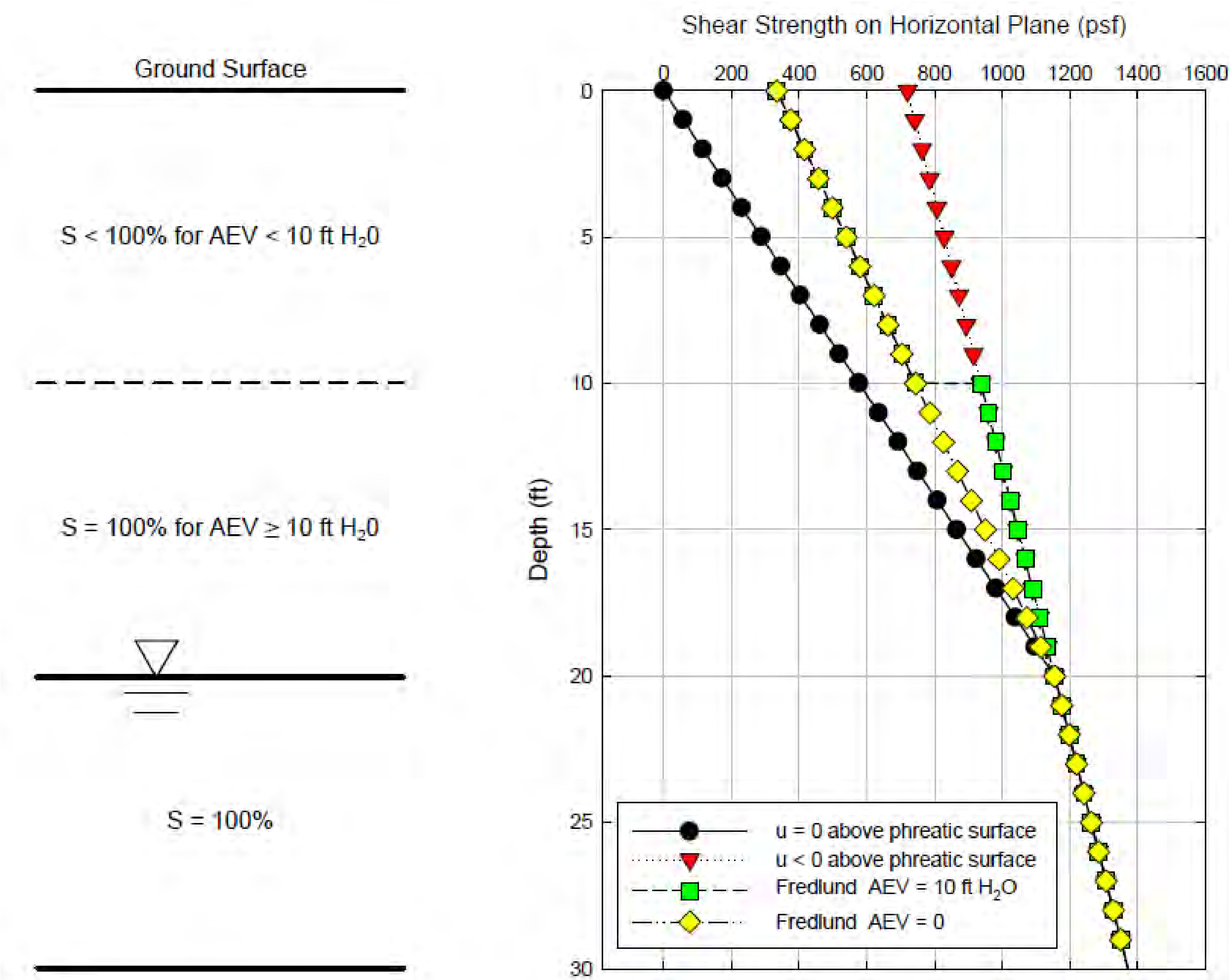



Figure 6    Cross section used to demonstrate differences between different shear strength concepts.

The third plot (squares) is the Fredlund method assuming an AEV of 10 ft $H_20$.  For depths ranging from the phreatic surface to 10 ft above the phreatic surface, the soil is considered to be saturated. Therefore this method would produce the same strengths in this zone as the Case 2 assumptions. At heights 10 ft above the phreatic surface, the soil is considered to be partially saturated, and Fredlund's equation applies. In this area, $\phi^b$ is assumed to be equal to $\phi'/2$.

The fourth plot shows the strength resulting from Fredlund's equation when the AEV is assumed to be equal to zero. This strength distribution is represented by the diamonds in the plot, and is the method used in the Case 3 analyses described previously.

## Phreatic Surface for Design

It would be difficult to determine the actual phreatic surface to be used for design. The water level in the outfall canals fluctuates on a daily basis. For times when the canal water level is extremely low, it could take weeks to years before a steady state condition is achieved. Owing to the difficulty in calculating both the phreatic surface before and after the low canal water level, it would be prudent to assume a horizontal phreatic surface at the low canal water level. This agrees with the intention of the authors of the HSDRRSD guidelines in that this analysis applies to a long-term water level drawdown where steady state conditions prevail.

## Summary and Conclusions

Based on an extensive review of New Orleans area soils, Brandon et al. (2011) developed correlations of effective stress friction angle for different soil classifications for both triaxial and direct shear tests. In general, the triaxial friction angles were 4 to 10 degrees higher than the direct shear friction angles. Table 3 is recommended to be used for design values for New Orleans area soils. The values in this table are the mean triaxial results less one standard deviation. If no triaxial tests results were available for a given soil type, the direct shear values are listed in the table. The direct shear friction angles were not reduced by one standard deviation since they are conservative compared to the triaxial test results.

Very little laboratory test results are available for the drained strength properties of the levee fill materials for the outfall canals. These materials are primarily CL soils, and would likely be overconsolidated due to the initial compactive effort, the repeated fluctuation of the canal water level, desiccation from the sun, etc. This would result in the levee soils having a considerable effective stress cohesion. Since test results are not available, unsaturated soil mechanics were applied to examine what value of effective stress cohesion can be conservatively applied for drained analysis of the levee fill soils. A value of $\phi' = 32$ degrees and $c' = 75$ psf can be safely used for the levee fill materials in conventional slope stability analyses. Whenever possible, direct shear tests should be conducted on levee fill materials in future projects to allow this estimate to be refined for other projects.

There are some inconsistencies regarding the undrained strengths suggested in the HSDRRSD guidelines. The partially saturated soils should realistically have both $c > 0$ and $\phi > 0$ in stability analyses. The use of an unconfined compressive strength in conjunction with a $\phi = 0$ analysis may indeed be conservative, but this should be checked. It isn't clear in the guidelines if the strengths offered for silt are drained or undrained strengths. It would be prudent to have recommendations for undrained strengths of silt for use in future projects. The correlations study submitted by Brandon et al. (2011) contains useful information that can be used for undrained strength recommendations for New Orleans area projects.

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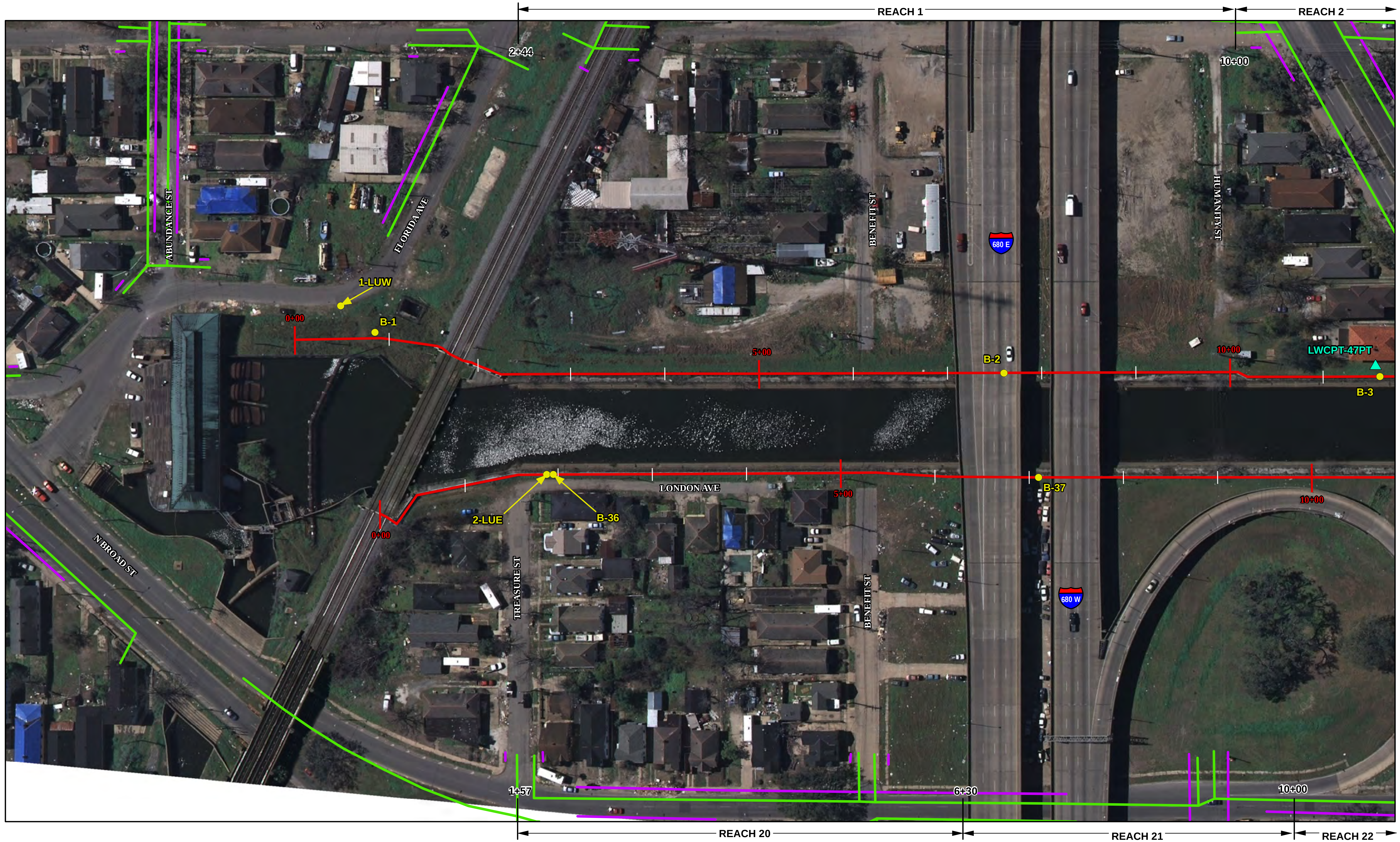
## APPENDIX M ELECTRONIC FILES

