ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS FINAL REPORT

San Miguel Electric Cooperative, Inc.
San Miguel Electric Plant
Christine, Texas

Prepared for
U.S. Environmental Protection Agency
Washington, D.C.

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CDM Smith Project No.:
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Section 1

Introduction, Summary Conclusions and Recommendations

1.1 Introduction

On December 22, 2008 the dike of a coal combustion waste (CCW) ash pond dredging cell failed at a facility owned by the Tennessee Valley Authority in Kingston, Tennessee. The failure resulted in a spill of over one billion gallons of coal ash slurry, which covered more than 300 acres, damaging infrastructure and homes. In light of the dike failure, the United States Environmental Protection Agency (USEPA) is assessing the stability and functionality of existing CCW impoundments at coal-fired electric utilities to ensure that lives and property are protected from the consequences of a failure.

This assessment of the stability and functionality of San Miguel Electric Cooperative Inc.'s San Miguel Electric Plant CCW impoundments is based on a review of available documents, site assessments conducted by CDM Smith on August 30, 2012, and technical information provided subsequent to the site visit. In summary, the Ash Water Transport Pond (Ash Pond) and Sludge Disposal Basin (Sludge Basin) embankments are classified as **FAIR** based on the lack of hydrologic and hydraulic information on the Ash Pond or Sludge Basin, and the adequate documentation of the embankments' structural stability including required analyses for normal operating pool, steady state conditions; maximum surcharge pool condition; and normal operating pool under seismic loading conditions.

It is critical to note that the condition of the embankment(s) depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the embankment(s) will continue to represent the condition of the embankment(s) at some point in the future. Only through continued care and inspection can there be likely detection of unsafe conditions.

1.2 Purpose and Scope

CDM Smith was contracted by the USEPA to perform site assessments of selected surface impoundments. As part of this contract, CDM Smith conducted site assessments of the Ash Pond and Sludge Basin at the San Miguel Electric Plant (Plant) site owned by San Miguel Electric Cooperative, Inc. (San Miguel). These ponds are located on the south and east sides of the site. The purpose of this report is to provide the results of the assessments and evaluations of the conditions and potential for waste release from the CCW impoundments.

A site visit was conducted by CDM Smith representatives on August 30, 2012, to collect relevant information, inventory the impoundments, and perform visual assessments of the impoundments.

1.3 Conclusions and Recommendations

1.3.1 Conclusions

Conclusions are based on visual observations during site assessment on August 30, 2012 and review of technical documentation provided by San Miguel.

1.3.1.1 Conclusions Regarding Structural Soundness of the CCW Impoundments

Structural stability documentation appears to be adequate. A geotechnical report, prepared by Arias & Associates, Inc. (Arias), was provided, and it included slope stability analyses for all required load conditions, with the exception of rapid drawdown and liquefaction. Because the impoundments do not include spillways or overflow structures, and liquids are pumped over the embankments, rapid drawdown conditions were considered only likely in the event of a breach. The potential for liquefaction is considered unlikely due to the subsurface soil conditions and low seismic hazard level. Slope stability analyses were provided for steady-state seepage, maximum surcharge pool, and seismic conditions, as well as the assessment for liquefaction potential. In general, slope stability safety factors for load conditions analyzed are satisfactory.

1.3.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of CCW Impoundments

No hydrologic and hydraulic information was provided by San Miguel to indicate CCW impoundments hydrologic/hydraulic safety. A target pool elevation of at least 18 inches of freeboard at both the Ash Pond and Sludge Basin was the only hydraulic information provided by San Miguel. During the site visit, both ponds were below the target pool elevation. Because no hydrologic/ hydraulic documentation was provided, the hydrologic/hydraulic safety is judged to be inadequate.

1.3.1.3 Conclusions Regarding Adequacy of Supporting Technical Documentation

Supporting data and documentation for the Ash Pond and Sludge Basin includes required structural stability analyses for normal operating pool, steady state conditions; maximum surcharge pool condition; and normal operating pool under seismic loading conditions. An assessment of liquefaction potential was also provided, with the conclusion that liquefaction is considered to be very unlikely based on existing subsurface soil conditions and the stated 6% chance of a seismic event of a magnitude 5.0 or greater occurring over a 250-year period. Technical documentation of the embankment stability under a sudden drawdown loading condition was not provided because rapid drawdown conditions were considered only likely in the event of a breach. CDM Smith agrees with the rationale provided regarding embankment stability, liquefaction potential, and rapid drawdown conditions. Supporting documentation for structural stability is considered to be adequate.

Because no supporting data or documentation was provided for hydrologic/hydraulic safety of the impoundments, it is considered to be inadequate.

1.3.1.4 Conclusions Regarding Description of the CCW Impoundments

The record drawings and descriptions of the CCW impoundments provided by San Miguel representatives appear to be consistent with the visual observations by CDM Smith during site assessment.

1.3.1.5 Conclusions Regarding Field Observations

During visual observations and site assessments, CDM Smith observed an area of potential seepage near the toe of the Ash Pond's west embankment, erosion rills on the interior and exterior slopes of the Ash Pond embankments and several rodent burrows on the crest and exterior slope of the Ash

Pond embankments. An area of erosion, approximately 5 feet wide, was also observed on the interior slope of the Ash Pond's east embankment. According to San Miguel representatives this erosion was a result of leakage from a water well pipe traversing the Ash Pond embankment. The water well pipe had been repaired at the time of the site assessment.

Soils had eroded or settled from under the Sludge Basin's stormwater inlet structure. Other observations of the Sludge Basin embankments included erosion rills on west embankment interior slope and an area of erosion on the interior slope of the west embankment, near the submersible pump outlet structure.

1.3.1.6 Conclusions Regarding Adequacy of Maintenance and Methods of Operation

Current maintenance and operation procedures appear to be generally adequate.

There was documentation regarding seepage at the Ash Pond in the 1980s. The pond liner was reconstructed in 1987, but an area of potential seepage was observed during the CDM Smith site assessment in the vicinity of one of the areas that had documented seepage in the 1980s. There was no evidence of previous spills or release of impounded liquids outside the plant property.

1.3.1.7 Conclusions Regarding Adequacy of Surveillance and Monitoring Program

Surveillance and monitoring procedures include weekly checks of the impoundments by the Plant Environmental Engineer for leaks or deficiencies, and recording pool levels for both the Ash Pond and Sludge Basin. Additionally, level gages are checked six times daily by the operations department. Instrumentation for the Ash Pond and Sludge Basin consists of local level gages, used by operations to record impoundment levels. In addition to the current surveillance and monitoring program, the area of potential seepage at the west embankment exterior slope of the Ash Pond should be monitored. Because of the erosion into the Ash Pond's east embankment slope from a leaking pipe, the surveillance and monitoring program should be revised to include more-detailed inspections.

1.3.1.8 Conclusions Regarding Suitability for Continued Safe and Reliable Operation

Main embankments do not show evidence of unsafe conditions requiring immediate remedial efforts, although maintenance to correct deficiencies noted above is required.

As described by San Miguel representatives operating procedures for the Ash Pond and Sludge Basin include methods of controlling the water levels in the lagoons, but no formal documentation was provided to CDM Smith.

1.3.2 Recommendations

Based on CDM Smith's visual assessment of Ash Pond and Sludge Basin and review of documentation provided by San Miguel, CDM Smith offers the following recommendations for consideration.

1.3.2.1 Recommendations Regarding the Hydrologic/Hydraulic Safety

It is recommended that a qualified professional engineer determine the required flood frequency and evaluate the hydrologic and hydraulic capacity of the CCW impoundments to withstand design storm events without overtopping.

1.3.2.2 Recommendations Regarding the Technical Documentation for Structural Stability

It is recommended that a qualified professional engineer reevaluate the impoundments for structural stability should conditions from those included in the Arias & Associates, Inc. structural stability analyses change.

1.3.2.3 Recommendations Regarding Field Observations

CDM Smith recommends corrective actions be taken for the specific conditions identified below:

- Erosion rills – Erosion rills were observed on the interior slopes of the Sludge Basin and the interior and exterior slopes of the Ash Pond. Structural fill should be placed and compacted in the rills and graded to adjacent existing contours. The area should be sodded or reseeded.
- Surface erosion - Structural fill should be placed and compacted, graded to adjacent existing contours, and sodded or reseeded. Alternatively, riprap or other armoring could be used. Riprap or other armoring is recommended for the west, north, and east interior slopes to reduce the potential for erosion.
- Rodent burrows - Rodent burrows were observed on the crest and exterior embankment of the Ash Pond. Although not seen on other embankments, vegetation cover may have hidden additional rodent burrows. CDM Smith recommends San Miguel accurately document areas disturbed by animal activity, remove the animals, and backfill the burrows with compacted structural fill to protect the integrity of the embankments.
- Potential seepage area - CDM Smith observed an area of potential seepage at the west embankment exterior slope of the Ash Pond. CDM Smith recommends San Miguel take the following actions:
    - ✓ Cut back and maintain vegetation in the area to facilitate monitoring the condition
    - ✓ Develop a regular surveillance program to monitor areas of seepage and potential seepage to measure the rate, volume, and turbidity of flow emerging from the embankment slope; and
    - ✓ Develop and execute a geotechnical exploration program that includes additional test borings and installation of piezometers and other instrumentation to analyze and regularly monitor embankment seepage and stability.

1.3.2.4 Recommendations Regarding Surveillance and Monitoring Program

Monitoring for potential seepage at the exterior embankment slopes is recommended for both the Ash Pond and Sludge Basin considering historical issues with seepage. Potential areas of seepage may be more readily assessed after clearing of trees and dense vegetation on embankment slopes. It is recommended that vegetation on the impoundment embankments be maintained with seasonal mowing, as necessary, for animal control and surveillance and monitoring of embankments.

1.3.2.5 Recommendations Regarding Continued Safe and Reliable Operation

Inspections should be made following periods of heavy and/or prolonged rainfall, and the occurrence of these events should be documented. Inspection procedures should be documented and inspection records should be retained at the facility for a minimum of three years.

Major repairs and slope restoration should be designed by a registered professional engineer experienced with earthen dam design.

None of the conditions observed require immediate attention or remediation, however, the above recommendations should be implemented to maintain continued safe and reliable operation of the CCW impoundments.

1.4 Participants and Acknowledgment

1.4.1 List of Participants

CDM Smith representatives, Jamal Daas, P.E. and Bevin Barringer, P.E, were accompanied at all times during the visual assessment by the following individuals from San Miguel and San Miguel's legal counsel, Jackson Walker, LLP:

- Joseph Eutizi – Engineering Manager, San Miguel Electric Cooperative, Inc.
- Michael Nasi – Jackson Walker, LLP
- Lisa Kost – Technical Specialist, Jackson Walker, LLP

1.4.2 Acknowledgement and Signature

CDM Smith acknowledges that the CCW impoundments referenced herein were assessed by Jamal Daas, P.E. and Bevin Barringer, P.E. Based on the documentation provided, the Ash Water Transport Pond and Sludge Disposal Basin are rated **FAIR**. Although the facility has static and seismic engineering studies following best professional engineering practice to support safety factors under normal loading conditions (static, seismic) in accordance with the applicable safety regulatory criteria, San Miguel has not provided any hydrologic and hydraulic information to evaluate the capacity of either the Ash Pond or Sludge Basin. Deficiencies exist that require remedial measures.

We certify that the CCW impoundments referenced herein have been assessed on August 30, 2012.

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Bevin Barringer

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Section 2

Description of the Coal Combustion Waste Impoundments

2.1 Location and General Description

The San Miguel Electric Plant (Plant), owned by San Miguel Electric Cooperative, Inc. (San Miguel) is located in Atascosa County at 6200 FM 3387, Christine, Texas, as shown on **Figure 2-1**. The Plant site is surrounded by open grassy areas with patches of trees, as shown on **Figure 2-2**. The majority of land surrounding the Plant is used as pastureland for livestock. A surface lignite mine, operated by San Miguel, is located east of the Plant site.

The Plant has two CCW impoundments: the Ash Water Transport Pond (Ash Pond) near the south end of Plant property and the Sludge Disposal Basin (Sludge Basin) near the east end of Plant property as shown on Figure 2-2. The Ash Pond was constructed as a side-hill impoundment with the northern embankment at or near natural grade. The Ash Pond includes a center embankment that separates the pond into north and south sections with a connecting gated channel that can be closed to isolate either pond. The channel is generally only closed to isolate the north or south pond for cleaning. According to the San Miguel representative, the Ash Pond was last dredged in 2005. The Sludge Basin was constructed as a diked impoundment that shares its western embankment with a water well storage pond. During the site assessment, the water level in the water well storage pond was above the water level in the Sludge Basin. Information was not provided regarding hydraulic connection between the Sludge Basin and the water well storage pond.

The total perimeter of the Ash Pond is approximately 6,000 feet, and the approximate surface area is 30.5 acres. The total perimeter of the Sludge Basin is approximately 4,800 feet, and the approximate surface area is 26.5 acres. **Table 2-1** shows a summary of the approximate size and dimension of the impoundments.

Table 2-1 – Summary of Impoundments Approximate Dimension and Size

	Impoundment	
	Ash Pond	Sludge Basin
Maximum Dam Height (ft)	20	24 to 34
Average Crest Width (ft)	20	20
Perimeter Length (ft)	6,000	4,800
Interior Slopes, H:V	2.5:1	3:1
Exterior Slopes, H:V	2.5:1	3:1

Note: All dimensions were obtained from construction drawings.

2.1.1 Horizontal and Vertical Datum

Project drawings from 1976 and 1977, provided by San Miguel to CDM Smith did not include reference to the horizontal and vertical datum used. Based on the date of the drawings and the datum in general use at the time, it is likely that the drawings were referenced to the National Geodetic

Vertical Datum of 1929 (NGVD 1929) and the North American Datum of 1927 (NAD 27). Elevations noted herein are in feet and are referenced to the datum used for the project drawings, which is assumed to be NGVD 1929, unless otherwise noted.

2.1.2 Site Geology

The San Miguel Electric Plant is located in south central Atascosa County, Texas. Based on review of the USGS Topographic Map, natural ground surface elevations in the area of the Plant range from approximately El. 350 to El. 280 feet referenced to the North American Vertical Datum of 1988. According to the Quaternary Geologic Map of the Austin 4 x 6 Quadrangle published by the United States Geological Survey, the Plant is located on massive clay decomposition residuum from the Quaternary and Tertiary Periods. These deposits consist of gray to dark-brownish gray, yellowish- to dark-brown, reddish-brown, or mottled light-red to orange, clay, sandy clay, and fine quartz sand commonly limonite stained. The lower part of the deposits locally contain fragments of brown coal and are formed chiefly on dark-gray clay or yellowish-gray and brown, soft, thin sandstone interbedded with shale. According to the United States Department of Agriculture, surface soils in the area are comprised of clay, clay loam, and sandy clay loam.

Soil boring information included in a letter from NFS/National Soil Services, Inc. dated September 25, 1978 was provided by San Miguel. These borings indicate that existing subsurface soils in the vicinity of the Ash Pond and Sludge Basin consist of stiff to hard clay with varying amounts of silt and sand underlain by a layer of dense to very dense clayey fine sand, silty fine sand and sandy silt. Soil boring information provided in the 1978 letter are included in **Appendix A**. Soil boring information was also provided in a report prepared by Arias & Associates, Inc. (Arias) dated November 19, 2012. In the Arias report, states that the embankment fill is comprised of clays, sandy clays, gravelly clays with some lignite material and sand pockets. The Arias report indicates the embankment fill is in a stiff to hard condition. The fill also contained gypsum material. Upper native soils include clays, sandy clays, and fine sands in a stiff to hard and medium dense condition. These upper native soils are underlain by clays, sandy clays, clayey sands, siltstones, and sandstone with occasional thin seams of lignite in a very stiff to very hard or very dense condition. The 2012 Arias report is included in **Appendix B**.

2.2 Coal Combustion Waste Handling

The Ash Pond receives liquids from the bottom ash dewatering bins, Sludge Basin, water well storage pond, cooling tower, coal pile runoff pond, and plant drain sumps.

The Sludge Basin receives liquids from the Ash Pond, stormwater runoff, sewage, emergency scrubber blowdown, and drainage from the acid storage area.

The Plant is a zero liquid discharge facility, and all of the liquids in the Ash Pond and Sludge Basin are recycled and used in Plant processes.

2.2.1 Fly Ash

Fly ash is removed from the flue gas by the Electrostatic Precipitator (ESP) – a dry process. It is then blown into a fly ash silo. From the fly ash silo, the fly ash is sold (as a Portland cement substitute) or mixed with the scrubber sludge for placement in the mine for reclamation purposes. Under emergency operating conditions, limited amounts of fly ash may be discharged to the Ash Pond by a wet sluice (Hydroveyor) system.

2.2.2 Bottom Ash

Bottom ash is collected in the ash hopper of the boiler and is sluiced to dewatering bins. Ash is dewatered every 24 hours, and the decanted water, that contains some ash, goes to the Ash Pond. The dewatered bottom ash is loaded into trucks and placed in the mine for reclamation purposes.

2.2.3 Boiler Slag

The San Miguel plant is not a slag-production type furnace, however a small amount of Boiler Slag is typically found in bottom ash.

2.2.4 Flue Gas Desulfurization Gypsum

The Flue Gas Desulfurization system (FGD) has a continuous blowdown of the scrubber liquor (that is 17% solids) to a thickener where the water is decanted off and the thickened waste material (35 to 50% solids) is pumped to a holding tank and then to a rotary filter where the solids are collected and the water is recycled. The solids (75 to 80% solids) are then mixed with the fly ash so the dry mixture can be placed in the mine for reclamation purposes.

2.3 Size and Hazard Classification

According to the United States Army Corps of Engineers (USACE) Guidelines for Safety Inspection of Dams (1979) (ER 1110-2-106), impoundments are categorized per **Table 2-2.**

Table 2-2 – USACE ER 1110-2-106 Size Classification

Category	Impoundment	
	Storage (acre-feet)	Embankment Height (feet)
Small	50 to < 1000	25 to < 40
Intermediate	1000 to < 50,000	40 to < 100
Large	> 50,000	> 100

The total storage capacity of the Ash Pond and Sludge Basin are approximately 800 and 600 acre-feet, respectively. Therefore, the embankments for both impoundments are classified as small dams as defined in ER 1110-2-106. The impoundment capacities were estimated by CDM Smith based on the geometry shown on the original construction drawings provided by San Miguel.

It is not known if the Plant impoundments currently have an assigned Hazard Potential Classification. Based on the USEPA classification system as presented on Page 2 of the USEPA checklist (**Appendix C**) and CDM Smith's review of the site and downstream areas, recommended hazard ratings have been assigned to the impoundments as summarized in **Table 2-3**:

Table 2-3 – Recommended Impoundment Hazard Classification Ratings

Ash Pond Unit	Recommended Hazard Rating	Basis
Ash Water Transport Pond	Significant Hazard	▪ Loss of human life is not anticipated. ▪ Failure or miss-operation could result in damage to plant infrastructure, operations, and utilities including transmission towers supporting high voltage overhead power circuits within 200 feet of the impoundment. ▪ Failure or miss-operation could result in economic loss and environmental damage to rural areas located adjacent to the Plant boundary. Discharge would likely flow towards normally dry creeks located south of the Ash Water Transport Pond and onto adjacent property. Portions of the adjacent property are used for cattle grazing and others are leased by the local mining company.
Sludge Disposal Basin	Significant Hazard	▪ Loss of human life is not anticipated. ▪ Failure or miss-operation could result in damage to plant infrastructure, operations, and utilities including transmission towers supporting high voltage overhead power circuits within 200 feet of the impoundment. ▪ Failure or miss-operation could result in economic loss and environmental damage to rural areas located adjacent to the Plant boundary. Discharge would likely flow towards normally dry creeks located west of the Sludge Disposal Basin and onto adjacent property. Portions of the adjacent property are used for cattle grazing and others are leased by the local mining company.

2.4 Amount and Type of CCW Currently Contained in the Unit(s) and Maximum Capacity

CDM Smith was not provided information on the amounts of CCW currently stored in the units. According to the San Miguel representative, the Ash Pond was last dredged in 2005 and a channel was dug through the sludge containing residual ash in the Sludge Basin approximately 2 years prior to CDM Smith's site visit. Based on information provided by San Miguel, the Ash Pond contains bottom ash residuals from dewatering hydrobin liquids, and the Sludge Basin contains relatively small amount of bottom ash residuals as a result of transferring liquids between the two impoundments. Under emergency operating conditions limited amounts of fly ash may be discharged to the Ash Pond, therefore there may be some fly ash in the Ash Pond. The pool area of the Ash Pond and Sludge Basin is approximately 30.5 and 26.5 acres, respectively. As previously mentioned the Plant is a zero liquid discharge facility, and neither impoundment includes an outfall.

