Geotechnical Engineering Study
Ash Water Transport and Equalization Ponds
San Miguel Electric Cooperative Power Plant
Atascosa County, Texas

Arias Job No. 2016-581

ARIAS GEOPROFESSIONALS

Prepared For

San Miguel Electric Cooperative, Inc.

October 11, 2016

ARIAS GEOPROFESSIONALS

142 Chula Vista, San Antonio, Texas 78232 • Phone: (210) 308-5884 • Fax: (210) 308-5886

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Arias Job No. 2016-581

Ms. Mari Willis
San Miguel Electric Cooperative, Inc.
P.O. Box 280
Jourdanton, TX 78026

RE: Geotechnical Engineering Study
Ash Water Transport and Equalization Ponds
San Miguel Electric Cooperative Power Plant
Atascosa County, Texas

Dear Ms. Willis:

The results of a Geotechnical Engineering Study for the existing Ash Water Transport and Equalization Ponds at the San Miguel Electric Cooperative Power Plant near Christine, Texas are presented in this report. This project was authorized via SMECI's Purchase Order 179706-168326, dated August 26, 2016, and the work was performed in general accordance with Arias' Proposal 2016-581, which was included as part of that purchase order noted above.

The purpose of this geotechnical engineering study was to perform the safety factor assessment for embankment slopes of impoundments required to be performed by the owners/operators as noted in Coal Combustion Residuals (CCR) Rule 40 CFR 257.73(f)(2)(i). Arias' work scope included: (1) making a site visit to observe the condition of the crests and downstream slopes of the Ash Water Transport and Equalization Ponds, and (2) performing global stability calculations to assess the present stability of the embankments.

Thank you for the opportunity to be of service to you.

Sincerely,
ARIAS & ASSOCIATES, INC.
TBPE Registration No: F-32

STATE OF TEXAS
TIMOTHY J. FOX
50177
LICENSED
PROFESSIONAL ENGINEER

10-11-16

Timothy J. Fox, P.E.
Senior Geotechnical Engineer

Spencer A. Higgs, P.E.
Director of Engineering

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INTRODUCTION AND PROJECT INFORMATION

The report presented herein is for geotechnical engineering services for the existing Coal Combustion Residuals (CCR) Surface Impoundments at the San Miguel Electric Cooperative, Inc. (SMECI) Power Plant in Atascosa County, Texas. This project was authorized via SMECI's Purchase Order 179706-168326, dated August 26, 2016, and the work was performed in general accordance with Arias' Proposal 2016-581, which was included as part of that purchase order.

Arias performed stability analyses for the CCR Surface Impoundments in 2012, and submitted the results of our analyses in a Geotechnical Report, Arias Job No. 2012-695, dated October 22, 2012. The CCR Surface Impoundments specifically included the Ash Water Transport and Equalization Ponds referenced in the aforementioned 2012 Geotechnical Report. The Geotechnical Report was performed to determine global stability safety factors at select embankment cross-sections for the impoundments. The calculated factors of safety presented in the 2012 Geotechnical Report met the minimum criteria presented in CCR Rule 40 CFR 257.73 (e)(1)(i) through (iv).

However, as noted in CCR Rule 40 CFR 257.73(f)(2)(i), the owners/operators must complete initial hazard potential classification, structural stability, and safety factor assessments no earlier than 42 months prior to October 17, 2016, i.e. no earlier than April 17, 2013. Since our Geotechnical Report was issued prior to April 17, 2013, we understand that an Update to our Geotechnical Report is needed. Our scope of services for the Update is described subsequently.

SCOPE OF SERVICES

The scope of services for the Update to our 2012 Geotechnical Report includes:

1. Performing a review of our prior stability analyses included in our 2012 Geotechnical Report, and a cursory review of the CCR Impoundment Inspection Report, dated January 16, 2016, prepared by HDR;
2. Having an Arias' Licensed Texas Professional Engineer (LTPE) perform a site reconnaissance to compare existing surface conditions to those documented/photographed in our 2012 Geotechnical Report; and,
3. Issuing an electronic copy of a formal engineering report prepared by a LTPE that will include:
    - Description of our observations (including photographs taken) from our site reconnaissance, and

- Conclusions based on both our site reconnaissance and review of the referenced documents and prior stability analyses to determine whether the results of our prior stability analysis presented in our 2012 Geotechnical remain applicable.

Environmental studies were not a part of our scope of services. Additionally, it was beyond our authorized service scope to provide excavation plans, temporary shoring and/or geotechnical/structural designs of bracing systems; these should be the responsibility of the Contractor.

PROJECT DESCRIPTION AND SITE DESCRIPTION

The Ash Water Transport and Equalization Ponds are located at the SMECI Power Plant in Atascosa County near Christine, Texas as depicted on the Site Vicinity Map provided in Appendix A. The Ash Water Transport Pond has a splitter dike running west to east across the central portion of the pond that divides the northern portion (Ash Water Transport Pond A) from the southern portion (Ash Water Transport Pond B). Hereinafter, when we refer to the Ash Water Transport Pond it is inclusive of Ponds A and B unless otherwise stated.

Representative site photographs of the existing impoundments and embankments of the Ash Water Transport Pond and Equalization Pond are provided in Appendices B and C of this report, respectively. SMECI provided design plans for the ponds, cross sections of the ponds from a recent survey, and groundwater level measurements taken from nearby monitor wells, which are included in Appendix E.

We understand that portions of the ponds were constructed by cutting into existing grades while other portions were constructed as fill slopes using the existing cut materials. The maximum embankment heights range from 25 feet for the Equalization Pond to 28 feet for the Ash Water Transport Pond. Arias was provided with the available original geotechnical information in the pond areas, available documentation on the embankment construction, and groundwater level data from monitor wells around the ponds including a Potentiometric Surface Map, dated August 16, 2016, prepared by Environmental Resources Management (ERM).

PREVIOUS ARIAS GEOTECHNICAL STUDY AT THE SITE

As previously noted, Arias performed a geotechnical study of the Ash Water Transport and Equalization Ponds and the results of that study were presented in a report, Arias Job No. 2012-695, dated November 19, 2012, to Mr. Joseph Eutizi with SMECI. The 2012 geotechnical study included the following work scope:

- Seventeen (17) soil borings were drilled through the crests and/or in the vicinity of the toe of the downstream embankment slopes of the Ash Water Transport and Equalization Ponds.

- Laboratory testing was performed on the soil samples collected from the soil borings noted above.

- Seepage analyses were first performed for representative cross sections at the ponds to develop groundwater conditions used in the subsequent global stability analyses performed for the downstream slopes.

- The field and laboratory data collected, and the results of the global stability analyses, were presented in the above noted report.

At the time of Arias' 2012 geotechnical study, it was our understanding that the Ash Water Transport Pond experienced some seepage issues in the 1980's and was subsequently reconstructed. Since that reconstruction, SMECI indicated to Arias in 2012 that the pond had been performing adequately with only a minor seepage issue apparent near the northwest corner of Ash Water Transport Pond A. This minor seepage area was modeled by Arias (in the 2012 study) as Section A-A in the stability analysis.

SUBSURFACE CONDITIONS

The geology, generalized stratigraphy, and groundwater conditions at the project site described in Arias' 2012 geotechnical report are given herein for reference. It should be noted that the subsurface and groundwater conditions are based on conditions encountered in the borings drilled between September 19 and 26, 2012.

Geology

The earth materials underlying the project site have been regionally mapped as the undivided Manning, Wellborn and Caddell Formations (Emwc) of the Eocene Epoch of the Tertiary Period of the Geologic Time Scale. A Geologic Map of site vicinity is included in Appendix A. No faults are known to cross through the project area.

Locally, the materials encountered in the test borings consist primarily of man-made fill soils, natural surface and alluvial soils and the much older Eocene deposits. The man-made fill soils were encountered in all of the embankment borings and two of the toe of slope borings and varied from approximately 4 to 28 feet in thickness. The fill soils are comprised of clays, sandy clays, gravelly clays with some lignite material and sand pockets and are generally in a stiff to hard condition. The fill also contained gypsum material and had a distinct multicolored mottling.

The upper native soils consisted of approximately 3 to 18 feet of clays, sandy clays with a stiff to hard consistency and fine sands in a medium dense condition. The underlying Eocene deposits are comprised of very stiff to hard clays and sandy clays, and very dense clayey sands, silty sands, sandy silts. Due to weathering and lack of cementation within these materials, from a geotechnical perspective, they should be considered as having soil-like characteristics. However, this formation can have siltstone, sandstone, and lignite seams and deposits of greater extent.

Site Stratigraphy and Engineering Properties

The generalized subsurface stratigraphy and summary of select field and laboratory test data based on Arias' previous 17 borings drilled at this site is summarized in Table 1 given subsequently. We have included the Boring Location Plan, Soil Boring Logs, and Key Terms for Classification in Appendix D of this report for reference.

Table 1: Generalized Soil Conditions

Stratum	Depth (feet)	Material Type	PI range	No. 200 range	Pocket Pen. (tsf)	N range
I	0 to (3 - 28)	**FILL:** Brown to Dark Brown and Gray to Dark Gray, **Fat CLAY (CH)**, **Fat CLAY (CH) with Sand**, **Lean CLAY (CL)**, **Lean CLAY (CL) with Sand**, **Gravelly Fat CLAY (CH)**, stiff to hard	23 - 59	-	1.25 - 9.0	13 - 29
II	(0 - 28) to (12 - 52)	Brown to Dark Brown and Gray, **Clayey SAND (SC)**, **Fat CLAY (CH)**, **Sandy Fat CLAY (CH)**, **Sandy Lean CLAY (CL)**, **Lean CLAY (CL)**, **Lean CLAY (CL) with Sand**, stiff to hard and medium dense to very dense, some of these soils are Eocene Age deposits	12 - 92	13 to 52	0.75 - 5.75	9 - 100^{+}
III	Below (0 - 52)	Gray and Brown, **Silty SAND (SM)**, **Sandy SILT (ML)**, **Sandy Fat CLAY (CH)**, **Sandy Lean CLAY (CL)**, **Clayey SAND (SC)**, **Fat CLAY (CH)**, very stiff to hard and loose to very dense, some alluvial soils but mostly Eocene Age deposits	1 - 66	13 to 56	-	8 - 100^{+}

Where: Depth - Depth from existing ground surface at the time of geotechnical study, feet
PI - Plasticity Index, %
No. 200 - Percent passing #200 sieve, %
Pocket Pen - Pocket Penetrometer reading (tons/ft^2)
N - Standard Penetration Test (SPT) value, blows per foot

Groundwater

A dry soil sampling method was used to obtain the soil samples at the 17 borings. Groundwater was observed within the soil borings during the soil sampling activities. Each boring was then left open for a minimum of 24 hours in order to obtain a delayed groundwater reading. The delayed groundwater levels were encountered as shallow as 1.8 feet below ground surface in the location of the toe of the embankments and as deep as 37.5 feet below ground surface in the location of the crest of the embankments. Groundwater levels should be expected to change over time in response to climatic conditions and to the amount of water impounded in the Ash Water Transport Pond and Equalization Ponds.

SITE RECONNAISSANCE

Arias performed a cursory review of HDR's CCR Impoundment Inspection Report, dated January 16, 2016, which was provided by SMECI. Arias performed a site reconnaissance on September 7, 2016, to observe conditions at the crest, downstream slopes, and areas beyond of the Ash Water Transport and Equalization Ponds. Since pond water levels were near or at the crests, it was not feasible to observe the condition of the upstream slopes of both ponds or the splitter dike crest and slopes in the Water Transport Pond. Based on our site reconnaissance, we have summarized the conditions of concern and recommended remedial action subsequently in the Tables 2 and 3 for the Ash Water Transport Pond and Equalization Pond, respectively. The photos noted in these tables are included in Appendix B.

Table 2: Ash Water Transport Pond – Conditions Requiring Remedial Action

Area	General Condition	Remedial Action Required
Crest	1. Localized rutting at various locations; and, 2. Because of existing grades less than the maximum surcharge level of Elevation 316.0 feet, temporary berms/dikes placed along upstream side of crest to prevent overtopping. **(See Photo 7 as example)**	1. Remove surficial base material. 2. Proof-roll to locate soft areas and undercut soft areas as necessary. 3. Place non-dispersive fill in undercut areas and to achieve design grades with clay meeting liner material, placement, and compaction requirements. Place base material above top grade for a more all-weather riding surface for vehicular traffic. Continue pumping water from the pond to lower the pool level.
Localized area in northern part of west downstream slope in area of Cross Section 1	1. An observed cut (i.e. steepened condition) in the existing bottom portion of slope; and, 2. Groundwater seepage and cattails growing in the cut. **(See Photos 2 to 4)**	1. Remove stumps and perform proper benching and keying into the existing slope and below the slope toe as required to remove softened soil. 2. Construct toe drain on cut subgrade resulting from Item 1 that flattens the slope to a 3.5H:1V: (a) place geotextile filter fabric on cut subgrade resulting from Item 1, (b) place and compact clean crushed limestone - as tested and approved by Geotechnical Engineer - to serve as a toe drain, (c) wrap geotextile fabric over crushed limestone, and (d) place minimum of 4 inches of topsoil over filter fabric and establish vegetation.
Localized area in southern part of west downstream slope in area of Cross Section 2	1. Excess fill placed on slope resulting in overly steep slope. **(See Photo 5)**	1. Cut off steep portion of slope near SW corner and regrade slope.
Various slopes	1. Erosion rills and surface irregularities present and vegetation not established. **(See Photo 1 as example)**	1. Fill in erosion rills, low spots and any holes - regrade and reestablish vegetation. Use non-dispersive soils as fill.
Various slopes	1. Plants are growing into bushes and grass is tall. **(See Photos 1 to 13 as examples)**	1. Cut grass and remove small bushes, and fill any holes (existing or resulting from bush removal).

Notes:

1. It was not feasible to observe the condition of the upstream slopes of the Ash Water Transport Pond nor the crest and slopes of the Splitter Dike due to the high water level in the pond.
2. Photos for the Ash Water Transport Pond are included in Appendix B.

Table 3: Equalization Pond – Conditions Requiring Remedial Action

Area	General Condition	Remedial Action Required
Crest	1. Localized rutting at various locations; and, 2. Grades less than the maximum surcharge level of Elevation 296.0 feet, temporary berms/dikes placed along upstream side of crest to prevent overtopping. **(See Photos 16 to 19 as examples)**	1. Remove surficial base material. 2. Proof-roll to locate soft areas and undercut soft areas as necessary. 3. Place non-dispersive fill in undercut areas and to achieve design grades with clay meeting liner material, placement, and compaction requirements. 4. Place base material above top grade for a more all-weather riding surface for vehicular traffic.
Various slopes	1. Plants are growing into bushes and grass is long. **(See Photos 14 to 22 as examples)**	1. Cut grass and remove small bushes, and fill any holes (existing or resulting from bush removal).

Notes:

1. It was not feasible to observe the condition of the upstream slopes due to the high water level in the pond.
2. Photos for the Equalization Pond are included in Appendix C.

SEEPAGE ANALYSES

For the purpose of the global stability analyses performed herein, it was first necessary to perform steady state seepage analyses to estimate the seepage conditions and phreatic surface within and through the embankments. These finite element seepage analyses were performed using the computer program SLIDE Version 7.0 by Rocscience. Input into the program included the parameters and boundary conditions presented subsequently:

- Permeability - Arias estimated the permeability for each soil material based on our experience with soils similar to those encountered in Arias' borings.
- Ash Water Transport Pond Design Water Levels - Maximum Storage Pool (i.e. normal operating condition) and Maximum Surcharge Level (i.e. crest level) are at Elevations 316.0 and 314.5 feet, as provided to Arias by SMECI. The presence of the water detention pond located west of the Ash Water Transport Pond was included in the analyses at Section 1B. SMECI recently surveyed the water level at Elevation 298.5 feet. This water level was used in the seepage analysis for the Maximum Storage Pool condition. The water level was assumed at Elevation 303.0 feet (i.e. top of bank) for the Maximum Surcharge Pool analysis.
- Equalization Pond Design Water Levels - Maximum Storage Pool and Maximum Surcharge (Pool) Level are at Elevations 294 and 296 feet, respectively, also provided to Arias by SMECI.
- Groundwater Levels - SMECI provided to Arias the most recent groundwater level measurements in the monitor wells that surround the two ponds and the interpretation of the groundwater conditions by ERM in the documents noted subsequently and provided in Appendix E.

- o Table 1 - Groundwater Elevation Measurements on May 24 and August 16, 2016.
- o Figure 1 - Potentiometric Surface Map for August 16, 2016.

The water levels in both ponds were within inches of the crests due to the substantial recent rainfalls. SMECI provided cross sections at locations selected by Arias that corresponded to sections where Arias performed seepage and global stability analyses as part of the 2012 study. The cross section locations are provided in Appendix A, and the original design embankment cross sections are provided in Appendix E.

The crest for the Ash Water Transport Pond ranged from Elevations 315.0 to 315.75 feet at the cross sections (i.e. 1B, 3, 8, and 9A) analyzed as given subsequently in Table 4. Accordingly, the water level was assumed at these elevations rather than at the maximum surcharge elevation of 316 feet. It should be noted that Cross Sections 1B, 3, and 8 correspond to Cross Sections A-A', B-B', and C-C', respectively, analyzed in Arias' 2012 study. SMECI indicated that Cross Section 9A was taken in the east embankment slope about 110 feet north of Section 9, which is located near the southeast corner of the pond.

The SMECI survey showed that the crest for the Equalization Pond was at Elevation 296 feet at Sections 11 and 16, i.e. at the maximum surcharge (pool) level. Section 11 is located in the south embankment slope near the southwest corner of the pond, and Section 16 is located in the north embankment. Section 16 is located where Section E-E' was analyzed for our 2012 study.

Arias estimated the groundwater elevation downstream of the embankment toes based on the groundwater levels in the monitoring wells and the potentiometric surface map provided in Appendix E as previously noted. The estimated groundwater levels downstream of the embankments that were used in the seepage analyses for the Ash Water Transport Pond and the Equalization Pond are presented subsequently in Tables 4 and 5, respectively. The seepage analyses for the Ash Water Transport Pond Section 1B (west embankment slope) incorporated the water level in the detention pond as previously discussed.

Based on inputting the appropriate pond water level and the groundwater level beyond the downstream slope toe, the phreatic surface in the embankment section was determined in our seepage analysis. Based on the results of the seepage analyses, the pond levels, phreatic surfaces, and seepage vectors are shown on the plots of the global stability results included in Appendices F and G for the Ash Water Transport Pond and Equalization Pond, respectively.

GLOBAL STABILITY ANALYSES

Global stability calculations were performed considering the interpreted stratigraphy at the explored boring locations for each of the cross sections analyzed as noted in the previous seegage analysis section and summarized subsequently in Tables 4 and 5 for the Ash Water Transport Pond and Equalization Pond, respectively. Strength parameters for the compacted clay soils in the embankments and underlying native soils were estimated based on the laboratory testing performed for our 2012 study and on our experience with similar soils.

Since the ponds were constructed about 25 years ago, Arias assumed that long-term, drained conditions had developed and performed analyses for this condition only. The global stability analyses were performed by using the SLIDE program utilizing the cross sections analyzed in the seepage analyses previously noted. Similar to our analyses performed in our 2012 study, the program searched non-circular failure surfaces using an optimization routine for locating the failure surface with the lowest factor safety.

The results of the stability analyses are tabulated in Tables 4 and 5 for the Ash Water Transport Pond and Equalization Pond, respectively. Furthermore, the graphical plots of the results of our stability analyses are presented in Appendices F and G for the Ash Water Transport Pond and Equalization Pond, respectively. The plots present a tabulation of soil properties and the critical cross section analyzed, which depicts the following:

- water level in the pond behind the crest,
- water level in the detention pond beyond the toe (Section 1B only);
- potential vehicular surcharge loading on the embankment crest;
- soil stratigraphy with different colors for each soil layer;
- groundwater phreatic surface and seepage vectors from the seepage analysis;
- search limits for evaluating the potential failure surfaces; and,
- critical failure surface and computed factor of safety.

Table 4: Global Stability Analysis Results – Ash Water Transport Pond

Stability Criteria	Pool Water Elevation (feet)	Downstream Groundwater Elevation (feet)	Section Analyzed	Computed Factor of Safety	Minimum Factor of Safety	Comments
Maximum Storage Pool Steady State Seepage Long-Term (Drained)	314.5	298.5	1B	1.43 (1.57)	1.5	Noncircular Searches Optimized Using Built-In Slide Optimization Routine
		285.0	3	1.67		
		281.0	8	1.54		
		281.0	9A	1.44		
Maximum Surcharge Pool Steady State Seepage Long-Term (Drained)	315.0	303.0	1B	1.31 (1.42)	1.4	Noncircular Searches Optimized Using Built-In Slide Optimization Routine
	315.5	288.0	3	1.51		
	315.75	284.0	8	1.45		
	315.42	284.0	9A	1.36		

Notes:

1. The recently surveyed water level at Elevation 298.5 feet in the detention pond located west of the Ash Water Transport Pond was used in the Maximum Storage Pool Steady State Seepage Analysis at Section 1B. For the Maximum Surcharge Pool Steady State Seepage Analysis at Section 1B, the detention pond water level was assumed at Elevation 303.0 feet, which correspond to the top of the bank.
2. The computed factors of safety for the improved conditions at Section 1B using the recommendations included herein are shown in the table above in parenthesis.

As stated in CCR Rule 40 CFR 257.73(f)(2)(i), the required minimum factors of safety are 1.4 for the maximum surcharge pool level and 1.5 for the maximum storage pool level. The results of the stability analyses for the Ash Water Transport Pond given above in Table 4 show that the computed factors of safety do not meet the minimum requirements at some of the cross sections as summarized below:

- Section 1B at West Slope - The computed factors of safety were 1.43 and 1.31, which are less than the minimum required values of 1.5 and 1.4 for the maximum storage pool and maximum surcharge pool conditions, respectively.
- Section 3 at South Slope - The computed factors of safety of 1.67 and 1.51 meet the minimum requirements of 1.5 and 1.4 for the maximum storage pool and maximum surcharge pool, respectively.
- Section 8 at South Slope - The computed factors of safety of 1.54 and 1.45 meet the minimum requirements of 1.5 and 1.4 for the maximum storage pool and maximum surcharge pool, respectively.

- Section 9A at East Slope - The computed factors of safety were 1.44 and 1.36, which are less than the minimum required of 1.5 and 1.4 for the maximum storage pool and maximum surcharge pool conditions, respectively.

As depicted in Photos 2 to 4 in Appendix B, the west downstream slope in the area of Cross Section 1B appears to have been cut steeper in the bottom portion and minor water seepage is evidenced by a limited amount of ponded water and the presence of cattails. The factors of safety are sufficiently above 1.0 that the slope is in a stable condition. However, Arias recommends that remedial action be taken as summarized previously in Table 2, and presented in greater detail in the next section of this report. *In summary, Arias recommends the following remedial action for the west downstream slope in the area of* ***Cross Section 1B***:

1. the softened soils be removed employing proper "keying and benching" techniques;
2. a toe drain consisting of clean, crushed limestone wrapped with a geotextile filter fabric be constructed to achieve a slope of 3.5H:1V similar to the upper slope; and,
3. an organic topsoil layer placed on the geotextile fabric, and be seeded with grass and suitable erosion protection (e.g., erosion mat) be applied so that vegetation can be established.

For Cross Section 9A, the factors of safety of 1.44 and 1.36 are slightly less than the minimum required of 1.5 and 1.4, respectively, for the maximum storage pool and maximum surcharge pool conditions. *The factors of safety at Cross Section 9A are believed to be representative of the existing east downstream embankment slopes.* Since the factors of safety are only slightly less than the minimum requirements, this does not present a need for immediate remedial action. However, remedial action is recommended in the near future to increase the factors of safety to the required minimums, and earthwork and slope maintenance should be performed as presented previously in Table 2 and summarized subsequently:

1. Grades should be raised in portions of the embankment crest that are below the required maximum surcharge pool level of Elevation 316 feet as evidenced by the surveyed cross sections and the need for temporary berms/dikes along the upstream crest (Photo 7 in Appendix B depicts this condition at the south slope). In the interim, employ means to lower the pool level.
2. Bushes should be removed from slopes and long grass should be cut (see Photo 13 in Appendix B).
3. Downstream slopes should be flattened to a 3H:1V or flatter.

For the east and south embankments, we understand that it is difficult to cut the grass on the steeper portions of the downstream slopes. Accordingly, we recommend that the downstream slopes for the south embankment also be flattened to at least 3H:1V. Flattening the downstream slopes is anticipated to increase the factors of safety to meet the minimum criteria. Under a separate service scope, Arias can perform additional global stability analyses to determine factors of safety on final slope configurations once they become available.

Table 5: Global Stability Analysis Results – Equalization Pond

Stability Criteria	Pool Water Elevation (feet)	Downstream Groundwater Elevation (feet)	Section Analyzed	Computed Factor of Safety	Minimum Factor of Safety	Comments
Maximum Storage Pool Steady State Seepage Long-Term (Drained)	294.0	278.0	11	1.80	1.5	Noncircular Searches Optimized Using Built-In Slide Optimization Routine
		274.0	16	1.54		
Maximum Surcharge Pool Steady State Seepage Long-Term (Drained)	296.0	278.0	11	1.72	1.4	Noncircular Searches Optimized Using Built-In Slide Optimization Routine
	296.0	274.0	16	1.55		

As stated in CCR Rule 40 CFR 257.73(f)(2)(i), the required minimum factors of safety are 1.4 for the maximum surcharge pool level and 1.5 for the maximum storage pool level. The results of the stability analyses for the Equalization Pond given in Table 5 above indicate the factors of safety exceed the minimum required for both pool conditions analyzed. However, remedial action is recommended in the future as described below including those recommendations presented previously in Table 3:

1. Grades should be raised in portions of the embankment crest that are below the required maximum surcharge pool level of Elevation 296 feet as evidenced: (a) by the surveyed cross sections, and (b) the need for temporary berms/dikes along the upstream crest (see Photos 16 to 19 in Appendix C). In the interim, employ means to lower the pool level.
2. Bushes should be removed from slopes and tall grass should be cut (see Photos 14 to 22 in Appendix C).