## APPENDIX N LEVEE REACH LOCATIONS




100 50 0 100 200 FT

N

London Avenue Canal
Reach Locations

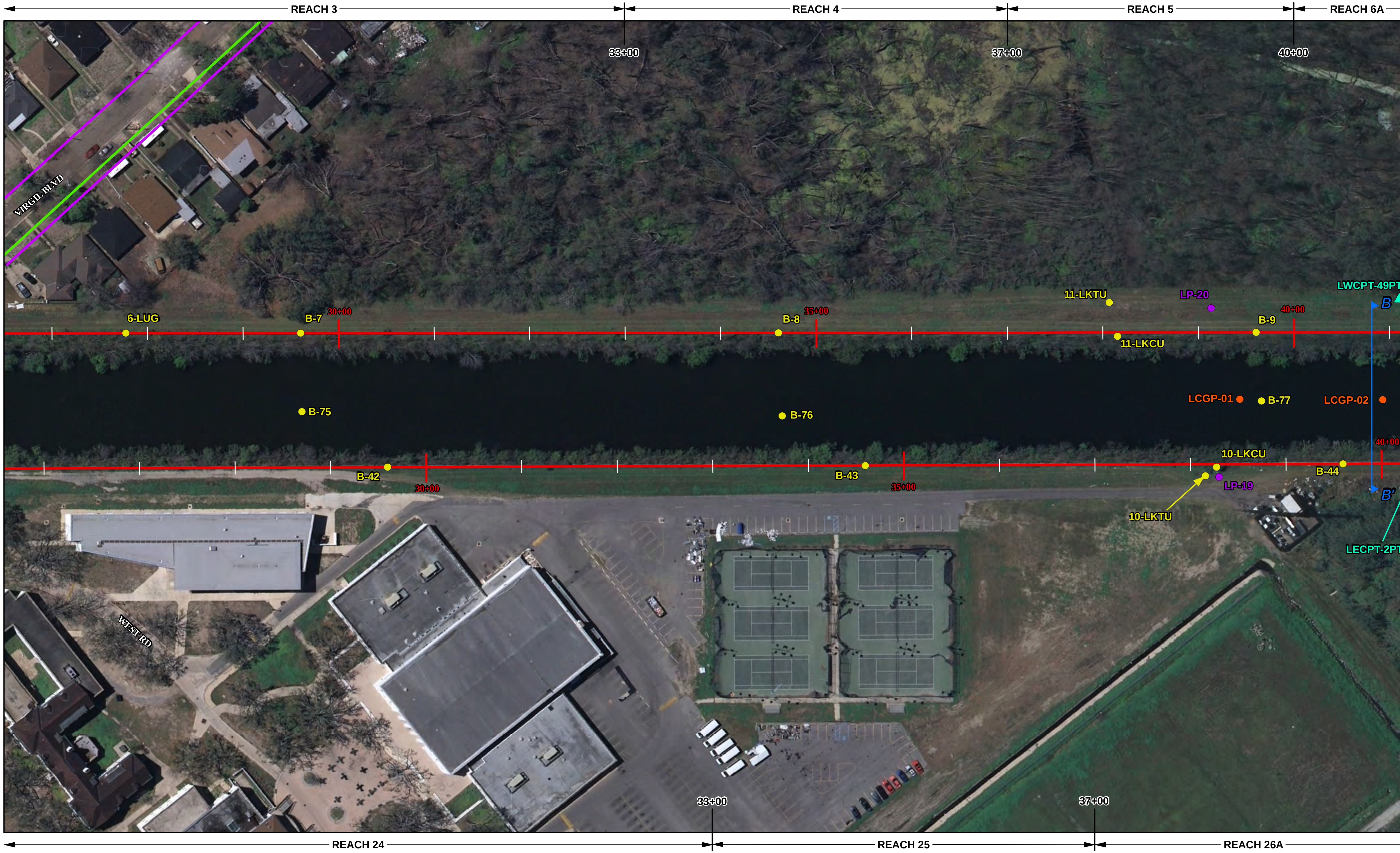
| | | |
|---|---|---|
| Sewer | Borings | CPT |
| Curb Drain | Existing Piezometer | Vane Shear |
| Cross Section | LCGB Canal Sample | 2010 DPT |
| | Slug Test Location | 2010 CPT |

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

NEW ORLEANS
August 2010

PLATE 1


REACH 2
REACH 2
REACH 3
12+21
13+88
21+00
PLEASURE ST
LAFRENIERE ST
SERE ST
VIRGIL BLVD
AP TUREAUD AVE
LWCPT-48PT
A
A'
15+00
20+00
25+00
B-4
B-5
B-6
B-73
B-74
B-38
B-39
B-40
B-41
LECPT-1PT
GENTILLY BLVD
VIRGIL BLVD
WEST RD
11+85
13+55
21+00
24+00
REACH 22
REACH 22
REACH 23
REACH 24
100
50
0
100
200
FT
N
London Avenue Canal
Reach Locations
Sewer
Curb Drain
Cross Section
Borings
Existing Piezometer
LCGB Canal Sample
Slug Test Location
CPT
Vane Shear
2010 DPT
2010 CPT
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NEW ORLEANS
August 2010



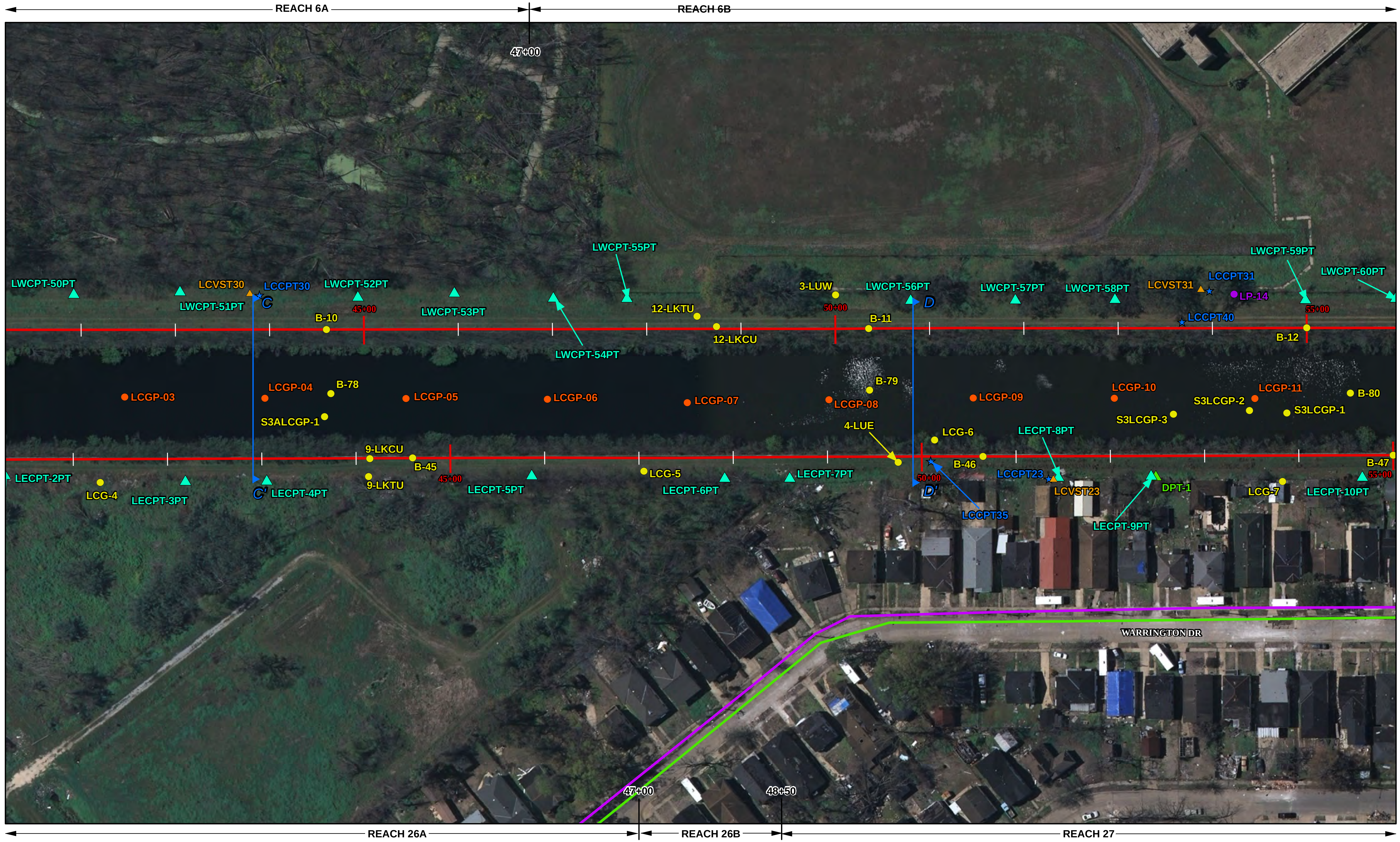


N

London Avenue Canal
Reach Locations

| | | |
|---|---|---|
| Sewer | Borings | CPT |
| Curb Drain | Existing Piezometer | Vane Shear |
| Cross Section | LCGB Canal Sample | 2010 DPT |
| | Slug Test Location | 2010 CPT |