2.5 Principal Project Structures

Principal structures of the Ash Pond include the following:

- Two 12-inch-diameter polyvinyl chloride (PVC) pipes at the west embankment interior slope that discharge liquids from the bottom ash dewatering bins,

- Two 16-inch-diameter PVC pipes at the west embankment interior slope that discharge liquids from plant sumps,
- One 12-inch-diameter steel pipe at the west embankment interior slope that discharges liquids from cooling tower blowdown,
- One 6-inch-diameter steel pipe at the north interior embankment that discharges liquids from the cooling tower makeup,
- One 6-inch-diameter high-density polyethylene (HDPE) pipe at the north interior embankment that discharges liquids from the water treatment sump,
- One 6-inch-diameter HDPE pipe at the west interior embankment that discharges liquids from the Sludge Basin,
- One 24-inch-diameter steel pipe at the west interior embankment that siphons water for reuse in plant processes,
- Earthen perimeter embankments composed of clay fill with varying amounts of sand, and
- A center embankment separating the Ash Pond into north and south sections with a 15-foot-wide steel gate structure located at the eastern end of the center embankment.

Principal structures of the Sludge Basin include the following:

- One 8-inch-diameter HDPE pipe at the west embankment interior slope that discharges drainage from acid storage area,
- One 6-inch-diameter HDPE pipe at the west embankment interior slope that discharges liquids from the SO_2 scrubber,
- One 8-inch-diameter HDPE pipe at the west embankment interior slope that discharges plant sewage,
- One 12-inch-diameter HDPE pipe at the west embankment interior slope that discharges drainage from the adjacent electric substation,
- One 12-inch-diameter steel or cast-iron pipe at the west embankment interior slope that discharges plant stormwater drainage,
- One 6-inch-diameter HDPE pipe and pump at the south embankment interior slope that can transport liquids from the Sludge Basin to the Ash Pond,
- One 6-inch-diameter HDPE pipe and pump at the west embankment interior slope that was not in service during the site assessment, and
- Earthen perimeter embankments composed of clay fill with varying amounts of sand.

2.6 Critical Infrastructure within Five Miles Downgradient

Based on available topographic maps, surface drainage in the vicinity of the San Miguel Electric Plant appears to be to the northwest towards Souse Creek and La Parita Creek. Flow in these creeks ultimately enters the Atascosa River, approximately 16.5 stream miles from the Plant. Critical infrastructure identified within five miles downgradient of the Plant includes overhead high voltage power lines. No schools, hospitals, waterways, roadways and bridges, and other major facilities were identified within five miles of the Plant site. Places of worship shown on Figure 2-1 are more than 5 miles from the Plant and are not downgradient of the impoundments.

Discharge from both impoundments would likely flow directly into the normally dry creeks located south of the Ash Pond and west of the Sludge Basin. The dry creeks adjacent to the Plant site discharge into La Parita Creek, approximately 4.2 stream miles from the Plant. Flow in La Parita Creek ultimately enters the Atascosa River, approximately 16.5 stream miles from the Plant. High voltage power lines are located adjacent to both the Ash Pond and Sludge Basin, between the impoundment and creeks.

Liquids discharged from a breach of the impoundment embankments would likely result in economic and environmental damage to Plant property, adjacent rural property, and adjacent creeks. A breach of the impoundment embankments is not expected to result in loss of human life.

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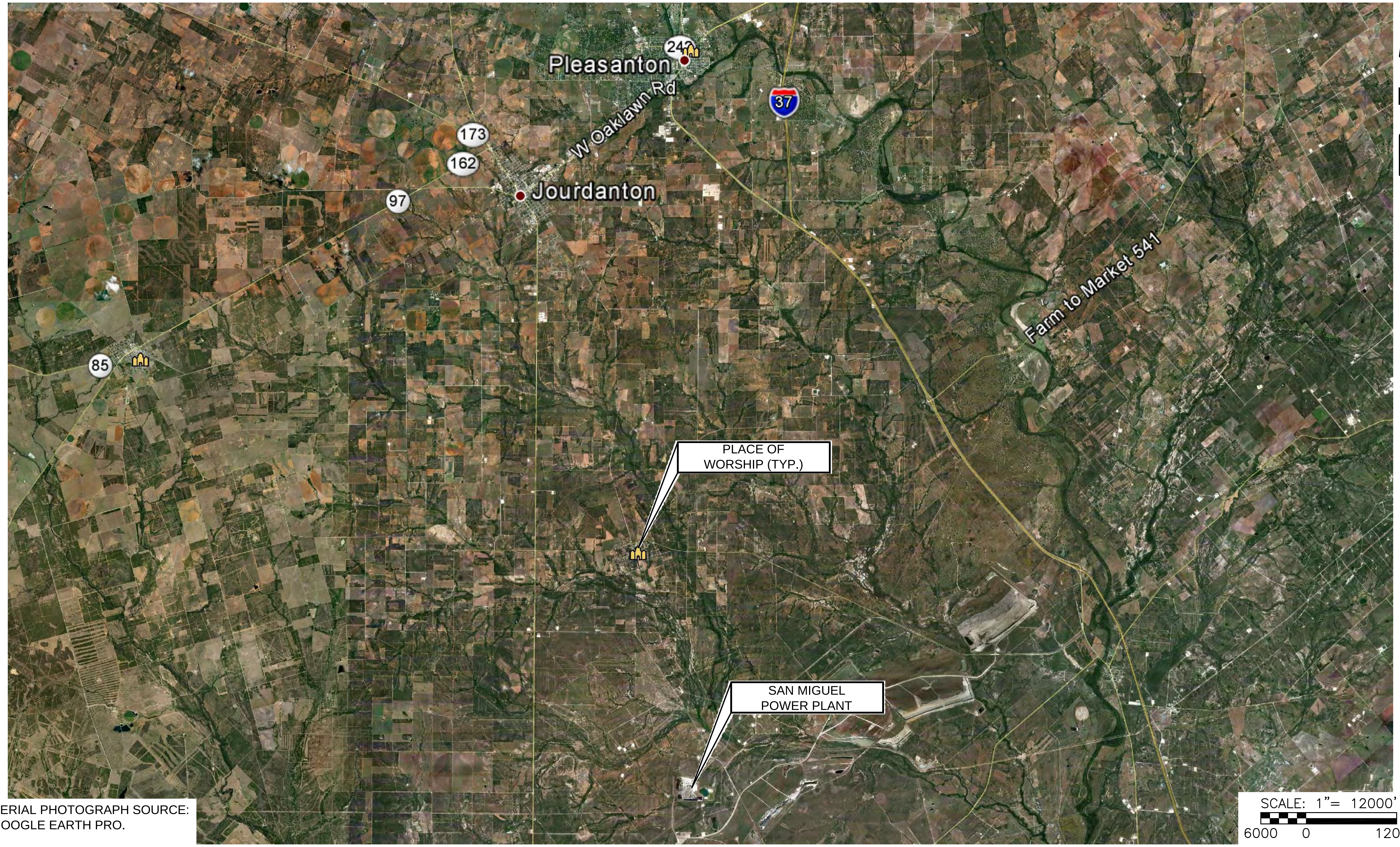
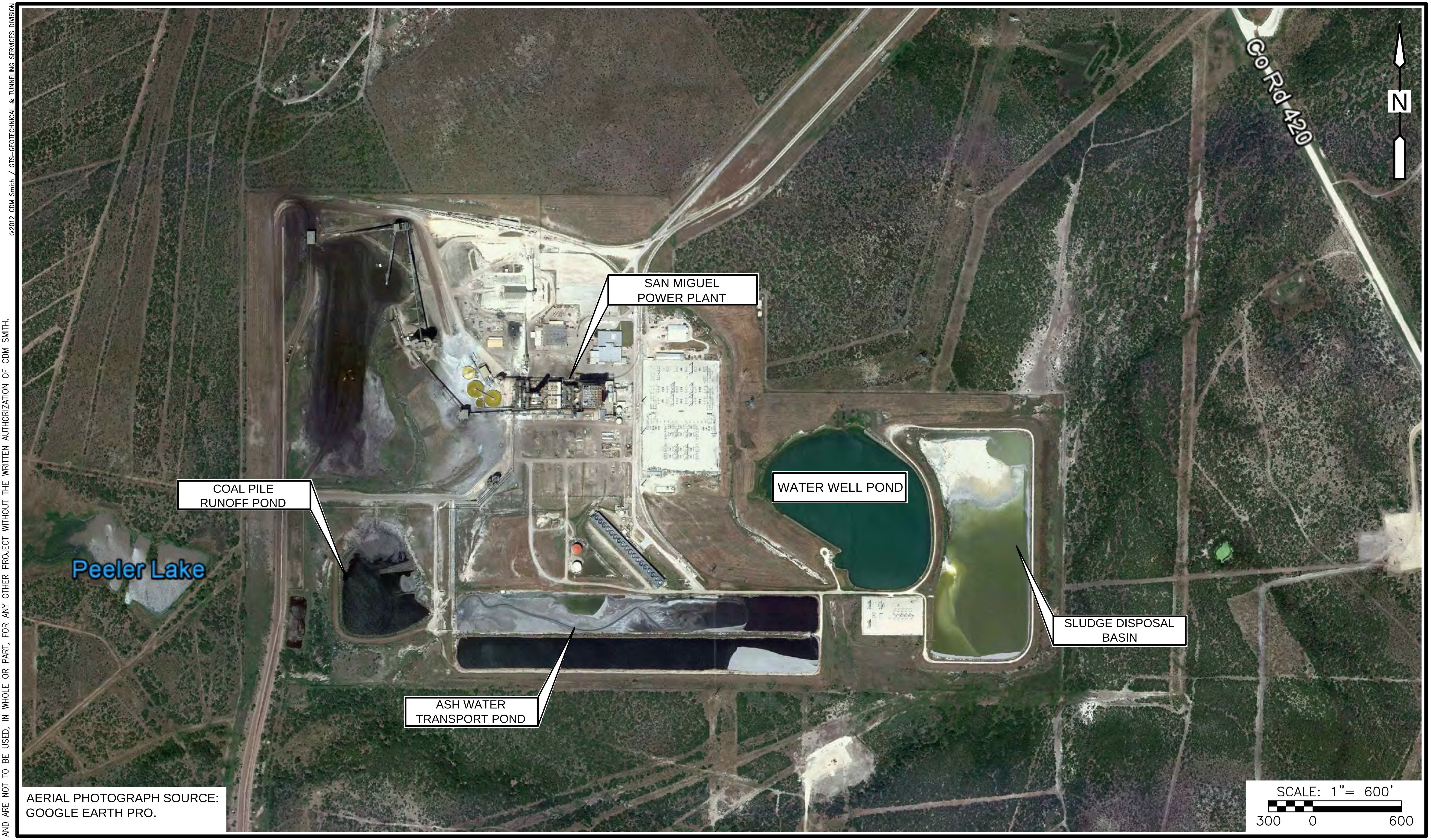


AERIAL PHOTOGRAPH SOURCE:
GOOGLE EARTH PRO.

CDM Smith

SAN MIGUEL POWER PLANT
CHRISTINE, TEXAS
VICINITY MAP
FIGURE 2-1



AERIAL PHOTOGRAPH SOURCE: GOOGLE EARTH PRO.

CDM Smith

SAN MIGUEL POWER PLANT
CHRISTINE, TEXAS
SITE PLAN
FIGURE 2-2

Section 3

Summary of Relevant Reports, Permits and Incidents

3.1 Summary of Reports on the Safety of the CCW Impoundments

Inspection of the Ash Pond and Sludge Basin embankments was performed by Pape-Dawson Engineers, Inc. (PDE) in 2010. Documentation provided by San Miguel included an inspection report prepared by PDE dated February 1, 2010. The PDE report included inspection reports for the Ash Pond (referred to as the Ash Pond Center Dike and North Ash Pond, and South Ash Pond) and Sludge Basin (referred to as the Equalization Pond). The 2010 PDE report is included in **Appendix D**.

Observations of the Ash Pond embankments documented in the 2010 PDE report include minor shore erosion, low spots along top of bank, and erosion rills on the center embankment. Wet spots were observed at the north section of the Ash Pond and PDE documented that no sediment load, ponding or flowing water was observed at the time of inspection. PDE's follow-up recommendations included monitoring areas of erosion and inspection of embankments after vegetation is cut back.

Observations at the Sludge Basin included erosion rills on the interior slope of the pond, erosion at inlet pipe headwall, and water ponding along the southeast side of pond. PDE documented that water at the southeast side of the pond did not seem to come from the pond, and suggested monitoring to see if ponding dissipates. Follow-up recommendations included inspection of embankments after vegetation is cut back, and addressing erosion at the inlet pipe.

The San Miguel representative indicated to his knowledge there have been no known structural or operational problems associated with the CCW impoundments, with the exception of seepage at the Ash Pond which resulted in reconstruction of the clay liner in 1987. This seepage is discussed in detail in Section 4.

3.2 Summary of Local, State, and Federal Environment Permits

Currently, the CCW impoundments are regulated by the Texas Commission on Environmental Quality (TCEQ).

The San Miguel Electric Plant was issued a permit by TCEQ under the National Pollutant Discharge Elimination System (NPDES) which includes the Ash Pond and Sludge Basin, though these ponds do not discharge waste. The Permit allows transfer of liquids between the Ash Pond and Sludge Basin and for use in Plant processes, but states that there shall be no wastewater discharge from the Ash Pond and Sludge Basin. The Plant only discharges liquids from the coal pile runoff pond during heavy rainfall events under this permit. The permit, WQ00260100, was issued on June 10, 2010 and expires on May 1, 2015.

3.3 Summary of Spill/Release Incidents

According to San Miguel representatives, no releases or spills have occurred at the Ash Pond and Sludge Basin.

Section 4

Summary of History of Construction and Operation

4.1 Summary of Construction History

4.1.1 Impoundment Construction and Historical Information

The San Miguel Electric Plant began operation in 1982. The 440 megawatt Plant is a lignite-based electric generating station.

The Ash Pond and Sludge Basin were constructed between 1977 and 1978. Historical information on the Ash Pond and Sludge Basin available for review included construction drawings from 1977 when the current impoundments were constructed. Construction drawings and other documentation provided by San Miguel are included in Appendix D. The 1977 drawings show an existing coal pile runoff pond to the west of the Ash Pond and water well storage pond west of the Sludge Basin. The current configurations and locations of the coal pile runoff pond and water well storage pond appear to be as shown on the 1977 drawings. Soil boring locations and subsurface soil profiles were provided as part of a letter from NFS/National Soil Services, Inc. dated September 25, 1978. Over 100 soil borings were performed across the Plant site. Boring location plans and soil boring logs that were provided by San Miguel are included in Appendix A. Based on the 1977 construction drawings, the Ash Pond and Sludge Basin embankments were constructed using clay fill material excavated on-site.

The Ash Pond was constructed as a side-hill configuration using the natural terrain that slopes downward to the south. Original grade in the area of the north embankment ranged from El. 315 to 305, requiring up to 10 feet of clay fill to construct to final crest El. 315. The west, south, and east embankments were constructed with up to 25 feet of clay, silty clay, and sandy clay fill. According to the 1977 drawings, the interior slopes and exterior slopes of the Ash Pond, including the center embankment were constructed at 2.5H:1V. The north embankment varies in height to approximately 10 feet. Based on information provided by San Miguel and visual observations, the Ash Pond embankment crest is at El. 315 around the perimeter and along the center embankment, and the crest width varies from about 15 to 35 feet.

The Sludge Basin was constructed by building embankments between 5 to 35 feet above natural grade. The type of fill material used during construction was not included in the documentation provided, though it was likely constructed with the same material as the Ash Pond as they were constructed at the same time. Based on recent soil borings performed within the Sludge Basin embankments, the fill material appears to consist of clay with varying amounts of sand. A water well storage pond was located just west of the Sludge Basin prior to construction, and the Sludge Basin shares its west embankment with the water well storage pond. According to the 1977 drawings, the interior slopes and exterior slopes were constructed at 3H:1V. Based on information provided by San Miguel and visual observations, the Sludge Basin embankment crest is at El. 295 around the perimeter, except at the adjacent embankment with the water well storage pond where the crest is at El. 305, and the crest width varies from about 15 to 20 feet.

4.1.2 Significant Changes/Modifications in Design since Original Construction

According to San Miguel representatives, no significant changes or modifications to the design have been made since original construction.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

Major repairs/rehabilitation to the embankments included addressing seepage observed at the Ash Pond and documented by the Texas Department of Water Resources in 1983. Documentation that includes letter correspondence between TDWR, San Miguel, and San Miguel's subconsultants discuss that seepage was reported by TDWR in 1983, the seepage was studied by Tippet & Gee, Inc. in 1984, and the embankment liner was reconstructed in 1987. Reconstruction included recompacting the top 2 feet of embankment fill on all inside slopes of the Ash Pond to obtain a permeability of less than 1x10-7 cm/sec. The reports and drawings documenting this liner reconstruction are included in Appendix D.

4.2 Summary of Operational Procedures

4.2.1 Original Operating Procedures

The Ash Pond has historically been used as settling ponds for liquids received from bottom ash dewatering bins and other plant wastes. Waste water streams discharged into the Ash Pond have included:

- Ash transport water
- Liquid from bottom ash dewatering bins
- Cooling tower blowdown and makeup
- Boiler blowdown
- Plant drain sumps
- Coal pile runoff
- Liquids from the Sludge Basin

The Sludge Basin has historically been used to store sewage generated by the Plant and other plant wastes. Waste water streams discharged into the Sludge Basin have included:

- Plant Sewage
- Stormwater runoff
- Emergency scrubber blowdown
- Acid storage area drainage
- Liquids from Ash Pond

4.2.2 Significant Changes in Operational Procedures and Original Startup

No significant changes in operational procedures had been made to the Ash Pond and Sludge Basin. There was no documentation provided that indicates different.

4.2.3 Current CCW Impoundment Configuration

The Ash Pond and Sludge Basin are currently configured as previously described and as shown on Figure 2-3. The approximate crest elevations of the embankments and pond areas are shown on **Table 4-1** below.

Table 4-1 – Approximate Crest Elevations and Surface Areas

Ash Pond	Approximate Crest Elevation (Feet)	Approximate Pond Surface Area (Acres)
Ash Water Transport Pond	315	30.5
Sludge Disposal Basin	295	26.5

Over the life of the impoundments, ash has been periodically excavated or dredged from the Ash Pond, and based on information provided, sludge was partially excavated from the Sludge Basin in 2010.

Under normal operating conditions, liquids are discharged into the Ash Pond through several pipes located at the north and west embankment's interior slopes. Liquids are siphoned from the Ash Pond through a 24-inch-diameter steel pipe and reused in Plant processes.

Under normal operating conditions, liquids are discharged into the Sludge Basin through several inlet pipes on the west embankment interior slope. A pump and 6-inch-diameter HDPE outlet pipe is located at the southeast corner of the impoundment, which can transport liquids from the Sludge Basin to the Ash Pond, if needed. A 6-inch-diameter HDPE outlet and submersible pump that were not in service during the site assessment were located near the southwest corner of the Sludge Basin.

4.2.4 Other Notable Events since Original Startup

Based on furnished information, there are no other notable events since original startup of the Ash Pond and Sludge Basin to report at this time.

Section 5

Field Observations

5.1 Project Overview and Significant Findings (Visual Observations)

CDM Smith performed visual assessments of the impoundments at the San Miguel Electric Plant site. Impoundments assessed included the Ash Water Transport Pond and Sludge Disposal Basin. These impoundments, referred to as the Ash Pond and Sludge Basin, are located on the south and east ends of the site, respectively. The perimeter embankments of the Ash Pond are approximately 6,000 feet long, not including the 2,475-foot-long center embankment, and approximately 20 feet high. The perimeter embankments of the Sludge Basin are approximately 4,800 feet long and vary from approximately 24 to 34 feet high. The assessments were completed following the general procedures and considerations contained in Federal Emergency Management Agency's (FEMA's) Federal Guidelines for Dam Safety (April 2004) to make observations concerning settlement, movement, erosion, seepage, leakage, cracking, and deterioration. A Coal Combustion Dam Inspection Checklist and Coal Combustion Waste (CCW) Impoundment Inspection Form, developed by USEPA, was completed for each of the aforementioned impoundments. Copies of these forms are included in Appendix C. Photograph locations are shown on **Figures 5-1A, 5-1B, 5-2A** and **5-2B**, and photographs are included in **Appendix E**. Photograph locations were logged using a handheld GPS device. The photograph coordinates are listed in Appendix E.