CONSTRUCTION CONSIDERATIONS

Ash Water Transport Pond – Priority Remedial Action for West Downstream Slope

The construction considerations presented herein apply to the highest priority remedial action need for the Ash Water Transport Pond west downstream slope as discussed in the previous section. The performance of the proposed slope and drainage improvements are directly related to proper site preparation and integration of the fill.

To aid in providing stability to the Ash Water Transport Pond west downstream slope, care should be taken to properly integrate the added fill into the existing embankment by using proper "keying and benching" techniques. The remedial action should be performed where the west downstream has been steepened in the bottom portion in the area of Cross Section 1B as previously in depicted in Photos 2 to 4 in Appendix B. We recommend the remedial action be performed in the sequence presented subsequently to maintain the stability of the embankment slope:

1. A key be constructed from the toe of existing slope to the toe of the proposed fill slope, which should be at 3.5H:1V to match the existing upper slope. The key excavation should be extended 18 inches below existing grade into firm competent soil as approved in the field by the Geotechnical Engineer or his representative. The bottom of the excavation should be sloped at least 2 percent downward away from the existing slope toe so that any water can be collected in a temporary sump and pumped out. The key should be filled by placing and compacting non-dispersive clay in controlled lifts that meets the material, placement, and compaction requirements given subsequently in Table 6.

2. Following construction of the key, the proposed toe drain should be integrated into the existing embankment by cutting horizontal benches into the existing embankment as an extension of each lift placed during construction. Specifically, horizontal benches should be cut into the existing slope to a maximum vertical height of 1 foot as the fill construction progresses (i.e. the 2nd bench should not be cut into the slope until the 1st bench is filled). The widths of the benches will vary depending upon the slope of the existing grade. Cross Sections 1A, 1B, and 1C provided by SMECI indicates that the grade of the existing embankment in the area requiring remedial action is generally sloped between 1.9H:1V and 2.4H:1V in the bottom portion and 3.4H:1V and 3.5H:1V in the upper portion. This would result in horizontal bench widths of 2 to 2.5 feet in the lower portion and 3.5 feet in the upper portion.

3. The benches should also be filled by 1st placing the geotextile fabric on bench and vertical cut above followed by placement and compaction of clean, crushed limestone fill material meeting the material, placement, and compaction requirements given in Table 6.

4. Steps 2 and 3 should be repeated until the toe drain has been integrated into the upper slope. It should be noted the toe drain should be extended sufficiently as indicated in Step 1 to achieve a final slope of 3.5H:1V. After completion, the surface of the final slope should be compacted prior to placement of the geotextile fabric that should be overlapped a minimum of 12 inches to completely encapsulate the crushed limestone.

5. Sufficient topsoil should be placed on the geotextile fabric, and be seeded with grass that is protected from erosion (e.g., use of an erosion mat) until the grass is established.

Ash Water Transport Pond – Near Future Slope Improvements

As also discussed previously, flattening of south and east downstream slopes will be required in the near future. We recommend the remedial action be performed in the sequence presented subsequently to maintain the stability of the embankment slope:

1. A key be constructed from the toe of existing slope to the toe of the proposed fill slope, which should be at 3H:1V or flatter. The key excavation should be extended 18 inches below existing grade into firm competent soil as approved in the field by the Geotechnical Engineer or his representative. The bottom of the excavation should be sloped at least 2 percent downward away from the existing slope toe so that any water can be collected in a temporary sump and pumped out. The key should be filled by placing and compacting non-dispersive clay in controlled lifts that meets the material, placement, and compaction requirements given subsequently in Table 6.

2. Following construction of the key, new fill should be integrated into the existing embankment by cutting horizontal benches into the existing embankment as an extension of each lift placed during construction. Specifically, horizontal benches should be cut into the existing slope to a maximum vertical height of 1 foot as the fill construction progresses (i.e. the 2nd bench should not be cut into the slope until the 1st bench is filled). The widths of the benches will vary depending upon the slope of the existing grade. in the upper portion.

Table 6: Construction Considerations – Ash Pond West Slope Improvements

CLAY MATERIAL FOR KEY AND FLATTENING DOWNSTREAM SLOPES	
Material Specification	• LL = 45 to 70 • PI ≧ 25 • Passing No. 200 Sieve ≧ 50% • Free of organic material, debris, & roots • Maximum particle size of 3 inches
Suitable Material Types from Borrow Area	Fat Clay (CH) and Sandy Fat Clay (CH)
Stripping Depth	18 inches or deeper to achieve firm subgrade approved in field by the Geotechnical Engineer or his representative
Exposed Subgrade Treatment	Disk to 6-inch depth and re-compact to ≥ 95% compaction at -2 to +2 from optimum (ASTM D 698)
Maximum Horizontal Loose Lift Fill Thickness	8 inches
Placement Criteria	ASTM D 698 ≥ 95% compaction at -2 to +2 from optimum
In-Place Density and Moisture Verification Testing	Each lift of fill placed should be tested. Testing should consist of a minimum of 3 tests per lift.
GEOTEXTILE FILTER FABRIC	
Material Specification	TxDOT DMS - 6200 Type 2
Placement Requirements	• Completely encapsulate the toe drain. • Overlap a minimum of 12 inches.
TOE DRAIN FILL	
Material Specification	Clean, crushed limestone (Tested and Approved by Arias Geotechnical Engineer)
Maximum Horizontal Loose Lift Fill Thickness	8 inches
Compaction Requirement	• Use small vibratory roller and plate compactor by making a minimum of 5 passes. • Overlap passes at least 6 inches. • Compact the face of the completed slope prior to covering with geotextile filter fabric.

Ash Water Transport Pond – Maintenance Related Remedial Action

As discussed in the previous section, the crest of the embankment for the Ash Water Transport Pond is presently below the required Maximum Surcharge Pool level of Elevation 316 feet. The temporary solution has been to construct berms/dikes along the upstream portion of the crest. When the pool level is lowered sufficiently, the following construction activities should be performed:

- Bushes and excessive vegetation should be removed from the upstream slopes crest, and downstream slope, and any resulting or observed holes should be filled with non-dispersive clay soil meeting the liner requirements.

- The temporary dikes, any other granular material, and any softened clay should be removed from the crest. Grades should be raised to the minimum required Elevation 316 feet using non-dispersive clay placed and compacted in controlled lifts that meets the material, placement, and compaction requirements for the clay liner.

- Vegetation should be re-established on the slopes and crest. If necessary, crushed limestone can be placed in lieu of vegetation on the crest above Elevation 316 feet to provide a more "all-weather" riding surface for vehicles.

Equalization Pond – Maintenance Related Remedial Action

As discussed in the previous section, portions of the crest of the embankment for the Equalization Pond is presently below the required Maximum Surcharge Pool level of Elevation 296 feet. The temporary solution has been to construct berms/dikes along the upstream portion of the crest. When the pool level is lowered sufficiently, the following construction activities should be performed:

- Bushes and excessive vegetation should be removed from the upstream slopes crest, and downstream slope, and any resulting or observed holes should be filled with non-dispersive clay soil meeting the liner requirements.

- The temporary dikes, any other granular material, and any softened clay should be removed from the crest. Grades should be raised to the minimum required Elevation 296 feet using non-dispersive clay placed and compacted in controlled lifts that meets the material, placement, and compaction requirements for the clay liner.

- Vegetation should be re-established on the slopes and crest. If necessary, crushed limestone can be placed in lieu of vegetation on the crest above Elevation 296 feet to provide a more "all-weather" riding surface for vehicles.

Erosion Control

Erosion of the constructed crest and side slopes must be considered in project design and site maintenance plans. We recommend that vegetation comparable in type and extent to that currently in place on the side slopes be used as a means of long-term erosion control. However, we should note that it will take time for seeded vegetation to become established in the new fill areas. During this time period, these areas of the embankment will be highly prone to erosion and some maintenance re-grading and re-compacting should be expected. However, other erosion control methods can be employed during this time period to aid in reducing the amount of required maintenance. Potential erosion control methods may include providing erosion control mats or blankets, a vegetative cover (sod), or some combination of methods. The project civil engineer should determine appropriate measures for erosion control. Despite implementation of erosion control methods, periodic maintenance and repair of erosional damage should be anticipated.

GENERAL COMMENTS

The scope of this study is to conduct seepage and associated slope stability evaluations of the embankments of the Ash Water Transport Pond and Equalization Pond. Environmental studies of any kind were not a part of our scope of work or services even though we are capable of providing such services.

This report was prepared for this project exclusively for the use of San Miguel Electric Cooperative, Inc. Arias is not responsible for the interpretations of our conclusions by a third party. If any of the assumptions presented herein change or if conditions observed during our site visits change, we should be informed and retained to ascertain the impact of these changes on our recommendations. We cannot be responsible for the potential impact of these changes if we are not informed.

Geotechnical Design Review

Arias should be given the opportunity to review the design and construction documents. The purpose of this review is to check to see if our geotechnical recommendations are properly interpreted into the project plans and specifications. Please note that design review was not included in the authorized scope and additional fees may apply.

Subsurface Variations

Subsurface conditions to be penetrated by future excavations may vary significantly from those conditions encountered in the prior soil borings. Our soil classifications and strength determinations are based solely on the materials encountered in previously conducted, widely-spaced soil borings. Conditions may occur between these borings that are not representative of the subsurface conditions modeled in these analyses.

Quality Assurance Testing

The long-term success of the project will be affected by the quality of materials used for construction and the adherence of the construction to the project plans and specifications. As Geotechnical Engineer of Record (GER), we should be engaged by the Owner to provide Quality Assurance (QA) testing. Our services will be to evaluate the degree to which constructors are achieving the specified conditions they're contractually obligated to achieve, and observe that the encountered materials during earthwork for foundation construction are consistent with those encountered during this study. In the event that Arias is not retained to provide QA testing, we should be immediately contacted if differing subsurface conditions are encountered during construction. Differing materials may require modification to the recommendations that we provided herein. A message to the Owner with regard to the project QA is provided in the ASFE publication included in Appendix I.

Arias has an established in-house laboratory that meets the standards of the American Standard Testing Materials (ASTM) specifications of ASTM E-329 defining requirements for Inspection and Testing Agencies for soil, concrete, steel and bituminous materials as used in construction. We maintain soils, concrete, asphalt, and aggregate testing equipment to provide the testing needs required by the project specifications. All of our equipment is calibrated by an independent testing agency in accordance with the National Bureau of Standards. In addition, Arias is accredited by the American Association of State Highway & Transportation Officials (AASHTO), the United States Army Corps of Engineers (USACE) and the Texas Department of Transportation (TxDOT), and also maintains AASHTO Materials Reference Laboratory (AMRL) and Cement and Concrete Reference Laboratory (CCRL) proficiency sampling, assessments and inspections.

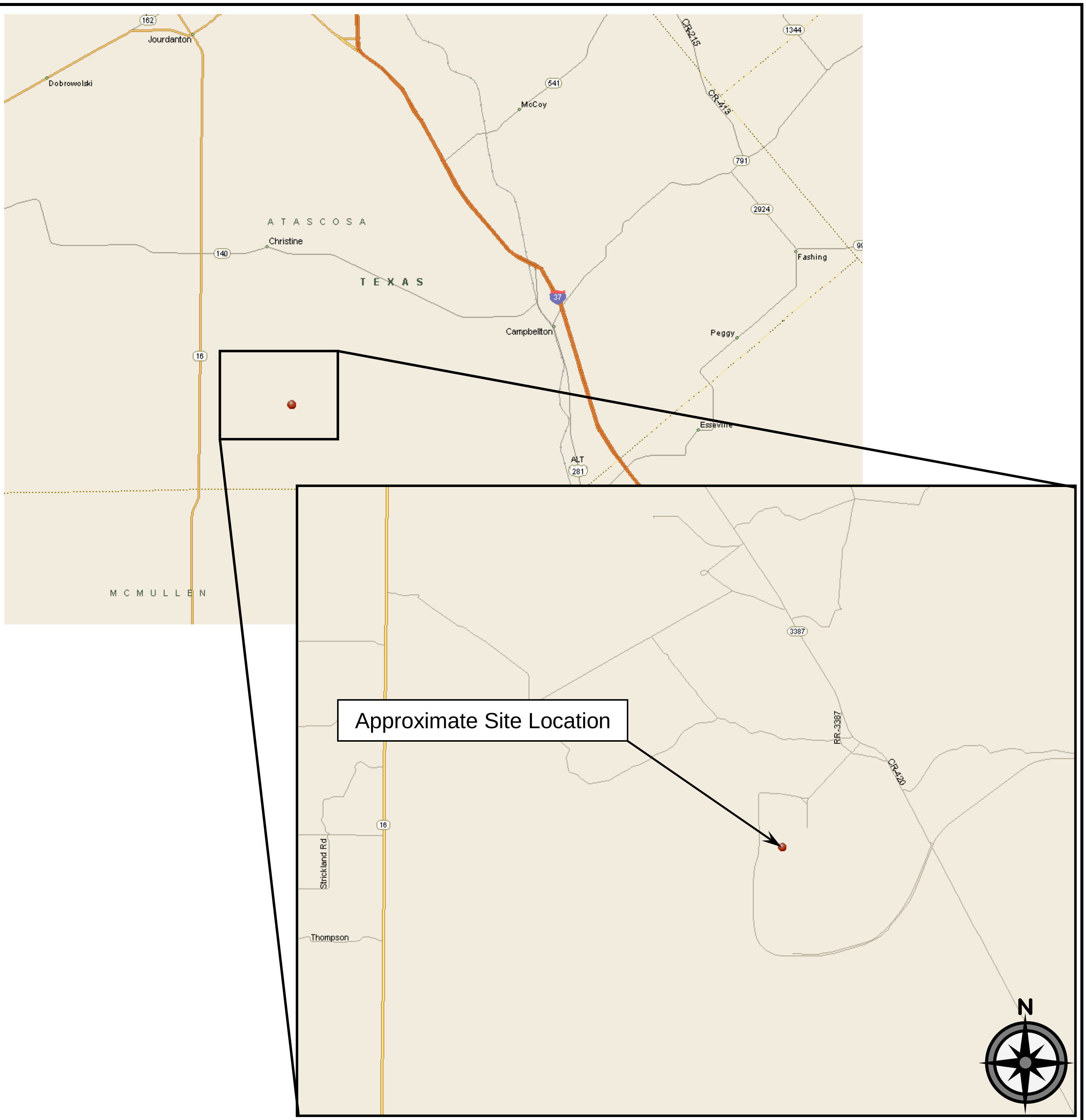
Furthermore, Arias employs a technical staff certified through the following agencies: the National Institute for Certification in Engineering Technologies (NICET), the American Concrete Institute (ACI), the American Welding Society (AWS), the Precast/Prestressed Concrete Institute (PCI), the Mine & Safety Health Administration (MSHA), the Texas Asphalt Pavement Association (TXAPA) and the Texas Board of Professional Engineers (TBPE). Our services are conducted under the guidance and direction of a Professional Engineer (P.E.) licensed to work in the State of Texas, as required by law.

Standard of Care

Subject to the limitations inherent in the agreed scope of services as to the degree of care and amount of time and expenses to be incurred, and subject to any other limitations contained in the agreement for this work, Arias has performed its services consistent with that level of care and skill ordinarily exercised by other professional engineers practicing in the same locale and under similar circumstances at the time the services were performed.

Information about this geotechnical report is provided in the ASFE publication included in Appendix H.

APPENDIX A: FIGURES



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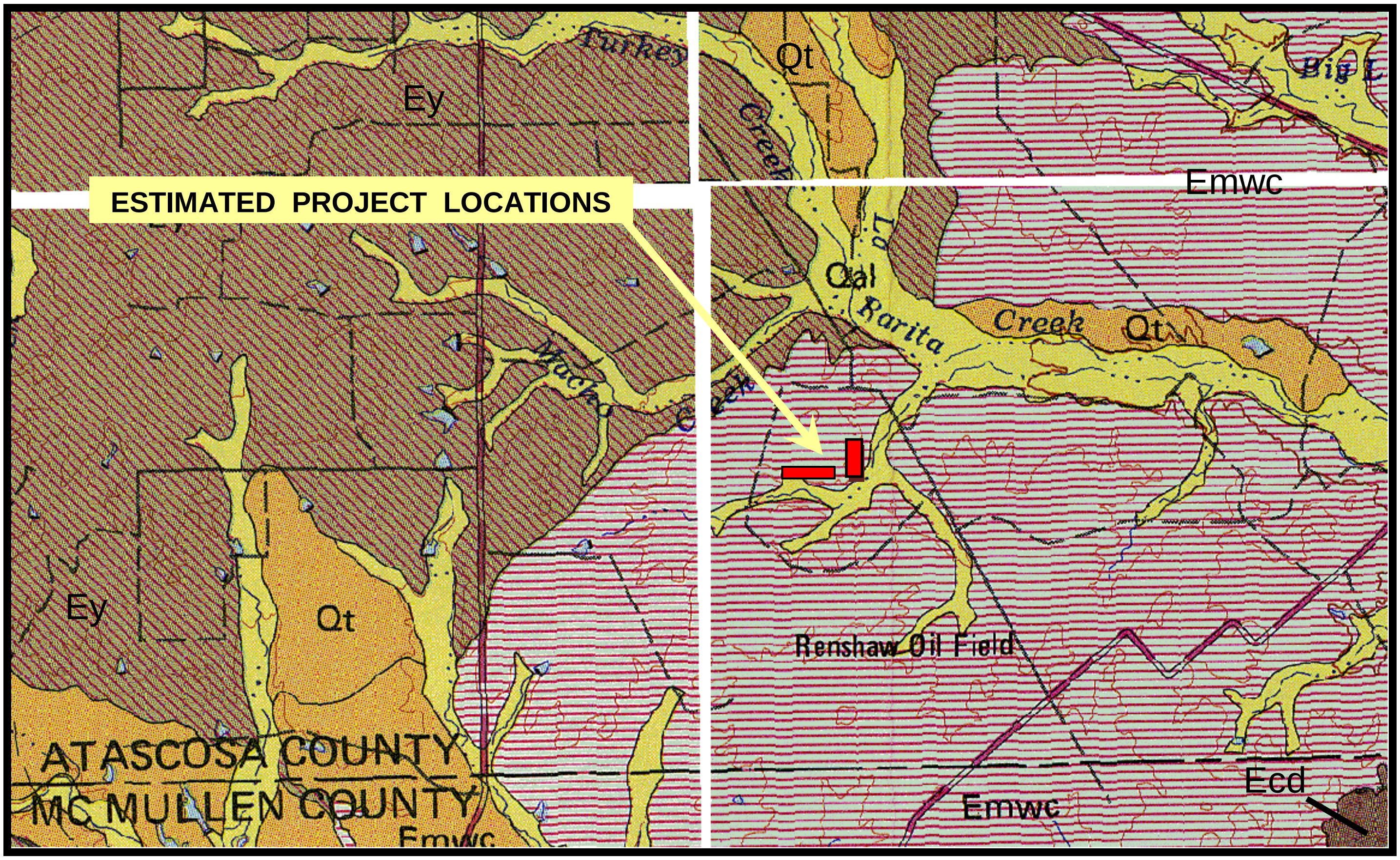
VICINITY MAP

Ash Transport Water Pond and Equalization Pond
Stability Analyses at San Miguel Lignite Mine
Atascosa County, Texas

Date: October 22, 2012	Job No.: 2012-695
Drawn By: TAS	Checked By: GRA
Approved By: DB	Scale: N.T.S.

Appendix A



PORTION OF GEOLOGIC ATLAS OF TEXAS

N

LEGEND

Symbol	Name	Age
Qal	Active Alluvial Deposits	Quaternary Period / Holocene Epoch
Qt	Alluvial Terrace Deposits	Quaternary Period / Pleistocene Epoch
Ecd	Conquista Clay & Dilworth Sandstone members of the Whitsett Formation	Tertiary Period / Eocene Epoch
Emwc	Manning, Wellborn & Caddell Formations, undivided	Tertiary Period / Eocene Epoch
Ey	Yegua Formation	Tertiary Period / Eocene Epoch

U D — Fault Segment with Indication of Relative Movement

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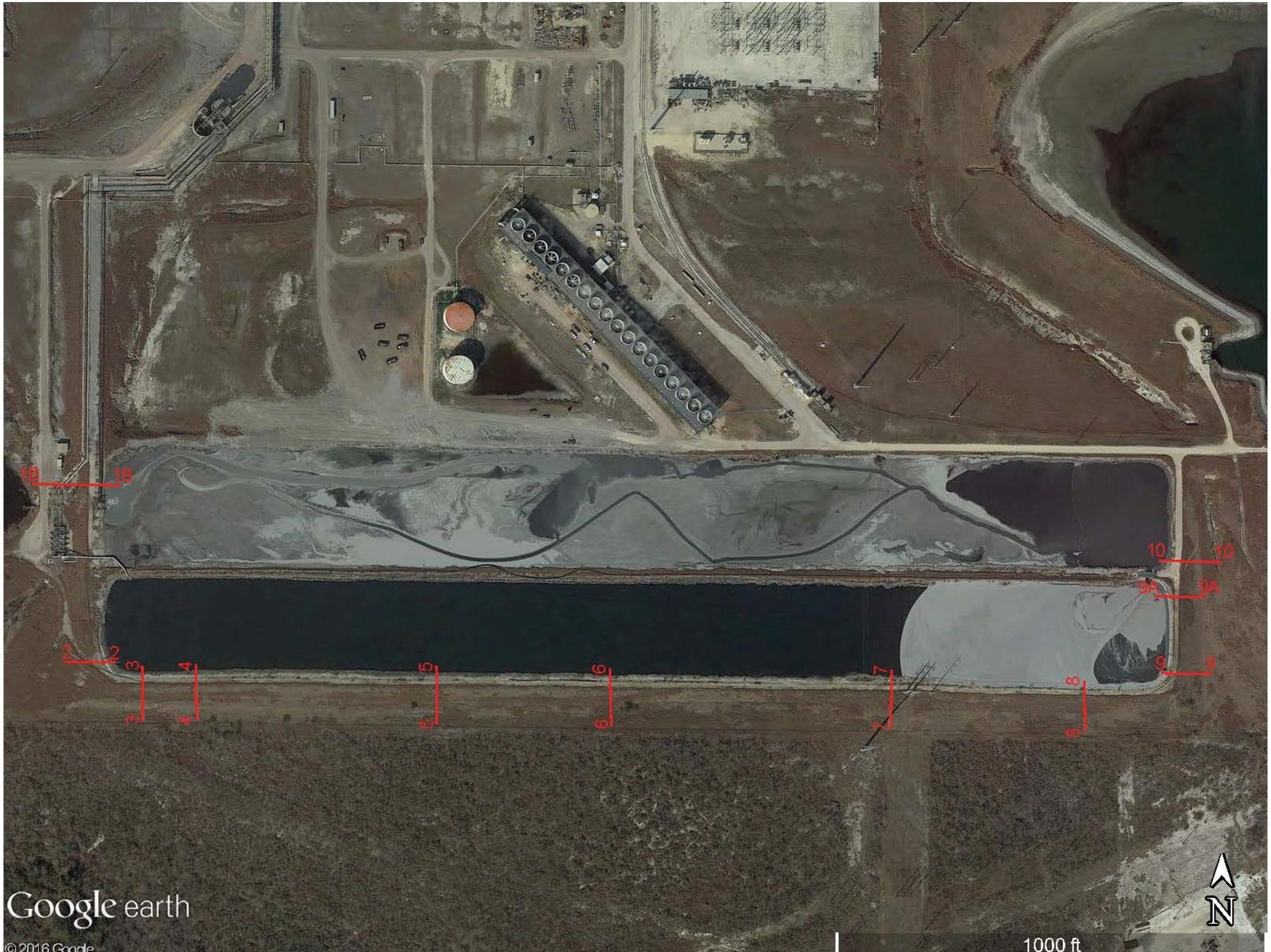
GEOLOGIC MAP

Ash Transport Water Pond and Equalization Pond
Stability Analyses at San Miguel Lignite Mine
Atascosa County, Texas

Date: October 4, 2012	Job No.: 2012-695
Drawn By: JLK	Checked By: GRA
Approved By: DB	Scale: N.T.S.

Appendix A



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CROSS SECTION LOCATION PLAN

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Job No.:	2013-458
Scale:	N.T.S.
Date:	October 11, 2016
Drawn By:	TAS
Checked By:	RPG
Approved By:	SAH

Appendix A

1 of 2

CROSS SECTION LOCATION PLAN

Equalization Pond
San Miguel Electric Cooperative
Christine, Texas

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Phone: (210) 308-5884 • Fax: (210) 308-5886

Job No.: 2013-458
Scale: N.T.S.
Date: October 7, 2016
Drawn By: TAS
Checked By: RPG
Approved By: SAH

Appendix A

APPENDIX B: RECENT SITE PHOTOGRAPHS OF ASH TRANSPORT POND

Photo 1 – View looking southeast of west end of north downstream slope of Ash Water Transport Pond.

Photo 2 – View looking north along downstream slope of cattails/wet/steep section in bottom portion of slope.

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SITE PHOTOS

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix B

Photo 3 – Close up view of Photo 2 of cattails in steep toe area where seepage is occurring.

Photo 4 – Close up view of Photo 2 of cattails, stump in ground and steepened bottom part of slope.

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SITE PHOTOS

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix B

Photo 5 – View looking south at excess fill on west downstream slope by bulldozer.