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS August 2010




100 50 0 100 200
FT

N

London Avenue Canal
Reach Locations

| | | |
|---|---|---|
| Sewer | Borings | CPT |
| Curb Drain | Existing Piezometer | Vane Shear |
| Cross Section | LCGB Canal Sample | 2010 DPT |
| | Slug Test Location | 2010 CPT |

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

NEW ORLEANS
August 2010

PLATE 4


London Avenue Canal
Reach Locations

| | | |
|---|---|---|
| Sewer | Borings | CPT |
| Curb Drain | Existing Piezometer | Vane Shear |
| Cross Section | LCGB Canal Sample | 2010 DPT |
| | Slug Test Location | 2010 CPT |

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

NEW ORLEANS
August 2010

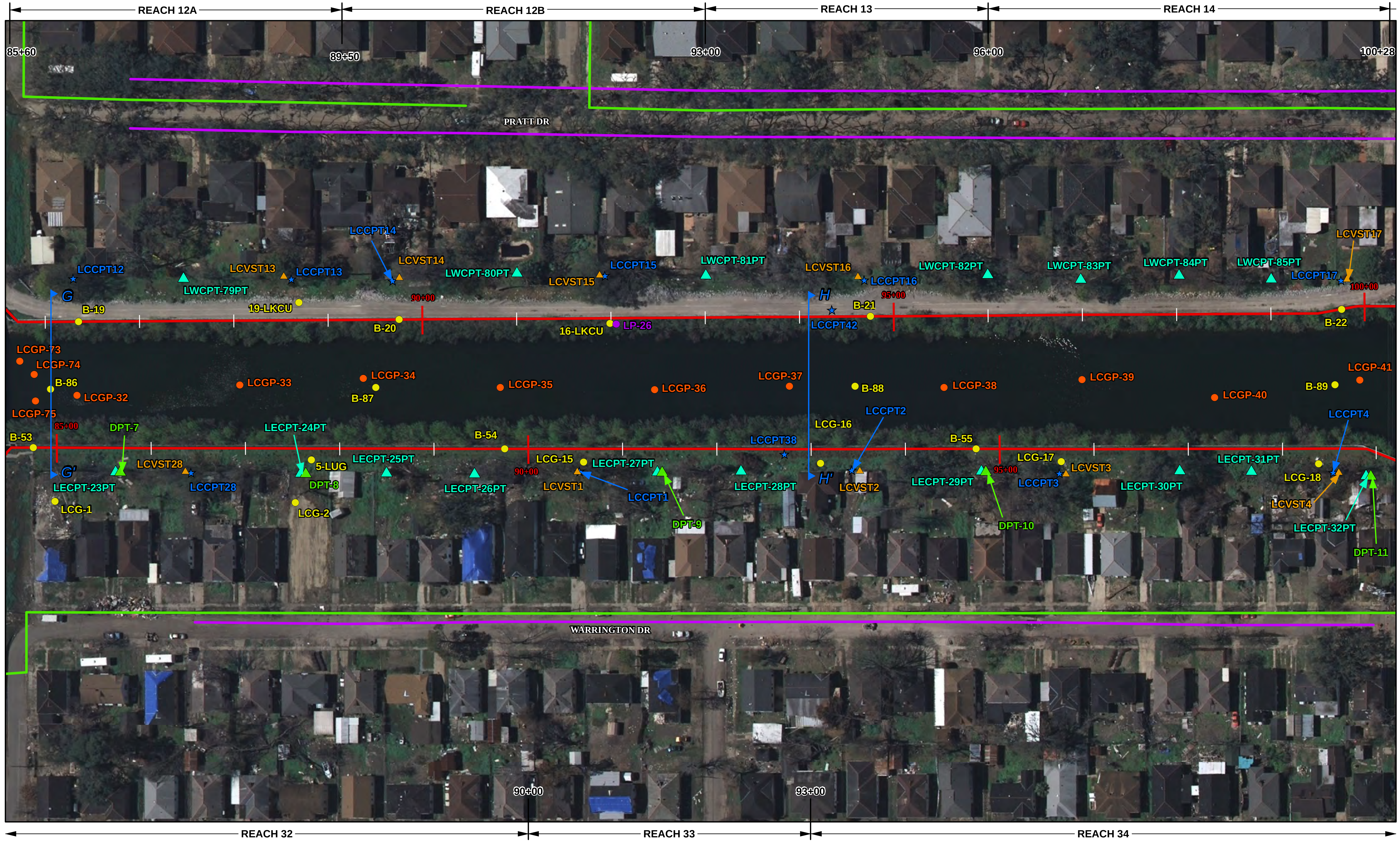

London Avenue Canal

Reach Locations

| | | |
|---|---|---|
| Sewer | Borings | CPT |
| Curb Drain | Existing Piezometer | Vane Shear |
| Cross Section | LCGB Canal Sample | 2010 DPT |
| | Slug Test Location | 2010 CPT |

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

NEW ORLEANS
August 2010




100 50 0 100 200 FT

N

**London Avenue Canal**

**Reach Locations**

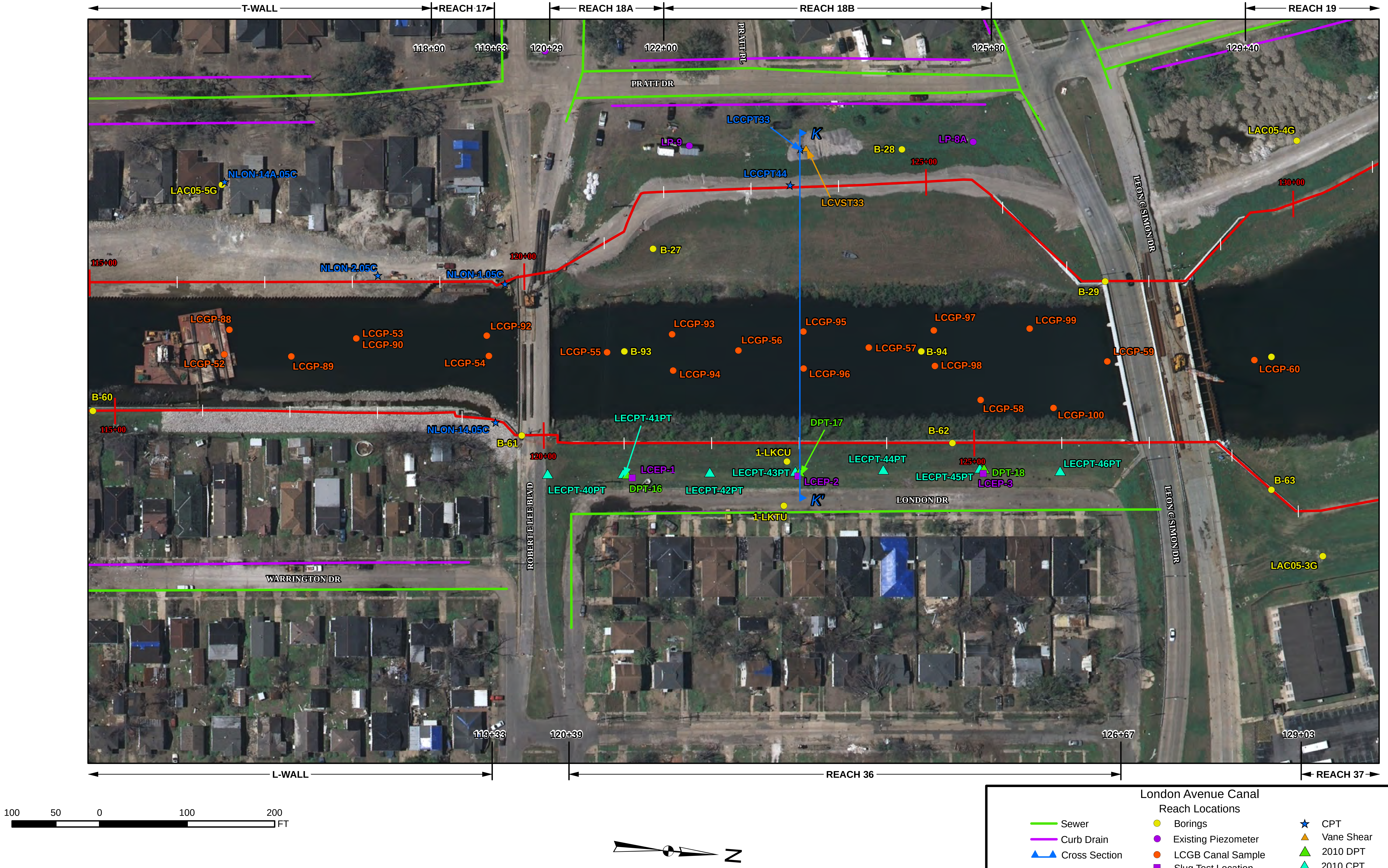
| | | |
|---|---|---|
| Sewer | Borings | CPT |
| Curb Drain | Existing Piezometer | Vane Shear |
| Cross Section | LCGB Canal Sample | 2010 DPT |
| | Slug Test Location | 2010 CPT |