CDM Smith visited the plant on August 30, 2012, to conduct visual assessments of the impoundments. The weather was generally sunny with daytime high temperatures up to 100 degrees Fahrenheit. The daily total precipitation prior to the site visit is shown in **Table 5-1**. The data were obtained from the National Oceanic and Atmospheric Administration (NOAA) at a site in Christine, Texas, approximately 6 miles northwest of the Plant.

Table 5-1 – Approximate Precipitation Prior to Site Visit

Date of Site Visit – August 30, 2012		
Day	**Date**	**Precipitation (inches)**
Monday	August 29	0
Sunday	August 28	0
Saturday	August 27	0
Friday	August 26	0
Thursday	August 25	0.01
Wednesday	August 24	0
Tuesday	August 23	0
Monday	August 22	0
Total	**(September 10 - 17, 2012)**	**0.01**
Total	**Month Prior to Site Visit (July 30 – August 30, 2012)**	**0.60**

Note: Precipitation data from NOAA. Station Location: Christine, TX. Lat. 28.7861; Lon. -98.5215; EL. 341 ft.

5.2 Ash Pond

At the time of the assessment, the Ash Pond contained ash and liquids with approximately 20 inches of freeboard. An overview of the photographs taken at the Ash Pond during the CDM Smith site assessment is included in **Figure 5-1A** and **5-1B**.

5.2.1 Crest

The crest of the Ash Pond appeared to be in satisfactory condition (Photographs 1, 21, 46, 72 and 82). The center embankment separating the Ash Pond into north and south sections included a metal gate structure that is kept open during normal operating conditions (Photographs 7, 9, and 78). Areas showing signs of tension or desiccation cracks were observed on the crest near the southeast and southwest corners of the impoundment (Photograph 13). Animal burrows were observed on the crest near the southwest corner (Photograph 42). The 15 to 35-foot-wide crest of the embankment consists of compacted granular soils and gravel and is exposed to minimal vehicle traffic. Support poles for overhead power lines were located on the crest of the south embankment (Photograph 27). No depressions or evidence of settlement were observed on the crest.

5.2.2 Interior Slopes

Due to the water level in the Ash Pond during the assessment, only the upper 1.5 to 2 feet of the interior slopes was visible (Photographs 2, 22, 51, 66, and 86). Based on drawings, the interior slopes are 2.5H:1V. An area of erosion into the interior slope approximately 5 feet wide was observed on the east embankment (Photograph 15). Reportedly, this erosion was a result of leakage from a water well pipe traversing the Ash Pond embankment. The water well pipe had been repaired at the time of the site assessment. Minor slope erosion was observed on the east embankment interior slope (Photograph 3). Minor erosion rills were observed on the south embankment interior slopes (Photographs 23 through 26). Grass, approximately 18 inches in height, covered some portions of the interior slopes that were visible (Photographs 2, 33, 63, and 84). Visible portions of interior slopes did not include riprap or other armoring.

Six inlet pipes are located on the interior slope of the west embankment: two 12-inch PVC, two 16-inch-diameter PVC, one 12-inch-diameter steel, and one 6-inch-diameter PVC pipe (Photograph 54). Two inlet pipes are located on the interior slope of the north embankment: a 6-inch-diameter metal and 6-inch-diameter high-density polyethylene (HDPE) pipe (Photographs 71 and 74). The outlet pipe is located on the west embankment interior slope (Photograph 50).

5.2.3 Exterior Slopes

The Ash Pond includes exterior slopes on the west, south, and east embankments. The north side of the Ash Pond is incised (Photograph 67). The exterior slopes appear to be in fair condition (Photographs 11, 31, and 48). An area of potential seepage approximately 20 feet by 10 feet was located on the west embankment exterior slope (Photographs 56 through 60). The area included cattails and other vegetation varying from the surrounding vegetation, and the ground was damp. According to documentation provided by San Miguel, this area of potential seepage is in the vicinity of a location of documented seepage in the 1980's. A berm approximately 10 feet wide adjacent to and about halfway up the south embankment exterior slope was observed (Photographs 40 and 41). Plant staff suggested this may have been constructed as a road embankment to access the pond during reconstruction of the clay liner in the 1980s or from cleanout operations. An animal burrow was observed on the east embankment exterior slope (Photograph 17). A few small trees and bushes with diameters less than 3 inches in diameter were observed on the exterior slopes at the southeast corner

(Photograph 16) and on the west embankment near the potential seepage area (Photograph 58). The exterior slopes are approximately 2.5H:1V and covered in grassy vegetation approximately 2 feet tall (Photographs 5, 19, and 52). The coal pile runoff pond is approximately 100 feet west of the west embankment exterior toe (Photograph 48).

5.2.4 Outlet Structures

The outlet structure consists of a 24-inch-diameter steel siphon pipe on the west embankment interior slope (Photographs 49 and 50). The steel pipe transports liquids to the pumps at the west embankment exterior toe, and the liquids are then pumped to the Plant for reuse in plant processes.

5.3 Sludge Basin

At the time of the assessment, the Sludge Basin contained sludge and liquids with approximately 8 feet of freeboard. An overview of the photographs taken at the Sludge Basin during the CDM Smith site assessment is included in **Figure 5-2A** and **5-2B**.

5.3.1 Crest

The embankment crest of the Sludge Basin appeared to be in satisfactory condition (Photographs 94, 106, 121, 137 and 145). The crest ranged from 15 to 20 feet wide. The crest of the embankment consists of a compacted gravel drive and grass. The surface is exposed to minimal vehicle traffic. No depressions or evidence of settlement were observed on the crest.

5.3.2 Interior Slopes

Interior slopes appeared to be in fair condition (Photographs 97, 128, 138, and 147). Erosion rills were observed on the west embankment interior slope (Photographs 99 and 100). An area of either erosion or settling of fill material was observed below the headwall for the stormwater inlet on the west embankment interior slope (Photograph 102). An area of erosion was observed near the outlet structure on the west embankment interior slope (Photograph 151). Based on construction drawings, the interior slopes are 3H:1V for all embankments, though slopes measured in the field ranged from 2H:1V to 3H:1V. Grassy vegetation and small trees up to 3 inches in diameter were observed on the upper portion of the west, north, and east interior slopes (Photographs 103, 108, 117, and 138). Riprap in good condition, but with vegetation growing within was observed on the upper portion of the south embankment interior slope (Photograph 147).

A 12-inch-diameter HDPE inlet pipe (Photographs 101 and 102), a 12-inch-diameter steel inlet pipe (Photograph 104), and an 8-inch-diameter HDPE inlet pipe (Photograph 109) were located on the west embankment interior slope. Reportedly, additional 6- and 8-inch-diameter inlet pipes discharge from the west embankment interior slope, though those inlets were not visible during the site assessment due to vegetation. Outlets were located on the west embankment interior slope (Photograph 93) and south embankment interior slope (Photograph (145).

5.3.3 Exterior Slopes

The exterior slopes appear to be in good condition and are covered with grassy vegetation approximately 2 feet high (Photographs 107, 122, 133, and 146). An animal burrow was observed on the south embankment exterior slope (Photograph 143). Based on construction drawings, the exterior slopes are 3H:1V for all embankments, though slopes measured in the field ranged from 3H:1V to 3.5H:1V. The water well storage pond is located at the west embankment exterior slope (Photographs

106, 107, and 114). During the site assessment the water level in the water well storage pond was above the water level in the Sludge Basin.

5.3.4 Outlet Structures

Two outlets were observed at the Sludge Basin, one of which was not in service during the site assessment. A catwalk structure to a 6-inch-diameter HDPE outlet pipe and submersible pump that was not in service during the site assessment is located on the west embankment interior slope (Photograph 93). A 6-inch-diameter HDPE outlet pipe was located on the south embankment interior slope (Photograph (145). Liquids are pumped from the Sludge Basin, via the two outlet pipes, to the Ash Water Transport Pond for recycling of the water.

AERIAL PHOTOGRAPH SOURCE:
GOOGLE EARTH PRO.

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SAN MIGUEL POWER PLANT
CHRISTINE, TEXAS
ASH WATER TRANSPORT POND PHOTOGRAPH LOCATION PLAN
FIGURE 5-1A

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AERIAL PHOTOGRAPH SOURCE:
GOOGLE EARTH PRO.

LEGEND:

◆ PHOTOGRAPH NUMBER AND ORIENTATION

SAN MIGUEL POWER PLANT
CHRISTINE, TEXAS
ASH WATER TRANSPORT POND PHOTOGRAPH LOCATION PLAN
FIGURE 5-1B

CDM Smith

SAN MIGUEL POWER PLANT
CHRISTINE, TEXAS
SLUDGE DISPOSAL BASIN PHOTOGRAPH LOCATION PLAN
FIGURE 5-2A

AERIAL PHOTOGRAPH SOURCE:
GOOGLE EARTH PRO.

SAN MIGUEL POWER PLANT
CHRISTINE, TEXAS
SLUDGE DISPOSAL BASIN PHOTOGRAPH LOCATION PLAN
FIGURE 5-2B

Section 6

Hydrologic/Hydraulic Safety

6.1 Impoundment Hydraulic Analysis

Because they are off-channel impoundments, coal combustion waste impoundments are not classified as dams by the TCEQ. TCEQ regulates coal combustion waste impoundments as industrial waste impoundments and provides recommendations for construction, operation, and maintenance of all nonhazardous surface impoundments in “Technical Guideline No. 4, Topic: Nonhazardous Industrial Solid Waste Surface Impoundments”, dated June 12, 2009. Hydrologic/hydraulic recommendations include surface water diversion dikes with a minimum height equal to two (2) feet above the 100-year flood water elevation should be constructed around the impoundment for industrial solid waste surface impoundments located within the 100-year flood plain. Industrial solid waste impoundments located above the 100-year flood water elevation should include surface water diversion dikes that are, at a minimum, capable of diverting all rainfall runoff from a 24-hour, 25-year storm.

FEMA standards, as specified in “Federal Guidelines for Dam Safety” dated April 2004, require impoundments to have the capacity to store some percentage of the Probable Maximum Precipitation (PMP) for a 6-hour storm event over a 10-square-mile area in the vicinity of the site. FEMA recommends that dams with a low hazard potential should be designed for a flood having an average return frequency of no less than once in 100 years. Significant hazard structures are required to store 50% PMP.

The drainage area contributing to the Ash Pond appears to be limited to the storage area within the impoundment and the coal pile, an additional area of approximately 15 acres. The Sludge Basin receives plant stormwater runoff; however San Miguel did not provide details of the plant stormwater collection system. The Ash Pond includes a center embankment that separates the pond into north and south sections with a connecting gated channel that can be closed to isolate either pond.

Documentation provided by San Miguel did not include any hydrologic or hydraulic information on the Ash Pond or Sludge Basin.

6.2 Adequacy of Supporting Technical Documentation

No hydrologic or hydraulic documentation was available.

6.3 Assessment of Hydrologic/Hydraulic Safety

Due to inadequate information, the Ash Pond and Sludge Basin are rated as poor for hydrologic/ hydraulic safety.

Section 7

Structural Stability

7.1 Supporting Technical Documentation

The available information regarding slope stability of the Ash Pond and Sludge Basin consists of a report titled “Geotechnical Engineering Study, Ash Water Transport Pond and Equalization Pond Stability Analyses, San Miguel Electric Cooperative, Christine, Texas”, prepared by Arias & Associates, Inc., (Arias) and dated November 19, 2012. The 2012 Arias report is included as Appendix B.

The report includes subsurface soil and groundwater conditions, and results of global stability calculations to assess short-term, long-term and seismic stability of the embankments at the Ash Pond and Sludge Basin (referred to as the Equalization Pond by Arias), as well as an assessment of the liquefaction potential of the underlying foundation soils.

7.1.1 Stability Analyses and Load Cases

TCEQ recommendations related to embankment stability of coal ash impoundments are included in “Technical Guideline No. 4, Topic: Nonhazardous Industrial Solid Waste Surface Impoundments”, dated June 12, 2009. TCEQ’s Technical Guideline No. 4 recommends all permanent earthen dikes that are used to retain waste or waste waters above ground level should have a top width of at least eight (8) feet and side slopes that are not steeper than one (1) foot vertical to three (3) feet horizontal. TCEQ’s recommended minimum factor of safety against dike slope failure is 1.4. In situations where a backup system is not used for potential catastrophic failure of the dikes, TCEQ recommends a minimum factor of safety of 1.5.

Procedures established by the United States Army Corps of Engineers (USACE), the United States Bureau of Reclamation, the Federal Energy Regulatory Commission, and the Natural Resources Conservation Service are generally accepted engineering practice. Minimum required factors of safety outlined by the USACE in EM 1110-2-1902, Table 3-1 and seismic factors of safety by FEMA Federal Guidelines for Dam Safety, Earthquake Analyses and Design of Dams (pgs. 31, 32 and 38, May 2005) are provided in **Table 7-1**.

Table 7-1 - Recommended Minimum Safety Factors

Load Case	Minimum Required Factor of Safety
	USACE
Steady-State Condition at Normal Pool or Maximum Storage Pool Elevation	1.5
Rapid Drawdown Condition from Normal Pool Elevation	1.3
Maximum Surcharge Pool (Flood) Condition	1.4
Seismic Condition at Normal Pool Elevation	1.1
Liquefaction	1.3

Arias performed slope stability analyses for the Ash Pond west embankment (Section A-A) and south embankment (Sections B-B and C-C), and for the Sludge Basin at the southeast corner (Section D-D) and north embankment (Section E-E). Slope stability analyses included steady-state seepage conditions using drained soil parameters, maximum surcharge pool using undrained soil parameters, and seismic conditions using undrained soil parameters. Seismic design parameters used in the seismic slope stability analyses included the mapped spectral response acceleration for an earthquake with 2% probability of exceedance in 50 years (0.13g) applied as a horizontal seismic load. Slope stability of the embankments' interior and exterior slopes was analyzed for each of the three conditions.

According to the 2012 Arias report, rapid drawdown load conditions were not analyzed for slope stability because the impoundments do not include spillways or discharge structures and water levels are lowered only by pumping water over the embankments. In addition, rapid drawdown would only occur if a failure of the embankments had already taken place. According to information provided by Arias, slope stability analyses for liquefaction conditions were not performed because liquefaction is very unlikely at the site due to the subsurface conditions and low seismic hazard level at the Plant site.

7.1.2 Design Parameters and Dam Materials

Arias was provided with available original geotechnical information for the Ash Pond and Sludge Basin. Embankment cross-sections analyzed by Arias were provided by San Miguel based upon ground surveys and bathymetric measurements performed specifically for Arias' analyses. Arias performed test soil borings at the Ash Pond and Sludge Basin embankment crest and toe. Seven borings were performed at the Ash Pond and ten were performed at the Sludge Basin. Soil and groundwater information obtained from these test borings was used in Arias' slope stability analyses. The soil properties and strength parameters used in Arias' slope stability analyses are included in **Table 7-2**.

Table 7-2 - Soil Parameters Used in Arias' Slope Stability Analyses

Stratum	Soil Profile Zone	Material	Unit Weight	Strength Function
I	All Fill Soils Above Natural Grade	Fat CLAY (CH), Lean CLAY (CL)	112 pcf	**Total Stress** c_u = 200 psf, ϕ = 17° **Effective Stress** c' = 250 psf, ϕ = 21°
II$_a$	Natural Soils Above Silty Sands	Fat CLAY (CH), Lean CLAY (CL)	112 pcf	**Total Stress** c_u = 200 psf, ϕ = 17° **Effective Stress** c' = 250 psf, ϕ = 21°
II$_b$	Natural Soils Above Silty Sands	Sandy Lean CLAY (CL), Clayey SAND (SC)	120 pcf	**Total Stress** c_u = 1000 psf, ϕ = 0° **Effective Stress** c' = 200 psf, ϕ = 24°
III	Silty Sands	Silty SAND (SM), Sandy SILT (ML)	120 pcf	**Model Only With Effective Stress** c' = 0 psf, ϕ = 30°

Source: Arias & Associates, Inc. October 22, 2012 report, "Geotechnical Engineering Study, Ash Water Transport Pond and Equalization Pond Stability Analyses, San Miguel Electric Cooperative, Christine, Texas".

According to the Arias report, strength parameters for the Stratum I and Stratum II were selected as the average strength from consolidated undrained triaxial compression tests, and other soil strengths used in the analyses were determined from Standard Penetration Test results, pocket penetrometer results, and experience with similar soils.

7.1.3 Uplift and/or Phreatic Surface Assumptions

According to the 2012 Arias report, phreatic surfaces were calculated using GeoSlope SEEP/W version 7.17. Pool levels of El. 311 and 290 within the Ash Pond and Sludge Basin, respectively, and groundwater levels at ground surface at the exterior toe of the embankment were used for the steady-state seepage and seismic slope stability analyses. A maximum surcharge pool elevation of 314.5 and 293.5 was used for the Ash Pond and Sludge Basin, respectively for the maximum surcharge pool slope stability analyses. According to the 2012 Arias report, the estimated phreatic surfaces were higher in elevation than those measured by the water level readings in the soil borings. Therefore, the phreatic surfaces in their analyses are considered to represent worst-case conditions when the impoundments are full and there has been a period of prolonged rainfall.

At the Ash Pond's west embankment, in the area where seepage was observed during CDM Smith's August 2012 site assessment, Arias modified the phreatic surface in accordance with their observation of seepage emerging at the embankment toe to model the seepage in the stability analyses.

7.1.4 Factors of Safety and Base Stresses

A summary of safety factors computed for the different cases of the Ash Pond (Sections A-A, B-B, and C-C) and Sludge Basin (Sections D-D and E-E) is included in **Table 7-3.**

Table 7-3 - Safety Factors Computed for Various Stability Conditions

Load Case	Ash Water Pond			Sludge Basin		Minimum Required Factor of Safety
	A-A	B-B	C-C	D-D	E-E	
Steady-State Condition at Normal Pool	2.2	1.9	1.7	2.2	2.1	1.5
Maximum Surcharge Pool (Flood) Condition	2.1	1.8	1.6	2.2	2.1	1.4
Seismic Condition at Normal Pool Elevation	1.5	1.2	1.2	1.5	1.4	1.1

Source: Arias & Associates, Inc. October 22, 2012 report, "Geotechnical Engineering Study, Ash Water Transport Pond and Equalization Pond Stability Analyses, San Miguel Electric Cooperative, Christine, Texas".

7.1.5 Liquefaction Potential

According to information provided by Arias, liquefaction is very unlikely at the site due to the subsurface soil and groundwater conditions, and seismic conditions at the Plant site. As reported by Arias, there is less than a 6% chance of an earthquake with magnitude of 5.0 or greater in 250 years, corresponding to an approximate peak ground acceleration of 0.09g. According the 2012 Arais report, the site is not located in a seismic impact zone and does not require specific analyses for liquefaction because the EPA identifies a seismic zone where the probability of an earthquake creating a peak ground acceleration of greater than 0.1g is greater than 10% over a 250-year period. And because loose sands or silts, which were above the groundwater table, were encountered in only one of the test borings performed at the site, the potential for liquefaction is considered very unlikely.

7.1.6 Critical Geological Conditions

According to the Quaternary Geologic Map of the Austin 4 x 6 Quadrangle published by the United States Geological Survey, geology in the area of the Plant consists of clay, sandy clay, and fine sand, with lower layers containing fragments of coal and sandstone interbedded with shale. According to the United States Department of Agriculture, surface soils in the area are comprised of clay, clay loam, and sandy clay loam.

Based on geographic location and the 2008 USGS National Seismic Hazard Map, Peak Ground Acceleration (PGA) for 2% probability of exceedance in 50 years is approximately 0.13g.

7.2 Adequacy of Supporting Technical Documentation

Structural stability documentation appears to be adequate. Supporting data and documentation for the Ash Pond and Sludge Basin includes required structural stability analyses for normal operating pool, steady state conditions; maximum surcharge pool condition, and normal operating pool under seismic loading conditions. An assessment of liquefaction potential was also provided, with the conclusion that liquefaction is considered to be very unlikely based on existing subsurface soil conditions and the stated 6% chance of a seismic event of a magnitude 5.0 or greater occurring over a 250-year-period. Technical documentation of the embankment stability under a rapid drawdown loading condition was not provided because rapid drawdown conditions were considered only likely in the event of a breach. CDM Smith agrees with the rationale provided regarding embankment stability, liquefaction potential, and rapid drawdown conditions.

7.3 Assessment of Structural Stability

Existing conditions and visual observations yield a satisfactory rating for structural stability of both the Ash Pond and Sludge Basin based on the following:

- Stability analyses of the Ash Pond and Sludge Basin embankments are adequate.
- The potential for liquefaction is unlikely based on assessment of the subsurface soil conditions and the low seismic hazard level at the Plant site.
- Water observed in the area of the potential seepage was clear, and there was no observed slope movement or slope instability noted during the visual assessment of the embankment.