Photo 6 – View looking northeast at splitter dike with excessive bushes and grass.

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SITE PHOTOS

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix B

Photo 7 – View looking west at south slope where there is rutting at crest, temporary berm due to high water level in pond and bushes on upstream slope.

Photo 8 – View looking east at western portion of south downstream slope where bench was previously cut for access road up the slope.

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SITE PHOTOS

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix B

Photo 9 – View looking east at western bottom portion of south downstream and beyond where monitor well can be seen.

Photo 10 – View looking west at south downstream slope and southeast corner of pond.

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SITE PHOTOS

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix B

Photo 11 – View looking southwest at east downstream slope and southeast corner of pond.

Photo 12 – View looking northwest at east downstream slope and southeast corner of pond.

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SITE PHOTOS

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix B

Photo 13 – View looking south along east downstream slope and drainage swale at toe of slope.

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SITE PHOTOS

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix B

APPENDIX C: RECENT SITE PHOTOGRAPHS OF EQUALIZATION POND

Photo 14 – View looking northeast at Equalization Pond from west side in central portion of bushes in upstream slope within pond.

Photo 15 – View looking south from northeast corner of pond at bushes in pond and on upstream west slope.

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SITE PHOTOS

Equalization Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix C

Photo 16 – View looking east from near northwest corner of pond at north embankment.

Photo 17 – View looking west from near northeast corner of pond at temporary dike along upstream crest.

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SITE PHOTOS

Equalization Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix C

Photo 18 – View looking northeast at temporary dike along upstream crest in northeast corner of pond.

Photo 19 – View looking south at east embankment and temporary dike along upstream crest of pond.

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SITE PHOTOS

Equalization Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix C

Photo 20 – View looking southeast from crest of south embankment at ponded water and bushes on downstream slope.

Photo 21 – View looking east at stone riprap and bushes on toe portion of south downstream slope and ponded water beyond slope toe.

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SITE PHOTOS

Equalization Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix C

Photo 22 – View looking west at stone riprap and bushes on toe portion of south downstream slope.

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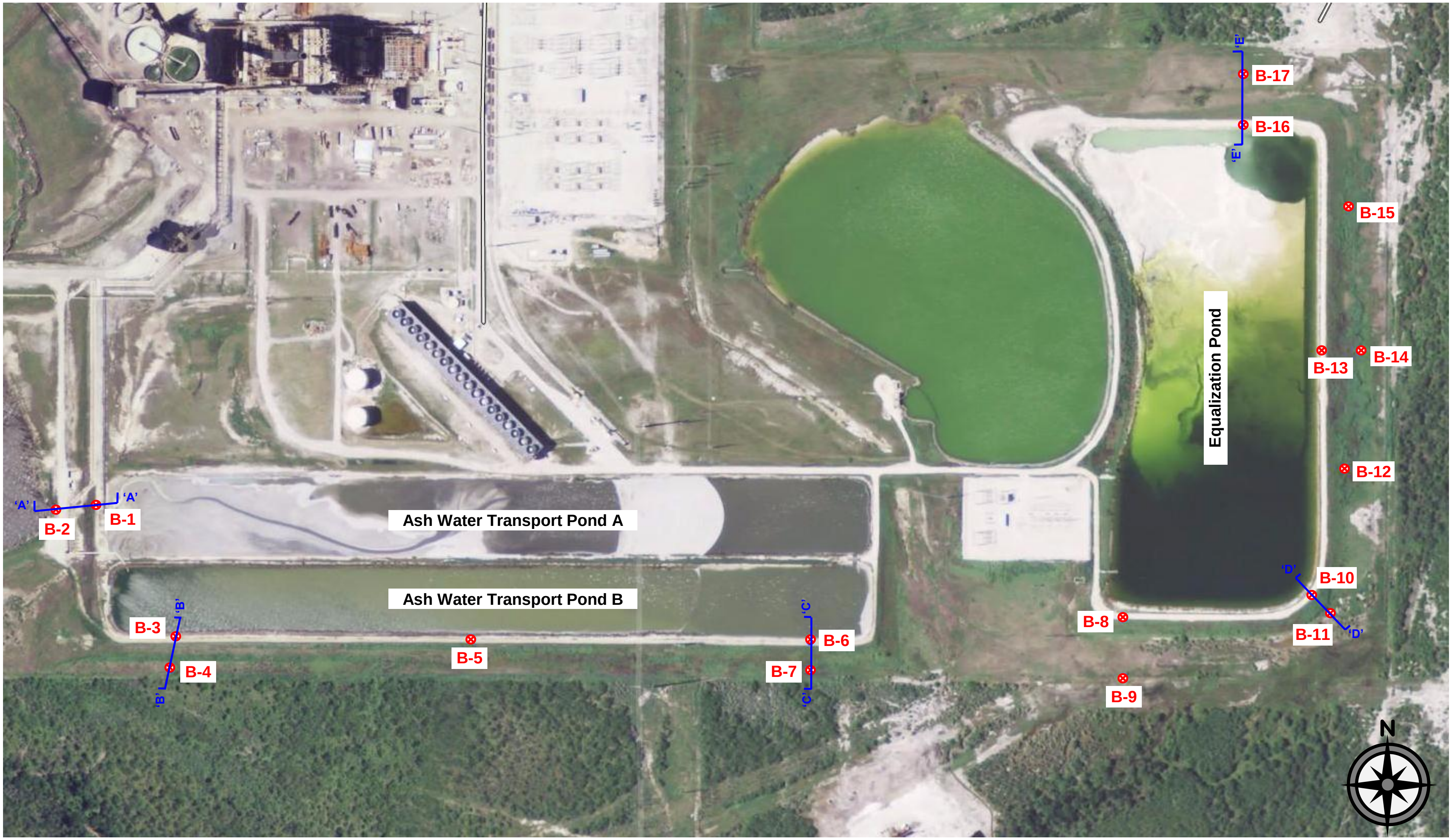
SITE PHOTOS

Equalization Pond
San Miguel Electric Cooperative
Christine, Texas

Date: October 7, 2016	Job No.: 2016-581
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix C

APPENDIX D: SOIL BORING INFORMATION FROM ARIAS PREVIOUS STUDY



DISCLAIMER: This drawing is for illustration only and should not be used for design or construction purposes. All locations are approximate.

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San Antonio, Texas 78232
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BORING LOCATION PLAN

Ash Transport Water Pond and Equalization Pond
Stability Analyses at San Miguel Lignite Mine
Atascosa County, Texas

Date: October 22, 2012	Job No.: 2012-695
Drawn By: TAS	Checked By: GRA
Approved By: DB	Scale: N.T.S.

Appendix C

Boring Log No. B-1

Project:	**Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**
Location:	See Boring Location Plan
Sampling Date:	9/24/12
Elevation:	315 ft (Estimated)
Coordinates:	N: 13438995.96 E: 2135464.98
Backfill:	Cement-bentonite grout

Soil Description

- FILL: Silty GRAVEL (GM) with sand, dense, gray and brown
- FILL: LEAN CLAY (CL) with sand, stiff to very stiff, gray and brown, trace of gypsum, mottled
- FAT CLAY (CH), very stiff to hard, gray to dark brown, with considerable gypsum seams
  - light brown an dgray below 8 ft.
  - seepage along gypsum seam at 10 ft.
- LEAN CLAY (CL), hard, gray and brown, with thin gypsum seams
  - considerable iron oxide material below 24 ft.
- SILTY Fine SAND (SM), very dense, gray and brown

Borehole terminated at 39 feet

Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
	SS	29	24	47	23		28	
	SS	30					14	
5	SS	33	28	67	39		23	
	SS	33					25	
	T	33	35	57	22	1.75		
10	T	31	37	56	19	1.5		
15	T							
20	SS	38					32	
25	SS	20	20	42	22		82	
30	SS						**50/1"	
35	SS	24					**50/6"	33
	SS	23					**50/6"	

Groundwater Data:
First encountered during drilling: 9.5-ft depth
After 60 hours: 9.6-ft depth (26.3-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 39 ft

Nomenclature Used on Boring Log

Split Spoon (SS) — Thin-walled tube (T)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-2

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 303 ft (Estimated)
Coordinates: N: 13438985.27 E: 2135331.45
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Silty GRAVEL (GM) with sand, medium dense, light gray and brown		SS	26					74	
LIGNITE Material, hard, dark brown and black									
FILL: GRAVELLY FAT CLAY (CH) with sand, very stiff, gray and brown		SS	24	21	53	32		28	
FAT CLAY (CH), very stiff to hard, gray and brown, with gypsum and silt seams	5	SS	33					36	
		SS	31	25	63	38		21	
		T	25	21	54	33	2.25		
- sandy with oxide staining below 10 ft.	10	T	24				5.0		
SILTY Fine SAND (SM), very dense, gray and brown									
	15	SS	23					86/12"	32
	20	SS	26					72	32
		SS	24					50/5"	31

Borehole terminated at 24.4 feet

Groundwater Data:
First encountered during drilling: 17-ft depth
After 48 hours: 13.4-ft depth (17.8-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 24.4 ft

Nomenclature Used on Boring Log

Split Spoon (SS) — Thin-walled tube (T)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-3

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/24/12
Elevation: 314 ft (Estimated)
Coordinates: N: 13438572.89 E: 2135716.20
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH), very stiff, gray and brown, mottled, trace sand, trace gravel		SS	30					19	
		SS	34	26	64	38		16	
	5	SS	29					22	
FILL: LEAN CLAY (CL), very stiff to hard, gray and brown, mottled, trace fine sand		SS	25	22	49	27		21	
	10	SS	21					28	
		T	26	18	46	28	4.0		
FILL: FAT CLAY (CH), very stiff, dark gray and brown, mottled	15	T	30				2.75		
	20	T	28	21	62	41	2.75		
	25	T	28	23	66	43	3.0		
FAT CLAY (CH), very stiff, gray and brown, with gypsum	30	T	38				3.0		
SILTY Fine SAND (SM), very dense, gray and brown, with yellow stains	35	SS	23					**50/5"	24
	40	SS	27					**50/5"	
SANDY SILT (ML), very dense, gray and brown - iron oxide lenses below 43 ft.	45	SS	22					50/5"	51
	50	SS	27					50/4"	
SANDY FAT CLAY (CH), dense to very dense, dark gray, with gypsum seams	55	SS	25	19	50	32		75	
	60	SS	26	22	77	55		44	

Borehole terminated at 60 feet

Groundwater Data:
First encountered during drilling: 33-ft depth
After 60 hours: 34.3-ft depth (47-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 60 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Boring Log No. B-4

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 289 ft (Estimated)
Coordinates: N: 13438471.89 E: 2135716.65
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
SANDY LEAN CLAY (CL), very stiff to hard, gray and dark brown		SS	9				32	
		SS	7	16	45	29	22	
SILTY SAND (SM), loose to medium dense, light gray and brown	5	SS	7				8	
		SS	14				15	20
- very dense below 9 ft.	10	SS	22	24	25	1	51	
		SS	24				**50/6"	
	15	SS	31				**50/6"	17
	20	SS	33				81	
	25	SS	25				**50/6"	31
	30	SS	27				50/4"	
SANDY FAT CLAY (CH), hard, gray	35	SS	29	19	54	35	51	

Borehole terminated at 35 feet

Groundwater Data:
First encountered during drilling: 12-ft depth
After 48 hours: 11.3-ft depth (18-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 35 ft

Nomenclature Used on Boring Log

Split Spoon (SS)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
N = SPT Blow Count

** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Boring Log No. B-5

Project: Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas	Sampling Date: 9/25/12
Location: See Boring Location Plan	Elevation: 314 ft (Estimated)
	Coordinates: N: 13438062.07 E: 2136671.33
	Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH) with sand, stiff to hard, gray and brown, mottled, trace gypsum		SS	29	29	87	58		23	
		SS	32					26	
	5	T	36	28	72	44	2.5		
		T	21				4.0		
	10	T	27	28	60	32	4.0		
		T	28				5.5		
- trace of fine gravel from 12 ft. to 13 ft. - dark gray and brown below 13 ft.									
	15	T	32	29	61	32	1.25		
FAT CLAY (CH), gray and brown, with iron oxide staining adn gypsum	20	T	28				5.75		
- brown below 23 ft.									
SILTY SAND (SM), very dense, gray and brown, with yellow stains	25	SS	31					65	52
FAT CLAY (CH), hard, gray and brown, with gypsum seams	30	SS	37	36	102	66		43	
	35	SS	32					52	
SILTY Fine SAND (SM), very dense, gray and brown		SS	22					50/4"	29
Borehole terminated at 39.3 feet									

Groundwater Data:
First encountered during drilling: 37.5-ft depth (23.2-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 39.3 ft

Nomenclature Used on Boring Log

Split Spoon (SS) — Thin-walled tube (T) — ▽ Water encountered during drilling

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
-200 = % Passing #200 Sieve

Boring Log No. B-6

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/24/12
Elevation: 315 ft (Estimated)
Coordinates: N: 13438561.88 E: 2137764.40
Backfill: Cement-bentonite grout

Soil Description

FILL: FAT CLAY (CH), very stiff, gray and brown, with mottling, sand seams, some dark brown layers

FAT CLAY (CH), hard, dark gray
- gray and brown below 30 ft.
- sand seams 33 ft. to 38 ft.
- gypsum seams below 38 ft.
- lignite seam at 49 ft.

SILTY SAND (SM), very dense, gray to dark gray

SANDY SILT (ML), very dense, gray to dark gray

Borehole terminated at 64.3 feet

SN	WC	PL	LL	PI	PP	N	-200
SS	18					29	
SS	24	29	83	54		21	
SS	34					21	
SS	29	28	81	53		21	
SS	24					22	
SS	30					19	
T	29	28	84	56	2.75		
T	32				2.75		
T	27				2.25		
T							
T	26	26	70	44	4.0		
SS	41					33	
SS		29	97	68		51	
SS						50/5"	
SS						**50/2"	
SS						**50/3"	17
SS						50/3"	50

Depth (ft): 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60

Groundwater Data:
First encountered during drilling: 51.5-ft depth
After 60 hours: 32.8-ft depth (49.6-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 64.3 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Boring Log No. B-7

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 289 ft (Estimated)
Coordinates: N: 13438470.98 E: 2137764.82
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH) with sand, stiff to very stiff, dark gray and brown, with mottling and organics		SS	20					18	
SANDY FAT CLAY (CH), hard, light gray and brown, with sand layers		SS	17					14	
	5	SS	25	28	70	42		50	
- less sand below 7 ft.		SS	23					56	
	10	SS	32	19	90	71		57	
- with gypsum below 10 ft.		SS	33					58	
FAT CLAY (CH), very stiff, gray, with gypsum seams	15	SS	40	35	109	74		22	
	20	T							
CLAYEY SAND (SC), hard, gray and brown	25	T	20				5.0		
		SS						**50/3"	
SILTY SAND (SM), very dense, gray	30								
		SS	27					**50/3"	13

Borehole terminated at 33.8 feet

Groundwater Data:
First encountered during drilling: 23-ft depth
After 48 hours: 13.3-ft depth (21.9-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 33.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-8

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 293 ft (Estimated)
Coordinates: N: 13438637.13 E: 2138770.33
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH), stiff to very stiff, light gray to dark brown, some mottling		SS	21	28	65	37		26	
		SS	32					14	
	5	SS	27	25	69	44		18	
		SS	30					14	
	10	SS	30	25	74	49		13	
		SS	35					15	
	15	T	38	27	74	47	2.75		
	20	T	36				2.75		
FAT CLAY (CH), very stiff to hard, brown to dark brown	25	T	26	19	58	39	2.25		
- with sand from 28 ft. to 33 ft.	30	T	19				4.75		
- brown and gray below 33 ft.	35	T	34	23	65	42	2.5		
CLAYEY Fine SAND (SC), very dense, light gray to brown	40	T	22				5.0		
SILTY SAND (SM), very dense, dark gray		SS	27					**50/5"	15

Borehole terminated at 43.9 feet

Groundwater Data:
First encountered during drilling: 32.5-ft depth
After 120 hours: 18.6-ft depth (26.3-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 43.9 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Boring Log No. B-9

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**	Sampling Date:	9/25/12
	Elevation:	276 ft (Estimated)
	Coordinates:	N: 13438445.24 E: 2138771.20
Location: See Boring Location Plan	Backfill:	Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAYEY SAND (SC), dense, dark brown, with white calcite		SS	13					17	
FAT CLAY (CH), stiff, black, trace organics		SS	27	21	65	44		14	
	5	SS	21					14	
SANDY LEAN CLAY (CL), very stiff, dark gray, trace organics		SS	24	13	39	26		16	
	10	SS	20					19	56
		SS	20					25	
FAT CLAY (CH), stiff to hard, light gray and brown, with gypsum	15	T	40	32	109	77	1.5		
- sandy below 19 ft.	20	T	27				4.25		

Borehole terminated at 20 feet

Groundwater Data:
During drilling: Not encountered
After 48 hours: 6.7-ft depth (8.3-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 20 ft

Nomenclature Used on Boring Log

Split Spoon (SS) — Thin-walled tube (T) — ▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-10

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 293 ft (Estimated)
Coordinates: N: 13438710.59 E: 2139375.54
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Poorly-graded GRAVEL with Sand (GP), dense, light gray and brown		SS	29					25	
FILL: FAT CLAY (CH), stiff to very stiff, light gray and brown, with mottling		SS	36	29	67	38		18	
- gray and brown from 4 ft. to 13 ft.	5	SS	33					23	
		SS	26					24	
	10	SS	30	32	86	54		17	
		SS	33					19	
- gray to dark brown below 13 ft.	15	T	36	25	84	59	1.75		
	20	T	33				1.5		
LEAN CLAY (CL), stiff, gray	25	T							
	30	T	25	18	49	31	1.5		
		T	20				1.75		
Fine SAND (SP), dense, gray to brown	35								
FAT CLAY (CH), hard, gray to brown, with gypsum	40	SS	25	24	72	48		43	
CLAYEY Fine SAND (SC), very dense, gray	45	SS	20					50/5"	
SILTY Fine SAND (SM), very dense, gray	50	SS	24					**50/4"	
		SS	28					**50/3"	14

Borehole terminated at 53.8 feet

Groundwater Data:
First encountered during drilling: 18.4-ft depth
After 120 hours: 18.1-ft depth (25.2-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 53.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Boring Log No. B-11

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 273 ft (Estimated)
Coordinates: N: 13438650.27 E: 2139438.15
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FAT CLAY (CH), stiff, dark brown - trace organics to 4 ft.		SS	25	21	65	44		9	
		SS	27					10	
- gray and brown below 5 ft.	5	T	33	22	57	35	1.75		
		T	32				1.75		
		T	30				1.75		
	10	T	25	21	56	35	1.75		
CLAYEY Fine SAND (SC), medium dense to very dense, light gray and brown	15	T	25	32	77	45	1.5		
	20	SS	22					32	
	25	SS	28	20	45	25		22	
SILTY SAND (SM), very dense, gray		SS	25					**50/6"	19
Borehole terminated at 29 feet									

Groundwater Data:
During drilling: Not encountered
After 120 hours: 1.8-ft depth (1.9-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 29 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-12

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 274 ft (Estimated)
Coordinates: N: 13439115.06 E: 2139480.55
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N
FILL: FAT CLAY (CH), hard, dark brown, trace organics		SS	31					27
		T	18	17	50	33	9.0	
	5	T	17				7.75	
LEAN CLAY with Sand (CL), stiff to hard, dark brown		T	20	17	29	12	3.0	
		T	20				2.0	
	10	T	20				1.25	
- less sand, light gray and brown below 15 ft.	15	SS	19	19	39	20		29
	20	SS	21	17	42	25		36
- some gypsum seams below 23 ft.	25	SS	26					31

Borehole terminated at 25 feet

Groundwater Data:
First encountered during drilling: 14-ft depth
After 120 hours: 6-ft depth (9.8-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 25 ft

Nomenclature Used on Boring Log

Split Spoon (SS) | Thin-walled tube (T)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count

Boring Log No. B-13

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/19/12
Elevation: 294 ft (Estimated)
Coordinates: N: 13439498.52 E: 2139407.56
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Poorly-graded SAND (SP) with gravel, medium dense, light gray and brown		SS	23					20	
FILL: FAT CLAY (CH) with sand, very stiff, gray and brown, mottled		SS	34					24	
	5	SS	36	30	71	41		21	
- less sand, dark gray and brown below 6 ft.		SS	25					17	
	10	SS	32	24	66	42		17	
		SS	33					20	
	15	SS	37	25	81	56		24	
	20	T	32	21	68	47	1.5		
- very stiff to hard below 23 ft.	25	T	26				3.5		
FAT CLAY (CH), very stiff to hard, dark gray and brown	30	T	27	24	75	51	4.25		
	35	T	22				2.25		
- gray and brown below 35 ft.									
- considerable gypsum below 40 ft.	40	T	28	20	57	37	4.0		
Poorly-graded Fine SAND (SP), very dense, light gray and brown, with lignite seam and sandy silt seams	45	SS	26					50/4"	
SANDY LEAN CLAY (CL), hard, light gray and brown		SS	30					**50/4"	56
Borehole terminated at 48.8 feet									

Groundwater Data:
First encountered during drilling: 44-ft depth
After 144 hours: 23.7-ft depth (28.8-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 48.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS) — Thin-walled tube (T)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-14

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/26/12
Elevation: 273 ft (Estimated)
Coordinates: N: 13439499.09 E: 2139532.23
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FAT CLAY (CH), medium stiff to very stiff, dark brown - trace organics to 4 ft.		SS	18					16	
		SS	19					12	
	5	T	26	16	50	34	1.0		
- gray with some calcite below 6 ft.		T	27				2.25		
- brown below 8 ft.		T	16	19	62	43	1.75		
	10	T	28				1.25		
SANDY LEAN CLAY (CL), stiff, light gray and brown	15	T	25	16	35	19	1.5		
CLAYEY SAND (SC), medium dense, light gray and brown	20	SS	19					46	43
SANDY LEAN CLAY (CL), hard, dark gray and brown - thin lignite lense at 24 ft.	25	SS	21	15	45	30		64	

Borehole terminated at 25 feet

Groundwater Data:
First encountered during drilling: 6-ft depth
After 24 hours: 7-ft depth (11.2-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 25 ft

Nomenclature Used on Boring Log

Split Spoon (SS) — Thin-walled tube (T)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-15

Project:	Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas
Location:	See Boring Location Plan
Sampling Date:	9/26/12
Elevation:	273 ft (Estimated)
Coordinates:	N: 13439963.51 E: 2139494.49
Backfill:	Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N
FAT CLAY (CH), medium stiff to very stiff, dark brown - trace organics to 2 ft.		SS	16					24
		SS	29					13
	5	T	26	19	58	39	1.5	
- gray and brown below 6 ft.		T	29				1.25	
		T	29	19	61	42	2.0	
- sandy from 10 ft. to 12 ft.	10	T	31				1.0	
	15	T	31	19	54	35	1.0	
SANDY FAT CLAY (CH), very stiff, light gray and brown	20	SS	21					18
	25	SS	21	18	52	34		30

Borehole terminated at 25 feet

Groundwater Data:
First encountered during drilling: 19-ft depth
After 24 hours: 4.8-ft depth (21.3-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 25 ft

Nomenclature Used on Boring Log

Split Spoon (SS) | Thin-walled tube (T)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-16

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/19/12
Elevation: 294 ft (Estimated)
Coordinates: N: 13440224.56 E: 2139154.93
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Poorly-graded Fine or Coarse SAND (SP) with gravel, medium dense, light gray and brown, some clay pockets		SS	30					19	
FILL: FAT CLAY (CH), very stiff, dark gray, gray and brown mottling, with sandy clay pockets		SS	28					21	
	5	SS	30					20	
		SS	29	23	69	46		23	
	10	SS	35					21	
		SS	37	27	76	49		21	
	15	SS	33					22	
	20	SS	27					21	
FAT CLAY (CH), medium stiff to very stiff, light gray and brown	25	T	37	24	69	45	1.0		
	30	T	36				3.0		
- gypsum seams below 33 ft.	35	T	34	26	118	92	3.25		
	40	T	35				3.5		
SILTY Fine SAND (SM), very dense, gray and brown	45	SS	32					**50/6"	19
	50	SS	30					**50/4"	
	55	SS	29					**50/6"	21
		SS	28					**50/6"	

Borehole terminated at 59 feet

Groundwater Data:
First encountered during drilling: 42.5-ft depth
After 144 hours: 20.8-ft depth (24.8-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 59 ft

Nomenclature Used on Boring Log

Split Spoon (SS) | Thin-walled tube (T) | ▽ Water encountered during drilling | ▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Boring Log No. B-17

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/26/12
Elevation: 273 ft (Estimated)
Coordinates: N: 13440386.15 E: 2139154.19
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FAT CLAY (CH), medium stiff to very stiff, gray and brown - trace organics to 4 ft.		SS	17					21	
		SS	19					16	
	5	SS	40	27	82	55		13	
		T	38				1.0		
		T	34				1.5		
	10	T	33	25	74	49	2.25		
- some gypsum below 13 ft.	15	T	31				3.25		
	20	T	22				2.75		
SANDY LEAN CLAY (CL), medium stiff, gray and brown	25	T	25	24	36	12	0.75		
SILTY SAND (SM), very dense, gray and brown		SS	26					**50/4"	19

Borehole terminated at 28.8 feet

Groundwater Data:
First encountered during drilling: 24-ft depth
After 24 hours: 5.2-ft depth (23-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 28.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS) | Thin-walled tube (T)

▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

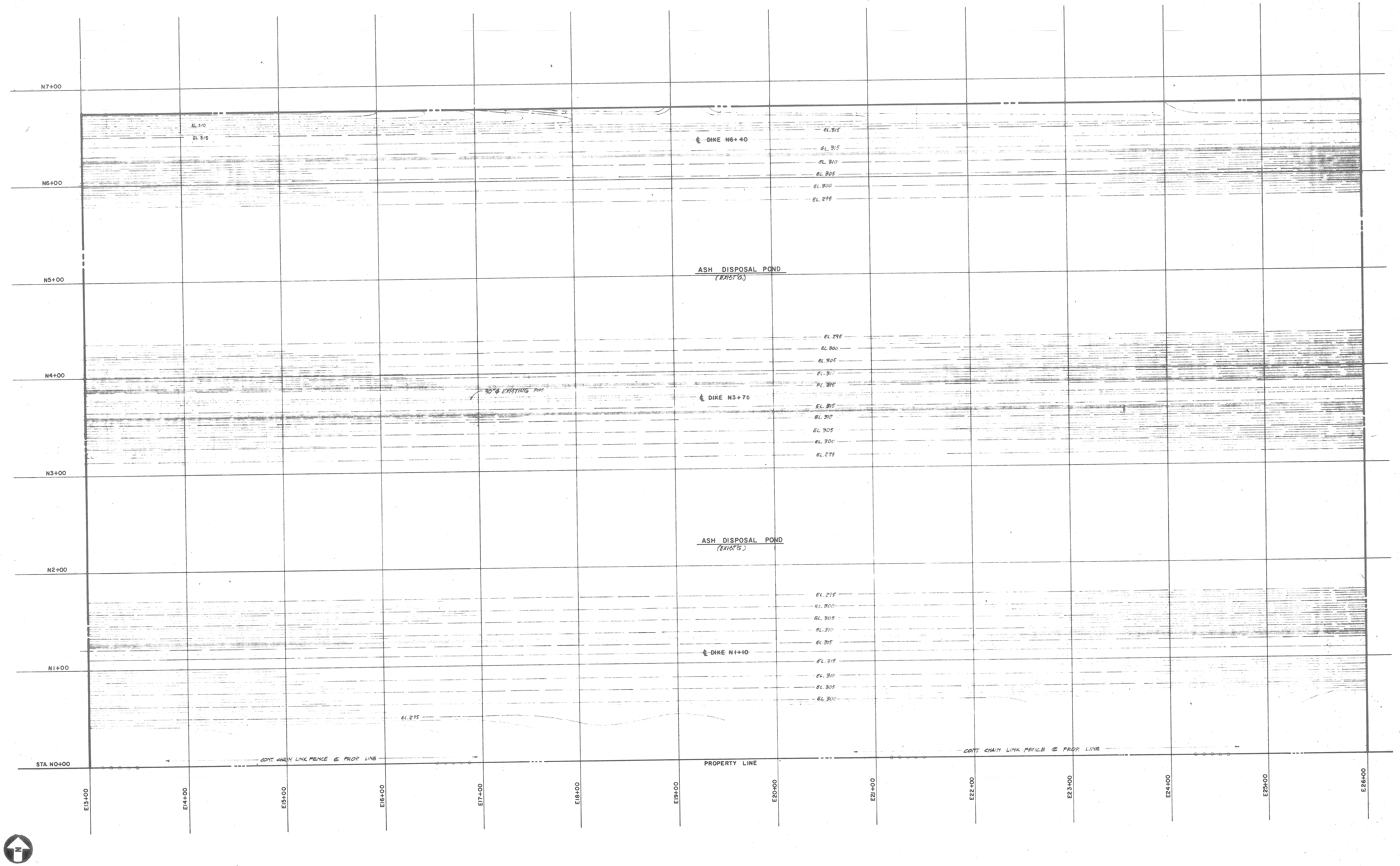
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

KEY TO CLASSIFICATION SYMBOLS USED ON BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS		DESCRIPTIONS
COARSE-GRAINED SOILS More Than Half of Material LARGER Than No. 200 Sieve size	GRAVELS More Than Half of Coarse Fraction is LARGER Than No. 4 Sieve Size	Clean Gravels (Little or no Fines)	GW		Well-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
			GP		Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
		Gravels With Fines (Appreciable Amount of Fines)	GM		Silty Gravels, Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS More Than Half of Coarse Fraction is SMALLER Than No. 4 Sieve Size	Clean Sands (Little or no Fines)	SW		Well-Graded Sands, Gravelly Sands, Little or no Fines
			SP		Poorly-Graded Sands, Gravelly Sands, Little or no Fines
		Sands With Fines (Appreciable Amount of Fines)	SM		Silty Sands, Sand-Silt Mixtures
			SC		Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS More Than Half of Material is SMALLER Than No. 200 Sieve Size	SILTS & CLAYS	Liquid Limit Less Than 50	ML		Inorganic Silts & Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
	SILTS & CLAYS	Liquid Limit Greater Than 50	MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils, Elastic Silts
			CH		Inorganic Clays of High Plasticity, Fat Clays
FORMATIONAL MATERIALS	SANDSTONE				Massive Sandstones, Sandstones with Gravel Clasts
	MARLSTONE				Indurated Argillaceous Limestones
	LIMESTONE				Massive or Weakly Bedded Limestones
	CLAYSTONE				Mudstone or Massive Claystones
	CHALK				Massive or Poorly Bedded Chalk Deposits
	MARINE CLAYS				Cretaceous Clay Deposits
	GROUNDWATER			▼	Indicates Final Observed Groundwater Level
				▽	Indicates Initial Observed Groundwater Location

Arias & Associates, Inc.

APPENDIX E: POND PLANS, CROSS SECTIONS, AND GROUNDWATER DATA PROVIDED TO ARIAS BY SMECI



NOTES

REV	DATE	BY	DESCRIPTION
A	5-18-77		REVISED PER ADDENDUM NO. 1
0	8-18-77		FINAL BID SET

SCALE 1" = 40'
DRAWN P.G.M.
DATE 4-1-77
CHECKED C.A.D.
APPROVED M.L.H., W.G.H.

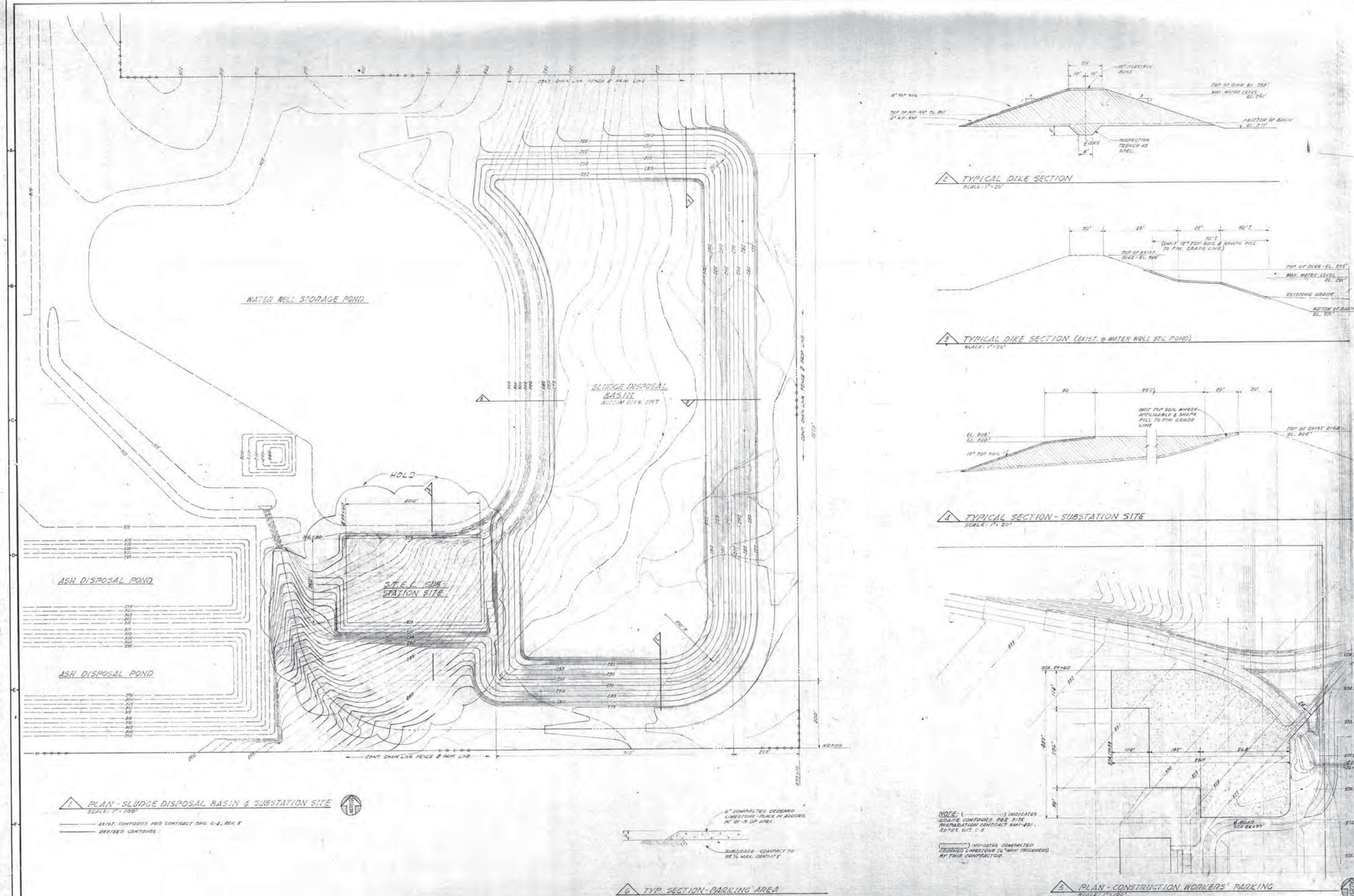
STATE OF TEXAS — M. L. HUGHES — 25324 — REGISTERED PROFESSIONAL ENGINEER
STATE OF TEXAS — William G. Hollowell — 15137 — REGISTERED PROFESSIONAL ENGINEER
STATE OF TEXAS — CHARLES A. DOBY — 37593 — REGISTERED PROFESSIONAL ENGINEER

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

SAN MIGUEL PLANT
UNIT NO. 1
B.E.P.C. S.T.E.C.

SITE PLAN
SECTION NO. 8

JOB NO. SMI-406
REV. 0
DRAWING NUMBER 1-C-37



NOTES

1. ALL FILL INDICATED /1\ SHALL BE AS SPECIFIED FOR CONTROLLED COMPACTED FILL.

REV	DATE	BY	DESCRIPTION
0		PK	ADD THIS DRAWING TO CONTRACT DRAWINGS

SCALE: AS NOTED
DRAWN: P.R.K.
DATE: 4-8-77
CHECKED: E.A.D.
APPROVED:

STATE OF TEXAS — William G. Hollowell 15137 — REGISTERED PROFESSIONAL ENGINEER

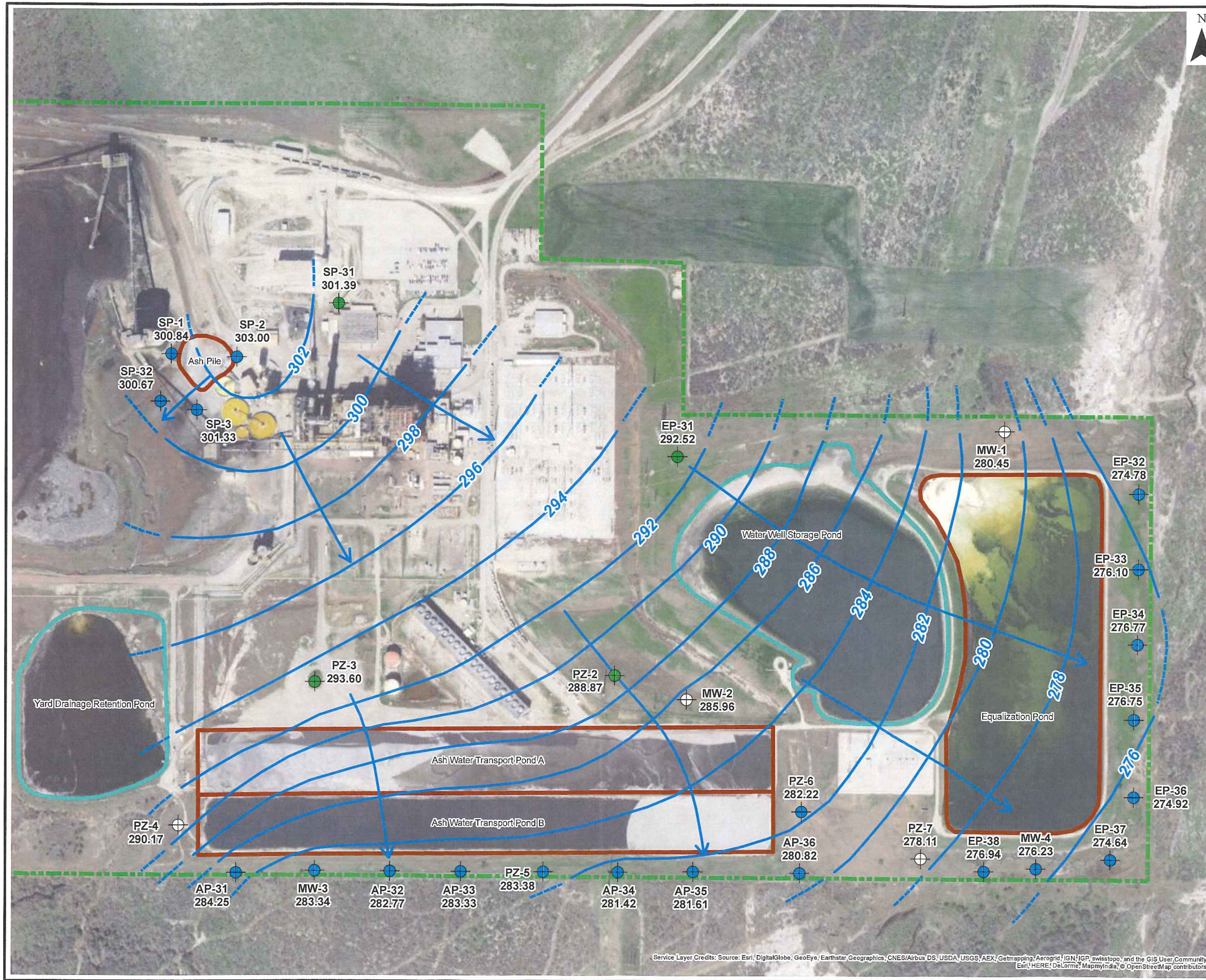
STATE OF TEXAS — M.L. HUGHES 25324 — REGISTERED PROFESSIONAL ENGINEER

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

SAN MIGUEL PLANT
UNIT NO. 1
B.E.P.C. S.T.E.C.

SLUDGE DISPOSAL BASIN, 69 KV SUBSTATION & TEMP. PARKING AREA

JOB NO.: SMI-401
REV.: 0
DRAWING NUMBER: C-12



Legend

- Background Monitor Well
- Point of Compliance Monitor Well
- Groundwater Elevation Observation Well
- Potentiometric Surface Contour (Dashed where inferred)
- Groundwater Flow Direction
- CCR Impoundment/Unit
- Non-CCR Impoundment
- Approximate Plant Boundary

STATE OF TEXAS
MELISSA BOYSUN
GEOLOGY
No. 11387
LICENSED
PROFESSIONAL GEOSCIENTIST
8/23/16

DRAFT
Privileged and Confidential
Attorney Work Product

0 400 800
Feet

FIGURE 1
POTENTIOMETRIC SURFACE MAP
AUGUST 16, 2016
Hydrogeologic Characterization and
Groundwater Monitoring System Installation
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN:	N. Houtchens	DRAWN:	EFC
CHECKED:	M. Boysun	DATE:	8/23/2016
SCALE:	AS SHOWN	REVISION:	0

FILE: K:\GIS\SMECI\Christine_TX\MXD\ph3\Fig1_potmap_16aug2016.mxd

ERM Environmental Resources Management

TABLE 1
GROUNDWATER ELEVATION MEASUREMENTS

CCR Unit Groundwater Monitoring (May - August 2016)
San Miguel Electric Cooperative, Inc.
Atascosa County, Texas

CCR Unit	Well ID	Top of Casing Elevation (ft. amsl) (1)	May 24, 2016			August 16, 2016		
			DTW	TD	GW El. (2)	DTW	TD	GW El. (2)
			Ft. btoc	Ft. btoc	Ft. amsl	Ft. btoc	Ft. btoc	Ft. amsl
Ash Pile	SP-31	335.01	33.45	59.99	301.56	33.62	60.05	301.39
	SP-32	327.89	27.42	45.51	300.47	27.22	45.28	300.67
	SP-1	325.97	25.36	44.81	300.61	25.13	44.40	300.84
	SP-2	329.80	27.29	46.80	302.51	26.80	46.31	303.00
	SP-3	328.34	27.18	49.74	301.16	27.01	49.50	301.33
Ash Pond	PZ-2	318.92	29.86	67.09	289.06	30.05	67.07	288.87
	PZ-3	323.19	29.50	56.87	293.69	29.59	56.45	293.60
	PZ-5	302.77	18.30	50.20	284.47	19.39	49.74	283.38
	PZ-6	297.42	14.36	53.54	283.06	15.20	53.40	282.22
	AP-31	292.80	6.94	25.97	285.86	8.55	25.65	284.25
	AP-32	297.94	14.27	36.93	283.67	15.17	36.48	282.77
	AP-33	304.67	20.47	44.78	284.20	21.34	44.40	283.33
	AP-34	296.32	13.61	41.09	282.71	14.90	40.50	281.42
	AP-35	298.36	14.67	46.22	283.69	16.75	45.80	281.61
	AP-36	288.75	6.75	43.19	282.00	7.93	42.80	280.82
	MW-3	295.90	11.64	42.66	284.26	12.56	42.45	283.34
Equalization Pond	EP-31	316.70	24.81	65.20	291.89	24.18	64.83	292.52
	EP-32	277.44	1.57	44.26	275.87	2.66	43.93	274.78
	EP-33	278.00	0.90	43.84	277.10	1.90	43.44	276.10
	EP-34	278.71	0.99	48.91	277.72	1.94	48.42	276.77
	EP-35	279.86	2.24	47.15	277.62	3.11	46.62	276.75
	EP-36	278.50	2.98	44.52	275.52	3.58	44.22	274.92
	EP-37	277.80	2.31	48.69	275.49	3.16	48.65	274.64
	EP-38	279.35	1.36	42.72	277.99	2.41	42.48	276.94
	MW-4	278.58	1.58	47.62	277.00	2.35	47.45	276.23
Groundwater Observation Well	MW-1	289.16	8.03	52.39	281.13	8.71	52.20	280.45
	MW-2	317.68	31.41	64.24	286.27	31.72	64.10	285.96
	PZ-4	303.21	11.36	34.25	291.85	13.04	34.50	290.17
	PZ-7	281.99	2.79	46.59	279.20	3.88	46.50	278.11

NOTES:

(1) Survey data from SAM survey report, 05/2016.

(2) Adjusted groundwater elevation has been calculated by subtracting the depth to water from the top of casing elevation.

DTW = Depth to Water
TD = Total depth
GW El. = Groundwater Elevation
Ft. = feet
btoc = below top of casing
amsl = above mean sea level

Appendix E Cross Sections 1 to 16 for Ash Water Transport Pond and Equalization Pond provided by SMECI

Arias Job No. 2016-581

					Position	Distance Along line	Elevation	Postion Along line
	Cross Section 1				***Cross Section 1***			
1001	1	13439020	2135326	301.562	*1*	*-0.02*	*301.56*	*West/Toe*
1002	2	13439020	2135328	301.567	*2*	*1.61*	*301.57*	
1003	3	13439020	2135329	301.573	*3*	*3.24*	*301.57*	
1004	4	13439020	2135331	301.579	*4*	*4.91*	*301.58*	
1005	5	13439020	2135333	301.584	*5*	*6.62*	*301.58*	
1006	6	13439020	2135334	301.591	*6*	*8.49*	*301.59*	
1007	7	13439020	2135337	301.599	*7*	*10.73*	*301.60*	
1008	8	13439020	2135340	301.609	*8*	*13.86*	*301.61*	
1009	9	13439020	2135369	302.155	*9*	*42.98*	*302.16*	
1010	10	13439020	2135358	301.904	*10*	*32.50*	*301.90*	
1011	11	13439020	2135348	301.65	*11*	*21.90*	*301.65*	
1012	12	13439020	2135377	302.341	*12*	*50.69*	*302.34*	
1013	13	13439020	2135383	302.934	*13*	*57.47*	*302.93*	
1014	14	13439020	2135393	304.39	*14*	*67.14*	*304.39*	
1015	15	13439020	2135400	305.471	*15*	*74.33*	*305.47*	
1016	16	13439020	2135404	305.956	*16*	*77.56*	*305.96*	
1017	17	13439020	2135405	306.243	*17*	*79.46*	*306.24*	
1018	18	13439020	2135407	306.53	*18*	*81.37*	*306.53*	
1019	19	13439020	2135411	307.075	*19*	*84.99*	*307.08*	
1020	20	13439020	2135413	307.401	*20*	*87.16*	*307.40*	
1021	21	13439020	2135417	308.035	*21*	*91.38*	*308.04*	
1022	22	13439020	2135425	309.113	*22*	*98.55*	*309.11*	
1023	23	13439020	2135428	309.559	*23*	*101.51*	*309.56*	
1024	24	13439020	2135434	310.54	*24*	*107.66*	*310.54*	
1025	25	13439020	2135437	311.032	*25*	*110.69*	*311.03*	
1026	26	13439020	2135439	311.332	*26*	*112.53*	*311.33*	
1027	27	13439020	2135440	311.631	*27*	*114.37*	*311.63*	
1028	28	13439020	2135442	311.866	*28*	*115.82*	*311.87*	
1029	29	13439020	2135443	311.982	*29*	*117.40*	*311.98*	
1030	30	13439020	2135453	312.126	*30*	*126.87*	*312.13*	
1031	31	13439020	2135455	312.16	*31*	*128.61*	*312.16*	
1032	32	13439020	2135456	312.195	*32*	*130.45*	*312.20*	
1033	33	13439020	2135458	312.222	*33*	*132.16*	*312.22*	
1034	34	13439020	2135460	312.25	*34*	*133.94*	*312.25*	
1035	35	13439020	2135461	312.262	*35*	*135.39*	*312.26*	
1036	36	13439020	2135463	312.297	*36*	*136.90*	*312.30*	
1037	37	13439020	2135465	312.327	*37*	*139.14*	*312.33*	
1038	38	13439020	2135474	312.47	*38*	*148.39*	*312.47*	
1039	39	13439020	2135484	313.477	*39*	*157.81*	*313.48*	
1040	40	13439020	2135491	314.317	*40*	*164.84*	*314.32*	
1041	41	13439020	2135502	315.606	*41*	*175.66*	*315.61*	
1042	42	13439020	2135496	314.976	*42*	*170.38*	*314.98*	

1043	43	13439020	2135508	315.866	*43*	*181.59*	*315.87*	
1044	44	13439020	2135511	315.863	*44*	*184.97*	*315.86*	
1045	45	13439020	2135513	315.861	*45*	*186.96*	*315.86*	*East/Water*
					Cross Section 2			
1046		13438587	2135199	296.556	*1*	*-0.47*	*296.56*	*West/Toe*
1047		13438587	2135210	296.834	*2*	*10.52*	*296.83*	
1048		13438587	2135217	296.974	*3*	*17.87*	*296.97*	
1049		13438587	2135222	297.068	*4*	*23.36*	*297.07*	
1050		13438587	2135226	297.146	*5*	*27.34*	*297.15*	
1051		13438587	2135233	297.278	*6*	*34.49*	*297.28*	
1052		13438587	2135240	297.403	*7*	*41.24*	*297.40*	
1053		13438587	2135246	297.512	*8*	*47.08*	*297.51*	
1054		13438587	2135251	297.607	*9*	*52.23*	*297.61*	
1055		13438587	2135256	297.701	*10*	*57.31*	*297.70*	
1056		13438587	2135262	297.806	*11*	*62.94*	*297.81*	
1057		13438587	2135275	298.054	*12*	*76.36*	*298.05*	
1058		13438587	2135278	298.11	*13*	*79.38*	*298.11*	
1059		13438587	2135281	298.166	*14*	*82.40*	*298.17*	
1060		13438587	2135284	298.223	*15*	*85.29*	*298.22*	
1061		13438587	2135287	298.268	*16*	*88.10*	*298.27*	
1062		13438587	2135290	298.321	*17*	*90.78*	*298.32*	
1063		13438587	2135292	298.36	*18*	*92.84*	*298.36*	
1064		13438587	2135295	298.416	*19*	*96.07*	*298.42*	
1065		13438587	2135300	298.516	*20*	*101.12*	*298.52*	
1066		13438587	2135304	298.581	*21*	*104.83*	*298.58*	
1067		13438587	2135307	298.647	*22*	*108.19*	*298.65*	
1068		13438587	2135311	298.715	*23*	*111.83*	*298.72*	
1069		13438587	2135316	298.812	*24*	*117.05*	*298.81*	
1070		13438587	2135328	299.026	*25*	*129.02*	*299.03*	
1071		13438587	2135339	299.236	*26*	*140.15*	*299.24*	
1072		13438587	2135349	299.427	*27*	*150.45*	*299.43*	
1073		13438587	2135361	299.64	*28*	*161.53*	*299.64*	
1074		13438587	2135369	299.944	*29*	*170.32*	*299.94*	
1075		13438587	2135378	300.236	*30*	*178.77*	*300.24*	
1076		13438587	2135398	301.657	*31*	*198.72*	*301.66*	
1077		13438587	2135400	302.022	*32*	*201.40*	*302.02*	
1078		13438587	2135408	302.996	*33*	*208.54*	*303.00*	
1079		13438587	2135414	303.868	*34*	*214.93*	*303.87*	
1080		13438587	2135420	304.681	*35*	*220.90*	*304.68*	
1081		13438587	2135426	305.454	*36*	*226.57*	*305.45*	
1082		13438587	2135430	306.063	*37*	*231.03*	*306.06*	
1083		13438587	2135435	306.72	*38*	*235.84*	*306.72*	
1084		13438587	2135438	307.213	*39*	*239.48*	*307.21*	
1085		13438587	2135440	307.458	*40*	*241.27*	*307.46*	
1086		13438587	2135442	307.653	*41*	*242.71*	*307.65*	
1087		13438587	2135444	307.908	*42*	*244.56*	*307.91*	
1088		13438587	2135445	308.104	*43*	*246.00*	*308.10*	