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS — NEW ORLEANS

August 2010

REACH 15
REACH 16
T-WALL
104+00
112+50
PRATT DR
WARRINGTON DR
PRENTISS AVE
BURBANK DR
LCVST18
LCCPT18
B-23
LWCPT-86PT
LWCPT-87PT
LWCPT-88PT
LCWP-1
LCVST19
LCCPT19
LCWP-2
LWCPT-89PT
LWCPT-90PT
LWCPT-91PT
LCWP-3
LWCPT-92PT
LCCPT20
LCVST20
LCCPT43
LWCPT-93PT
LCWP-4
LCCPT21
LCVST21
LP-38
LP-37
NLON-10.05C
LAC05-6G
NLON-15.05C
LCVST22
LCCPT22
B-24
B-25
NLON-13.05C
NLON-12.05C
5-LUW
NLON-11.05C
B-26
S1LCGP-3
S1LCGP-2
LCGP-47
LKGSC-2
LCCPT39
LCGP-82
LCGP-83
LCGP-84
LCGP-43
LCGP-44
B-90
LCGP-45
LCGP-46
LCSLT-2U
LP-30
LCGP-48
LCGP-49
LCGP-50
B-92
B-91
S1LCGP-1
LCSLT-3U
S1ALCGP-1
LCSLT-1U
LC-3-07C
LCCPT9
B-56
B-57
B-58
LP-28
B-59
B-60
10-LUGA
LECPT-33PT
DPT-12
LECPT-34PT
LCG-19
LECPT-35PT
LECPT-36PT
LKGSC-1
LKGSC-3
LCVST9
LECPT-37PT
LECPT-38PT
LECPT-39PT
LCG-20
DPT-13
LCVST5
LCCPT5
LCVST6
LKGST-1
LCCPT6
LCSLT-6UT
LC-2-07C
LCCPT7
LCVST7
LC-5-07C
LC-4-07C
LP-35
LC-1-07C
LCCPT8
LCSLT-2UT
LKGST-2
LCVST8
LCSLT-5UT
LKGST-3
LCCPT10
LCVST10
DPT-14
DPT-15
10-LUG
100+00
105+00
110+00
115+00
99+53
102+42
103+50
114+66
REACH 34
PUMPING STATION #4
REACH 35A
REACH 35B
100 50 0 100 200
FT
N
London Avenue Canal
Reach Locations
Sewer
Curb Drain
Cross Section
Borings
Existing Piezometer
LCGB Canal Sample
Slug Test Location
CPT
Vane Shear
2010 DPT
2010 CPT
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NEW ORLEANS
March 2011