During CDM Smith's visual observations and site assessments of the Ash Pond, the water level in the impoundment prevented observation of the interior slopes, and areas of minor erosion were observed at the Ash Pond and Sludge Basin.

Based on the review of the stability analyses and visual observations made during the site visit, CDM Smith considers the condition rating to be SATISFACTORY for structural stability of the Ash Pond and Sludge Basin embankments.

Section 8

Adequacy of Maintenance and Methods of Operation

8.1 Operating Procedures

During normal operating procedures, the Ash Pond receives liquids from the bottom ash dewatering bins, cooling tower, and plant sumps. The Ash Pond includes a center embankment that separates the pond into north and south sections with a connecting channel with a gate that can be closed to isolate either pond. The gate is generally only closed to isolate the north or south pond for ash removal. The liquids from the ash dewatering bins are discharged at the west embankment interior slope into the north section of the Ash Pond. Liquids flow to the east toward the open gate structure within the center embankment into the south section of the Ash Pond. Liquids are siphoned from the south section of the Ash Pond at the west embankment interior slope. Floating skimmers were observed in both the north and south sections of the Ash Pond. Settled solids are periodically dredged or excavated from the Ash Pond. According to San Miguel representatives, the target pool level in the Ash Pond is at least 18 inches of freeboard.

During normal operating procedures, the Sludge Basin receives liquids from stormwater runoff and plant sewage. Liquids are discharged into the Sludge Basin at the west embankment interior slope. When needed, liquids are pumped from the Sludge Basin through an outlet pipe at the interior slope near the southeast corner. Liquids can be transferred to the Ash Pond for reuse in Plant processes. According to San Miguel representatives, the target pool level in the Sludge Basin is at least 18 inches of freeboard.

The Plant is a zero-liquid-discharge facility, and all of the liquids in the Ash Pond and Sludge Basin are recycled and used in Plant processes.

8.2 Maintenance of the Dam and Project Facilities

A San Miguel representative indicated during the site assessment that visual inspections are performed for both the Ash Pond and Sludge Basin once a week when water level readings are measured. Documentation of the inspections includes a checklist report. Weekly checklist reports completed for the month of August 2012 are included in Appendix D.

The only regular maintenance operations include very infrequent mowing of embankments adjacent to the Ash Pond and Sludge Basin.

8.3 Assessment of Maintenance and Methods of Operations

8.3.1 Adequacy of Operating Procedures

Based on CDM Smith’s visual observations and review of documents provided by San Miguel, operating procedures appear to be generally adequate for the impoundments. There is no readily available indication that suggests that the Ash Pond and Sludge Basin primary purposes are not being accomplished.

8.3.2 Adequacy of Maintenance

Maintenance issues at the Ash Pond included an area of erosion at the east embankment interior slope, an area of potential seepage at the west embankment exterior slope, an animal burrow at the east embankment exterior slope, small areas of trees on the exterior slopes, tension cracks and erosion holes in the crest, and erosion rills at the south embankment interior slope.

Maintenance issues on the west embankment interior slope of the Sludge Basin included trees and vegetation, areas of erosion at the stormwater inlet, erosion rills, and erosion near the outlet structure. An animal burrow was observed at the south embankment exterior slope.

A maintenance schedule and maintenance procedures should be developed to address these issues.

Section 9

Adequacy of Surveillance and Monitoring Program

9.1 Surveillance Procedures

The surveillance procedures include the management of water levels and checking for leaks or other deficiencies at each of the impoundments. Ash Pond and Sludge Basin water levels are measured and recorded six times daily by the operations department. Water levels are measured from a reference level at 18 inches of freeboard at each impoundment. Documentation of the water levels includes completion of a checklist report, performed once a week by the Plant Environmental Engineer. The checklist report documents impoundment water levels and whether leaks or other deficiencies were observed in each impoundment. Checklists from August 2012 are included in Appendix D.

Inspection of the Ash Pond and Sludge Basin embankments was performed by Pape-Dawson Engineers, Inc. (PDE) in 2010. Documentation provided by San Miguel included an inspection report prepared by PDE dated February 1, 2010. The PDE report included inspection reports for the Ash Pond (referred to as the Ash Pond Center Dike and North Ash Pond, and South Ash Pond) and Sludge Basin (referred to as the Equalization Pond). The 2010 PDE report is included in Appendix D. Observations of the Ash Pond embankments documented in the 2010 PDE report include minor shore erosion, low spots along top of bank, erosion rills on the center embankment, and seepage at the northeast corner of the Ash Pond. Observations at the Sludge Basin included erosion at inlet pipe headwall and water ponding along the southeast side of pond. Follow-up recommendations included monitoring areas of erosion and inspection of embankments after vegetation was cut back in both the Ash Pond and Sludge Basin and addressing erosion at inlet pipe at Sludge Basin.

9.2 Instrumentation Monitoring

The Ash Pond and Sludge Basin do not include any instrumentation monitoring. As previously mentioned, water levels are measured manually once a week.

The Ash Pond and Sludge Basin embankments do not have an instrumentation monitoring system to monitor structural stability, seepage, or ground displacement.

9.3 Assessment of Surveillance and Monitoring Program

9.3.1 Adequacy of Inspection Programs

The San Miguel surveillance program for the Sludge Basin is judged adequate. The San Miguel surveillance program for the Ash Pond is judged inadequate, based on the erosion of the Ash Pond's east embankment interior slope caused by leakage from a water well pipe traversing the Ash Pond embankment. Accordingly, the surveillance and monitoring program should be revised to include more-detailed inspections. Additionally, the area of potential seepage at the west embankment exterior slope of the Ash Pond should be investigated and monitored.

9.3.2 Adequacy of Instrumentation Monitoring Program

The San Miguel surveillance program for the Ash Pond and Sludge Basin is inadequate. As mentioned above, instrumentation is not present within the Ash Pond and Sludge Basin embankments.

Detrimental conditions or indications for potential failure of embankments were not observed at the Ash Pond or Sludge Basin. Minor issues at the Ash Pond included the area of potential seepage at the west embankment and erosion in the east embankment interior slope. The area of potential seepage at the west embankment exterior slope of the Ash Pond should be investigated and monitored.

Section 10

Reports and References

The following is a list of reports and drawings that were provided by San Miguel Electric Cooperative, Inc. and were used during the preparation of this report and the development of the conclusions and recommendations presented herein.

1. San Miguel Plan Unit No. 1 Construction Drawings – Sheets 1-C-1-C, 1-C-33, 1-C-37, 1-C-40, 1-C-41, 1-C-42, C-6, and C-12, dated 1977.

2. Miscellaneous correspondence from San Miguel Electric Cooperative, Inc., Texas Department of Water Resources, NFS/National Soil Services, Inc., and Tippet & Gee, Inc. regarding Ash Water Transport Pond seepage, dated 1978 to 1983.

3. Miscellaneous correspondence from San Miguel Electric Cooperative, Inc. and Professional Service Industries, Inc regarding Ash Water Transport Pond clay liner reconstruction, dated 1987.

4. Pape-Dawson Engineer, Inc. 2009 Embankments Inspections letter, dated February 1, 2010.

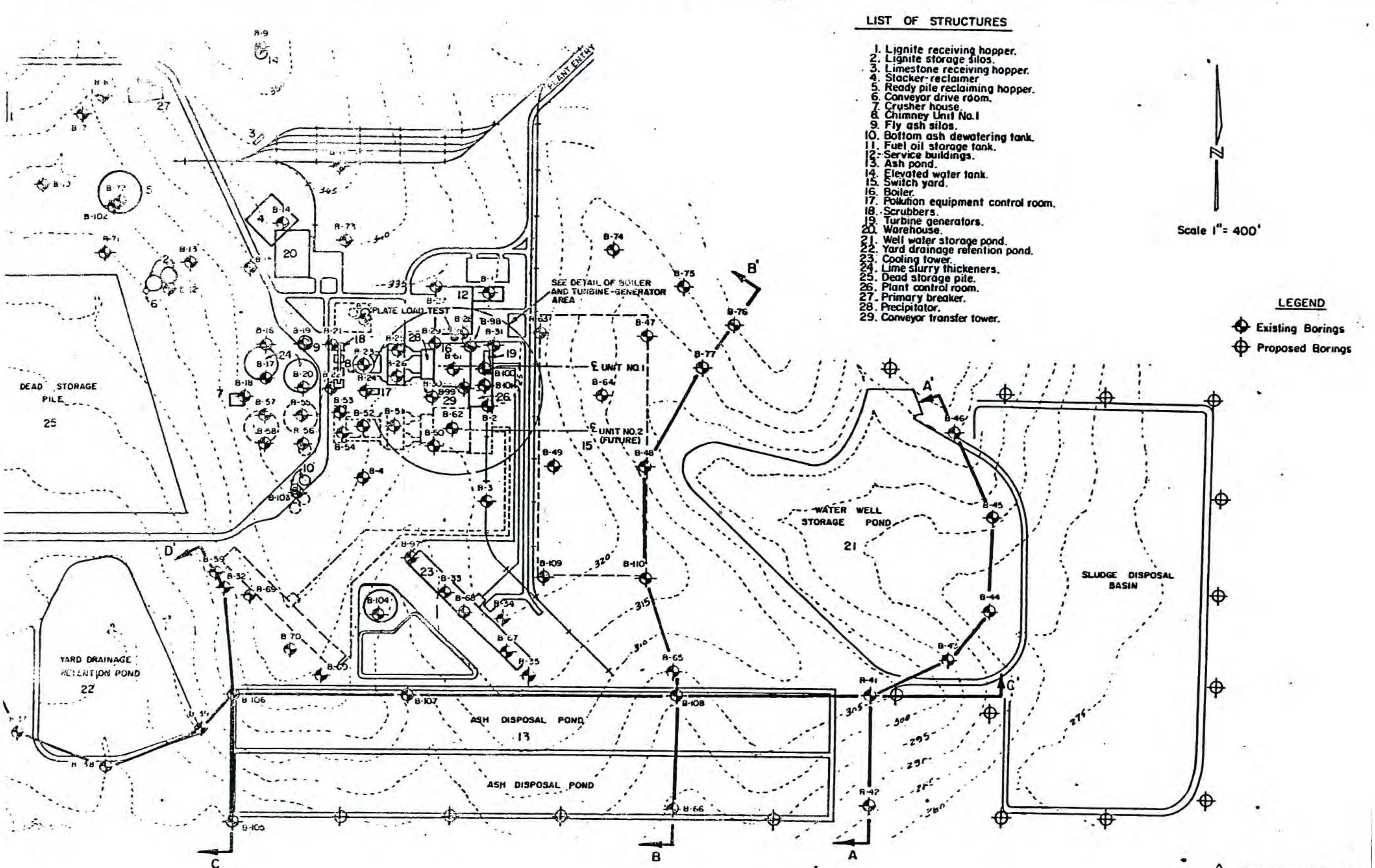
5. Weekly Facility Inspection Reports for August 3, 2012, August 10, 2012, August 17, 2012, and August 24, 2012.

6. Pond Inlet Piping and Elevations table.

7. Arias & Associates, Inc. Geotechnical Engineering Study, Ash Water Transport Pond and Equalization Pond Stability Analyses, San Miguel Electric Cooperative, Christine, Texas, dated October 22, 2012.

Appendix A

Soil Boring Information



LIST OF STRUCTURES

1. Lignite receiving hopper.
2. Lignite storage silos.
3. Limestone receiving hopper.
4. Stacker-reclaimer
5. Ready pile reclaiming hopper.
6. Conveyor drive room.
7. Crusher house.
8. Chimney Unit No.1
9. Fly ash silos.
10. Bottom ash dewatering tank.
11. Fuel oil storage tank.
12. Service buildings.
13. Ash pond.
14. Elevated water tank.
15. Switch yard.
16. Boiler.
17. Pollution equipment control room.
18. Scrubbers.
19. Turbine generators.
20. Warehouse.
21. Well water storage pond.
22. Yard drainage retention pond.
23. Cooling tower.
24. Lime slurry thickeners.
25. Dead storage pile.
26. Plant control room.
27. Primary breaker.
28. Precipitator.
29. Conveyor transfer tower.

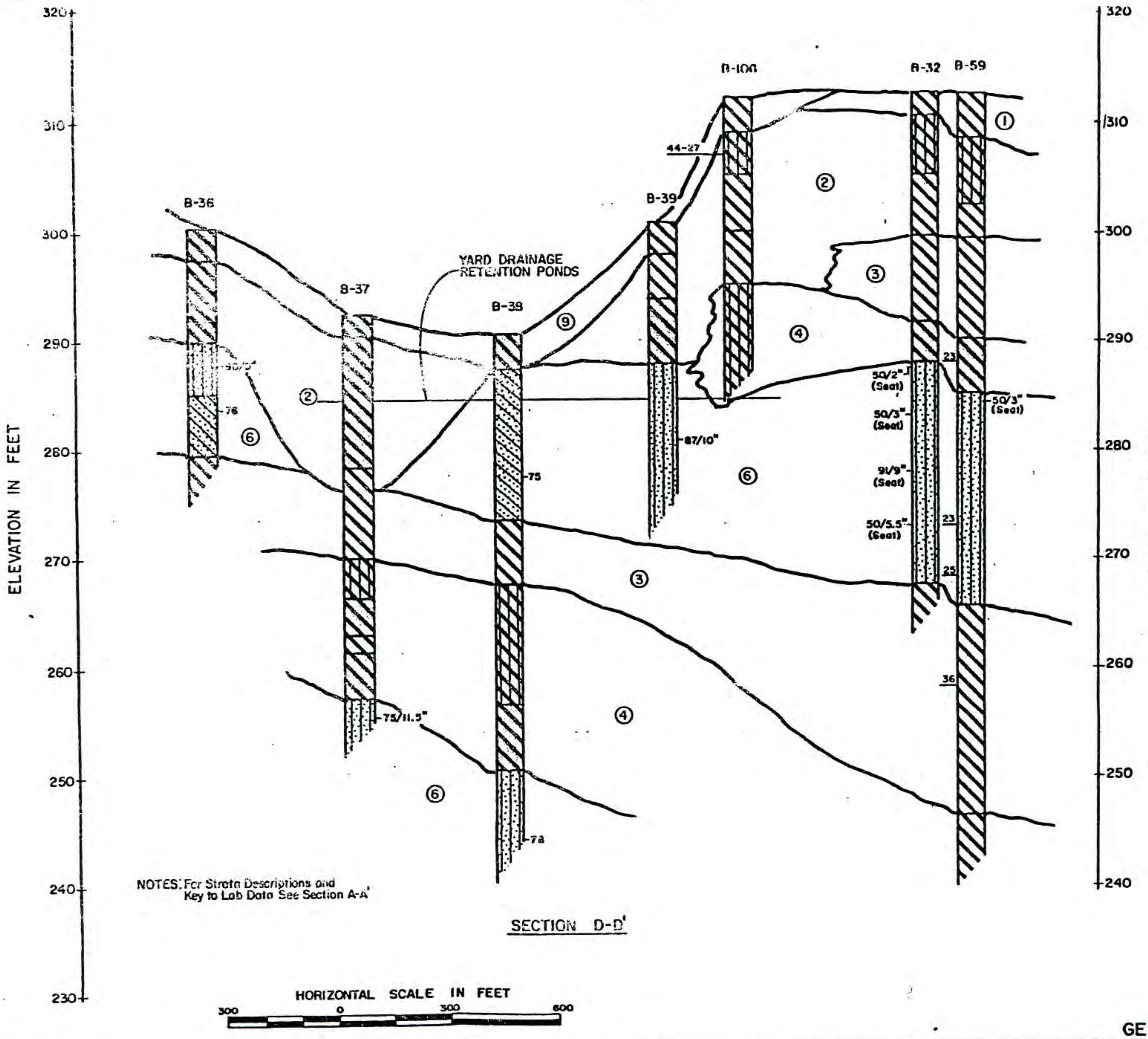
LEGEND

⊕ Existing Borings
⊕ Proposed Borings

3 CORRECTIONS SEPT 1,1978
2 CORRECTIONS JULY 12,1976
1 CORRECTIONS JUNE 10,1976

PLAN OF BORINGS

PLATE 1

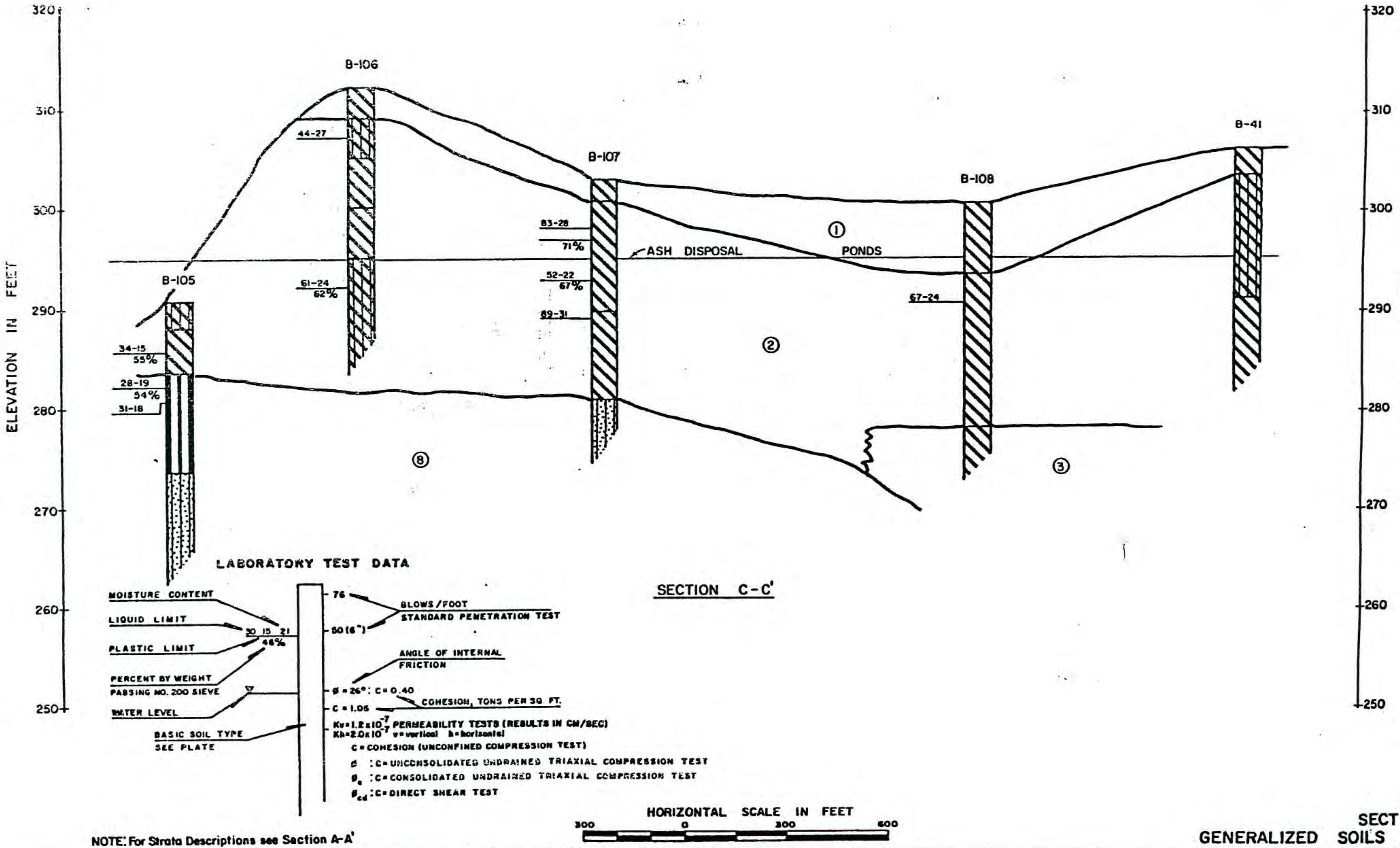


NOTES: For Strata Descriptions and Key to Lab Data See Section A-A'

SECTION D-D'