1089	13438587	2135447	308.321	44	247.58	308.32	
1090	13438587	2135448	308.527	45	249.09	308.53	
1091	13438587	2135450	308.796	46	251.09	308.80	
1092	13438587	2135451	308.956	47	252.25	308.96	
1093	13438587	2135453	309.144	48	253.63	309.14	
1094	13438587	2135463	310.556	49	264.00	310.56	
1095	13438587	2135465	310.879	50	266.34	310.88	
1096	13438587	2135468	311.172	51	268.89	311.17	
1097	13438587	2135474	311.821	52	274.67	311.82	
1098	13438587	2135483	312.826	53	283.66	312.83	
1099	13438587	2135488	313.649	54	288.77	313.65	
1100	13438587	2135494	314.723	55	294.77	314.72	
1101	13438587	2135499	315.181	56	300.32	315.18	
1102	13438587	2135509	315.374	57	309.65	315.37	
1103	13438587	2135519	315.596	58	320.43	315.60	East/Water
				Cross Section 3			
1104	13438567	2135659	314.802	1	0.23	314.80	North/Water
1105	13438565	2135659	314.877	2	2.17	314.88	
1106	13438560	2135659	315.533	3	7.22	315.53	
1107	13438555	2135659	315.523	4	12.17	315.52	
1108	13438550	2135659	315.191	5	16.85	315.19	
1109	13438549	2135659	315.097	6	18.19	315.10	
1110	13438548	2135659	314.895	7	19.49	314.90	
1111	13438546	2135659	314.385	8	20.88	314.39	
1112	13438544	2135659	313.62	9	22.98	313.62	
1113	13438542	2135659	312.881	10	25.01	312.88	
1114	13438541	2135659	312.34	11	26.49	312.34	
1115	13438539	2135659	311.708	12	27.91	311.71	
1116	13438538	2135659	311.023	13	29.44	311.02	
1117	13438536	2135659	310.39	14	30.85	310.39	
1118	13438535	2135659	309.719	15	32.35	309.72	
1119	13438533	2135659	309.157	16	33.60	309.16	
1120	13438532	2135659	308.67	17	34.70	308.67	
1121	13438531	2135659	308.16	18	35.83	308.16	
1122	13438530	2135659	307.653	19	36.96	307.65	
1123	13438529	2135659	307.143	20	38.10	307.14	
1124	13438528	2135659	306.641	21	39.23	306.64	
1125	13438527	2135659	306.169	22	40.30	306.17	
1126	13438526	2135659	305.664	23	41.45	305.66	
1127	13438524	2135659	305.187	24	42.53	305.19	
1128	13438523	2135659	304.691	25	43.67	304.69	
1129	13438522	2135659	304.538	26	44.76	304.54	
1130	13438521	2135659	304.379	27	45.95	304.38	
1131	13438520	2135659	304.218	28	47.06	304.22	
1132	13438519	2135659	304.029	29	48.47	304.03	
1133	13438515	2135659	303.535	30	52.15	303.54	
1134	13438512	2135659	302.822	31	55.26	302.82	

1135	13438509	2135659	301.85	*32*	*58.37*	*301.85*	
1136	13438506	2135659	300.976	*33*	*61.18*	*300.98*	
1137	13438504	2135659	300.607	*34*	*62.81*	*300.61*	
1138	13438503	2135659	300.304	*35*	*64.50*	*300.30*	
1139	13438501	2135659	300.033	*36*	*66.01*	*300.03*	
1140	13438499	2135659	299.094	*37*	*67.67*	*299.09*	
1141	13438498	2135659	298.272	*38*	*69.11*	*298.27*	
1142	13438497	2135659	297.808	*39*	*69.91*	*297.81*	
1143	13438496	2135659	297.314	*40*	*70.77*	*297.31*	
1144	13438495	2135659	296.837	*41*	*71.60*	*296.84*	
1145	13438495	2135659	296.358	*42*	*72.43*	*296.36*	
1146	13438494	2135659	295.838	*43*	*73.32*	*295.84*	
1147	13438493	2135659	295.199	*44*	*74.42*	*295.20*	
1148	13438491	2135659	294.513	*45*	*75.59*	*294.51*	
1149	13438491	2135659	294.105	*46*	*76.36*	*294.11*	
1150	13438490	2135659	294.026	*47*	*77.25*	*294.03*	
1151	13438489	2135659	293.936	*48*	*78.26*	*293.94*	
1152	13438487	2135659	293.659	*49*	*79.86*	*293.66*	
1153	13438484	2135659	292.779	*50*	*82.88*	*292.78*	
1154	13438481	2135659	292.222	*51*	*86.43*	*292.22*	
1155	13438474	2135659	291.375	*52*	*93.09*	*291.38*	
1156	13438466	2135659	290.928	*53*	*100.87*	*290.93*	
1157	13438458	2135659	290.751	*54*	*108.96*	*290.75*	*South/toe*
				Cross Section 4			
1158	13438569	2135890	316.304	*1*	*-2.30*	*316.30*	*North/Water*
1159	13438568	2135890	316.305	*2*	*-1.41*	*316.31*	
1160	13438564	2135891	316.311	*3*	*3.42*	*316.31*	
1161	13438558	2135890	316.318	*4*	*8.54*	*316.32*	
1162	13438554	2135890	316	*5*	*12.83*	*316.00*	
1163	13438553	2135891	315.629	*6*	*14.09*	*315.63*	
1164	13438460	2135892	292.694	*7*	*107.45*	*292.69*	
1165	13438467	2135892	293.021	*8*	*99.71*	*293.02*	
1166	13438477	2135892	293.621	*9*	*90.12*	*293.62*	
1167	13438481	2135892	294.558	*10*	*86.05*	*294.56*	
1168	13438487	2135892	296.467	*11*	*79.52*	*296.47*	
1169	13438494	2135891	298.26	*12*	*73.40*	*298.26*	
1170	13438500	2135891	300.111	*13*	*67.08*	*300.11*	
1171	13438506	2135891	301.782	*14*	*61.38*	*301.78*	
1172	13438512	2135892	303.572	*15*	*55.26*	*303.57*	
1173	13438517	2135891	305.066	*16*	*50.16*	*305.07*	
1174	13438520	2135891	306.047	*17*	*46.81*	*306.05*	
1175	13438523	2135891	306.922	*18*	*43.82*	*306.92*	
1176	13438526	2135891	307.76	*19*	*40.96*	*307.76*	
1177	13438529	2135891	308.64	*20*	*37.96*	*308.64*	
1178	13438532	2135891	309.496	*21*	*35.03*	*309.50*	
1179	13438535	2135891	310.371	*22*	*32.05*	*310.37*	
1180	13438539	2135891	311.685	*23*	*27.56*	*311.69*	

1181	13438542	2135891	312.55	24	24.60	312.55	
1182	13438545	2135891	313.434	25	21.59	313.43	
1183	13438548	2135891	314.285	26	18.68	314.29	
1184	13438550	2135891	314.718	27	17.20	314.72	South/Toe
				Cross Section 5			
1185	13438568	2136375	314.861	28	-0.75	314.86	North/Water
1186	13438566	2136375	314.993	29	1.24	314.99	
1187	13438559	2136375	315.465	30	8.32	315.47	
1188	13438553	2136375	315.533	31	14.32	315.53	
1189	13438548	2136375	314.425	32	18.86	314.43	
1190	13438544	2136375	313.313	33	23.42	313.31	
1191	13438539	2136375	312.162	34	28.14	312.16	
1192	13438534	2136375	311.036	35	32.75	311.04	
1193	13438530	2136375	309.891	36	37.45	309.89	
1194	13438526	2136375	309.119	37	40.61	309.12	
1195	13438525	2136375	308.727	38	42.22	308.73	
1196	13438523	2136375	308.373	39	43.67	308.37	
1197	13438520	2136375	307.588	40	46.89	307.59	
1198	13438515	2136375	306.456	41	51.53	306.46	
1199	13438512	2136375	305.71	42	54.58	305.71	
1200	13438508	2136375	304.611	43	59.09	304.61	
1201	13438501	2136375	302.915	44	66.04	302.92	
1202	13438494	2136375	301.214	45	73.01	301.21	
1203	13438487	2136375	299.685	46	79.72	299.69	
1204	13438491	2136375	300.455	47	76.34	300.46	
1205	13438480	2136375	298.1	48	86.66	298.10	
1206	13438473	2136375	296.521	49	93.58	296.52	
1207	13438477	2136375	297.292	50	90.20	297.29	
1208	13438457	2136375	295.995	51	110.29	296.00	South/Toe
				Cross Section 6			
1209	13438570	2136963	315.677	1	-2.61	315.68	North/Water
1210	13438560	2136963	315.663	2	6.55	315.66	
1211	13438567	2136963	315.663	3	0.21	315.66	
1212	13438554	2136963	316.019	4	13.32	316.02	
1213	13438553	2136963	316	5	13.86	316.00	
1214	13438552	2136963	315.494	6	15.23	315.49	
1215	13438548	2136963	313.981	7	19.32	313.98	
1216	13438545	2136963	312.978	8	22.03	312.98	
1217	13438542	2136963	311.946	9	24.82	311.95	
1218	13438540	2136963	310.966	10	27.50	310.97	
1219	13438537	2136963	309.967	11	30.25	309.97	
1220	13438535	2136963	309.466	12	31.63	309.47	
1221	13438534	2136963	308.964	13	33.00	308.96	
1222	13438533	2136963	308.479	14	34.34	308.48	
1223	13438530	2136963	307.48	15	37.08	307.48	
1224	13438527	2136963	306.485	16	39.82	306.49	
1225	13438526	2136963	305.991	17	41.17	305.99	

1226	13438523	2136963	304.984	18	43.94	304.98	
1227	13438520	2136963	303.997	19	46.65	304.00	
1228	13438519	2136963	303.496	20	48.03	303.50	
1229	13438518	2136963	302.991	21	49.41	302.99	
1230	13438516	2136963	302.506	22	50.75	302.51	
1231	13438515	2136963	302.012	23	52.10	302.01	
1232	13438507	2136963	301.487	24	60.03	301.49	
1233	13438511	2136963	301.687	25	56.11	301.69	
1234	13438502	2136963	301.238	26	64.92	301.24	
1235	13438497	2136964	300.974	27	70.07	300.97	
1236	13438487	2136964	300.453	28	80.27	300.45	
1237	13438477	2136963	299.942	29	90.30	299.94	
1238	13438467	2136963	299.44	30	100.37	299.44	
1239	13438457	2136963	298.997	31	110.40	299.00	South/Toe
					Cross Section 7		
1240	13438569	2137382	316.706	1	-1.63	316.71	North/Water
1241	13438563	2137382	316.727	2	4.15	316.73	
1242	13438555	2137383	316.759	3	12.24	316.76	
1243	13438550	2137382	315.988	4	16.54	315.99	
1244	13438548	2137382	315.022	5	19.36	315.02	
1245	13438545	2137382	314.018	6	22.28	314.02	
1246	13438542	2137382	313.027	7	25.17	313.03	
1247	13438539	2137382	312	8	28.16	312.00	
1248	13438535	2137382	310.512	9	32.49	310.51	
1249	13438532	2137382	309.522	10	35.38	309.52	
1250	13438529	2137382	308.531	11	38.27	308.53	
1251	13438524	2137382	307.032	12	42.63	307.03	
1252	13438521	2137382	306.029	13	45.55	306.03	
1253	13438518	2137382	305.013	14	48.51	305.01	
1254	13438513	2137382	303.023	15	54.31	303.02	
1255	13438508	2137382	301.57	16	58.51	301.57	
1256	13438506	2137382	300.546	17	61.47	300.55	
1257	13438500	2137382	298.528	18	67.30	298.53	
1258	13438497	2137382	297.541	19	70.15	297.54	
1259	13438494	2137382	296.529	20	73.07	296.53	
1260	13438491	2137382	295.499	21	76.05	295.50	
1261	13438488	2137382	294.525	22	78.87	294.53	
1262	13438485	2137382	293.988	23	81.93	293.99	
1263	13438466	2137382	293.479	24	101.11	293.48	
1264	13438453	2137383	293.199	25	113.65	293.20	South/Toe
					Cross Section 8		
1265	13438560	2137797	315.746	1	6.63	315.7	North/Water
1266	13438558	2137797	315.734	2	8.55	315.7	
1267	13438553	2137796	315.7	3	14.05	315.7	
1268	13438547	2137797	315.998	4	19.54	316.0	
1269	13438543	2137796	315.539	5	24.10	315.5	
1270	13438537	2137797	313.542	6	29.92	313.5	

1271	13438533	2137796	312.087	7	34.15	312.1	
1272	13438527	2137797	310.09	8	39.96	310.1	
1273	13438523	2137797	308.61	9	44.27	308.6	
1274	13438517	2137797	306.662	10	49.94	306.7	
1275	13438513	2137797	305.181	11	54.25	305.2	
1276	13438507	2137797	303.173	12	60.10	303.2	
1277	13438503	2137796	301.742	13	64.26	301.7	
1278	13438498	2137797	300.257	14	68.59	300.3	
1279	13438494	2137797	298.752	15	72.97	298.8	
1280	13438490	2137797	297.269	16	77.26	297.3	
1281	13438485	2137797	295.635	17	81.57	295.6	
1282	13438483	2137796	294.561	18	84.43	294.6	
1283	13438478	2137797	292.915	19	88.76	292.9	
1284	13438475	2137797	291.972	20	91.66	292.0	
1285	13438466	2137797	291.449	21	100.69	291.4	
1286	13438455	2137797	290.99	22	112.09	291.0	South/Toe
				Cross Section 9			
1287	13438605	2137957	315.098	1	0	315.098	West/Water
1288	13438605	2137967	313.645	2	10	313.645	
1289	13438605	2137962	314.113	3	5	314.113	
1290	13438605	2137977	312.777	4	20	312.777	
1291	13438606	2137980	312.5	5	23	312.5	
1292	13438605	2137984	312.167	6	27	312.167	
1293	13438605	2137987	311.914	7	30	311.914	
1294	13438605	2137990	311.672	8	33	311.672	
1295	13438605	2137993	311.422	9	36	311.422	
1296	13438606	2137995	311.166	10	38	311.166	
1297	13438605	2137998	310.475	11	41	310.475	
1298	13438605	2138001	308.851	12	44	308.851	
1299	13438606	2138004	307.583	13	47	307.583	
1300	13438605	2138007	306.382	14	50	306.382	
1301	13438605	2138010	305.206	15	53	305.206	
1302	13438606	2138014	303.65	16	57	303.65	
1303	13438605	2138018	302.141	17	61	302.141	
1304	13438605	2138022	300.536	18	65	300.536	
1305	13438606	2138024	299.446	19	67	299.446	
1306	13438605	2138028	298.54	20	71	298.54	
1307	13438605	2138031	298.092	21	74	298.092	
1308	13438605	2138035	296.589	22	78	296.589	
1309	13438606	2138038	295.486	23	81	295.486	
1310	13438605	2138052	290.515	24	95	290.515	
1311	13438605	2138065	289.483	25	108	289.483	
1312	13438605	2138079	288.992	26	122	288.992	
1313	13438605	2138096	288.482	27	139	288.482	
1314	13438605	2138112	287.998	28	155	287.998	
1315	13438606	2138131	287.451	29	174	287.451	East/Toe
				Cross Section 10			

1316	13438879	2137966	315.7	1	8.55	315.70	West/Water
1317	13438878	2137977	316.155	2	19.52	316.16	
1318	13438879	2137987	316	3	30.34	316.00	
1319	13438878	2137990	315.157	4	33.31	315.16	
1320	13438878	2137993	314.293	5	36.35	314.29	
1321	13438878	2137996	313.444	6	39.33	313.44	
1322	13438878	2137999	312.555	7	42.38	312.56	
1323	13438878	2138002	311.663	8	45.40	311.66	
1324	13438878	2138005	310.792	9	48.36	310.79	
1325	13438878	2138008	309.897	10	51.40	309.90	
1326	13438878	2138011	309.01	11	54.40	309.01	
1327	13438878	2138014	308.113	12	57.45	308.11	
1328	13438878	2138017	307.222	13	60.47	307.22	
1329	13438878	2138019	306.787	14	61.95	306.79	
1330	13438878	2138020	306.344	15	63.44	306.34	
1331	13438878	2138022	305.883	16	65.01	305.88	
1332	13438878	2138023	305.451	17	66.47	305.45	
1333	13438878	2138027	304.56	18	69.50	304.56	
1334	13438878	2138030	303.671	19	72.52	303.67	
1335	13438878	2138031	303.23	20	74.01	303.23	
1336	13438878	2138038	301.268	21	81.07	301.27	
1337	13438878	2138040	301.013	22	83.32	301.01	
1338	13438878	2138045	300.495	23	88.02	300.50	
1339	13438878	2138050	299.989	24	92.52	299.99	
1340	13438879	2138054	299.522	25	97.41	299.52	
1341	13438879	2138061	299.032	26	103.87	299.03	
1342	13438878	2138067	298.554	27	110.15	298.55	
1343	13438878	2138070	297.502	28	112.68	297.50	
1344	13438878	2138072	296.754	29	114.65	296.75	
1345	13438878	2138073	297.223	30	115.83	297.22	
1346	13438878	2138074	297.652	31	116.65	297.65	
1347	13438878	2138076	298.034	32	119.18	298.03	
1348	13438878	2138086	298.03	33	129.17	298.03	
1349	13438878	2138094	297.998	34	137.13	298.00	
1350	13438878	2138110	297.825	35	153.29	297.83	
1351	13438879	2138127	297.504	36	169.63	297.50	East/Toe
	Cross Section 11				***Cross Section 11***		
1352	13438662	2138742	295	1	0.30	295.00	East/Water
1353	13438657	2138742	295.353	2	5.03	295.35	
1354	13438651	2138742	296.162	3	11.32	296.16	
1355	13438644	2138742	296.404	4	17.92	296.40	
1356	13438632	2138742	296.041	5	30.28	296.04	
1357	13438629	2138742	295.739	6	33.37	295.74	
1358	13438621	2138742	293.744	7	41.19	293.74	
1359	13438616	2138742	292.208	8	46.38	292.21	
1360	13438611	2138742	290.754	9	51.36	290.75	

1361	13438606	2138742	289.272	10	55.75	289.27	
1362	13438603	2138742	288.206	11	58.72	288.21	
1363	13438597	2138742	286.207	12	64.54	286.21	
1364	13438592	2138742	284.695	13	69.78	284.70	
1365	13438587	2138742	283.224	14	75.50	283.22	
1366	13438582	2138742	282.212	15	80.00	282.21	
1367	13438576	2138742	280.709	16	85.99	280.71	
1368	13438570	2138742	279.215	17	91.81	279.22	
1369	13438566	2138742	278.424	18	96.10	278.42	
1370	13438560	2138742	278.063	19	101.77	278.06	West/Toe
				Cross Section 12			
	Cross Section 12						
1371	13438696	2139349	295	1	-0.15	295.00	NorthWest/Wat
1372	13438695	2139351	295.572	2	1.11	295.57	
1373	13438693	2139354	296	3	2.61	296.00	
1374	13438691	2139357	295.965	4	4.61	295.97	
1375	13438688	2139362	295.8	5	7.99	295.80	
1376	13438685	2139367	295.664	6	10.63	295.66	
1377	13438682	2139371	295.515	7	13.52	295.52	
1378	13438681	2139375	294.806	8	15.50	294.81	
1379	13438678	2139380	293.21	9	18.46	293.21	
1380	13438675	2139384	291.79	10	21.22	291.79	
1381	13438672	2139388	290.254	11	23.98	290.25	
1382	13438669	2139393	288.717	12	26.52	288.72	
1383	13438666	2139398	286.769	13	29.72	286.77	
1384	13438664	2139402	285.242	14	32.10	285.24	
1385	13438661	2139406	283.727	15	34.91	283.73	
1386	13438659	2139410	282.227	16	37.45	282.23	
1387	13438657	2139414	281.26	17	39.38	281.26	
1388	13438654	2139418	279.826	18	42.31	279.83	
1389	13438651	2139422	278.708	19	44.74	278.71	
1390	13438648	2139427	277.254	20	47.56	277.25	
1391	13438645	2139432	276.749	21	50.82	276.75	
1392	13438640	2139440	276.774	22	55.99	276.77	
1393	13438635	2139449	276.604	23	61.30	276.60	
1394	13438629	2139458	276.358	24	66.90	276.36	
1395	13438623	2139467	276.149	25	72.60	276.15	
1396	13438618	2139475	276	26	77.51	276.00	
1397	13438615	2139481	276	27	81.05	276.00	SouthEast
				Cross Section 13			
	Cross Section 13						
1398	13439041	2139408	295	1	-0.37	295.00	West/Water
1399	13439041	2139410	295.729	2	1.95	295.73	
1416	13439041	2139411	296.018	19	3.16	296.02	
1400	13439040	2139415	296.014	3	6.88	296.01	
1417	13439041	2139425	296.001	20	16.81	296.00	
1401	13439040	2139426	295.939	4	17.87	295.94	

1402	13439041	2139432	295.225	*5*	*24.40*	*295.23*	
1403	13439041	2139436	294.211	*6*	*28.35*	*294.21*	
1404	13439041	2139441	292.714	*7*	*33.30*	*292.71*	
1405	13439041	2139446	291.269	*8*	*37.67*	*291.27*	
1406	13439041	2139450	289.747	*9*	*41.90*	*289.75*	
1407	13439041	2139454	288.249	*10*	*45.90*	*288.25*	
1408	13439041	2139458	286.741	*11*	*50.32*	*286.74*	
1409	13439041	2139463	285.246	*12*	*54.68*	*285.25*	
1410	13439041	2139467	283.775	*13*	*59.11*	*283.78*	
1411	13439041	2139470	282.748	*14*	*62.30*	*282.75*	
1412	13439041	2139476	281.19	*15*	*67.52*	*281.19*	
1413	13439041	2139482	279.688	*16*	*74.03*	*279.69*	
1414	13439041	2139489	278.938	*17*	*81.35*	*278.94*	
1415	13439041	2139500	278.275	*18*	*91.88*	*278.28*	
1418	13439040	2139510	277.824	*21*	*102.31*	*277.82*	
1419	13439041	2139524	277.282	*22*	*115.80*	*277.28*	
1420	13439040	2139540	276.685	*23*	*132.33*	*276.69*	
1421	13439040	2139557	276.151	*24*	*149.02*	*276.15*	
1422	13439040	2139567	275.886	*25*	*158.86*	*275.89*	
1423	13439040	2139593	275.251	*26*	*184.83*	*275.25*	*East/Toe*
					Cross Section 14		
	Cross Section 14						
1424	13439529	2139406	295	*1*	*-1.98*	*295.00*	*West/Water*
1425	13439529	2139409	295.754	*2*	*0.70*	*295.75*	
1426	13439529	2139413	296	*3*	*4.79*	*296.00*	
1427	13439529	2139424	295.676	*4*	*15.74*	*295.68*	
1428	13439529	2139430	295.232	*5*	*22.22*	*295.23*	
1429	13439529	2139439	292.793	*6*	*31.19*	*292.79*	
1430	13439529	2139410	296	*7*	*2.02*	*296.00*	
1431	13439529	2139414	296	*8*	*6.29*	*296.00*	
1432	13439529	2139429	295.511	*9*	*20.50*	*295.51*	
1433	13439529	2139445	290.78	*10*	*37.18*	*290.78*	
1434	13439529	2139451	288.718	*11*	*43.11*	*288.72*	
1435	13439529	2139455	287.222	*12*	*47.50*	*287.22*	
1436	13439529	2139461	285.273	*13*	*53.20*	*285.27*	
1437	13439529	2139464	284.231	*14*	*56.22*	*284.23*	
1438	13439529	2139471	283.5	*15*	*62.83*	*283.50*	
1439	13439529	2139477	280.214	*16*	*68.82*	*280.21*	
1440	13439529	2139483	278.72	*17*	*75.04*	*278.72*	
1441	13439529	2139490	277.937	*18*	*81.71*	*277.94*	
1442	13439529	2139498	277.426	*19*	*89.63*	*277.43*	
1443	13439529	2139507	276.944	*20*	*98.99*	*276.94*	
1444	13439529	2139519	276.86	*21*	*110.61*	*276.86*	
1445	13439529	2139532	275.894	*22*	*124.00*	*275.89*	
1446	13439529	2139557	274.965	*23*	*149.39*	*274.97*	
1447	13439529	2139579	274.296	*24*	*170.56*	*274.30*	
1448	13439529	2139594	273.5	*25*	*185.61*	*273.50*	*East/Toe*