PLATE 8

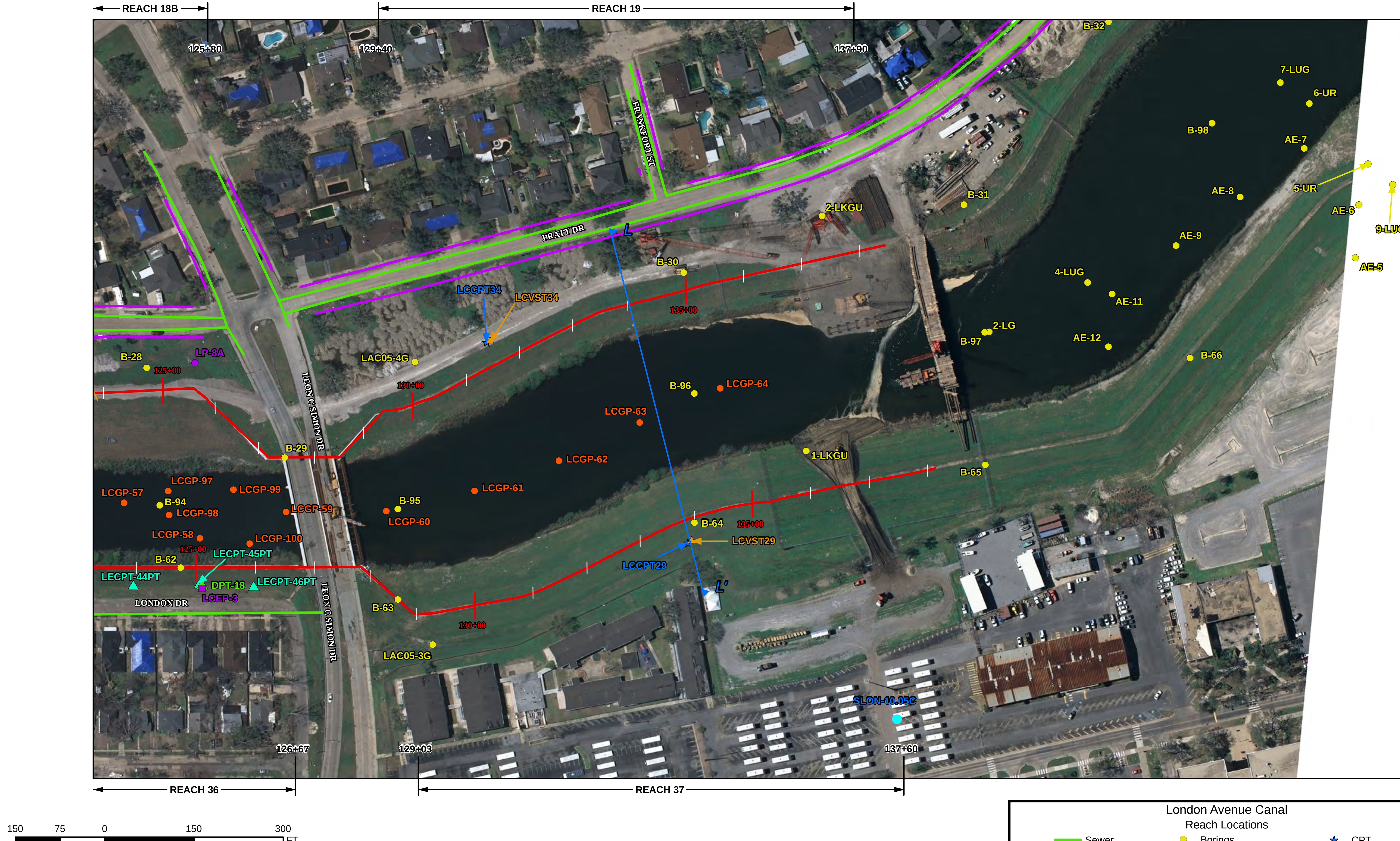



London Avenue Canal

Reach Locations

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

NEW ORLEANS
March 2011

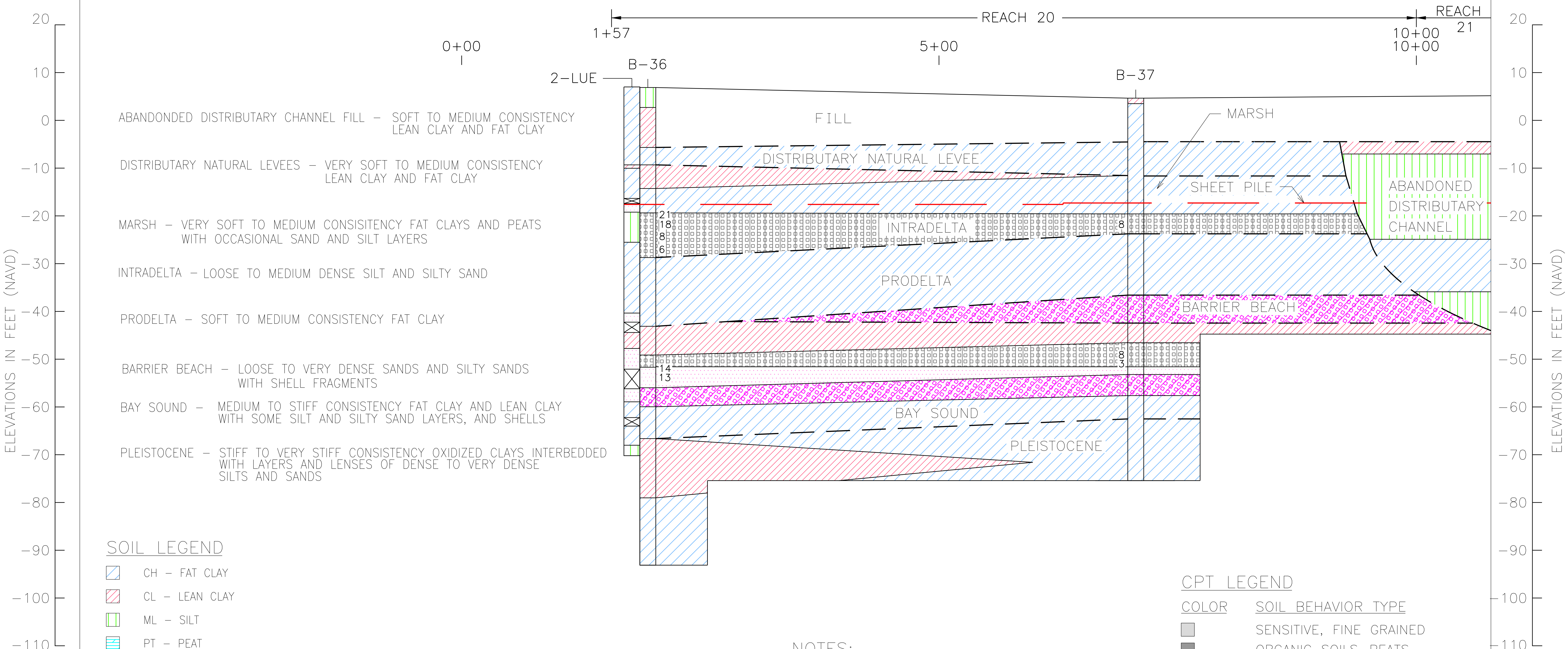



London Avenue Canal
Reach Locations

| | | |
|---|---|---|
| Sewer | Borings | CPT |
| Curb Drain | Existing Piezometer | Vane Shear |
| Cross Section | LCGB Canal Sample | 2010 DPT |
| | Slug Test Location | 2010 CPT |

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

NEW ORLEANS
December 2010




## SOIL LEGEND

- CH - FAT CLAY
- CL - LEAN CLAY
- ML - SILT
- PT - PEAT
- SC - CLAYEY SAND
- SM - SILTY SAND
- SP - SAND POORLY-GRADED
- WD - WOOD
- NO SAMPLE
- GP - GRAVEL POORLY-GRADED
- FILL - BRICK, SHELLS, ORGANICS, ETC - ARTIFICALLY PLACED

## NOTES:

1. VST RESULTS INDICATE Su IN psf.
2. FILL WAS IDENTIFIED BASED ON;
   a) FOR BORINGS, PREVIOUS PROFILES, AND/OR STIFF SOILS WITHOUT WOOD.
   b) FOR CPTS, RELATIVELY STIFF SOIL ZONES.
3. +50 SPT TESTS REACHED 50 IN LESS THAN 12 INCHES.

## CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| | SENSITIVE, FINE GRAINED |
| | ORGANIC SOILS-PEATS |
| | CLAY |
| | SILTY CLAY TO CLAY |
| | CLAYEY SILT TO SILTY CLAY |
| | SANDY SILT TO CLAYEY SILT |
| | SILTY SAND TO SANDY SILT |
| | SAND TO SILTY SAND |
| | SAND |
| | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

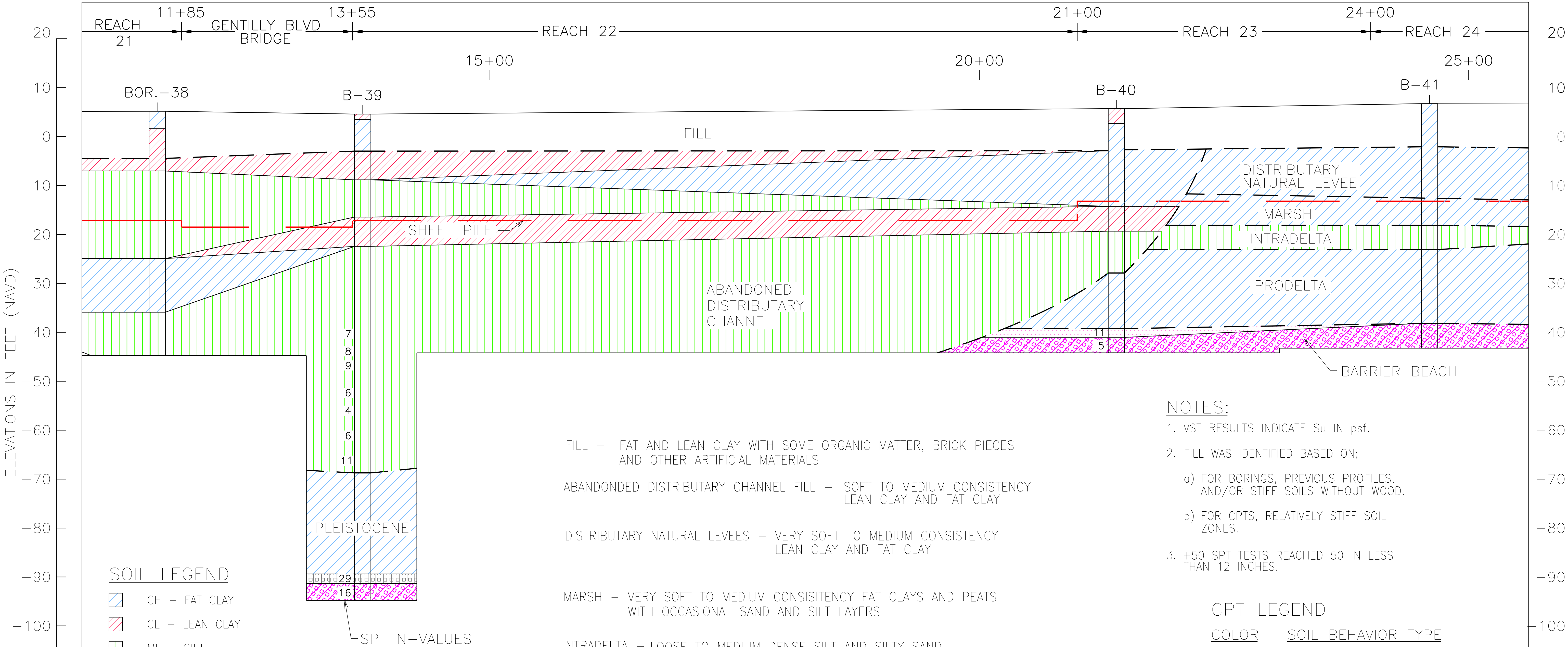
100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

# SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 11




## SOIL LEGEND

- CH – FAT CLAY
- CL – LEAN CLAY
- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

FILL – FAT AND LEAN CLAY WITH SOME ORGANIC MATTER, BRICK PIECES AND OTHER ARTIFICIAL MATERIALS

ABANDONDED DISTRIBUTARY CHANNEL FILL – SOFT TO MEDIUM CONSISTENCY LEAN CLAY AND FAT CLAY

DISTRIBUTARY NATURAL LEVEES – VERY SOFT TO MEDIUM CONSISTENCY LEAN CLAY AND FAT CLAY

MARSH – VERY SOFT TO MEDIUM CONSISITENCY FAT CLAYS AND PEATS WITH OCCASIONAL SAND AND SILT LAYERS

INTRADELTA – LOOSE TO MEDIUM DENSE SILT AND SILTY SAND

PRODELTA – SOFT TO MEDIUM CONSISTENCY FAT CLAY

BARRIER BEACH – LOOSE TO VERY DENSE SANDS AND SILTY SANDS WITH SHELL FRAGMENTS

BAY SOUND – MEDIUM TO STIFF CONSISTENCY FAT CLAY AND LEAN CLAY WITH SOME SILT AND SILTY SAND LAYERS, AND SHELLS

PLEISTOCENE – STIFF TO VERY STIFF CONSISTENCY OXIDIZED CLAYS INTERBEDDED WITH LAYERS AND LENSES OF DENSE TO VERY DENSE SILTS AND SANDS

## NOTES:

1. VST RESULTS INDICATE Su IN psf.
2. FILL WAS IDENTIFIED BASED ON;
   a) FOR BORINGS, PREVIOUS PROFILES, AND/OR STIFF SOILS WITHOUT WOOD.
   b) FOR CPTS, RELATIVELY STIFF SOIL ZONES.
3. +50 SPT TESTS REACHED 50 IN LESS THAN 12 INCHES.

## CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| light gray | SENSITIVE, FINE GRAINED |
| gray | ORGANIC SOILS–PEATS |
| dark red | CLAY |
| brown | SILTY CLAY TO CLAY |
| yellow | CLAYEY SILT TO SILTY CLAY |
| green | SANDY SILT TO CLAYEY SILT |
| blue | SILTY SAND TO SANDY SILT |
| light blue | SAND TO SILTY SAND |
| orange | SAND |
| red | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

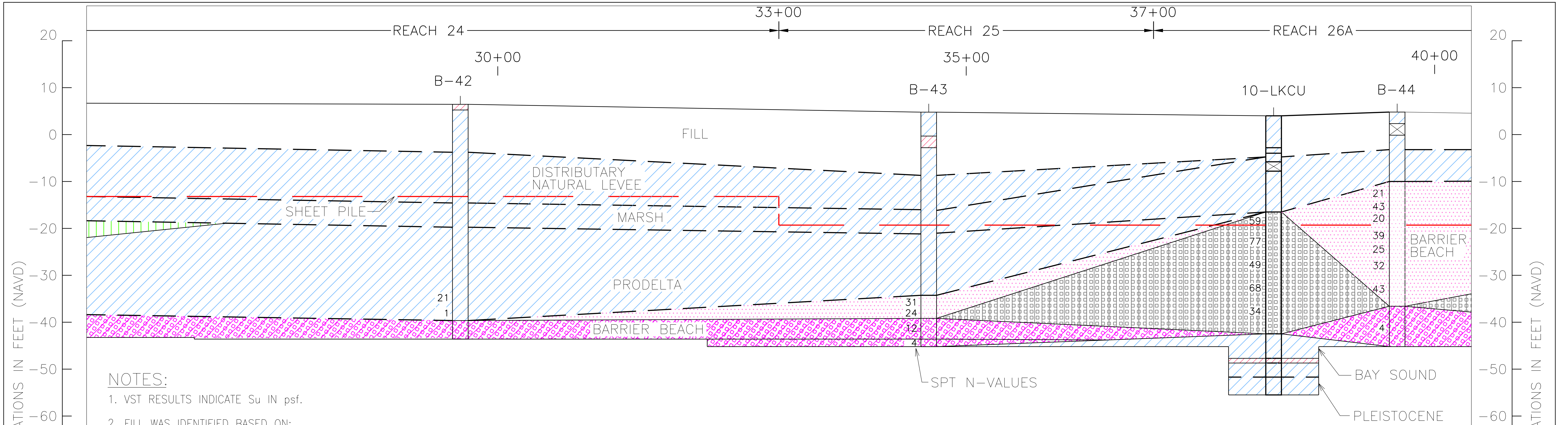
100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

# SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 12




NOTES:

1. VST RESULTS INDICATE Su IN psf.
2. FILL WAS IDENTIFIED BASED ON;
   a) FOR BORINGS, PREVIOUS PROFILES, AND/OR STIFF SOILS WITHOUT WOOD.
   b) FOR CPTS, RELATIVELY STIFF SOIL ZONES.
3. +50 SPT TESTS REACHED 50 IN LESS THAN 12 INCHES.

SOIL LEGEND

- CH – FAT CLAY
- CL – LEAN CLAY
- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

FILL – FAT AND LEAN CLAY WITH SOME ORGANIC MATTER, BRICK PIECES AND OTHER ARTIFICIAL MATERIALS

DISTRIBUTARY NATURAL LEVEES – VERY SOFT TO MEDIUM CONSISTENCY LEAN CLAY AND FAT CLAY

MARSH – VERY SOFT TO MEDIUM CONSISITENCY FAT CLAYS AND PEATS WITH OCCASIONAL SAND AND SILT LAYERS

PRODELTA – SOFT TO MEDIUM CONSISTENCY FAT CLAY

BARRIER BEACH – LOOSE TO VERY DENSE SANDS AND SILTY SANDS WITH SHELL FRAGMENTS

BAY SOUND – MEDIUM TO STIFF CONSISTENCY FAT CLAY AND LEAN CLAY WITH SOME SILT AND SILTY SAND LAYERS, AND SHELLS

PLEISTOCENE – STIFF TO VERY STIFF CONSISTENCY OXIDIZED CLAYS INTERBEDDED WITH LAYERS AND LENSES OF DENSE TO VERY DENSE SILTS AND SANDS

CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| | SENSITIVE, FINE GRAINED |
| | ORGANIC SOILS-PEATS |
| | CLAY |
| | SILTY CLAY TO CLAY |
| | CLAYEY SILT TO SILTY CLAY |
| | SANDY SILT TO CLAYEY SILT |
| | SILTY SAND TO SANDY SILT |
| | SAND TO SILTY SAND |
| | SAND |
| | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

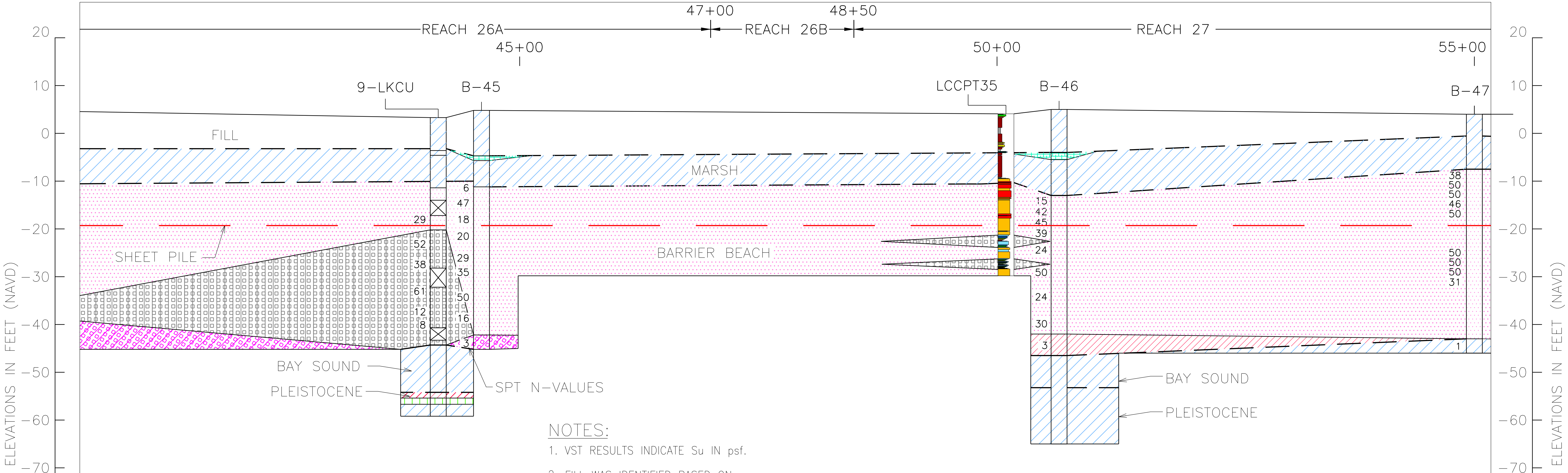
100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 13




## NOTES:

1. VST RESULTS INDICATE Su IN psf.
2. FILL WAS IDENTIFIED BASED ON;
   a) FOR BORINGS, PREVIOUS PROFILES, AND/OR STIFF SOILS WITHOUT WOOD.
   b) FOR CPTS, RELATIVELY STIFF SOIL ZONES.
3. +50 SPT TESTS REACHED 50 IN LESS THAN 12 INCHES.

FILL – FAT AND LEAN CLAY WITH SOME ORGANIC MATTER, BRICK PIECES AND OTHER ARTIFICIAL MATERIALS

MARSH – VERY SOFT TO MEDIUM CONSISTENCY FAT CLAYS AND PEATS WITH OCCASIONAL SAND AND SILT LAYERS

BARRIER BEACH – LOOSE TO VERY DENSE SANDS AND SILTY SANDS WITH SHELL FRAGMENTS

BAY SOUND – MEDIUM TO STIFF CONSISTENCY FAT CLAY AND LEAN CLAY WITH SOME SILT AND SILTY SAND LAYERS, AND SHELLS

PLEISTOCENE – STIFF TO VERY STIFF CONSISTENCY OXIDIZED CLAYS INTERBEDDED WITH LAYERS AND LENSES OF DENSE TO VERY DENSE SILTS AND SANDS

## SOIL LEGEND

- CH – FAT CLAY
- CL – LEAN CLAY
- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

## CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| (light gray) | SENSITIVE, FINE GRAINED |
| (gray) | ORGANIC SOILS–PEATS |
| (dark red) | CLAY |
| (brown) | SILTY CLAY TO CLAY |
| (yellow) | CLAYEY SILT TO SILTY CLAY |
| (green) | SANDY SILT TO CLAYEY SILT |
| (dark blue) | SILTY SAND TO SANDY SILT |
| (light blue) | SAND TO SILTY SAND |
| (orange) | SAND |
| (red) | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

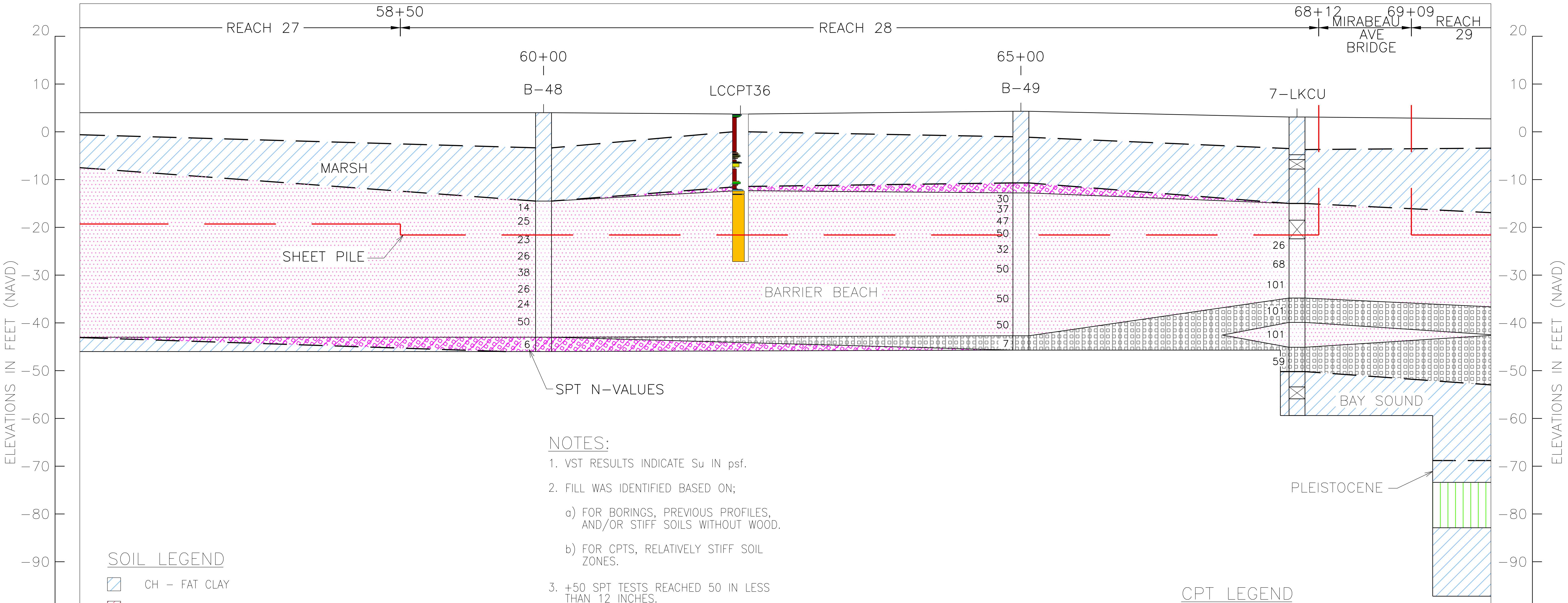
100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

# SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 14




## NOTES:

1. VST RESULTS INDICATE Su IN psf.
2. FILL WAS IDENTIFIED BASED ON;
   a) FOR BORINGS, PREVIOUS PROFILES, AND/OR STIFF SOILS WITHOUT WOOD.
   b) FOR CPTS, RELATIVELY STIFF SOIL ZONES.
3. +50 SPT TESTS REACHED 50 IN LESS THAN 12 INCHES.

FILL – FAT AND LEAN CLAY WITH SOME ORGANIC MATTER, BRICK PIECES AND OTHER ARTIFICIAL MATERIALS

MARSH – VERY SOFT TO MEDIUM CONSISITENCY FAT CLAYS AND PEATS WITH OCCASIONAL SAND AND SILT LAYERS

BARRIER BEACH – LOOSE TO VERY DENSE SANDS AND SILTY SANDS WITH SHELL FRAGMENTS

BAY SOUND – MEDIUM TO STIFF CONSISTENCY FAT CLAY AND LEAN CLAY WITH SOME SILT AND SILTY SAND LAYERS, AND SHELLS

PLEISTOCENE – STIFF TO VERY STIFF CONSISTENCY OXIDIZED CLAYS INTERBEDDED WITH LAYERS AND LENSES OF DENSE TO VERY DENSE SILTS AND SANDS

## SOIL LEGEND

- CH – FAT CLAY
- CL – LEAN CLAY
- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

## CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| Light grey | SENSITIVE, FINE GRAINED |
| Grey | ORGANIC SOILS–PEATS |
| Dark red | CLAY |
| Brown | SILTY CLAY TO CLAY |
| Yellow | CLAYEY SILT TO SILTY CLAY |
| Green | SANDY SILT TO CLAYEY SILT |
| Dark blue | SILTY SAND TO SANDY SILT |
| Light blue | SAND TO SILTY SAND |
| Orange | SAND |
| Red | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

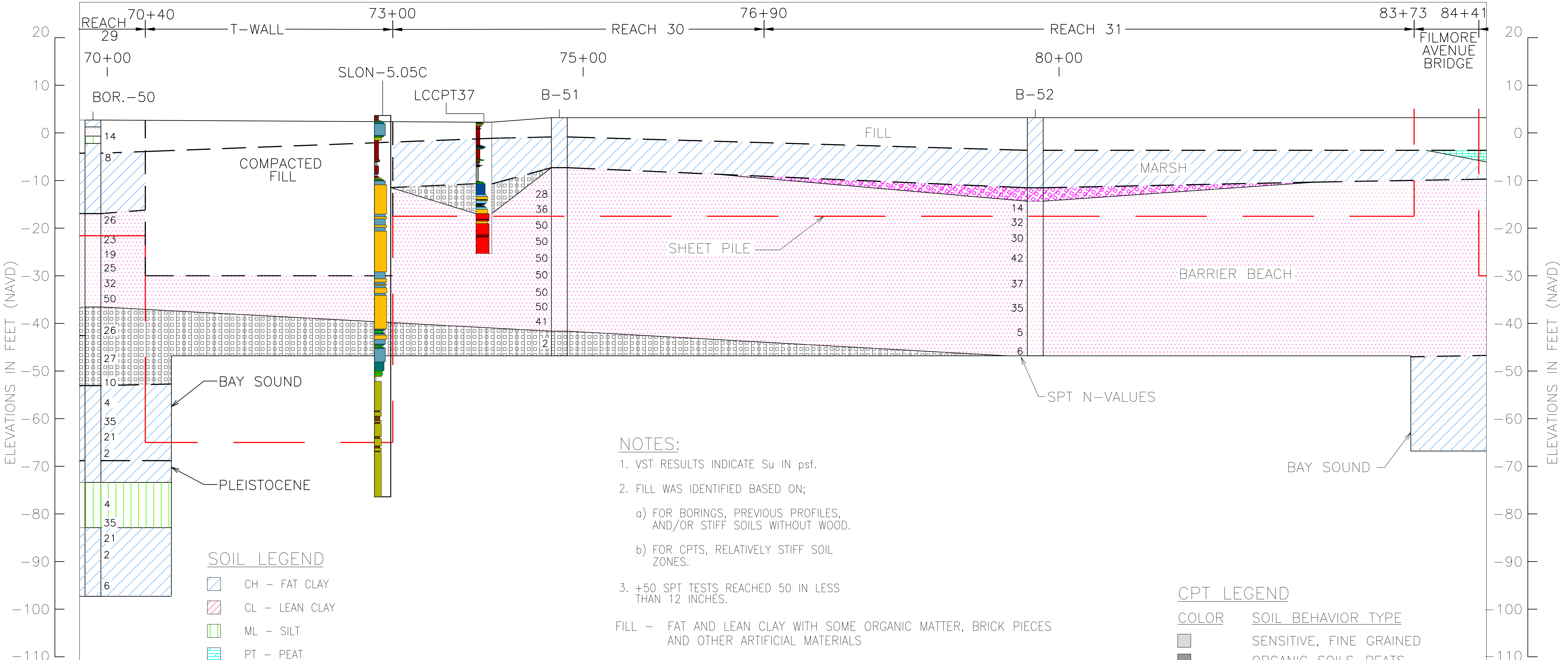
100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

# SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 15




## NOTES:

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PLEISTOCENE – STIFF TO VERY STIFF CONSISTENCY OXIDIZED CLAYS INTERBEDDED WITH LAYERS AND LENSES OF DENSE TO VERY DENSE SILTS AND SANDS

## SOIL LEGEND

- CH – FAT CLAY
- CL – LEAN CLAY
- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

## CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| light grey | SENSITIVE, FINE GRAINED |
| grey | ORGANIC SOILS-PEATS |
| dark red | CLAY |
| brown | SILTY CLAY TO CLAY |
| yellow-olive | CLAYEY SILT TO SILTY CLAY |
| green | SANDY SILT TO CLAYEY SILT |
| blue | SILTY SAND TO SANDY SILT |
| light blue | SAND TO SILTY SAND |
| orange | SAND |
| red | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

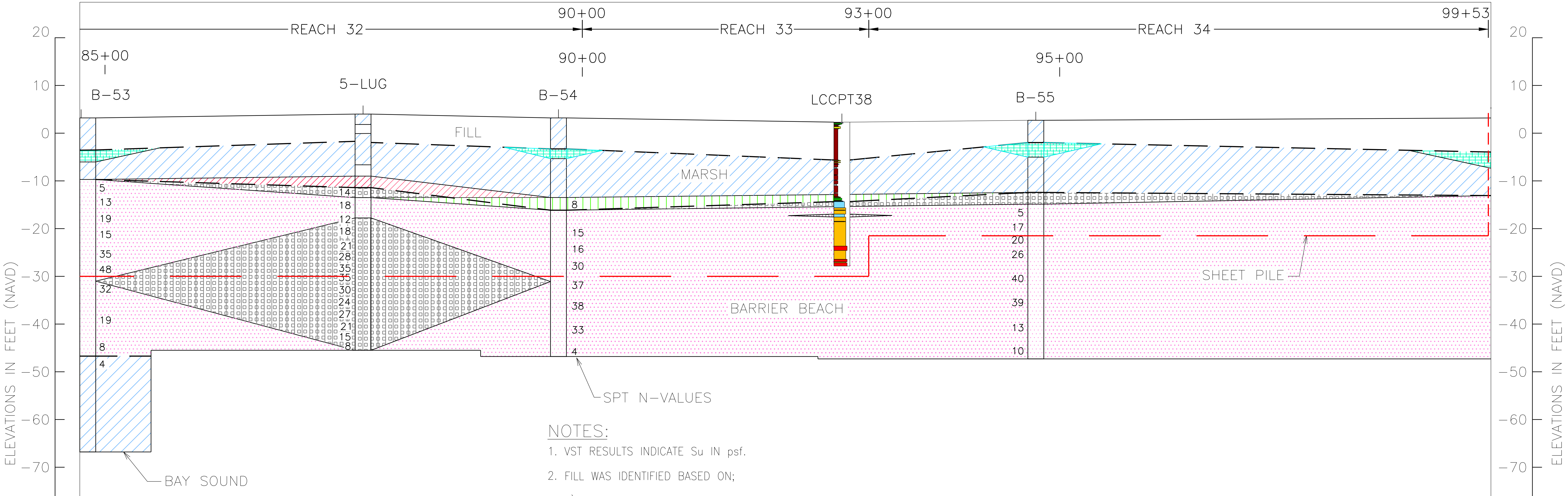
100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

# SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 16




NOTES:

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BARRIER BEACH – LOOSE TO VERY DENSE SANDS AND SILTY SANDS WITH SHELL FRAGMENTS

BAY SOUND – MEDIUM TO STIFF CONSISTENCY FAT CLAY AND LEAN CLAY WITH SOME SILT AND SILTY SAND LAYERS, AND SHELLS

PLEISTOCENE – STIFF TO VERY STIFF CONSISTENCY OXIDIZED CLAYS INTERBEDDED WITH LAYERS AND LENSES OF DENSE TO VERY DENSE SILTS AND SANDS

SOIL LEGEND

- CH – FAT CLAY
- CL – LEAN CLAY
- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| Light gray | SENSITIVE, FINE GRAINED |
| Gray | ORGANIC SOILS–PEATS |
| Dark red | CLAY |
| Brown | SILTY CLAY TO CLAY |
| Yellow | CLAYEY SILT TO SILTY CLAY |
| Green | SANDY SILT TO CLAYEY SILT |
| Dark blue | SILTY SAND TO SANDY SILT |
| Light blue | SAND TO SILTY SAND |
| Orange | SAND |
| Red | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

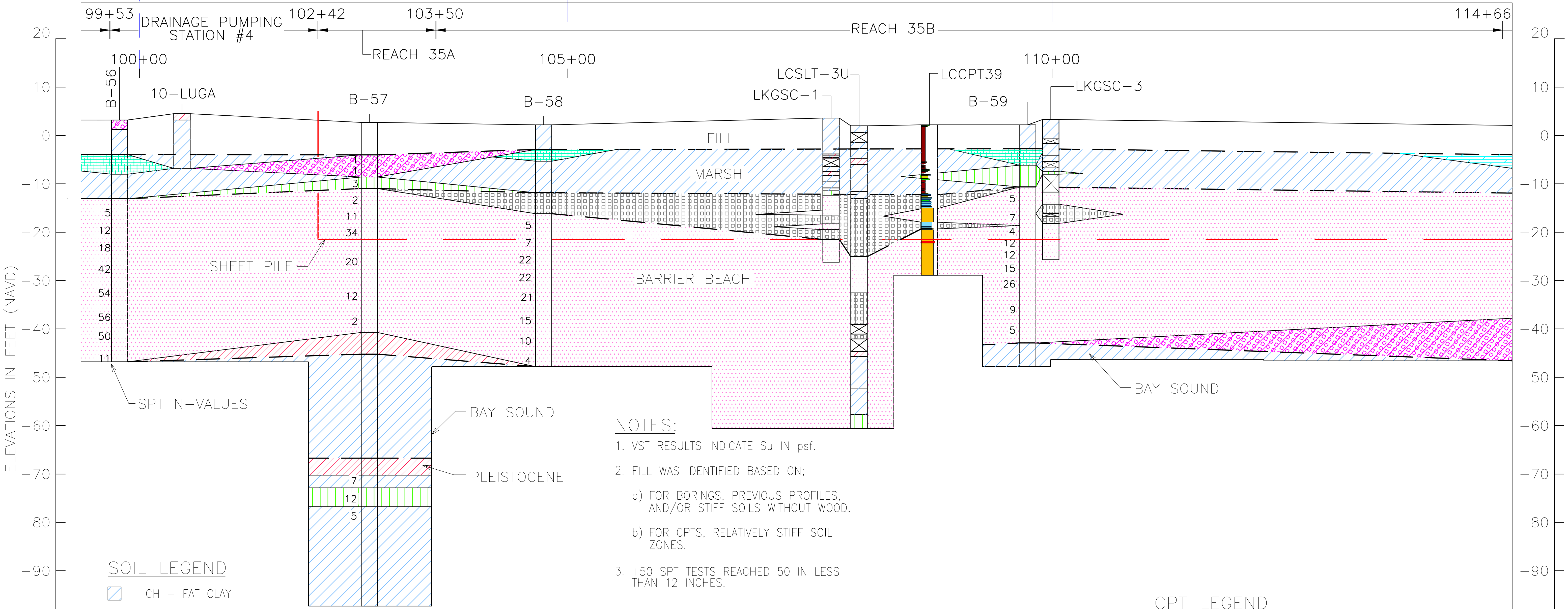
100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 17

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## SOIL LEGEND

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- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

## CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| light gray | SENSITIVE, FINE GRAINED |
| gray | ORGANIC SOILS–PEATS |
| dark red | CLAY |
| brown | SILTY CLAY TO CLAY |
| yellow | CLAYEY SILT TO SILTY CLAY |
| green | SANDY SILT TO CLAYEY SILT |
| blue | SILTY SAND TO SANDY SILT |
| light blue | SAND TO SILTY SAND |
| orange | SAND |
| red | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
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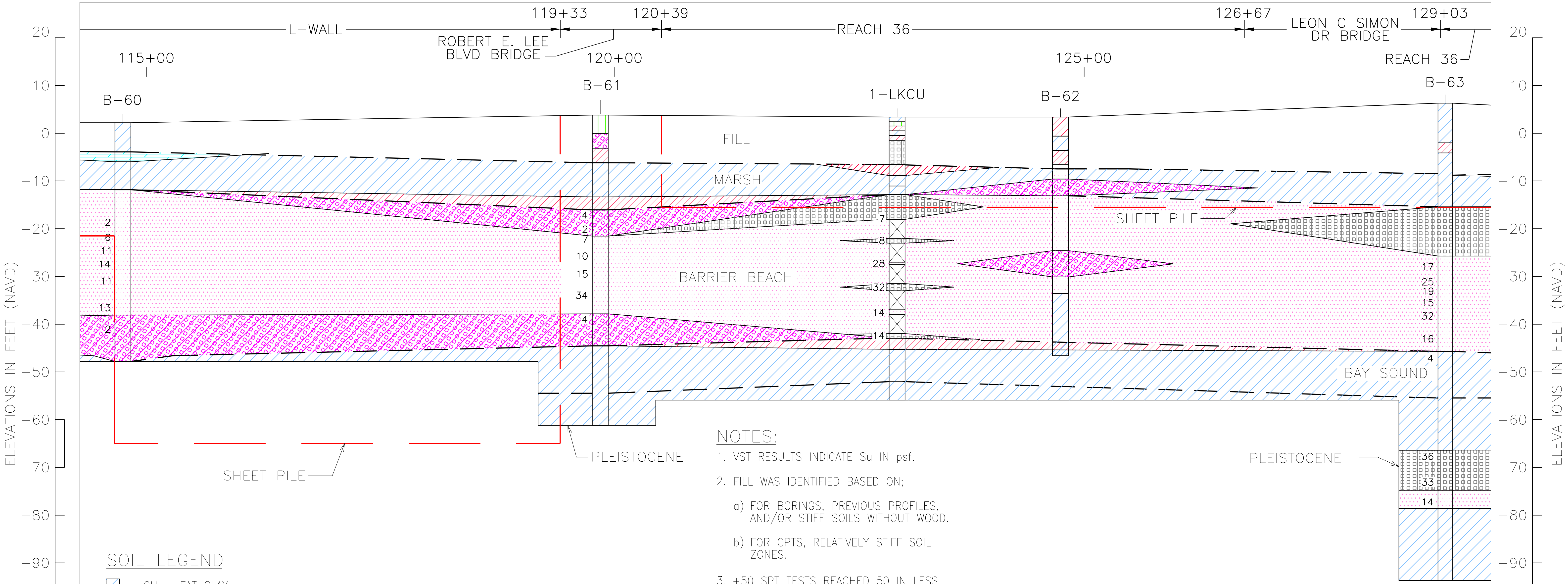
# SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 18

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- ML – SILT
- PT – PEAT
- SC – CLAYEY SAND
- SM – SILTY SAND
- SP – SAND POORLY-GRADED
- WD – WOOD
- NO SAMPLE
- GP – GRAVEL POORLY-GRADED
- FILL – BRICK, SHELLS, ORGANICS, ETC – ARTIFICALLY PLACED

## CPT LEGEND

| COLOR | SOIL BEHAVIOR TYPE |
|---|---|
| | SENSITIVE, FINE GRAINED |
| | ORGANIC SOILS-PEATS |
| | CLAY |
| | SILTY CLAY TO CLAY |
| | CLAYEY SILT TO SILTY CLAY |
| | SANDY SILT TO CLAYEY SILT |
| | SILTY SAND TO SANDY SILT |
| | SAND TO SILTY SAND |
| | SAND |
| | GRAVELLY SAND TO SAND |

HORIZONTAL SCALE IN FEET

100 50 0 100 200 FT

LAKE PONTCHARTRAIN AND VICINITY
LONDON AVENUE OUTFALL CANAL
EASTBANK ℄

# SOIL AND GEOLOGIC PROFILE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
NEW ORLEANS, LOUISIANA

PLOT SCALE: 1 : 1
DATE: 11-06-09
FILE NO.
PLATE 19