SECTION D-D'
GENERALIZED SOILS PROFILE

PLATE 5

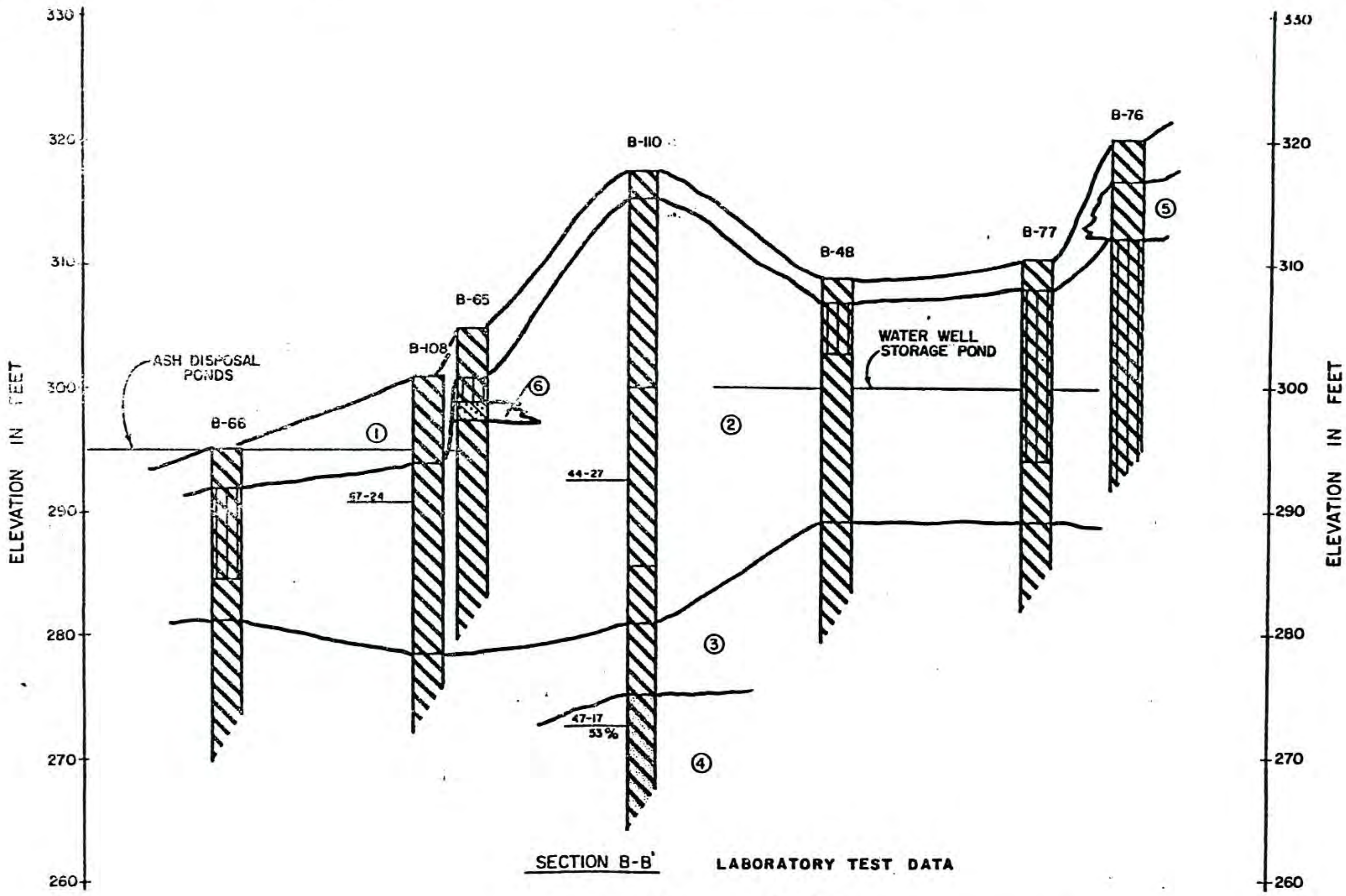


NOTE: For Strata Descriptions see Section A-A'

SECTION

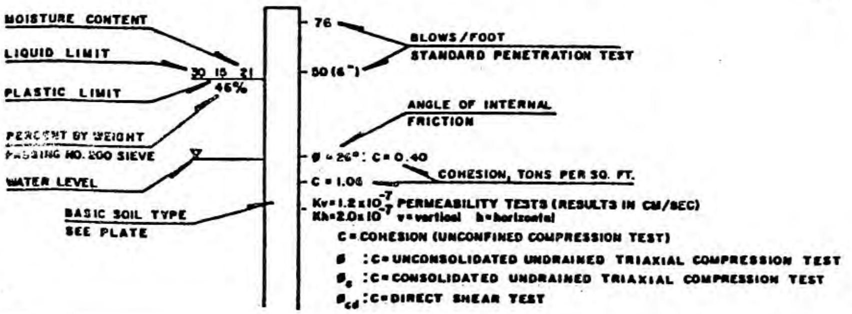
GENERALIZED SOILS PRO

PLAT



SECTION B-B'

LABORATORY TEST DATA



C = COHESION (UNCONFINED COMPRESSION TEST)

ø : C = UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

$ø_c$: C = CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

$ø_{cd}$: C = DIRECT SHEAR TEST

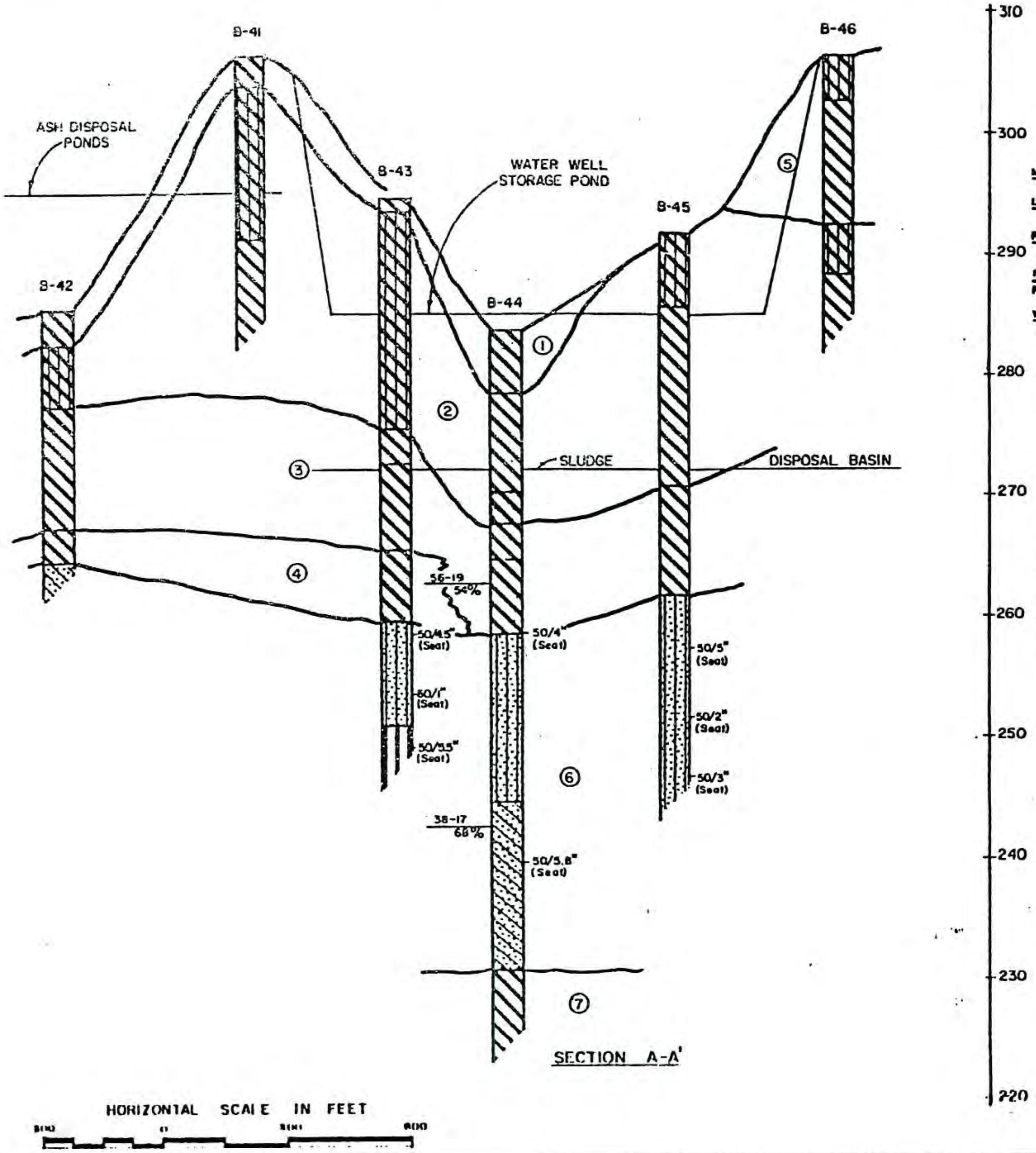
NOTE: For Strata Descriptions see Section A-A'

HORIZONTAL SCALE IN FEET

SECTION B

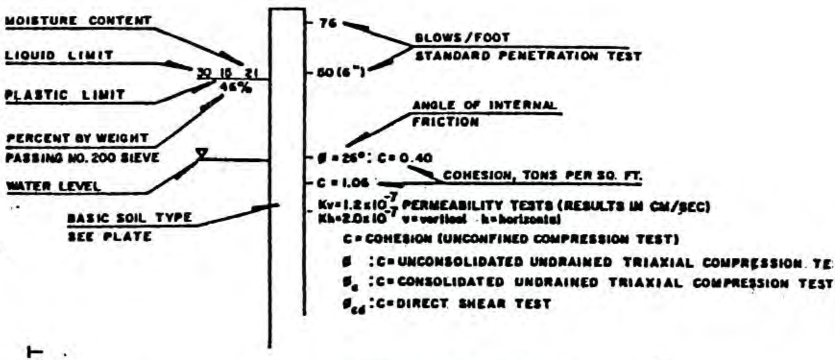
GENERALIZED SOILS PROFI

PLATE



SECTION A-A'

LABORATORY TEST DATA



STRATA DESCRIPTIONS

① Stiff to hard, dark gray or dark brown clays.

② Very stiff to hard, light tan, tan, light brown, brown, red, light red, gray or light gray, silty and sandy clays interbedded w/clays and w/occasional fractures and joints, selenite seams, limonite seams, ironstaining and calcareous pockets.

③ Very stiff to hard, tan, light brown, light red, brown, greenish-gray or gray clays w/ occasional slickensides, joints, selenite and limonite filled fractures and sand pockets.

④ Hard tan, brown, greenish-gray or gray sandy and silty w/occasional clay or silty sand s seams, laminations and pockets.

⑤ Very stiff to hard light green clays and silty clays w/occasional selenite and calcareou or silty clay pockets.

⑥ Dense to very dense, light tan, brown, light green, greenish-gray or gray, clayey fine sands, silty fine sands and sandy silts. w/occasional clay balls and seams, selenite, ironstaining and carbonaceous material.

⑦ Hard green clays w/white bivalve.

⑧ Dense to very dense tan silty fine sands and sandy silts w/ironstains.

SECTION A-A
GENERALIZED SOILS PROFILE

PLATE 2

Appendix B

Arias & Associates, Inc. Geotechnical Engineering Study

Geotechnical Engineering Study

Ash Water Transport Pond And Equalization Pond Stability Analyses
San Miguel Electric Cooperative
Christine, Texas

Arias Job No. 2012-695

ARIAS & ASSOCIATES
Geotechnical • Environmental • Testing

Prepared For
San Miguel Electric Cooperative

November 19, 2012

ARIAS & ASSOCIATES
Geotechnical • Environmental • Testing

November 19, 2012

Arias Job No. 2012-695

Mr. Joseph Eutizi
San Miguel Electric Cooperative
P.O. Box 280
Jourdanton, TX 78026

RE: Geotechnical Engineering Study
Ash Water Transport Ponds and Equalization Pond
Stability Analyses
San Miguel Electric Cooperative
Christine, Texas

Dear Mr. Eutizi:

The results of a Geotechnical Engineering Study for the existing Ash Water Transport Ponds and Equalization Pond at the San Miguel Electric Cooperative near Christine, Texas are presented in this report. This project was authorized by you on September 18, 2012 indicating acceptance of Arias Proposal No. 2012-695, dated September 10, 2012 by San Miguel Electric Cooperative Purchase Order No. 164892-151106.

The purpose of this geotechnical engineering study was to investigate the subsurface soil and groundwater conditions present at the Ash Water Transport Ponds and Equalization Pond and to perform global stability calculations to assess short-term, long-term, rapid drawdown, and seismic stability of the embankments and to assess the liquefaction potential of the underlying foundation soils.

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

Sincerely,
Arias & Associates, Inc.
TBPE Registration No: F-32

DEXTER BACON
54560

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REPORT FORMAT INFORMATION

To improve clarity in the intent of our geotechnical recommendations for this project, the report is organized into two separate, but equally important sections.

Section I – *Synopsis* is a summary of our geotechnical findings specific to this project.

Section II - The *Main Report* contains more detailed information about the subsurface conditions and the results of the stability calculations.

A study of both of the above referenced sections is recommended. Arias & Associates, Inc. cautions that Section I is a consolidated quick reference overview of the more detailed geotechnical findings contained in Section II and should not be utilized exclusively from the remainder of the report.

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TABLE OF CONTENTS

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Tables

SECTION I: SYNOPSIS

This synopsis includes a brief description of the project, subsurface findings, and calculated Factors of Safety for the stability of the embankments associated with the Ash Water Transport Ponds and the Equalization Pond.

Table 1: Project Description

Project:	Ash Water Transport Ponds and Equalization Pond
Project Location:	San Miguel Electric Cooperative Christine, Texas
Development:	Two Ash Water Transport Ponds (2,475 ft by 265 ft each) One Equalization Pond (approx. 1,650 ft by 800 ft)
Dike Geometry:	**Ash Water Transport Ponds** 0 ft to 31 ft high 2.5H to 1V Side Slopes **Equalization Basin** 0 ft to 22 ft high 3.5H to 1V Side Slopes
Pond Fill Elevation:	**Ash Water Transport Ponds –** El. 311 ft **Equalization Pond –** El. 290 ft
Impoundment Material Used in Analysis:	**Ash Water Transport Ponds –** Water **Equalization Pond -** Water

Table 2: Existing Conditions at Time of Geotechnical Study

Ground Cover:	Grass with a few small trees and bushes
Predominant Soil Types:	Fill/Natural Fat CLAY (CH) Fill/Natural Lean CLAY (CL) Sandy Lean CLAY (CL) Silty Fine SAND (SM)
Average Plasticity Index (PI) of Upper Clays (Natural and Fills):	41 (Range 12 - 92)
Groundwater Depth Measured:	Minimum: 1.8 ft (Toe Area) Maximum: 37.5 ft (Crest)

Table 3: Computed Global Stability Factors of Safety

Stability Case	Ash Water Transport Ponds			Equalization Pond	
	Section A-A	Section B-B	Section C-C	Section D-D	Section E-E
Normal Operating Pool Steady State Seepage (long-term)	2.2	1.9	1.7	2.2	2.1
Maximum Surcharge Pool Undrained (short-term)	2.1	1.8	1.6	2.2	2.1
Normal Operating Pool Undrained (Seismic)	1.5	1.2	1.2	1.5	1.4

Notes

1. Factor of Safety greater than 1.5 for Steady State Seepage and Undrained conditions is considered to be adequate.
2. Factor of Safety greater than 1.0 for Seismic conditions is considered to be adequate.
3. Summary of stability runs presented in Appendix F

SECTION II: MAIN REPORT

PROJECT AND SITE DESCRIPTION

The Ash Water Transport Ponds and Equalization Pond are located at the San Miguel Electric Cooperative near Christine, Texas. A Site Vicinity Map is provided in Appendix A. Representative site photographs that include each of the boring locations in this subsurface investigation are provided in Appendix B of this report.

Portions of the ponds were constructed by cutting into existing grades while other portions were constructed with filled slopes using the existing cut materials to maximum embankment heights ranging from 22 feet (Equalization Pond) to 31 feet (Ash Water Transport Ponds).

An EPA consultant recently visited the site and requested that slope stability analyses of the existing Ash Water Transport Ponds and Equalization Pond be performed to document estimated current factors of safety against slope stability failures. We were provided with the available original geotechnical information in the pond areas and other available documentation.

It is our understanding that the Ash Water Transport Ponds experienced some seepage issues in the 1980's and were subsequently reconstructed. Since that reconstruction, these ponds have been performing adequately with only a minor seepage issue apparent near the northeast corner of Ash Water Transport Pond A. This minor seepage area was modeled as Section A-A for stability.

GEOLOGY

The earth materials underling the project site have been regionally mapped as within the undivided Manning, Wellborn and Caddell Formations (Emwc) mapped to be within the Eocene Epoch of the Tertiary Period of the Geologic Time Scale.

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 ft thick. The fill soils are comprised of clays, sandy clays, gravelly clays with some lignite material and sand pockets and are 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 ft of clays, sandy clays and fine sands in a stiff to hard and medium dense condition. The underlying Eocene deposits are comprised of clays, sandy clays, clayey sands, siltstones and sandstones with occasional thin seams of lignite in a very stiff to very hard or very dense condition. Due to weathering and lack of cementation within these materials, from a geotechnical perspective, they should be considered as having soil-like characteristics.

No faults are known to cross through the project area and, from a geologic perspective, future tectonic activity in this geographic area should pose minimal seismic risk to the disposal ponds and basin.

SOIL BORINGS AND LABORATORY TESTS

Seventeen (17) soil test borings were drilled at the approximate locations shown on the Boring Location Plan provided in Appendix C. The borings were drilled at the crest and toe of the dikes to depths of 20 to 64.3 feet. The subsurface investigation was conducted between September 19 and September 26, 2012. The boring depths were measured from below the existing ground surface elevation. Soil interpreted to be clay in the field was sampled by either pushing a thin-walled tube (ASTM D 1587) or with a split barrel sampler while performing the Standard Penetration Test (ASTM D 1586). Soil interpreted to be sand or gravel in the field was sampled with a split barrel sampler just described.

A truck-mounted drill rig using continuous flight augers together with the sampling tool noted was used to secure the subsurface soil samples. Soil classifications and borehole logging were conducted during the exploration by our Engineering Geologist under supervision of our Geotechnical Engineer. Final soil classifications, as seen on the attached boring logs (Appendix C), were determined in the laboratory based on laboratory and field test results and applicable ASTM procedures.

As a supplement to the field exploration, laboratory testing to determine soil water content, Atterberg Limits, unconfined compressive strength using a pocket penetrometer, and percent passing the US Standard No. 200 sieve, was conducted. In addition, selected samples of both the natural and compacted clays were tested for strength using a multistage triaxial compression test with isotropic consolidation and with effective consolidation pressures selected to mimic the approximate range in expected insitu stresses. The laboratory results are reported in the attached boring logs included in Appendix C. A key to the terms and symbols used on the logs is also included in Appendix D. The soil laboratory testing for this project was done in accordance applicable ASTM procedures with the specifications and definitions for these tests listed in the Appendix E.

Remaining soil samples recovered from this exploration will be routinely discarded following submittal of this report.

SUBSURFACE CONDITIONS

Generalized stratigraphy and groundwater conditions are discussed in the following sections. The subsurface and groundwater conditions are based on conditions encountered at the boring locations to the depths explored.

Site Stratigraphy and Engineering Properties

The generalized subsurface stratigraphy encountered at this site is summarized in the table below.

Table 4: Generalized Soil Conditions

Stratum	Depth (ft)	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 project site. Groundwater was observed within the soil borings during the soil sampling activities. Each boring was then left open for a minimum of 24 hrs in order to obtain a delayed groundwater reading. The delayed groundwater levels were encountered as shallow as 1.8 ft below ground surface in the location of the toe of the embankments and as deep as 37.5 ft 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 Ponds and Equalization Pond.

For the purpose of the stability calculations performed herein, the groundwater has been assumed to be at ground surface near the toe of the embankments. The normal operating pool elevations in the Ash Water Transport Ponds and Equalization Pond have been assumed to be 311 ft and 290 ft, respectively. The maximum surcharge pool elevations in the Ash Water Transport Ponds and Equalization Pond have been assumed to be 314.5 ft. and 293.5 ft. respectively. The phreatic surface in the embankment sections B-B, C-C, D-D, and E-E were estimated using SEEP/W version 7.17, by GeoSlope using the boundary conditions just described and estimated soil permeabilities based upon experience with similar soils. In each case, these estimated phreatic surface elevations were higher in elevation than those measured by the delayed water level readings in the borings. As such, the phreatic surfaces in these analyses are considered to represent worst case conditions for the Ash Water Transport Ponds and Equalization Pond. The phreatic surface in the embankment section A-A was taken directly from the observed groundwater levels in the corresponding borings and modified in accordance with the direct observation of seepage emerging at the toe of the upper slope.

After obtaining samples and final groundwater measurements, the bore holes were backfilled with a mixture of cement grout and bentonite pellets sealed with a cement cap at the surface.

IBC Site Classification and Seismic Design Coefficients

Section 1613 of the International Building Code (2009) requires that every structure be designed and constructed to resist the effects of earthquake motions, with the seismic design category to be determined in accordance with Section 1613 or ASCE 7. Site classification according to the International Building Code (2009) is based on the soil profile encountered to 100-foot depth. The stratigraphy at the site location was explored to a maximum 64.3-foot depth.