				Cross Section 15			
	Cross Section 15						
1449	13440091	2139409	295	*1*	*1.16*	*295.00*	*West/Water*
1450	13440091	2139412	295.782	*2*	*4.40*	*295.78*	
1451	13440090	2139418	295.922	*3*	*9.84*	*295.92*	
1452	13440090	2139430	295.242	*4*	*22.26*	*295.24*	
1453	13440090	2139416	295.986	*5*	*8.23*	*295.99*	
1454	13440090	2139428	295.504	*6*	*20.41*	*295.50*	
1455	13440090	2139436	293.763	*7*	*27.94*	*293.76*	
1456	13440090	2139439	292.694	*8*	*31.25*	*292.69*	
1457	13440090	2139444	291.161	*9*	*36.25*	*291.16*	
1458	13440090	2139452	288.797	*10*	*44.08*	*288.80*	
1459	13440090	2139455	287.756	*11*	*47.23*	*287.76*	
1460	13440090	2139461	285.833	*12*	*52.79*	*285.83*	
1461	13440090	2139469	282.735	*13*	*61.33*	*282.74*	
1462	13440090	2139475	280.781	*14*	*67.12*	*280.78*	
1463	13440090	2139478	279.727	*15*	*70.27*	*279.73*	
1464	13440090	2139483	278.187	*16*	*75.22*	*278.19*	
1465	13440090	2139491	276.242	*17*	*82.79*	*276.24*	
1466	13440090	2139501	275.527	*18*	*93.33*	*275.53*	
1467	13440090	2139511	275.051	*19*	*102.80*	*275.05*	
1468	13440090	2139522	274.672	*20*	*113.90*	*274.67*	
1469	13440090	2139530	274.347	*21*	*122.18*	*274.35*	
1470	13440090	2139539	273.96	*22*	*131.10*	*273.96*	
1471	13440090	2139551	273.751	*23*	*142.99*	*273.75*	
1472	13440090	2139568	273.73	*24*	*160.16*	*273.73*	
1473	13440090	2139578	273.195	*25*	*170.41*	*273.20*	
1474	13440090	2139599	271.74	*26*	*191.37*	*271.74*	
1475	13440090	2139622	271.5	*27*	*214.29*	*271.50*	
1476	13440090	2139650	271.173	*28*	*242.49*	*271.17*	*East/Toe*
				Cross Section 16			
1477	13440204	2139306	295	*1*	*-0.31*	*295.00*	*South/Water*
1478	13440205	2139307	295.225	*2*	*1.45*	*295.23*	
1479	13440208	2139307	295.787	*3*	*3.67*	*295.79*	
1480	13440211	2139307	296	*4*	*7.18*	*296.00*	
1481	13440218	2139307	295.712	*5*	*13.69*	*295.71*	
1482	13440222	2139307	295.446	*6*	*18.35*	*295.45*	
1483	13440228	2139307	295.046	*7*	*24.34*	*295.05*	
1484	13440234	2139307	293.687	*8*	*29.81*	*293.69*	
1485	13440238	2139307	292.219	*9*	*34.12*	*292.22*	
1486	13440242	2139306	291.175	*10*	*37.51*	*291.18*	
1487	13440246	2139306	289.725	*11*	*42.31*	*289.73*	
1488	13440209	2139306	296	*12*	*4.89*	*296.00*	
1489	13440213	2139306	295.979	*13*	*8.86*	*295.98*	
1490	13440253	2139307	287.26	*14*	*49.46*	*287.26*	
1491	13440258	2139307	285.696	*15*	*54.09*	*285.70*	
1492	13440261	2139307	284.734	*16*	*57.16*	*284.73*	

1493	13440268	2139307	282.747	*17*	*63.78*	*282.75*	
1494	13440274	2139307	280.823	*18*	*70.25*	*280.82*	
1495	13440279	2139307	279.735	*19*	*74.59*	*279.74*	
1496	13440283	2139307	278.785	*20*	*79.20*	*278.79*	
1497	13440288	2139307	277.83	*21*	*83.96*	*277.83*	
1498	13440295	2139307	276.771	*22*	*90.54*	*276.77*	
1499	13440299	2139307	276.277	*23*	*95.19*	*276.28*	*North/Toe*

Postion	Distance	elevation
CROSS SECTION 1A - 30 ft North of Stake one		
1	0	303.069
2	8.071	301.905
3	19.579	301.049
4	34.947	301.115
5	60.523	302.164
6	77.826	309.672
7	97.153	315.215
8	129.814	315.204
9	133.841	314.931

0 = line was edge of road, toe of pond is lower
Edge of road is road height

CROSS SECTION 1B - In line with Stake 1		
1	-0.752	303.072
2	8.523	301.135
3	18.976	300.796
4	35.916	301.085
5	62.295	301.717
6	75.486	308.694
7	97.483	315.203
8	129.637	315.181
9	137.991	314.325
10	134.652	315.059

CROSS SECTION 1C - 30 ft South of Stake one		
1	-0.511	302.703
2	6.956	300.581
3	19.683	300.989
4	34.265	301.28
5	61.374	301.839
6	75.605	308.691
7	97.436	315.092
8	128.893	315.116
10	134.777	315.157
9	137.762	314.349

CROSS SECTIONS 1A, 1B, AND 1C

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Appendix E

Postion	Distance	elevation	
<u>CROSS SECTION 9A</u> <u>- 110 ft North of Stack 9</u>			
1	0	315.419	Water side
2	9.853	314.977	
3	12.338	315.302	
4	17.788	314.251	
5	26.289	310.722	
6	35.615	305.739	
7	49.933	299.837	
8	64.107	295.077	
9	76.905	292.692	Toe of hill side
CROSS SECTION 9			
1	-9.537	315.142	Water side
2	-3.149	315.336	Negative numbers are because curve of pond
3	1.801	315.24	
4	7.708	315.241	
5	12.755	313.684	
6	20.643	310.858	
7	27.466	307.569	
8	40.241	302.511	
9	52.343	297.272	
10	64.837	292.421	
11	73.876	289.319	
12	83.078	287.546	Toe of hill side

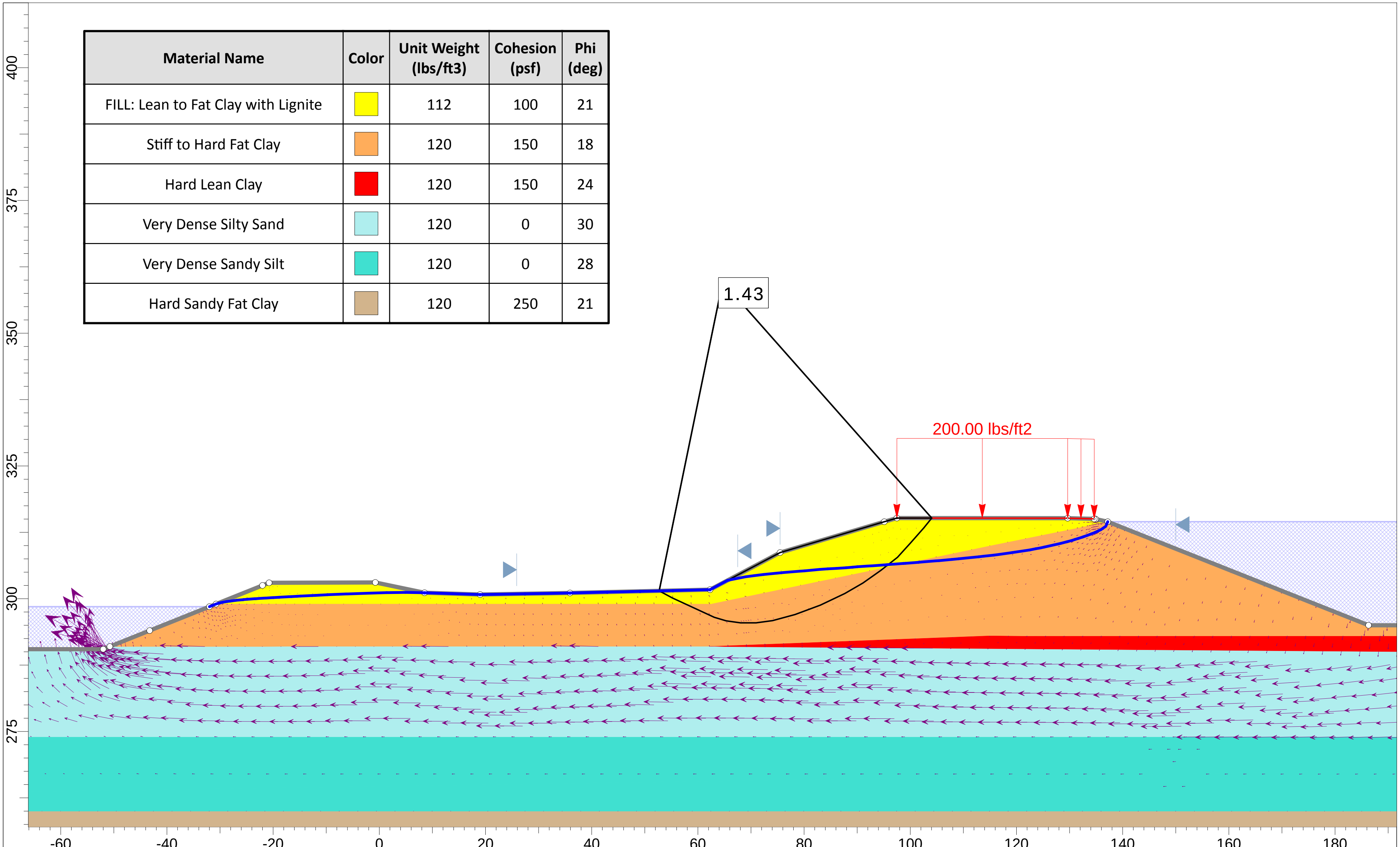
CROSS SECTIONS 9A AND 9

Ash Water Transport Pond
San Miguel Electric Cooperative
Christine, Texas

Appendix E

APPENDIX F: ASH POND SEEPAGE/STABILITY ANALYSIS RESULTS

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Lean to Fat Clay with Lignite	Yellow	112	100	21
Stiff to Hard Fat Clay	Orange	120	150	18
Hard Lean Clay	Red	120	150	24
Very Dense Silty Sand	Light blue	120	0	30
Very Dense Sandy Silt	Turquoise	120	0	28
Hard Sandy Fat Clay	Tan	120	250	21



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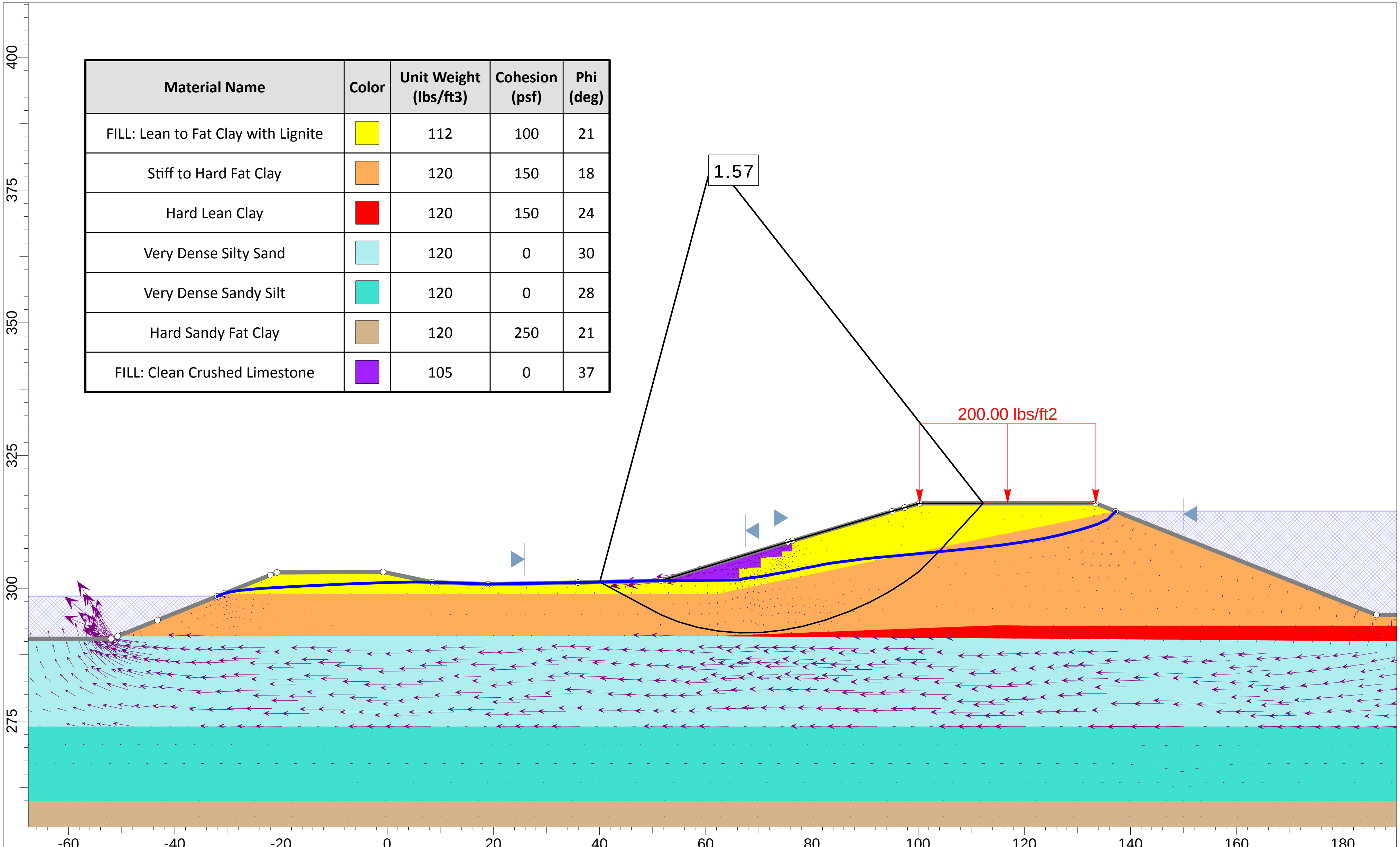
SLIDEINTERPRET 7.010

Project	San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 1B - Maximum Storage Pool		
Analysis Description	Long Term Drained Condition		
Drawn By Tim Fox, P.E.	*Scale* 1:300	*Company*	Arias Geoprofessionals, Inc.
Date	9/29/2016, 4:07:29 PM	*File Name*	Ash Pond Section 1B - Maximum Storage.slim

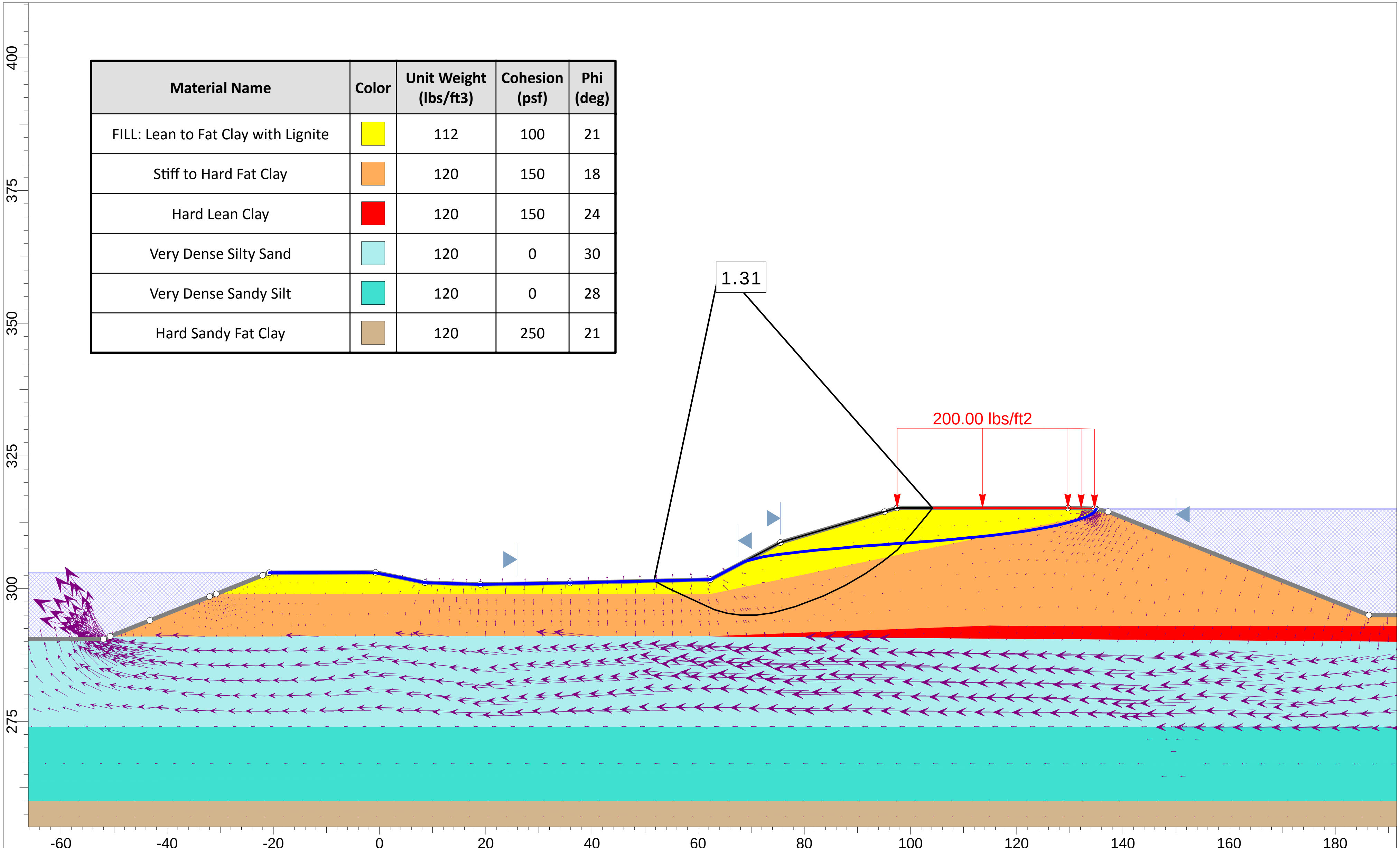


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Lean to Fat Clay with Lignite	Yellow	112	100	21
Stiff to Hard Fat Clay	Orange	120	150	18
Hard Lean Clay	Red	120	150	24
Very Dense Silty Sand	Light blue	120	0	30
Very Dense Sandy Silt	Turquoise	120	0	28
Hard Sandy Fat Clay	Tan	120	250	21
FILL: Clean Crushed Limestone	Purple	105	0	37

rocscience

SLIDEINTERPRET 7.010

Project	San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 1B - Maximum Storage Pool
Analysis Description	Slope Repair - Long Term Drained Condition
Drawn By	Tim Fox, P.E.
Scale	1:300
Company	Arias Geoprofessionals, Inc.
Date	9/29/2016, 4:07:29 PM
File Name	Ash Pond Section 1B - Max Storage Surcharge - Slope Repair.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Lean to Fat Clay with Lignite		112	100	21
Stiff to Hard Fat Clay		120	150	18
Hard Lean Clay		120	150	24
Very Dense Silty Sand		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21

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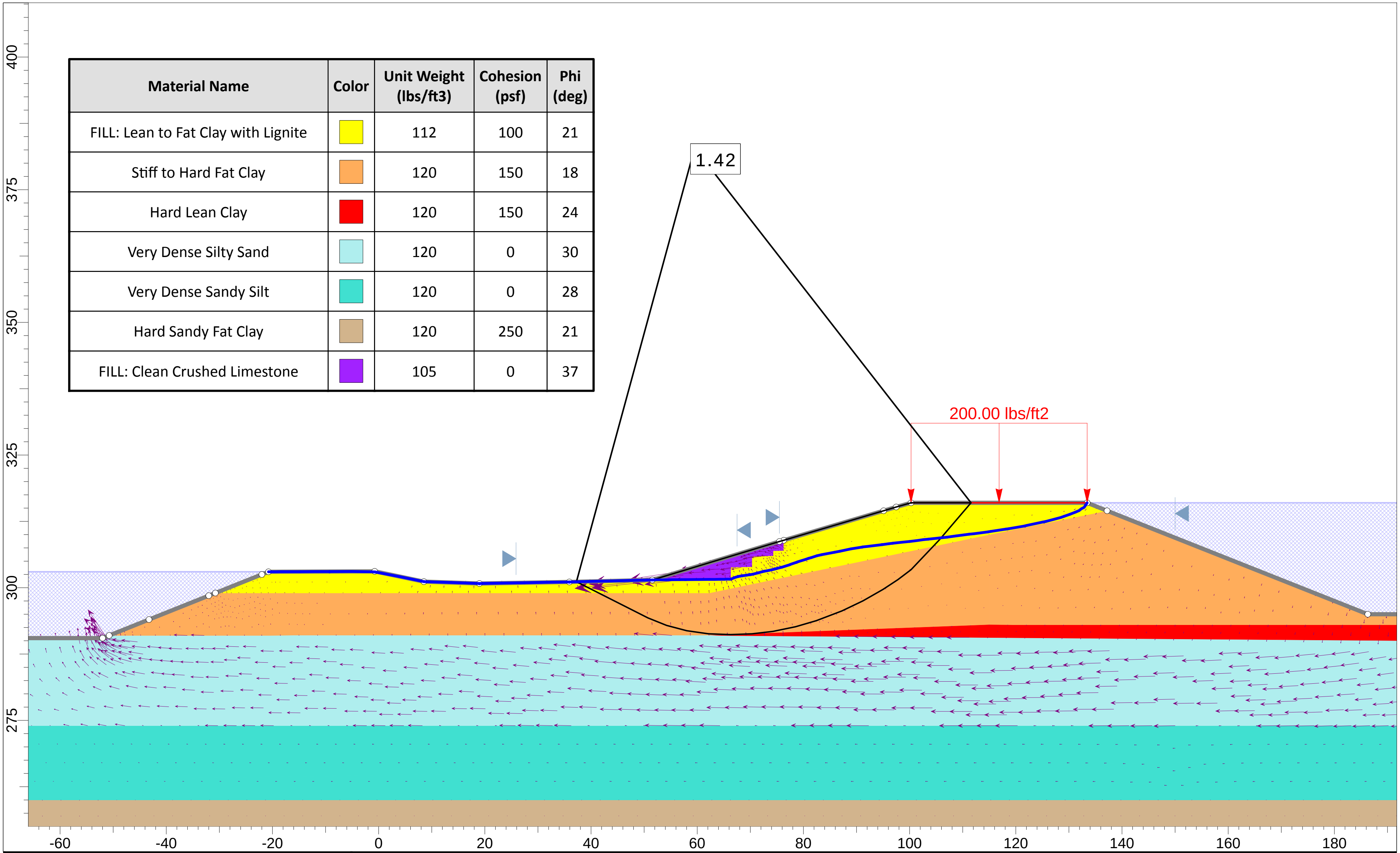
SLIDEINTERPRET 7.010

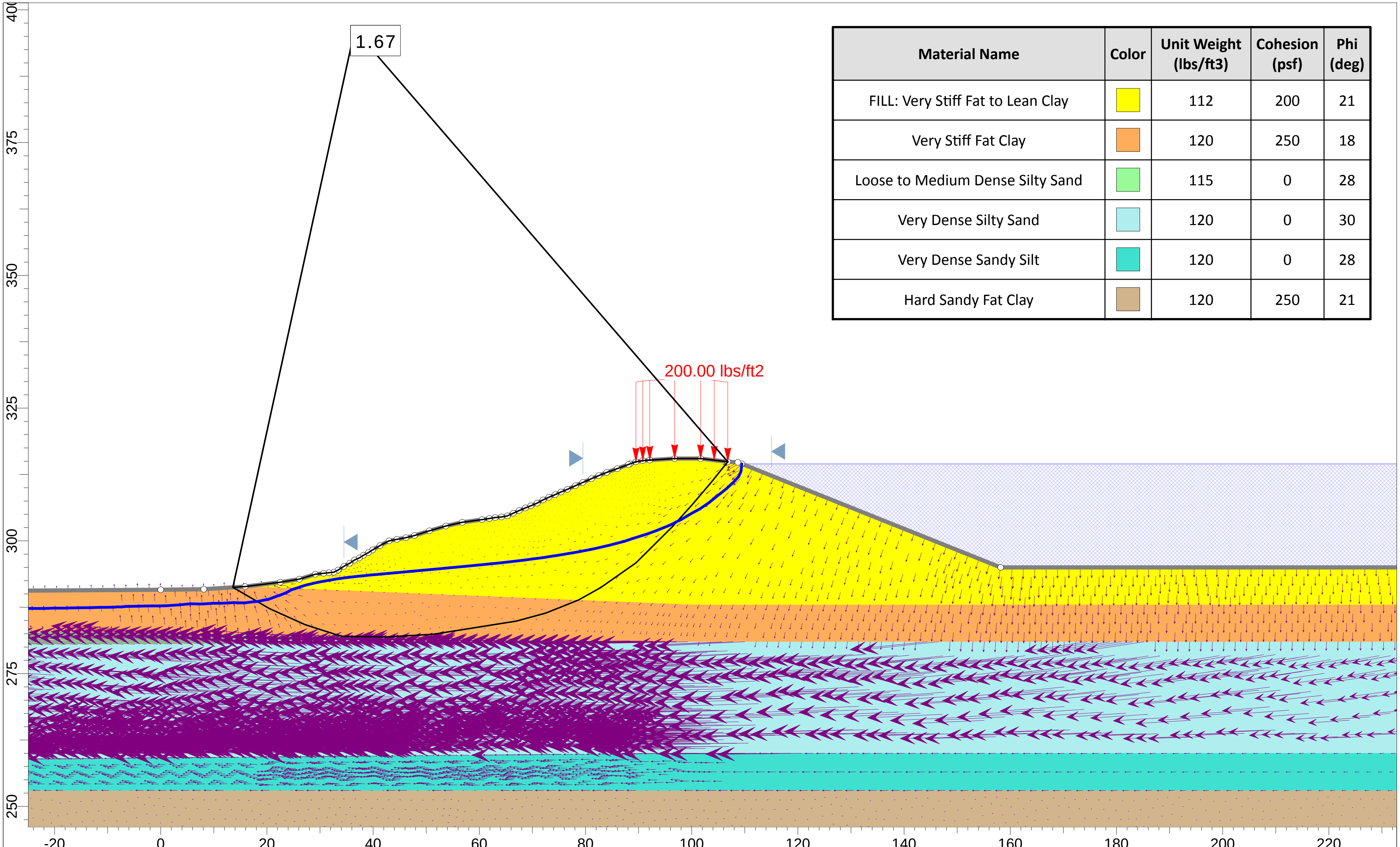
Project	San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 1B - Maximum Surcharge Pool		
Analysis Description	Long Term Drained Condition		
Drawn By	Tim Fox, P.E.	*Scale*	1:300
Company	Arias Geoprofessionals, Inc.		
Date	9/29/2016, 4:07:29 PM	*File Name*	Ash Pond Section 1B - Maximum Surcharge - opt.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Lean to Fat Clay with Lignite		112	100	21
Stiff to Hard Fat Clay		120	150	18
Hard Lean Clay		120	150	24
Very Dense Silty Sand		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21
FILL: Clean Crushed Limestone		105	0	37