Clayey and Sandy soils and Eocene aged deposits having similar consistency were extrapolated to be present between 64.3 and 100-foot depths. On the basis of the site class definitions included in Table 1613.5.2 and 1613.5.5 of the 2009 Code and the encountered generalized stratigraphy, we characterize the site as Site Class C.

Seismic design coefficients were determined using the on-line software, Seismic Hazard Curves and Uniform Response Spectra, version 5.1.0, dated February 10, 2011 accessed at (http://earthquake.usgs.gov/hazards/designmaps/javacalc.php). Analyses were performed considering the 2009 International Building Code. Input included zip code 78012 and Site Class C. Seismic design parameters for the site are summarized in the following table.

Table 5: Seismic Design Parameters

Site Classification	F_a	F_v	S_s	S_1
C	1.2	1.7	0.130g	0.026g

Where: Fa = Site coefficient
Fv = Site coefficient
Ss = Mapped spectral response acceleration for short periods
S1 = Mapped spectral response acceleration for a 1-second period

SLOPE STABILITY CALCULATIONS

Slope stability calculations were performed considering the interpreted stratigraphy at the explored boring locations for each of the five cross sections analyzed. These cross sections are shown in the Boring Location Plan in the Appendix C. Cross sections A-A, B-B and C-C were cut through the southernmost Ash Water Transport Pond and cross sections D-D and E-E were cut through the Equalization Pond. Strength parameters for the compacted clay soils in Strata I and the natural clay soils in Strata II were selected as the average strength from the three multistage consolidated undrained triaxial compression tests previously described. The other soil strengths used in these analyses were determined from the results of the Standard Penetration Tests, pocket penetrometer results and experience with similar soils. In each case, these estimated strengths are considered to be conservative.

The embankment cross sections analyzed were provided by the San Miguel Electric Cooperative based upon ground surveys and bathymetric measurements performed specifically for this project. The surveys indicate that the current geometry is similar to the original design geometry. These slope stability analyses were performed by Mr. Glen Andersen, Sc.D., P.E., acting as a subcontract employee to ARIAS.

Table 6: Properties and Strength Parameters for Global Stability Analyses

Stratum	Soil Profile Zone	Material	Unit Weight	Strength Function
I	All Fill Soils Above Natural Grade	Fat CLAY (CH), Lean CLAY (CL)	112 pcf	**Total Stress** c_u = 216 psf $\phi = 17.2^o$ **Effective Stress** c' = 288 psf $\phi = 20.3^o$
II_a	Natural Soils Above Silty Sands	Fat CLAY (CH), Lean CLAY (CL)	112 pcf	**Total Stress** c_u = 216 psf $\phi = 17.2^o$ **Effective Stress** c' = 288 psf $\phi = 20.3^o$
II_b	Natural Soils Above Silty Sands	Sandy Lean CLAY (CL), Clayey SAND (SC)	120 pcf	**Total Stress** c_u = 1000 psf, $\phi = 0^o$ **Effective Stress** c' = 200 psf, $\phi = 24^o$
III	Silty Sands	Silty SAND (SM), Sandy SILT (ML)	120 pcf	**Model Only With Effective Stress** c' = 0 psf, $\phi = 30^o$

Note:

1. No soils below the Strata III Silty Sands were modeled in these seepage and stability analyses

Table 7: Stability Analyses Results

Stability Criteria	Pool Elevation (ft)	Section Analyzed	Computed Factor of Safety	Minimum Factor of Safety	Comments
Normal Operating Pool Steady State Seepage Long-Term (Drained)	311	A-A	2.2	1.5	Both Circular and Noncircular Searches Optimized Using Built-In Slope/W Optimization Routine
		B-B	1.9		
		C-C	1.7		
	290	D-D	2.2		
		E-E	2.1		
Maximum Surcharge Pool Short-Term (Undrained)	314.5	A-A	2.1	1.5	Both Circular and Noncircular Searches Optimized Using Built-In Slope/W Optimization Routine
		B-B	1.8		
		C-C	1.6		
	293.5	D-D	2.2		
		E-E	2.1		
Normal Operating Pool Seismic (Undrained)	311	A-A	1.5	1.0	Both Circular and Noncircular Searches Optimized Using Built-In Slope/W Optimization Routine
		B-B	1.2		
		C-C	1.2		
	290	D-D	1.5		
		E-E	1.4		

All controlling Slope/W and Seep/W runs are summarized in the Appendix.

Rapid Drawdown Failure

The analysis for a rapid drawdown failure is necessary only in circumstances where there is the potential for a rapid lowering of the impoundment that would potentially destabilize the embankment and trigger a rapid and uncontrolled release of the impoundment. For embankments such as the ones associated with this project, such a rapid release could only be caused by human failure or mechanical failure of an outfall structure. However, for each of these ponds, there is no outfall structure. The only way for water to be released from them is through evaporation or physical pumping. Under such circumstances, it is not possible to trigger a rapid lowering of the reservoir except for the case of a global failure of the embankments. If the embankments experience a global failure, a failure associated with the attending rapid drawdown would be considered a secondary failure and hence is not considered in these stability calculations.

Seismic Loading

According to EPA requirements published in the Federal Register Vol. 75, No. 118, pages 35200 and 35201, only structures located in a seismic impact zone require seismic considerations. The EPA identifies a seismic zone where the probability of an earthquake creating a peak ground acceleration of greater than 0.1g is greater than 10% over a 250 year period. Based upon earthquake probability maps computed from the United States Geological Survey Report OFT 08-1128, and a rough correspondence between a M = 5.0 earthquake and a peak ground acceleration of 0.09g, the probability of the peak ground acceleration equal to or greater than 0.1g at the project site is less than 6% over a 250 year period. Hence, the project site is not located in an EPA defined seismic impact zone.

However, seismic stability calculations were performed for each of these cross sections using a lateral earthquake coefficient of 0.13g corresponding to the short period mapped spectral response acceleration provided earlier in this report. Such an approach is considered to be conservative. These calculations indicate that the existing embankment slopes have a suitable Factor of Safety for seismic conditions.

Liquefaction Potential

Given that these impoundments are not located in an EPA defined seismic impact zone, no specific analyses are required for seismically induced liquefaction. However, a review of the boring logs developed for this project indicates that there is only one location (Boring B-4) at the toe of Cross Section B-B where loose sands or silts were encountered. In all other locations, the uncorrected SPT blow counts were 65 or greater in the sands and silts. In addition, these loose sands are encountered above the water table. Also, there is less than a 6% chance of a magnitude 5.0 or greater earthquake in 250 years. In order to have a liquefaction event, three conditions must be met. First, granular soils must be present at a sufficiently low density. Second, these low density granular soils must be encountered below the groundwater table. Third, seismic shaking must be sufficiently strong to induce a collapse of the soil skeleton at the insitu density.

Based upon the actual conditions at the project site, liquefaction is considered to be very unlikely according to the criteria established by Seed and Idriss (1971) in their paper “Simplified Procedure for Evaluating Soil Liquefaction Potential”. Hence, slope stability evaluations accounting for potential liquefaction are not necessary for this site.

GENERAL COMMENTS

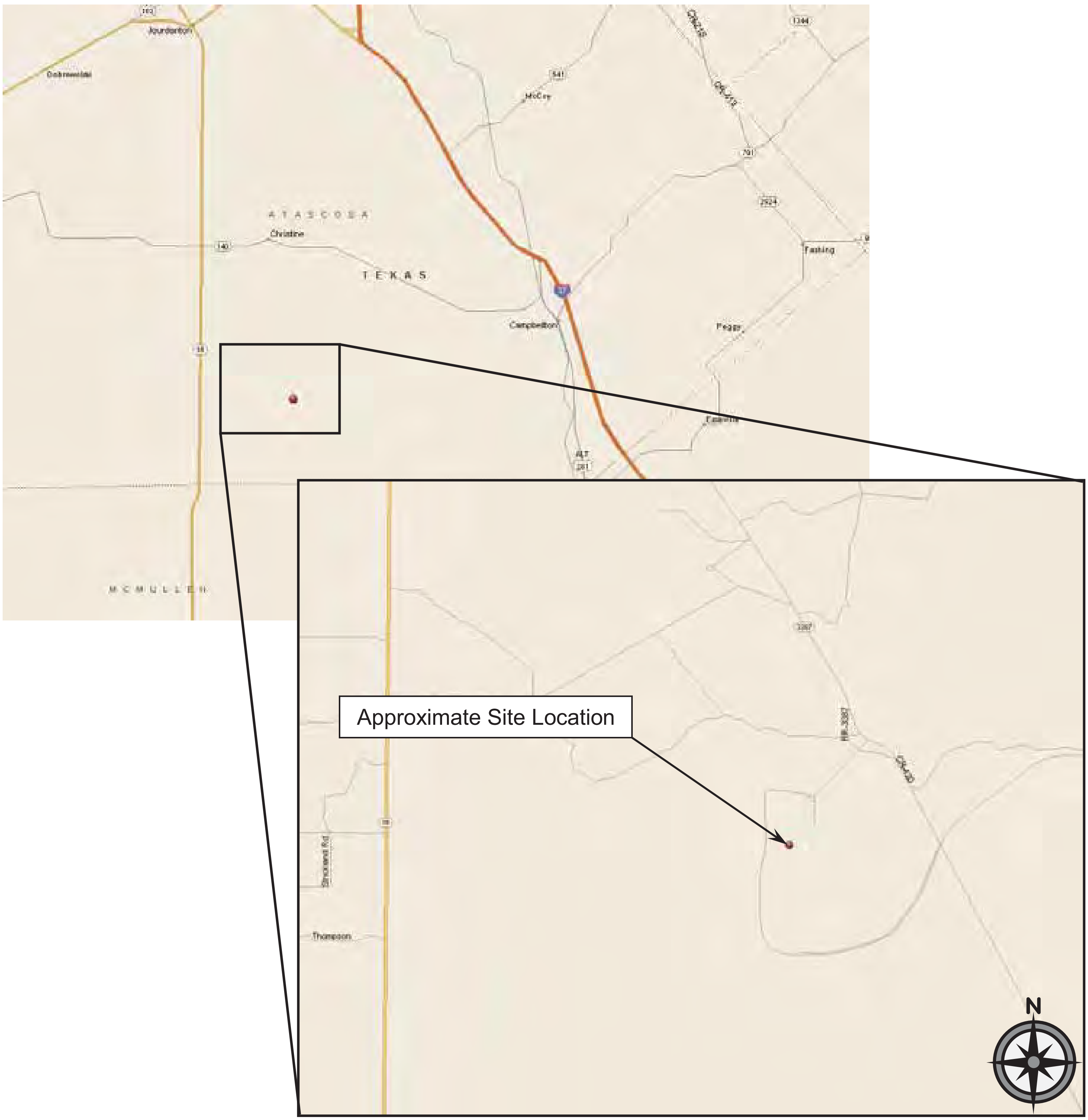
The scope of this study is to conduct seepage and associated slope stability evaluations of the embankments of the Ash Water Transport Ponds and Equalization Pond. Environmental studies of any kind were not a part of our scope of work or services even though we are capable of providing such services.

This report was prepared for this project exclusively for the use of San Miguel Electric Cooperative. Arias and Associates 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.

The soils to be penetrated by the borings conducted for this subsurface investigation may vary significantly across the site. Our soil classifications and strength determinations are based solely on the materials encountered in widely spaced exploratory test borings and our review of previously conducted borings. Conditions may occur between these borings that are not representative of the subsurface conditions modeled in these analyses

This report has been prepared in accordance with ordinary degree of skill and care that would be used by other reasonably competent geotechnical engineers under similar circumstances, taking into consideration the contemporary state of the art and geographic idiosyncrasies.

APPENDIX A: SITE VICINITY MAP AND GEOLOGIC MAP



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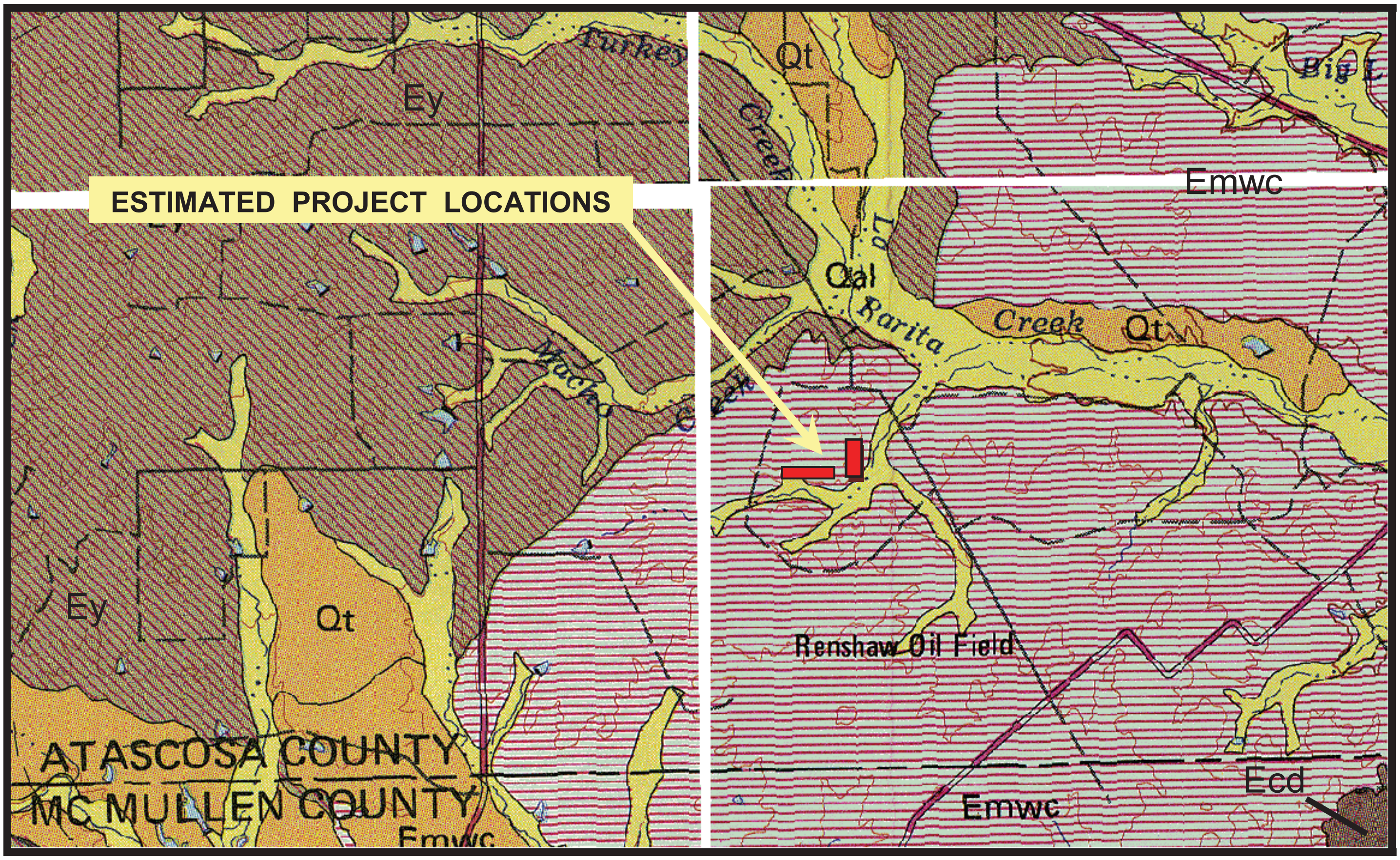
VICINITY MAP

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

1 of 1



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

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

1 of 1

APPENDIX B: SITE PHOTOGRAPHS

Photo 1 – View looking west at Boring B-2 and the Yard Drainage Retention Pond.

Photo 2 – View looking west from Ash Disposal Pond at Boring B-1, with Boring B-2 in the distance.

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SITE PHOTOS

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 B

Photo 3 – View looking north at Ash Disposal Pond from Boring B-5.

Photo 4 – View looking south from Boring B-6 towards Boring B-7 near the fence.

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SITE PHOTOS

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 B

Photo 5 – View looking south from Sludge Disposal Basin at Boring B-8, with Boring B-9 in the distance.

Photo 6 – View looking to the northwest at Boring B-11, with Boring B-10 at top near the truck.

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SITE PHOTOS

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 B

Photo 7 – View looking east from Sludge Disposal Basin at Boring B-13, with Boring B-14 in the distance.

Photo 8 – View looking north from Sludge Disposal Basin at Boring B-16, with Boring B-17 in the distance.

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SITE PHOTOS

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 B

APPENDIX C: BORING LOCATION PLAN AND BORING LOGS

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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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

1 of 1

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	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Silty GRAVEL (GM) with sand, dense, gray and brown		SS	29	24	47	23		28	
FILL: LEAN CLAY (CL) with sand, stiff to very stiff, gray and brown, trace of gypsum, mottled		SS	30					14	
FAT CLAY (CH), very stiff to hard, gray to dark brown, with considerable gypsum seams	5	SS	33	28	67	39		23	
		SS	33					25	
- light brown an dgray below 8 ft. ▼	10	T	33	35	57	22	1.75		
- seepage along gypsum seam at 10 ft.		T	31	37	56	19	1.5		
	15	T							
	20	SS	38					32	
LEAN CLAY (CL), hard, gray and brown, with thin gypsum seams - considerable iron oxide material below 24 ft.	25	SS	20	20	42	22		82	
SILTY Fine SAND (SM), very dense, gray and brown	30	SS						**50/1"	
	35	SS	24					**50/6"	33
		SS	23					**50/6"	

Borehole terminated at 39 feet

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

Arias & Associates, Inc.

Job No.: 2012-695

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		
	10									
- sandy with oxide staining below 10 ft.		■	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

Arias & Associates, Inc.

Job No.: 2012-695

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

Arias & Associates, Inc.

Job No.: 2012-695

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**
Location:	See Boring Location Plan
Sampling Date:	9/25/12
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

Arias & Associates, Inc.

Job No.: 2012-695

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	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH), very stiff, gray and brown, with mottling, sand seams, some dark brown layers		SS	18					29	
		SS	24	29	83	54		21	
	5	SS	34					21	
		SS	29	28	81	53		21	
	10	SS	24					22	
		SS	30					19	
	15	T	29	28	84	56	2.75		
	20	T	32				2.75		
	25	T	27				2.25		
FAT CLAY (CH), hard, dark gray	30	T							
- gray and brown below 30 ft.									
- sand seams 33 ft. to 38 ft. ▼	35	T	26	26	70	44	4.0		
- gypsum seams below 38 ft.	40	SS	41					33	
	45	SS		29	97	68		51	
- lignite seam at 49 ft. ▽	50	SS						50/5"	
SILTY SAND (SM), very dense, gray to dark gray	55	SS						**50/2"	
	60	SS						**50/3"	17
SANDY SILT (ML), very dense, gray to dark gray		SS						50/3"	50

Borehole terminated at 64.3 feet

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

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Job No.: 2012-695

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

Arias & Associates, Inc.

Job No.: 2012-695

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

Boring Log No. B-9

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: 276 ft (Estimated)
Coordinates: N: 13438445.24 E: 2138771.20
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

Arias & Associates, Inc.

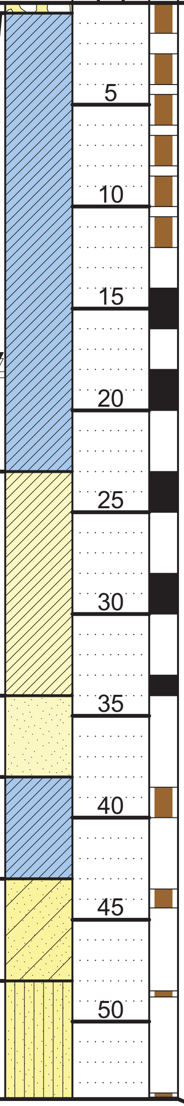
Job No.: 2012-695

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 - gray and brown from 4 ft. to 13 ft.		SS	36	29	67	38		18	
	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

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

Arias & Associates, Inc.

Job No.: 2012-695

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

Arias & Associates, Inc.

Job No.: 2012-695

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	
	10	T	20				2.0	
		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.									
	40	T	28	20	57	37	4.0		
- considerable gypsum below 40 ft.									
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

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

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.	10	T	16	19	62	43	1.75		
		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

Arias & Associates, Inc.

Job No.: 2012-695

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

Arias & Associates, Inc.

Job No.: 2012-695

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

Arias & Associates, Inc.

Job No.: 2012-695

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		
		T	22				2.75		
	20								
SANDY LEAN CLAY (CL), medium stiff, gray and brown ▽		T	25	24	36	12	0.75		
	25								
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

Arias & Associates, Inc.

Job No.: 2012-695

APPENDIX D: KEY TO CLASSIFICATION SYMBOLS

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

APPENDIX E: LABORATORY AND FIELD TEST PROCEDURES

FIELD AND LABORATORY EXPLORATION

The field exploration program included drilling at selected locations within the site and intermittently sampling the encountered materials. The boreholes were drilled using either single flight auger (ASTM D 1452) or hollow-stem auger (ASTM D 6151). Samples of encountered materials were obtained using a split-barrel sampler while performing the Standard Penetration Test (ASTM D 1586), using a thin-walled tube sampler (ASTM D 1587), or by taking material from the auger as it was advanced (ASTM D 1452). The sample depth interval and type of sampler used is included on the soil boring log. Arias' field representative visually logged each recovered sample and placed a portion of the recovered sampled into a plastic bag for transport to our laboratory.

SPT N values and blow counts for those intervals where the sampler could not be advanced for the required 18-inch penetration are shown on the soil boring log. If the test was terminated during the 6-inch seating interval or after 10 hammer blows were applied used and no advancement of the sampler was noted, the log denotes this condition as blow count during seating penetration. Penetrometer readings recorded for thin-walled tube samples that remained intact also are shown on the soil boring log.

Arias performed soil mechanics laboratory tests on selected samples to aid in soil classification and to determine engineering properties. Tests commonly used in geotechnical exploration, the method used to perform the test, and the column designation on the boring log where data are reported are summarized as follows:

Test Name	Test Method	Log Designation
Water (moisture) content of soil and rock by mass	ASTM D 2216	WC
Liquid limit, plastic limit, and plasticity index of soils	ASTM D 4318	PL, LL, PI
Amount of material in soils finer than the No. 200 sieve	ASTM D 1140	-200
Particle size analysis of soils (with or without fines fraction)	ASTM D 422	-200

The laboratory results are reported on the soil boring logs.

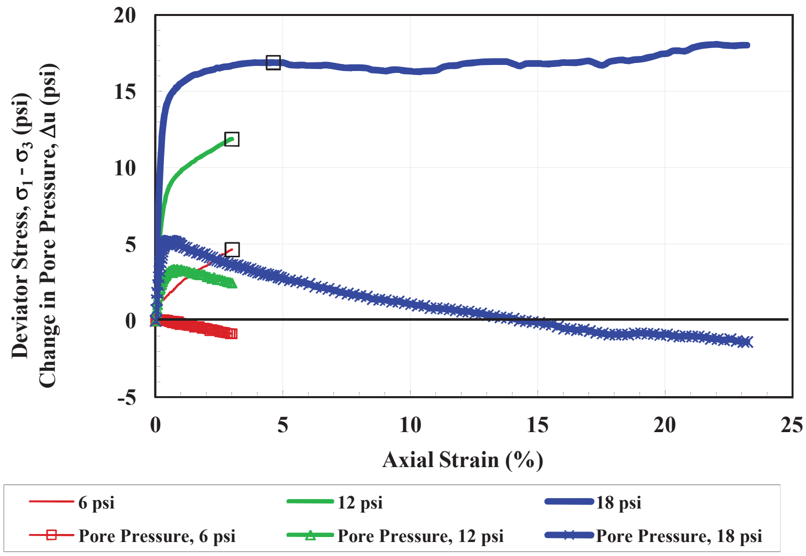
TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

Consolidated-Undrained Triaxial Compression Test Report

Client: Arias & Associates
Sample No.: B-1 (14 - 16 ft)
Project: San Miguel Electric Cooperative
Type of Test: Multi-stage CU
TRI Log No.: E2365-91-06
Strain Rate (%/hr): 1 % / hr
Test Method: Modified ASTM D 4767
Test Date: 10/04/12
Type of Specimen: Undisturbed

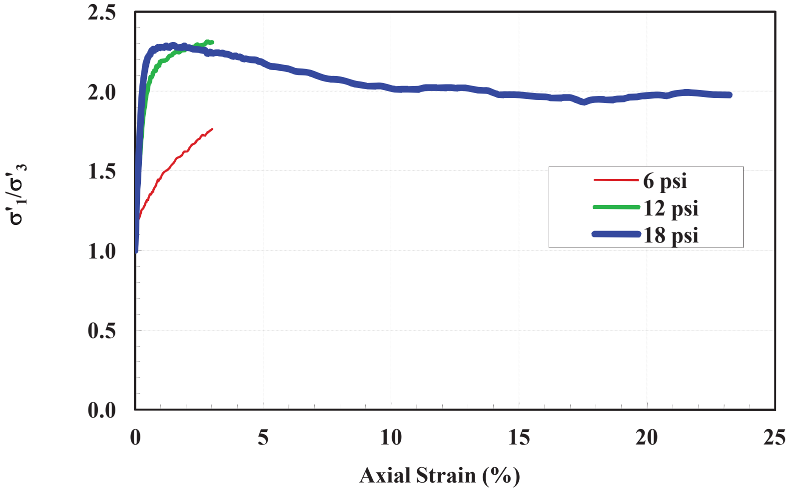
Total Stresses	
Friction Angle, ϕ (°):	**19.3**
Cohesion, c (psi):	**0.0**
Effective Stresses	
Friction Angle, ϕ' (°):	**21.8**
Cohesion, c' (psi):	**0.0**

Deviator Stress and Pore Pressure versus Axial Strain



Initial Specimen Conditions				
Stage		#1	#2	#3
Eff. Consolidation Stress (psi)		6	12	18
Depth/Elev (ft):		14 - 16	14 - 16	14 - 16
Avg. Diameter (in)	D_o	2.84		
Avg. Height (in)	H_o	5.75		
Avg. Water Content (%)	w_o	35.4		
Bulk Density (pcf)	WD_o	109.3		
Dry Density (pcf)	DD_o	80.8		
Saturation (%)	S_o	87.8		
Void Ratio	e_o	1.09		
Specific Gravity (assumed)	G_s	2.70		
B-Coefficient	B	0.98		
Specimen Conditions after Consolidation				
Void Ratio	e_c	1.06	1.03	1.00
Area (in^2)	A_1	6.29	6.23	6.18
Saturation (%)	Sr			100.0
Avg. Water Content (%)	w_f			41.8

Principal Stress Ratio vs. Axial Strain



Stresses at Failure			
Deviator Stress (psi)	4.7	11.9	16.9
Total Stresses at Failure			
σ_1 (psi)	9.9	23.5	33.9
σ_3 (psi)	5.3	11.6	17.0
Effective Stresses at Failure			
σ'_1 (psi)	10.8	20.9	31.0
σ'_3 (psi)	6.1	9.1	14.1

Note 2: Specimens were mounted in the triaxial cells using the back-pressure saturation method. Failure stresses were determined at the greatest deviator stress or at 15% strain, whichever occurred first.

Note 1: Specimen was undisturbed

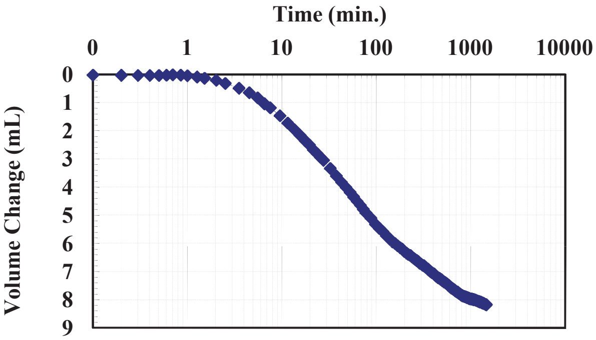
Trevor Yates, 10/15/12
Analysis & Quality Review/Date
Specimens prepared by: Jon Millsap

Triaxial Compression Test Appendix 1

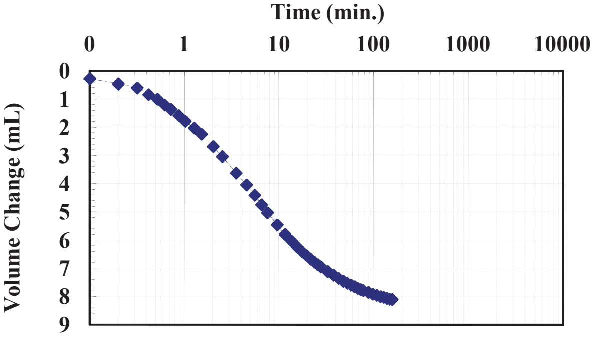
Client: Arias & Associates
Project: San Miguel Electric Cooperative
Specimen: B-1 (14 - 16 ft)

TRI Log No.: E2365-91-06
Test Method: ASTM D 4767
Test Date: 10/04/12

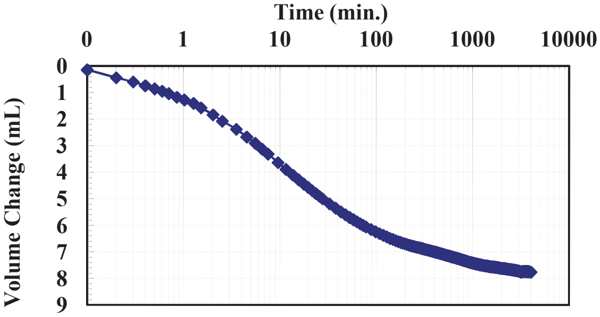
Stage 1 Isotropic Consolidation Test



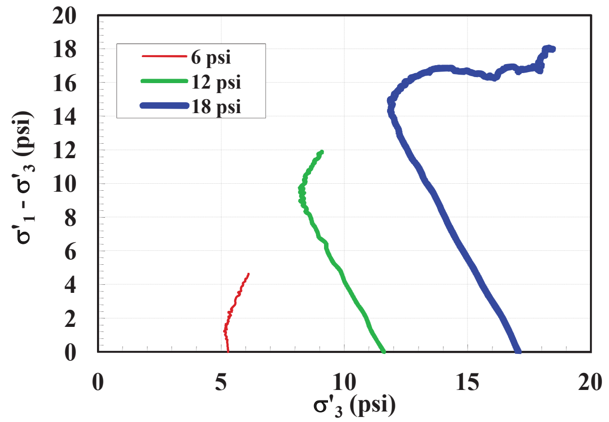
Stage 2 Isotropic Consolidation Test



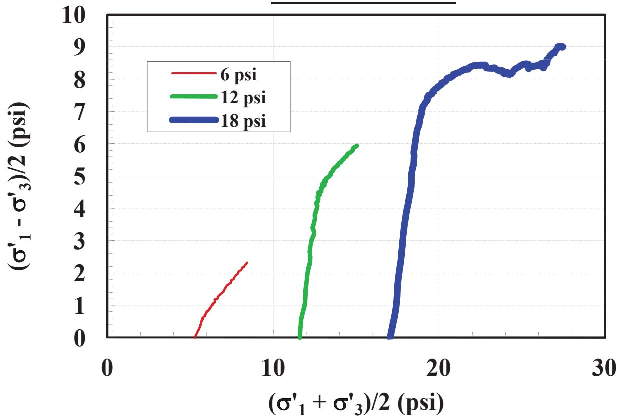
Stage 3 Isotropic Consolidation Test



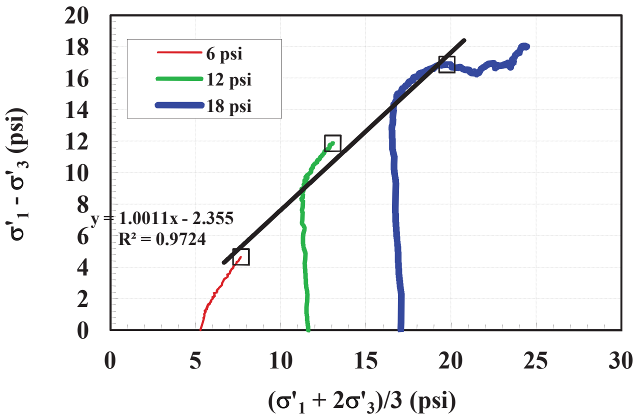
Modified Mohr-Coulomb Stress Paths



MIT Stress Paths



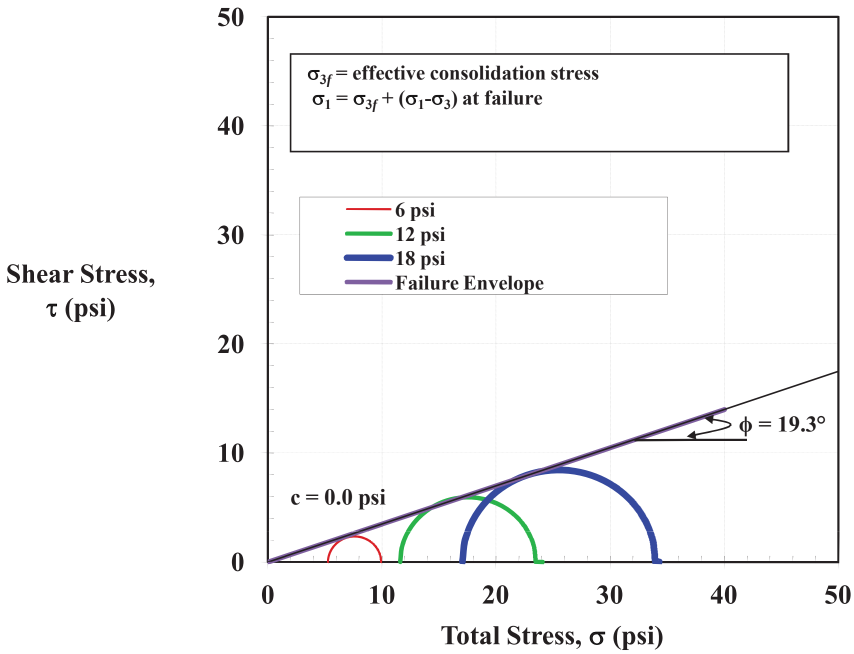
Cambridge Stress Paths (*p'*-*q*)



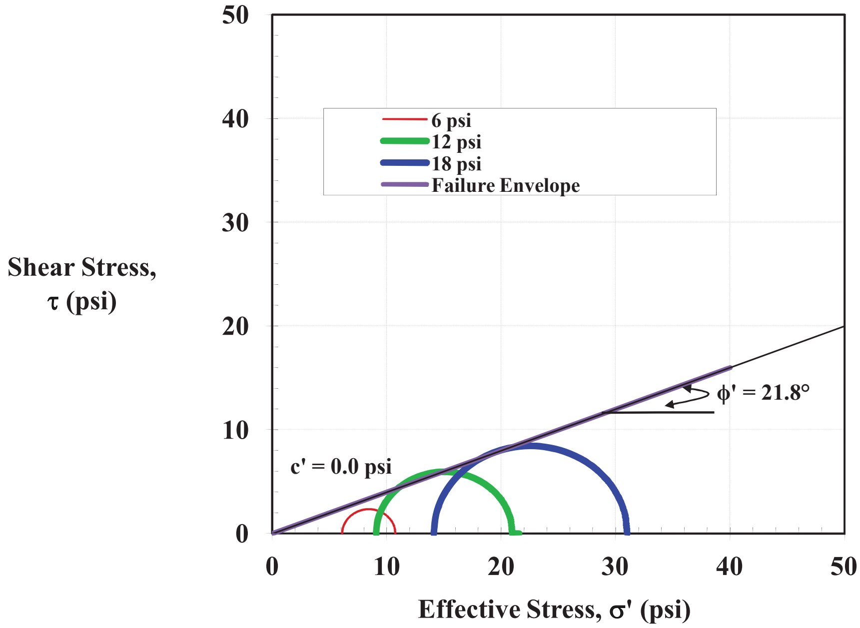
Triaxial Compression Test Appendix 2

Client:	Arias & Associates	TRI Log No.:	E2365-91-06
Project:	San Miguel Electric Cooperative	Test Method:	ASTM D 4767
Specimen:	B-1 (14 - 16 ft)	Test Date:	10/04/12

Mohr's Circles (Total Stress)



Mohr's Circles (Effective Stress)



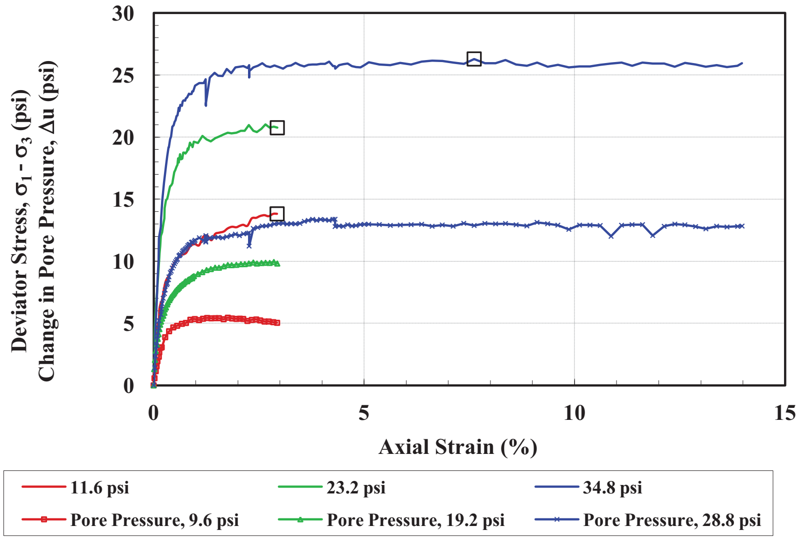
Consolidated-Undrained Triaxial Compression Test Report

Client: Arias & Associates
Project: San Miguel Electric Cooperative
TRI Log No.: E2365-91-06
Test Method: Modified ASTM D 4767
Type of Specimen: Undisturbed

Sample No.: B-6 (28 - 30 ft)
Type of Test: Multi-stage CU
Strain Rate (%/hr): 0.19, 0.083, & 0.045
Test Date: 10/02/12

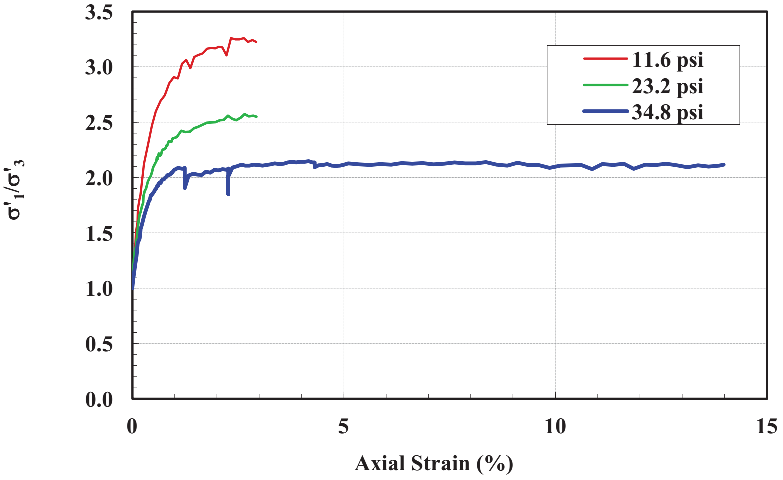
Total Stresses	
Friction Angle, ϕ (^{o}):	**13.1**
Cohesion, c (psi):	**3.0**
Effective Stresses	
Friction Angle, ϕ' (^{o}):	**15.2**
Cohesion, c' (psi):	**3.5**

Deviator Stress and Pore Pressure versus Axial Strain



Initial Specimen Conditions				
Stage		#1	#2	#3
Eff. Consolidation Stress (psi)		12	23	35
Depth/Elev (ft):		28 -30	28 -30	28 -30
Avg. Diameter (in)	D$_o$	2.81	-	-
Avg. Height (in)	H$_o$	5.64	-	-
Avg. Water Content (%)	w$_o$	28.1	-	-
Bulk Density (pcf)	WD$_o$	116.6	-	-
Dry Density (pcf)	DD$_o$	91.1	-	-
Saturation (%)	S$_o$	89.0	-	-
Void Ratio	e$_o$	0.85	-	-
Specific Gravity (assumed)	G$_s$	2.70	-	-
B-Coefficient	B	0.98	-	-
Specimen Conditions after Consolidation				
Void Ratio	e$_c$	0.83	0.68	0.62
Area (in^2)	A$_1$	6.16	5.81	5.65
Saturation (%)	Sr	-	-	100.0
Avg. Water Content (%)	w$_f$	-	-	31.3

Principal Stress Ratio vs. Axial Strain



Stresses at Failure			
Deviator Stress (psi)	13.8	20.7	26.3
Total Stresses at Failure			
□$_1$ (psi)	25.0	44.0	60.6
□$_3$ (psi)	11.2	23.2	34.3
Effective Stresses at Failure			
□'$_1$ (psi)	20.0	34.0	45.0
□'$_3$ (psi)	6.2	13.4	21.3

Note 2: Specimens were mounted in the triaxial cells using the back-pressure saturation method. Failure stresses for the first two stages were determined at 3 percent and 6 percent strain.