SLIDEINTERPRET 7.010

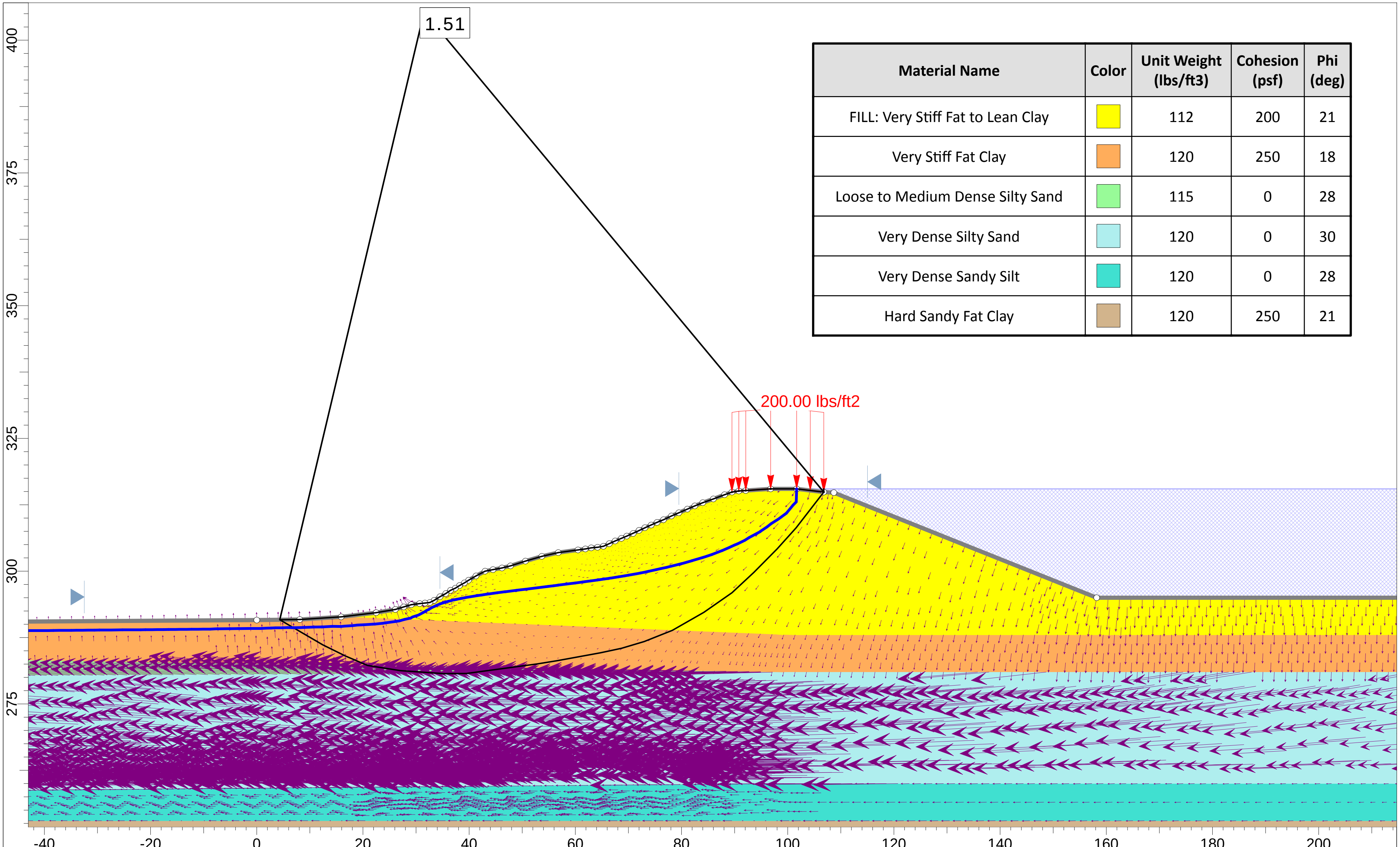
Project	San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 1B - Maximum Surcharge Pool
Analysis Description	Slope Repair - Long Term Drained Condition
Drawn By	Tim Fox, P.E.
Scale	1:300
Company	Arias Geoprofessionals, Inc.
Date	9/29/2016, 4:07:29 PM
File Name	Ash Pond Section 1B - Maximum Surcharge - Slope Repair.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Very Stiff Fat to Lean Clay		112	200	21
Very Stiff Fat Clay		120	250	18
Loose to Medium Dense Silty Sand		115	0	28
Very Dense Silty Sand		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21

SLIDEINTERPRET 7.010

Project	San Miguel Electric Cooperative - Ash Pond Downsteam Slope - Cross Section 3 - Maximum Storage Pool
Analysis Description	Long Term Drained Condition
Drawn By	Tim Fox, P.E.
Scale	1:300
Company	Arias Geoprofessionals, Inc.
Date	9/20/2016, 6:11:58 PM
File Name	Ash Pond X-Section 3 - Maximum Storage Pool - opt.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Very Stiff Fat to Lean Clay		112	200	21
Very Stiff Fat Clay		120	250	18
Loose to Medium Dense Silty Sand		115	0	28
Very Dense Silty Sand		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21

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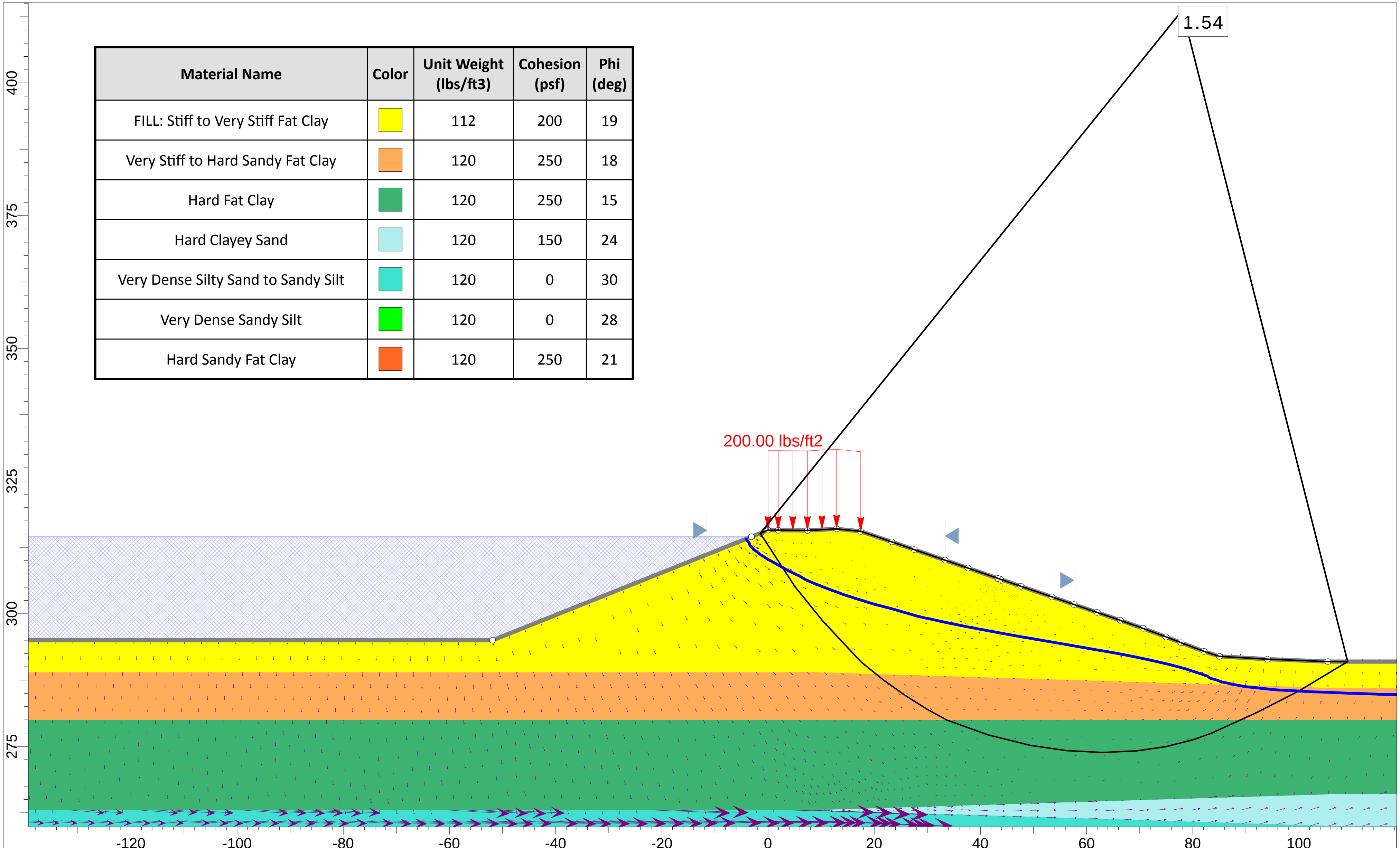
SLIDEINTERPRET 7.010

Project	San Miguel Electric Cooperative - Ash Pond Downsteam Slope - Cross Section 3 - Maximum Surcharge Pool
Analysis Description	Long Term Drained Condition
Drawn By	Tim Fox, P.E.
Scale	1:300
Company	Arias Geoprofessionals, Inc.
Date	9/20/2016, 6:11:58 PM
File Name	Ash Pond X-Section 3 - Maximum Surcharge Pool - Drained.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Stiff to Very Stiff Fat Clay		112	200	19
Very Stiff to Hard Sandy Fat Clay		120	250	18
Hard Fat Clay		120	250	15
Hard Clayey Sand		120	150	24
Very Dense Silty Sand to Sandy Silt		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21

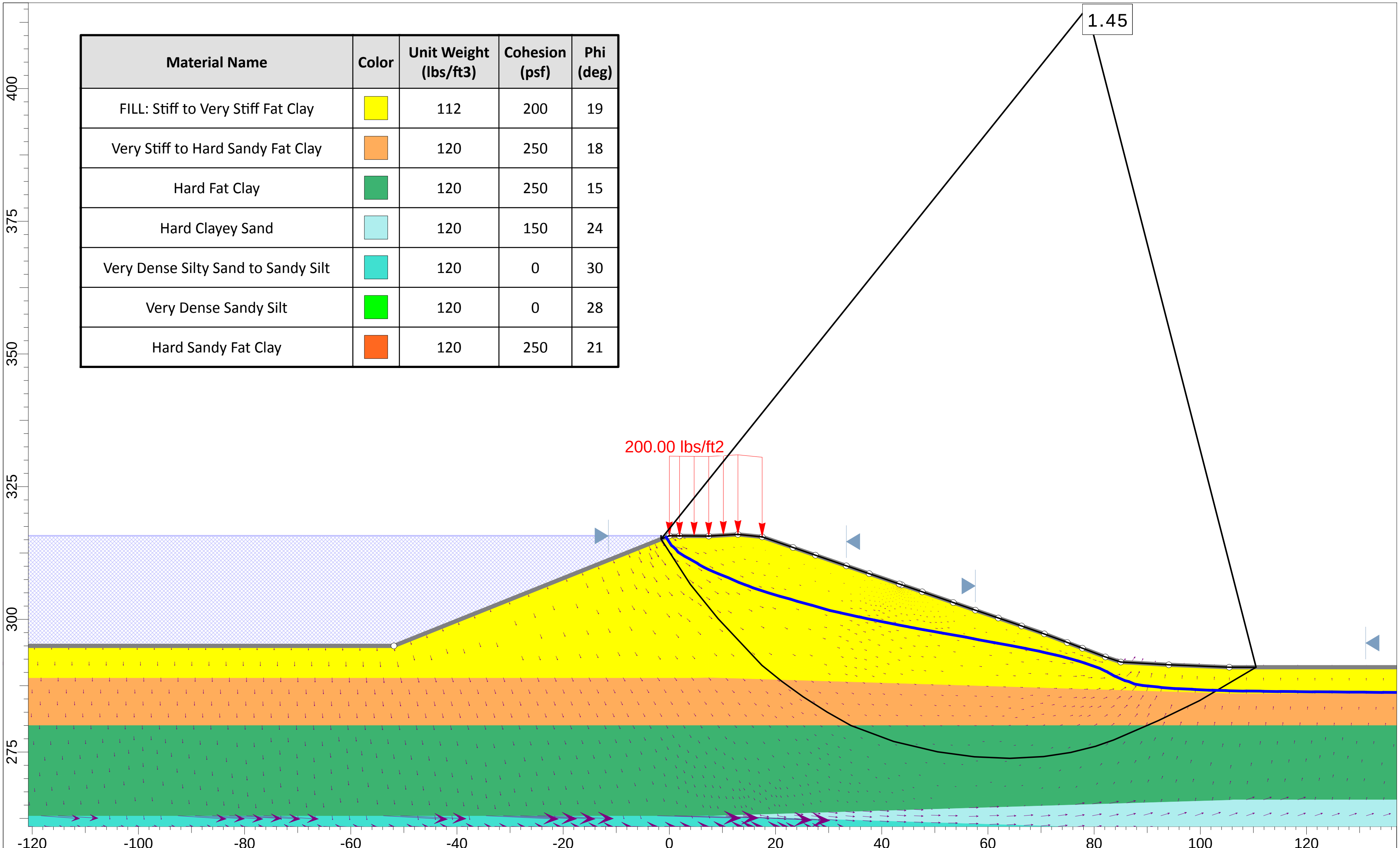
Project
San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 8 - Maximum Storage Pool

Analysis Description
Long Term Drained Condition

Drawn By Tim Fox, P.E.
Scale 1:300
Company Arias Geoprofessionals, Inc.

Date 9/21/2016, 5:02:22 PM
File Name Ash Pond X-Section 8 - Maximum Storage Pool - Drained.slim

SLIDEINTERPRET 7.010

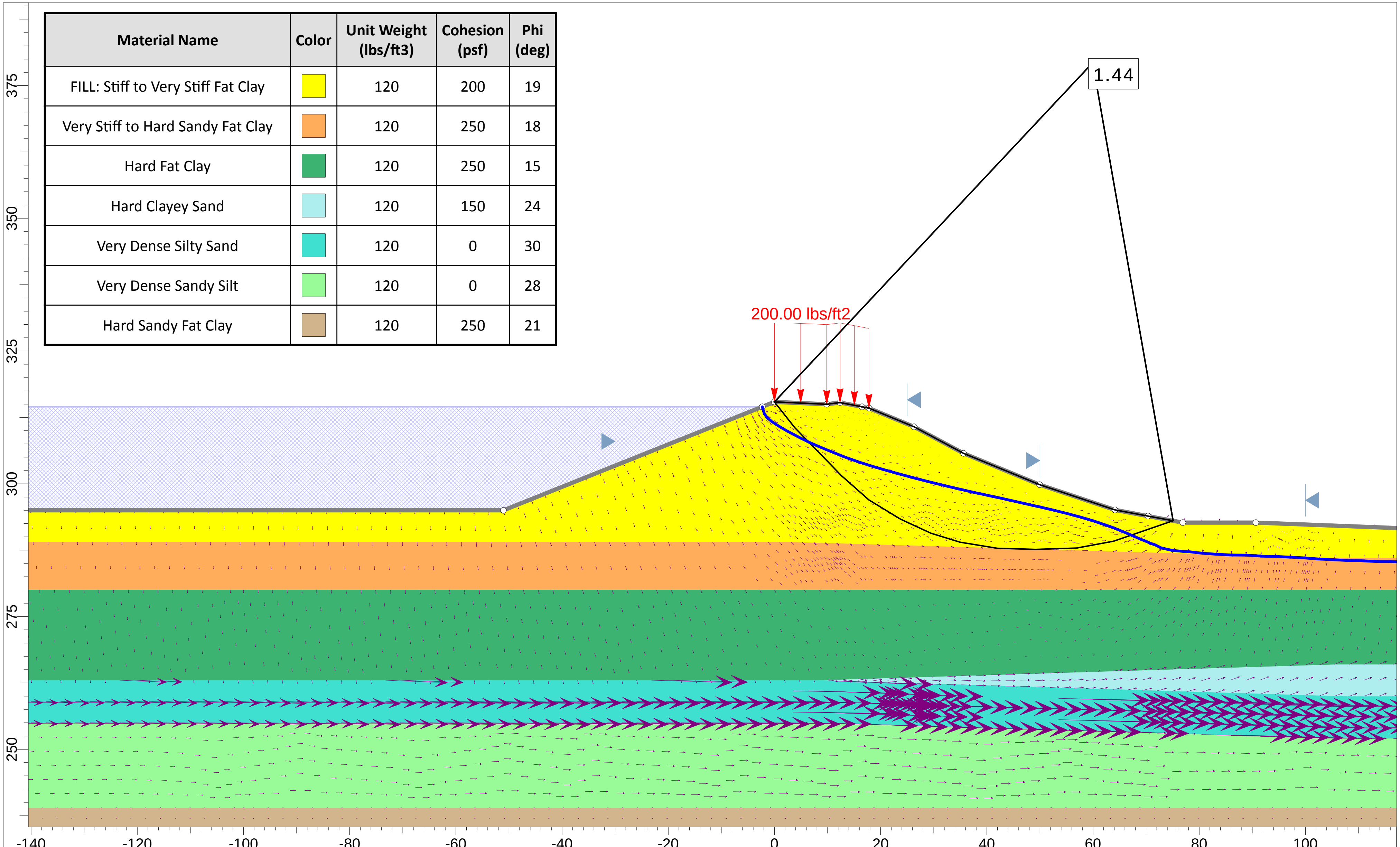


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Stiff to Very Stiff Fat Clay		112	200	19
Very Stiff to Hard Sandy Fat Clay		120	250	18
Hard Fat Clay		120	250	15
Hard Clayey Sand		120	150	24
Very Dense Silty Sand to Sandy Silt		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21

SLIDEINTERPRET 7.010

Project	San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 8 - Maximum Surcharge Pool		
Analysis Description	Long Term Drained Condition		
Drawn By	Tim Fox, P.E.	*Scale*	1:300
Company	Arias Geoprofessionals, Inc.		
Date	9/21/2016, 5:02:22 PM	*File Name*	Ash Pond X-Section 8 - Maximum Surcharge Pool - Drained.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Stiff to Very Stiff Fat Clay		120	200	19
Very Stiff to Hard Sandy Fat Clay		120	250	18
Hard Fat Clay		120	250	15
Hard Clayey Sand		120	150	24
Very Dense Silty Sand		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21



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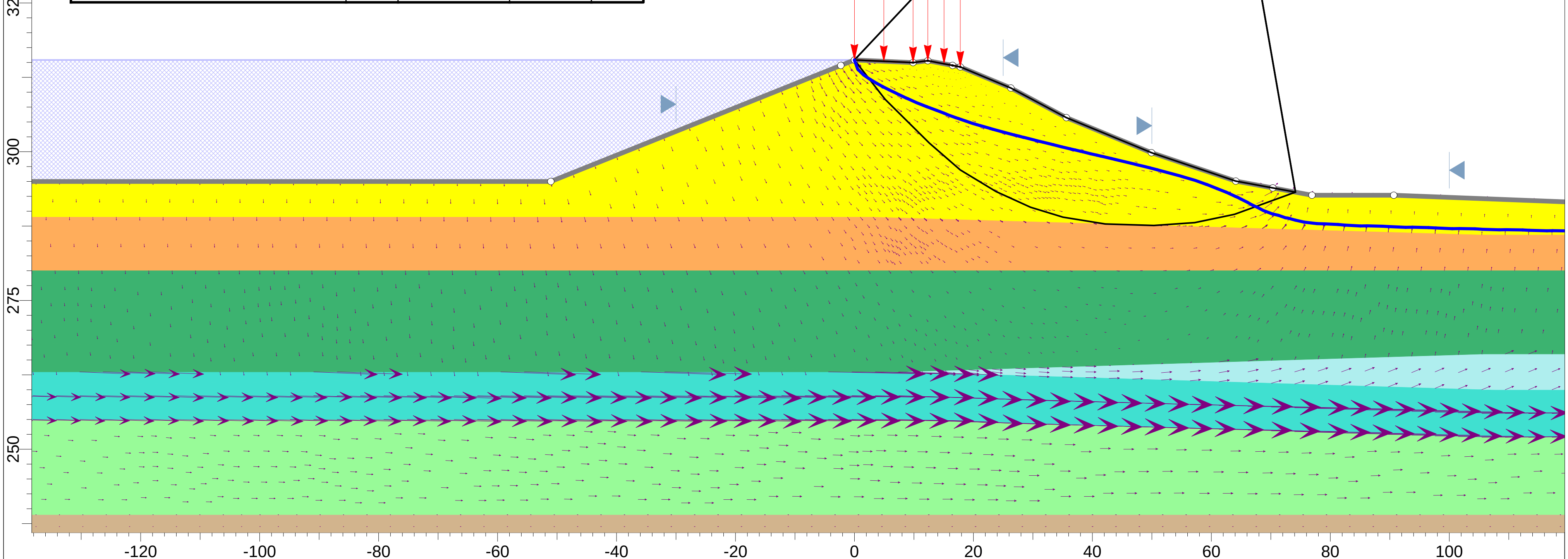
SLIDEINTERPRET 7.010

Project	San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 9A
Analysis Description	Maximum Storage Pool - Long Term Drained Condition
Drawn By	Tim Fox, P.E.
Scale	1:300
Company	Arias Geoprofessionals
Date	9/29/2016, 3:47:09 PM
File Name	Ash Pond Section 9A - Max Storage Pool - Drained.slim

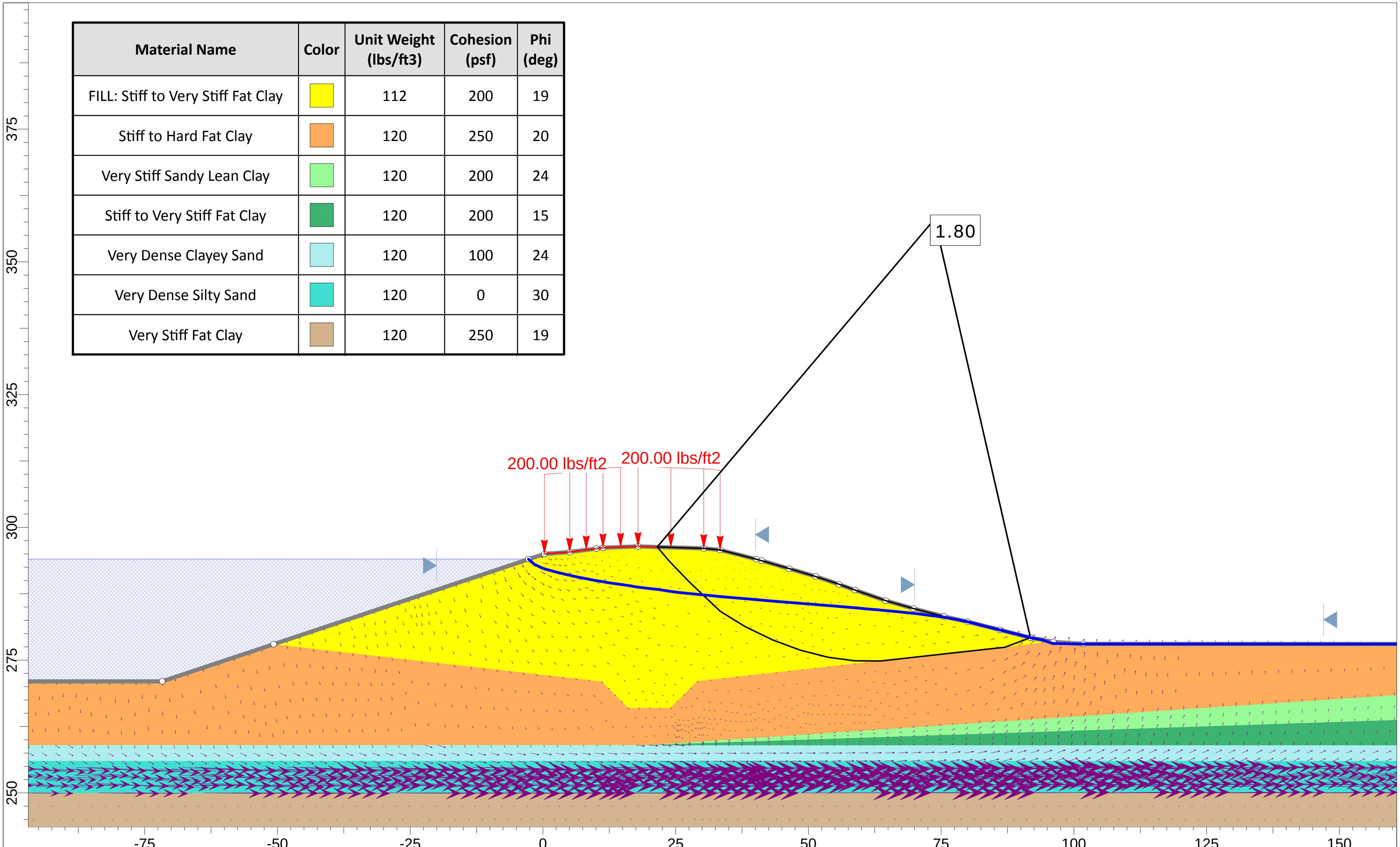
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Stiff to Very Stiff Fat Clay		120	200	19
Very Stiff to Hard Sandy Fat Clay		120	250	18
Hard Fat Clay		120	250	15
Hard Clayey Sand		120	150	24
Very Dense Silty Sand		120	0	30
Very Dense Sandy Silt		120	0	28
Hard Sandy Fat Clay		120	250	21



Project	San Miguel Electric Cooperative - Ash Pond Downstream Slope - Cross Section 9A
Analysis Description	Maximum Surcharge Pool - Long Term Drained Condition
Drawn By	Tim Fox, P.E.
Scale	1:300
Company	Arias Geoprofessionals
Date	9/29/2016, 3:47:09 PM
File Name	Ash Pond Section 9A - Max Surcharge Pool - Drained.slim

SLIDEINTERPRET 7.010

APPENDIX G: EQUALIZATION POND SEEPAGE/STABILITY ANALYSIS RESULTS



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Stiff to Very Stiff Fat Clay	Yellow	112	200	19
Stiff to Hard Fat Clay	Orange	120	250	20
Very Stiff Sandy Lean Clay	Light green	120	200	24
Stiff to Very Stiff Fat Clay	Green	120	200	15
Very Dense Clayey Sand	Light cyan	120	100	24
Very Dense Silty Sand	Turquoise	120	0	30
Very Stiff Fat Clay	Tan	120	250	19

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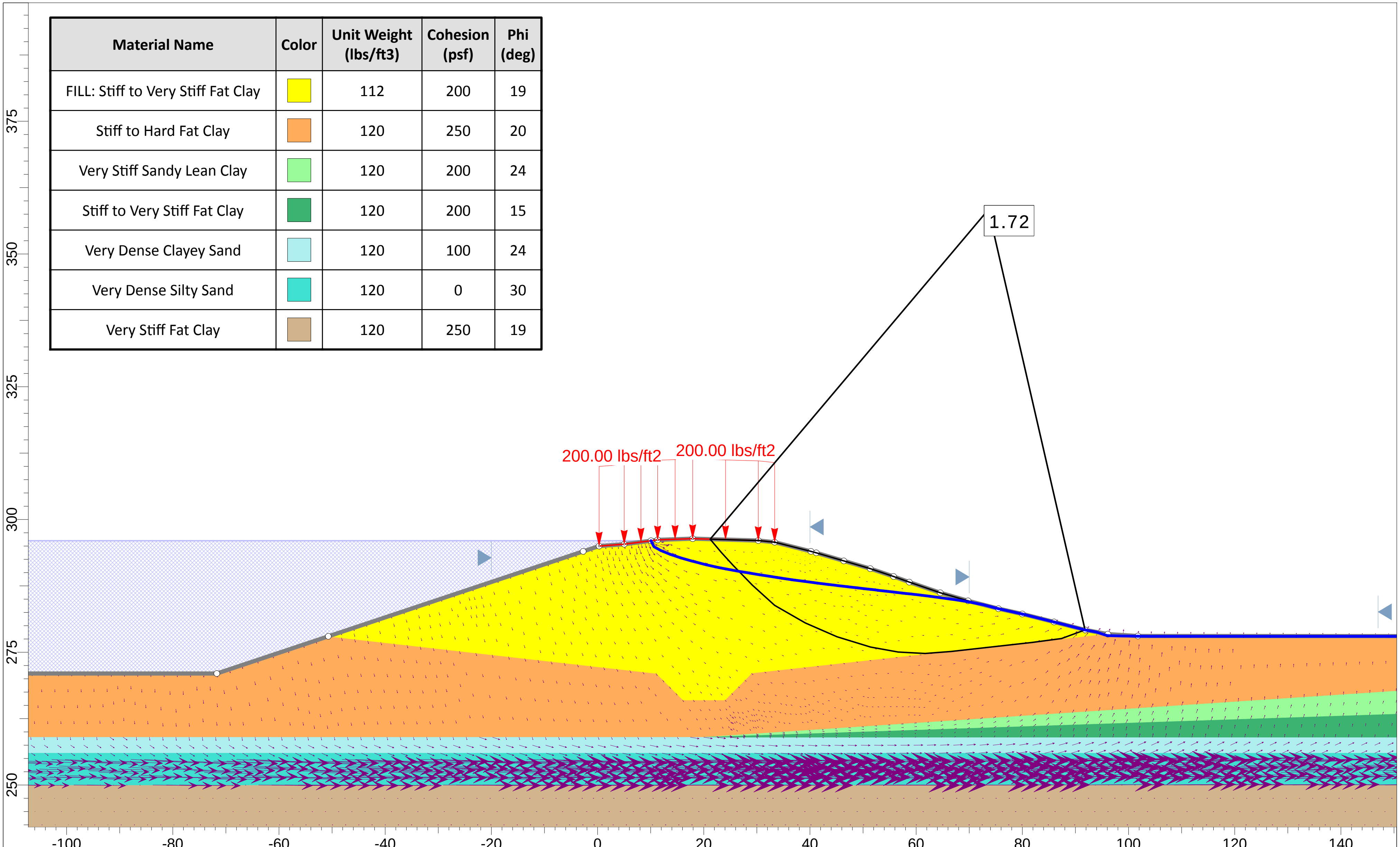
SLIDEINTERPRET 7.010

Project
San Miguel Electric Cooperative - Equalization Pond Downstream Slope - Cross Section 11

Analysis Description
Maximum Storage Pool - Long Term Drained Condition

Drawn By Tim Fox, P.E. | *Scale* 1:300 | *Company* Arias Geoprofessionals, Inc.

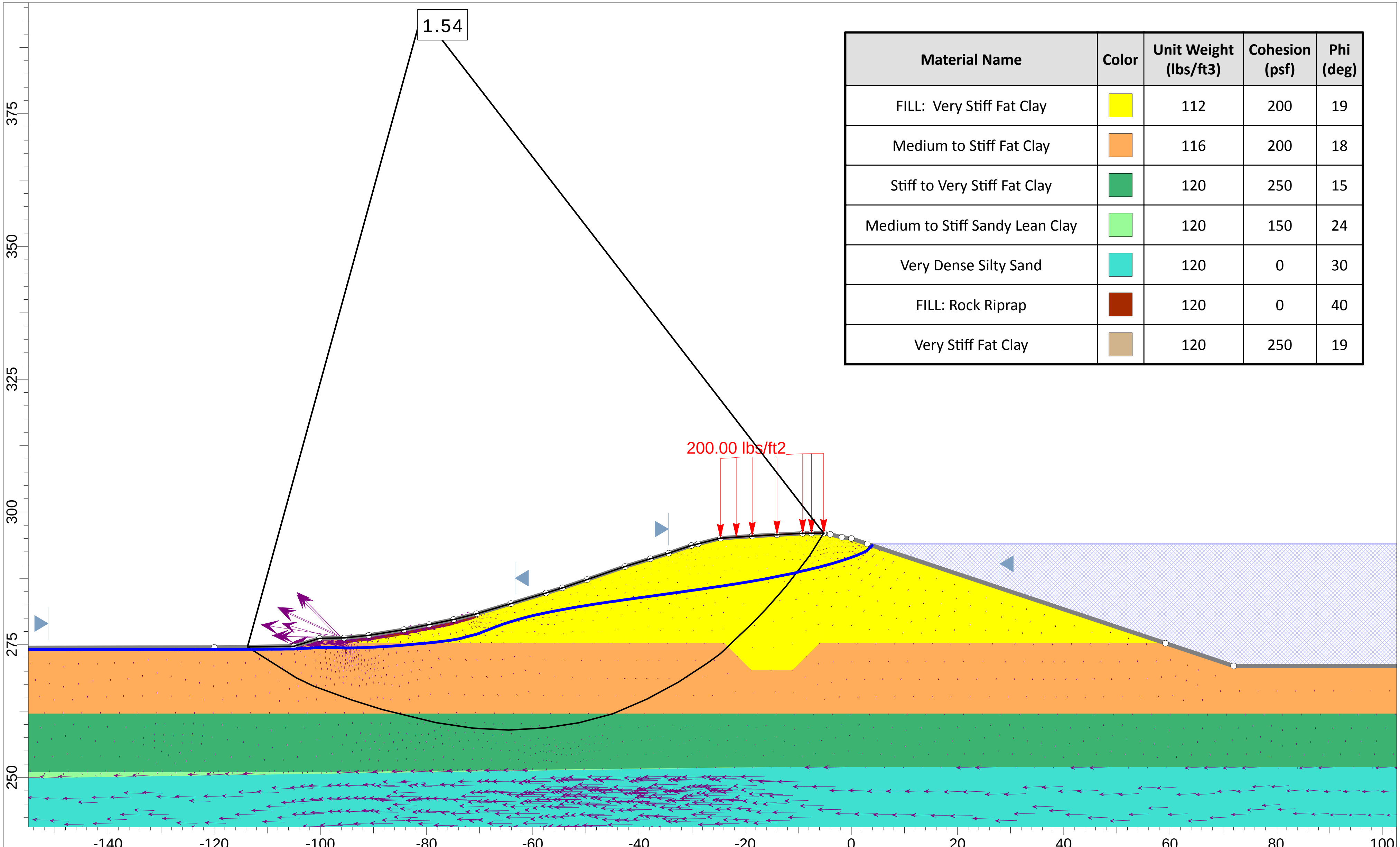
Date 9/29/2016, 9:28:36 AM | *File Name* Ash Pond X-Section 11 - Max Storage Pool - Drained.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Stiff to Very Stiff Fat Clay		112	200	19
Stiff to Hard Fat Clay		120	250	20
Very Stiff Sandy Lean Clay		120	200	24
Stiff to Very Stiff Fat Clay		120	200	15
Very Dense Clayey Sand		120	100	24
Very Dense Silty Sand		120	0	30
Very Stiff Fat Clay		120	250	19

SLIDEINTERPRET 7.010

Project	San Miguel Electric Cooperative - Equalization Pond Downstream Slope - Cross Section 11		
Analysis Description	Maximum Surcharge Pool - Long Term Drained Condition		
Drawn By Tim Fox, P.E.	*Scale* 1:300	*Company*	Arias Geoprofessionals, Inc.
Date 9/29/2016, 9:28:36 AM		*File Name*	Ash Pond X-Section 11 - Max Surcharge Pool - Drained.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Very Stiff Fat Clay		112	200	19
Medium to Stiff Fat Clay		116	200	18
Stiff to Very Stiff Fat Clay		120	250	15
Medium to Stiff Sandy Lean Clay		120	150	24
Very Dense Silty Sand		120	0	30
FILL: Rock Riprap		120	0	40
Very Stiff Fat Clay		120	250	19

SLIDEINTERPRET 7.010

Project
San Miguel Electric Cooperative - Equilization Pond Downstream Slope - Cross Section 16

Analysis Description
Maximum Storage Pool - Long Term Drained Condition

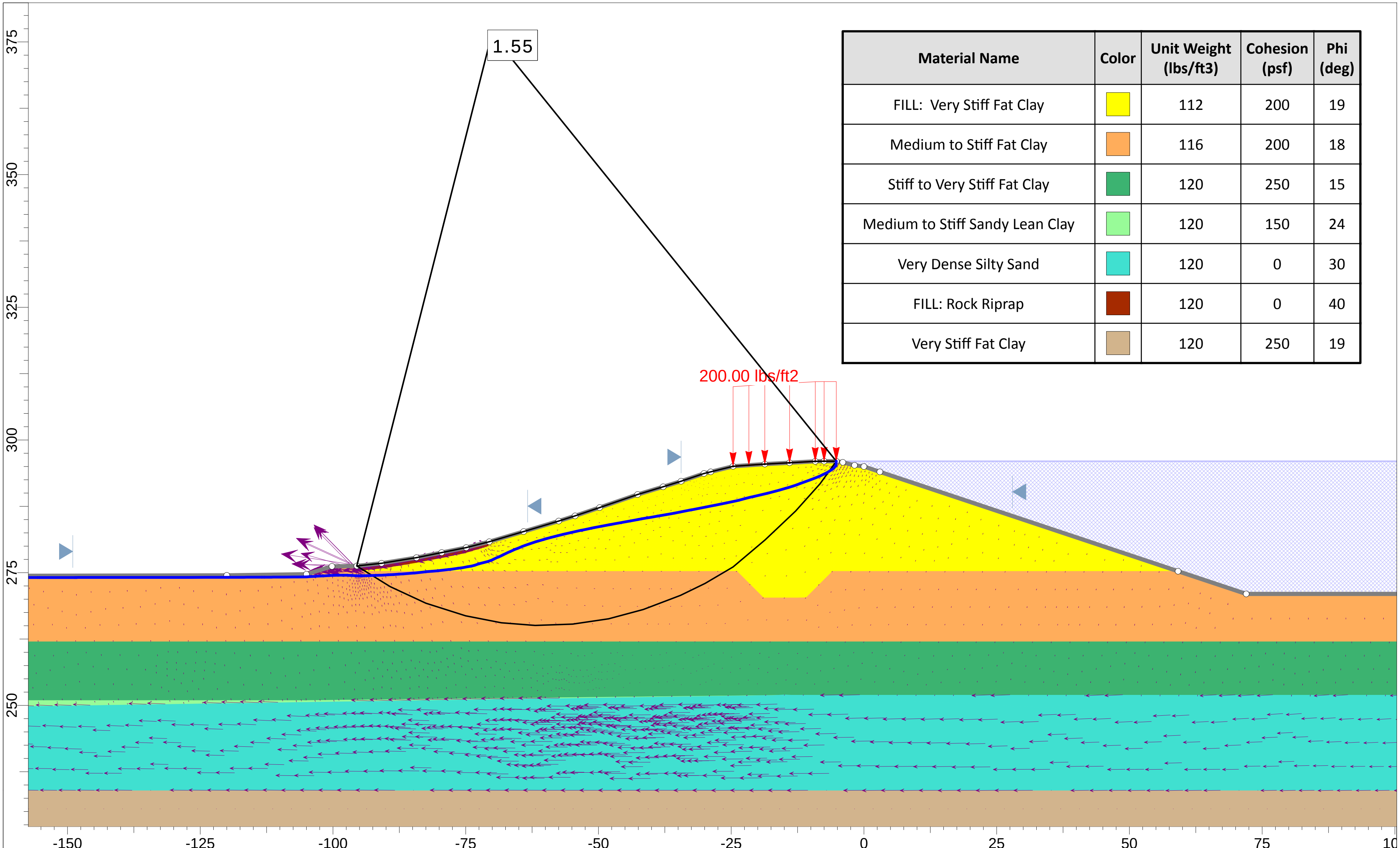
Drawn By Tim Fox, P.E.

Scale 1:300

Company Arias Geoprofessionals, Inc.

Date 9/26/2016, 12:33:47 PM

File Name Ash Pond X-Section 16 - Max Storage Pool - Drained.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
FILL: Very Stiff Fat Clay	Yellow	112	200	19
Medium to Stiff Fat Clay	Orange	116	200	18
Stiff to Very Stiff Fat Clay	Green	120	250	15
Medium to Stiff Sandy Lean Clay	Light green	120	150	24
Very Dense Silty Sand	Turquoise	120	0	30
FILL: Rock Riprap	Dark red	120	0	40
Very Stiff Fat Clay	Tan	120	250	19

rocscience

SLIDEINTERPRET 7.010

Project
San Miguel Electric Cooperative - Equilization Pond Downstream Slope - Cross Section 16

Analysis Description
Maximum Surcharge Pool - Long Term Drained Condition

Drawn By Tim Fox, P.E.
Scale 1:300
Company Arias Geoprofessionals, Inc.

Date 9/26/2016, 12:33:47 PM
File Name Ash Pond X-Section 16 - Max Surcharge Pool - Drained.slim

APPENDIX H: ASFE INFORMATION – GEOTECHNICAL REPORT

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

APPENDIX I: PROJECT QUALITY ASSURANCE

A Message to Owners

Construction materials engineering and testing (CoMET) consultants perform quality-assurance (QA) services to evaluate the degree to which constructors are achieving the specified conditions they're contractually obligated to achieve. Done right, QA can save you time and money; prevent unanticipated-conditions claims, change orders, and disputes; and reduce short-term and long-term risks, especially by detecting molehills before they grow into mountains.

Done right, QA can save you time and money; prevent claims and disputes; and reduce risks. Many owners don't do QA right because they follow bad advice.

Many owners don't do QA right because they follow bad advice; e.g., "CoMET consultants are all the same. They all have accredited facilities and certified personnel. Go with the low bidder." But there's no such thing as a standard QA scope of service, meaning that – to bid low – each interested firms *must* propose the cheapest QA service it can live with, jeopardizing service quality and aggravating risk for the entire project team. Besides, the advice is based on misinformation.

Fact: ***Most CoMET firms are not accredited***, and the quality of those that are varies significantly. Accreditation – which is important – nonetheless means that a facility met an accrediting body's minimum criteria. Some firms practice at a much higher level; others just barely scrape by. And what an accrediting body typically evaluates – management, staff, facilities, and equipment – can change substantially before the next review, two, three, or more years from now.

Most CoMET firms are not accredited. It's dangerous to assume CoMET personnel are certified.

Fact: ***It's dangerous to assume CoMET personnel are certified.*** Many have no credentials at all; some are certified by organizations of questionable merit, while others have a valid certification, but *not* for the services they're assigned.

Some CoMET firms – the "low-cost providers" – *want* you to believe that price is the only difference between QA providers. It's not, of course. Firms that sell low price typically lack the facilities, equipment, personnel, and insurance quality-oriented firms invest in to achieve the reliability concerned owners need to achieve quality in quality assurance.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION
8811 Colesville Road
Suite G106
Silver Spring, Maryland 20910
Voice: 301.565.2733
Fax: 301.589.2017
E-mail: info@asfe.org
Internet: www.asfe.org

Firms that sell low price typically lack the facilities, equipment, personnel, and insurance quality-oriented firms invest in to achieve the reliability concerned owners need to achieve quality in quality assurance.

To derive maximum value from your investment in QA, require the CoMET firm's project manager to serve actively on the project team from beginning to end, a level of service that's relatively inexpensive and can pay huge dividends. During the project's planning and design stages, experienced CoMET professionals can help the design team develop uniform technical specifications and establish appropriate observation, testing, and instrumentation procedures and protocols. They can also analyze plans and specs much as constructors do, looking for the little errors, omissions, conflicts, and ambiguities that often become the basis for big extras and big claims. They can provide guidance about operations that need closer review than others, because of their criticality or potential for error or abuse. They can also relate their experience with the various constructors that have expressed interest in your project.

To derive maximum value, require the project manager to serve actively on the project team from beginning to end.

CoMET consultants' construction-phase QA services focus on two distinct issues: those that relate to geotechnical engineering and those that relate to the other elements of construction.

The geotechnical issues are critically important because they are essential to the "observational method" geotechnical engineers use to significantly reduce the amount of sampling they'd otherwise require. They apply the observational method by developing a sampling plan for a project, and then assigning field representatives to ensure samples are properly obtained, packaged, and transported. The engineers review the samples and, typically, have them tested in their own laboratories. They use the information they derive to characterize the site's subsurface and develop *preliminary* recommendations for the structure's foundations and for the specifications of various "geo" elements, like excavations, site grading, foundation-bearing grades, and roadway and parking-lot preparation and surfacing.

Geotechnical engineers cannot finalize their recommendations until they or their field representatives are on site to observe what's excavated to verify that the subsurface conditions the engineers predicted are those that actually exist.

When unanticipated conditions are observed, recommendations and/or specifications should be modified.

Responding to client requests, many geotechnical-engineering firms have expanded their field-services mix, so they're able to perform overall construction QA, encompassing – in addition to geotechnical issues – reinforced concrete, structural steel, welds, fireproofing, and so on. Unfortunately, that's caused some confusion. Believing that all CoMET consultants are alike, some owners take bids for the overall CoMET package, including the geotechnical field observation. *Entrusting geotechnical field observation to someone other than the geotechnical engineer of record (GER) creates a significant risk.*

Geotechnical engineers cannot finalize their recommendations until they are on site to verify that the subsurface conditions they predicted are those that actually exist. Entrusting geotechnical field observation to someone other than the geotechnical engineer of record (GER) creates a significant risk.

GERs have developed a variety of protocols to optimize the quality of their field-observation procedures. Quality-focused GERs meet with their field representatives before they leave for a project site, to brief them on what to look for and where, when, and how to look. (***No one can duplicate this briefing***, because no one else knows as much about a project's geotechnical issues.) And once they arrive at a project site, the field representatives know to maintain timely, effective communication with the GER, because that's what the GER has trained them to do. By contrast, it's extremely rare for a different firm's field personnel to contact the GER, even when they're concerned or confused about what they observe, because they regard the GER's firm as "the competition."

Divorcing the GER from geotechnical field operations is almost always penny-wise and pound-foolish. Still, because owners are given bad advice, it's commonly done, helping to explain why ***"geo" issues are the number-one source of construction-industry claims and disputes.***

Divorcing the GER from geotechnical field operations is almost always penny-wise and pound-foolish, helping to explain why "geo" issues are the number-one source of construction-industry claims and disputes.

To derive the biggest bang for the QA buck, identify three or even four quality-focused CoMET consultants. (If you don't know any, use the "Find a Geoprofessional" service available free at www.asfe.org.) Ask about the firms' ongoing and recent projects and the clients and client representatives involved; *insist upon receiving verification of all claimed accreditations, certifications, licenses, and insurance coverages.*

Insist upon receiving verification of all claimed accreditations, certifications, licenses, and insurance coverages.

Once you identify the two or three most qualified firms, meet with their representatives, preferably at their own facility, so you can inspect their laboratory, speak with management and technical staff, and form an opinion about the firm's capabilities and attitude.

Insist that each firm's designated project manager participate in the meeting. You will benefit when that individual is a seasoned QA professional familiar with construction's rough-and-tumble. Ask about others the firm will assign, too. There's no substitute for experienced personnel who are familiar with the codes and standards involved and know how to:

- read and interpret plans and specifications;
- perform the necessary observation, inspection, and testing;
- document their observations and findings;
- interact with constructors' personnel; and
- respond to the unexpected.

Important: Many of the services CoMET QA field representatives perform – like observing operations and outcomes – require the good judgment afforded by extensive training and experience, especially in situations where standard operating procedures do not apply. You need to know who will be exercising that judgment: a 15-year "veteran" or a rookie?

Many of the services CoMET QA field representatives perform require good judgment.

Also consider the tools CoMET personnel use. Some firms are passionate about proper calibration; others, less so. Passion is a good thing! Ask to see the firm's calibration records. If the firm doesn't have any, or if they are not current, be cautious. *You cannot trust test results derived using equipment that may be out of calibration.* Also ask a firm's representatives about their reporting practices, including report distribution, how they handle notifications of nonconformance, and how they resolve complaints.

Scope flexibility is needed to deal promptly with the unanticipated.

For financing purposes, some owners require the constructor to pay for CoMET services. ***Consider an alternative approach*** so you don't convert the constructor into the CoMET consultant's client. If it's essential for you to fund QA via the constructor, have the CoMET fee included as an allowance in the bid documents. This arrangement ensures that you remain the CoMET consultant's client, and it prevents the CoMET fee from becoming part of the constructor's bid-price competition. (Note that the International Building Code (IBC) *requires the owner to pay* for Special Inspection (SI) services commonly performed by the CoMET consultant as a service separate from QA, to help ensure the SI services' integrity. Because failure to comply could result in denial of an occupancy or use permit, having a contractual agreement that conforms to the IBC mandate is essential.)

If it's essential for you to fund QA via the constructor, have the CoMET fee included as an allowance in the bid documents. Note, too, that the International Building Code (IBC) requires the owner to pay for Special Inspection (SI) services.

CoMET consultants can usually quote their fees as unit fees, unit fees with estimated total (invoiced on a unit-fee basis), or lump-sum (invoiced on a percent-completion basis referenced to a schedule of values). No matter which method is used, estimated quantities need to be realistic. Some CoMET firms lower their total-fee estimates by using quantities they know are too low and then request change orders long before QA is complete.

Once you and the CoMET consultant settle on the scope of service and fee, enter into a written contract. Established CoMET firms have their own contracts; most owners sign them. Some owners prefer to use different contracts, but that can be a mistake when the contract was prepared for construction services. *Professional services are different.* Wholly avoidable problems occur when a contract includes provisions that don't apply to the services involved and fail to include those that do.

Some owners create wholly avoidable problems by using a contract prepared for construction services.

This final note: CoMET consultants perform QA for owners, not constructors. While constructors are commonly allowed to review QA reports as a *courtesy*, you need to make it clear that constructors do *not* have a legal right to rely on those reports; i.e., if constructors want to forgo their own observation and testing and rely on results derived from a scope created to meet *only* the needs of the owner, they *must do so at their own risk*. In all too many cases where owners have not made that clear, some constructors have alleged that they did have a legal right to rely on QA reports and, as a result, the CoMET consultant – not they – are responsible for their failure to deliver what they contractually promised to provide. The outcome can be delays and disputes that entangle you and all other principal project participants. Avoid that. Rely on a CoMET firm that possesses the resources and attitude needed to manage this and other risks as an element of a quality-focused service. Involve the firm early. Keep it engaged. And listen to what the CoMET consultant says. A good CoMET consultant can provide great value.

For more information, speak with your ASFE-Member CoMET consultant or contact ASFE directly.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

8811 Colesville Road
Suite G106
Silver Spring, Maryland 20910
Voice: 301.565.2733
Fax: 301.589.2017
E-mail: info@asfe.org
Internet: www.asfe.org