Note 1: Specimen was undisturbed

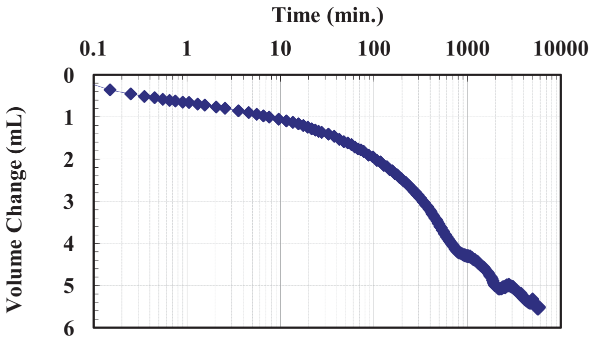
Jeffrey A. Kuhn, E.I.T., Ph.D., 11/13/12
Analysis & Quality Review/Date
Specimens prepared by: Jon Millsap

Triaxial Compression Test Appendix 1

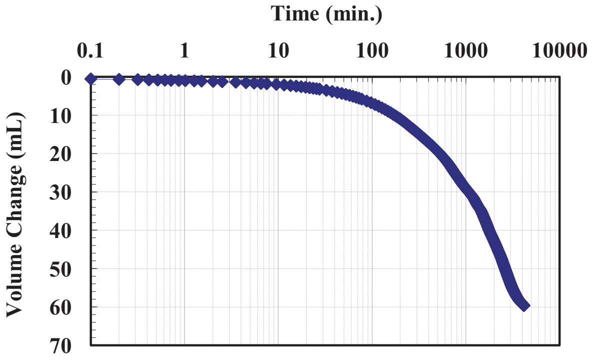
Client: Arias & Associates
Project: San Miguel Electric Cooperative
Specimen: B-6 (28 - 30 ft)

TRI Log No.: E2365-91-06
Test Method: ASTM D 4767
Test Date: 10/02/12

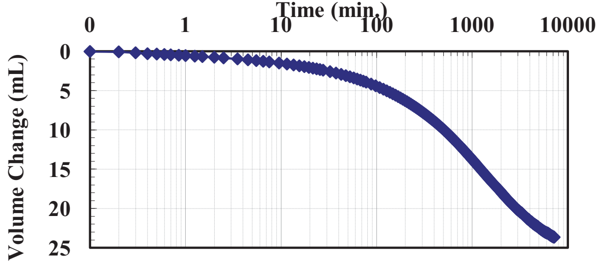
Stage 1 Isotropic Consolidation Test



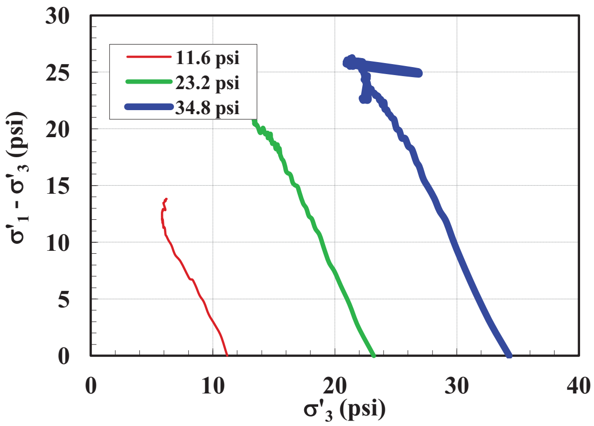
Stage 2 Isotropic Consolidation Test



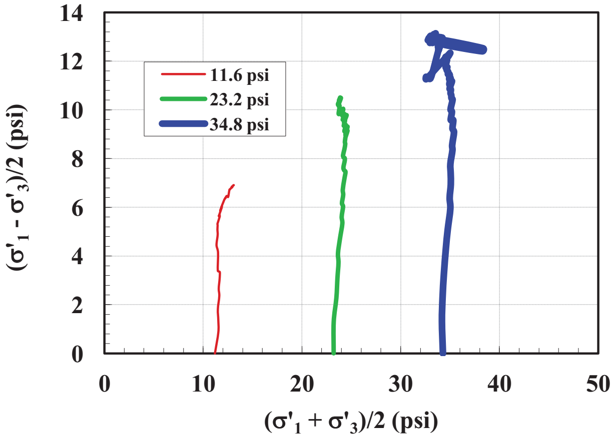
Stage 3 Isotropic Consolidation Test



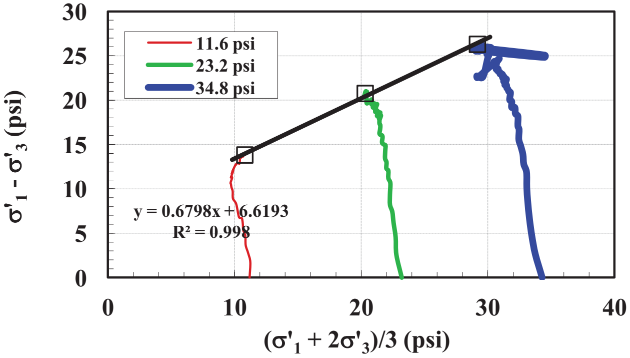
Modified Mohr-Coulomb Stress Paths



MIT Stress Paths



Cambridge Stress Paths (*p'*-*q*)

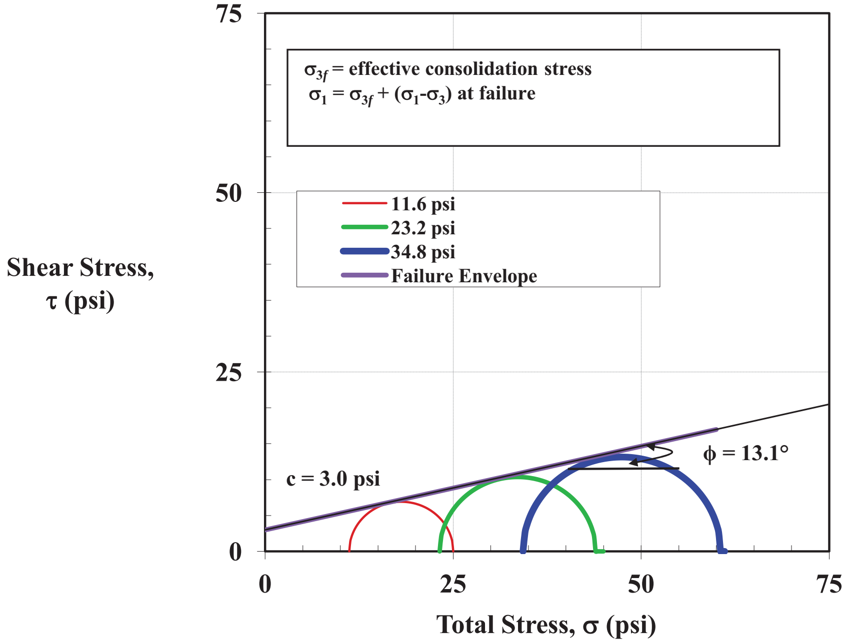


Triaxial Compression Test Appendix 2

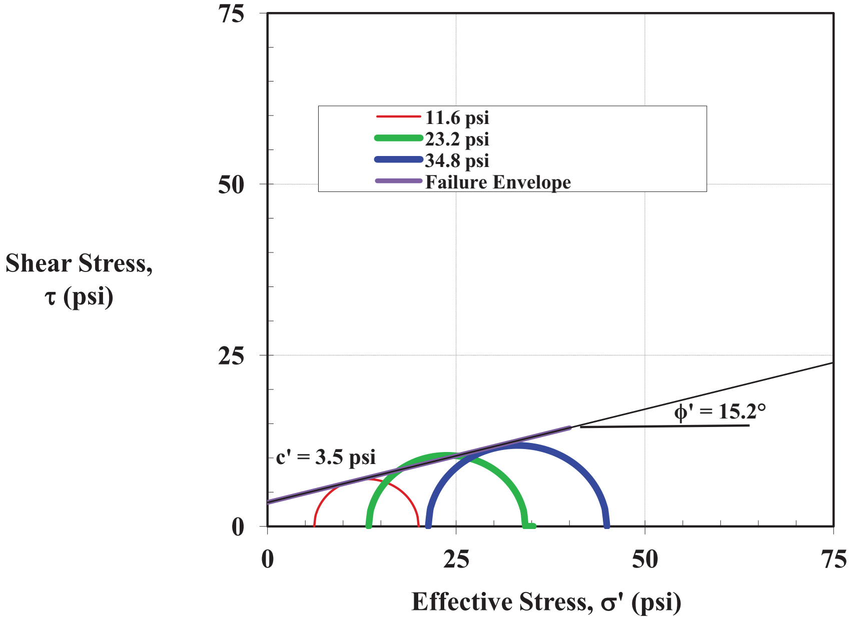
Client: Arias & Associates
Project: San Miguel Electric Cooperative
Specimen: B-6 (28 - 30 ft)

TRI Log No.: E2365-91-06
Test Method: ASTM D 4767
Test Date: 10/02/12

Mohr's Circles (Total Stress)



Mohr's Circles (Effective Stress)

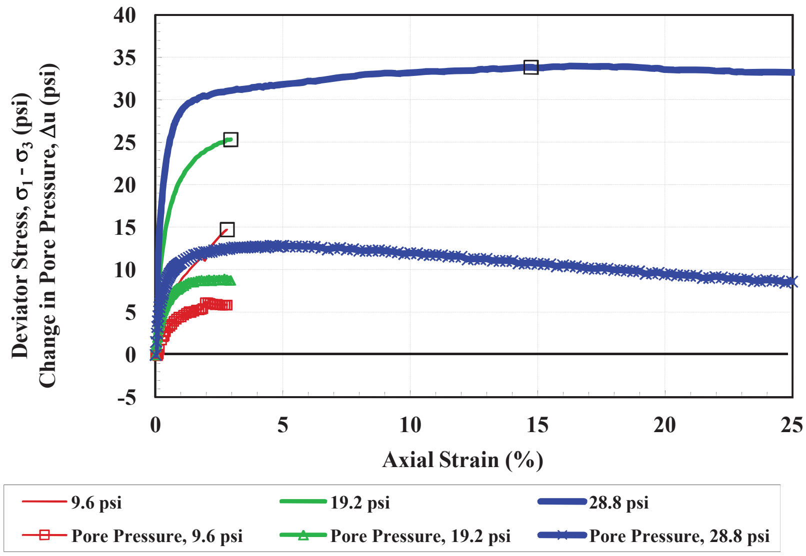


Consolidated-Undrained Triaxial Compression Test Report

Client: Arias & Associates
Sample No.: B-10 (23 - 25 ft)
Project: San Miguel Electric Cooperative
Type of Test: Multi-stage CU
TRI Log No.: E2365-91-06
Strain Rate (%/hr): 5 % / hr
Test Method: Modified ASTM D 4767
Test Date: 10/04/12
Type of Specimen: Undisturbed

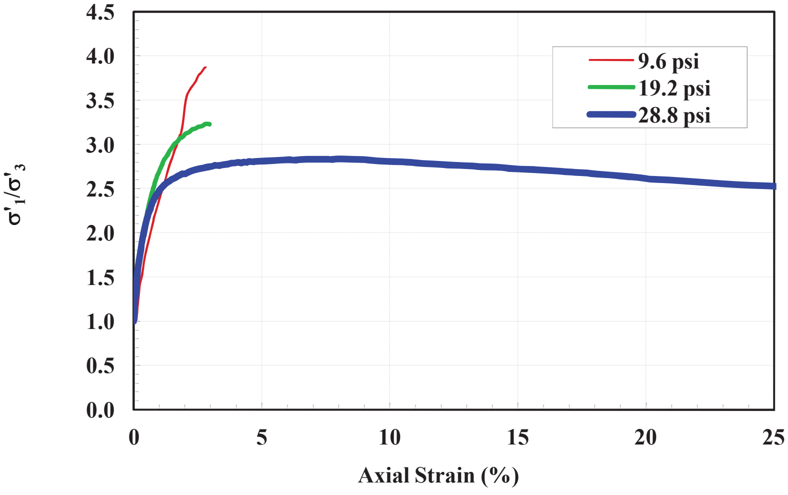
Total Stresses	
Friction Angle, ϕ (°):	**19.0**
Cohesion, c (psi):	**1.5**
Effective Stresses	
Friction Angle, ϕ' (°):	**23.6**
Cohesion, c' (psi):	**2.5**

Deviator Stress and Pore Pressure versus Axial Strain



Initial Specimen Conditions				
Stage		#1	#2	#3
Eff. Consolidation Stress (psi)		10	19	29
Depth/Elev (ft):		23 - 25	23 - 25	23 - 25
Avg. Diameter (in)	D_o	2.83		
Avg. Height (in)	H_o	5.66		
Avg. Water Content (%)	w_o	26.5		
Bulk Density (pcf)	WD_o	111.9		
Dry Density (pcf)	DD_o	88.5		
Saturation (%)	S_o	79.0		
Void Ratio	e_o	0.91		
Specific Gravity (assumed)	G_s	2.70		
B-Coefficient	B	0.98		
Specimen Conditions after Consolidation				
Void Ratio	e_c	0.89	0.86	0.83
Area (in^2)	A_1	6.27	6.20	6.13
Saturation (%)	Sr			90.5
Avg. Water Content (%)	w_f			27.7

Principal Stress Ratio vs. Axial Strain



Stresses at Failure			
Deviator Stress (psi)	14.7	25.3	33.8
Total Stresses at Failure			
σ_1 (psi)	25.7	45.5	64.1
σ_3 (psi)	10.9	20.2	30.2
Effective Stresses at Failure			
σ'_1 (psi)	19.9	36.6	53.5
σ'_3 (psi)	5.1	11.4	19.6

Note 2: Specimens were mounted in the triaxial cells using the back-pressure saturation method. Failure stresses were determined at the greatest deviator stress or at 15% strain, whichever occurred first.

Note 1: Specimen was undisturbed

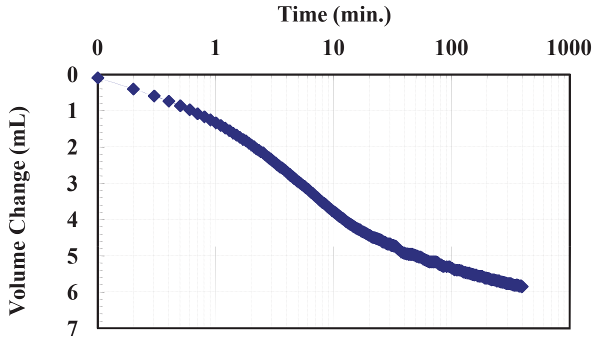
Trevor Yates, 10/15/12
Analysis & Quality Review/Date
Specimens prepared by: Jon Millsap

Triaxial Compression Test Appendix 1

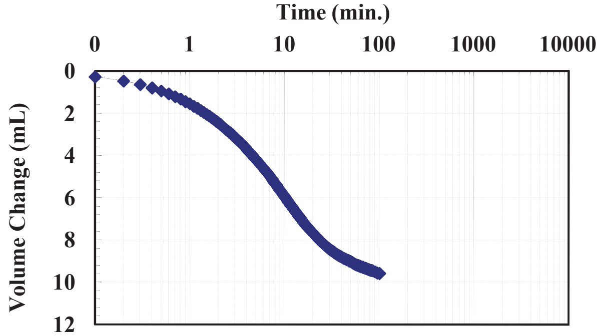
Client: Arias & Associates
Project: San Miguel Electric Cooperative
Specimen: B-10 (23 - 25 ft)

TRI Log No.: E2365-91-06
Test Method: ASTM D 4767
Test Date: 10/04/12

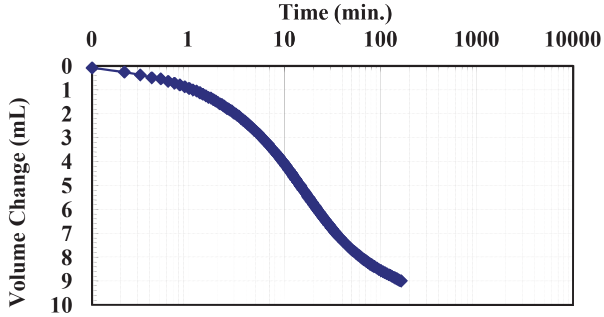
Stage 1 Isotropic Consolidation Test



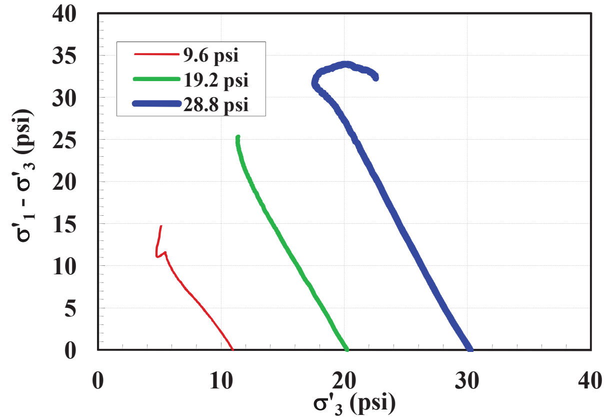
Stage 2 Isotropic Consolidation Test



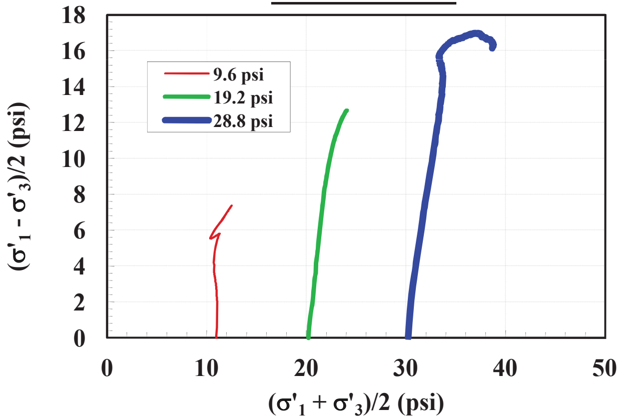
Stage 3 Isotropic Consolidation Test



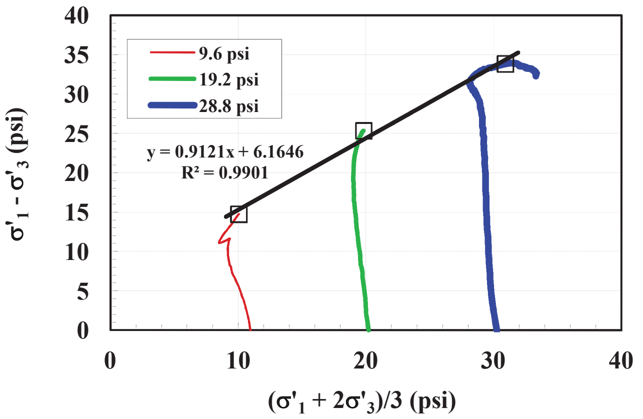
Modified Mohr-Coulomb Stress Paths



MIT Stress Paths



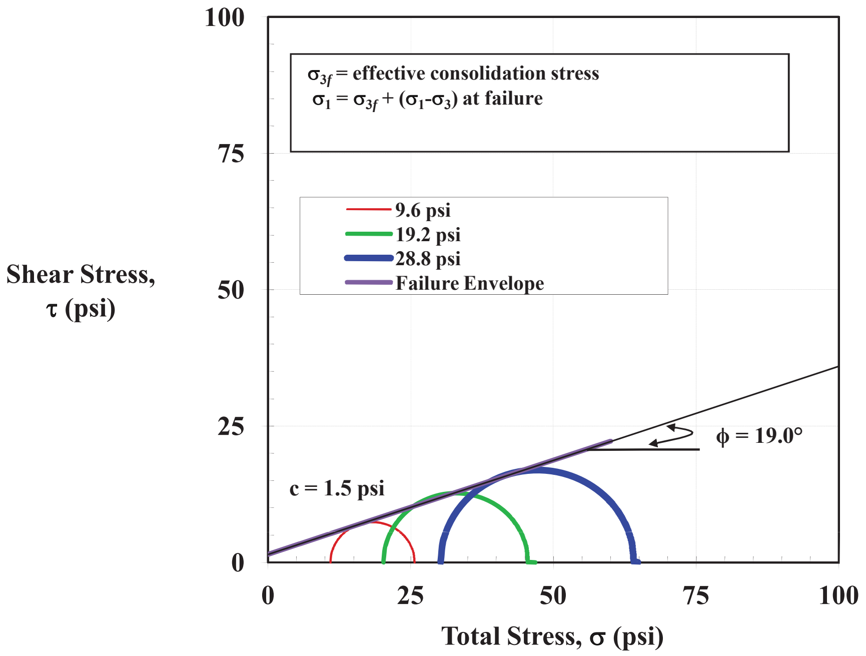
Cambridge Stress Paths (*p'*-*q*)



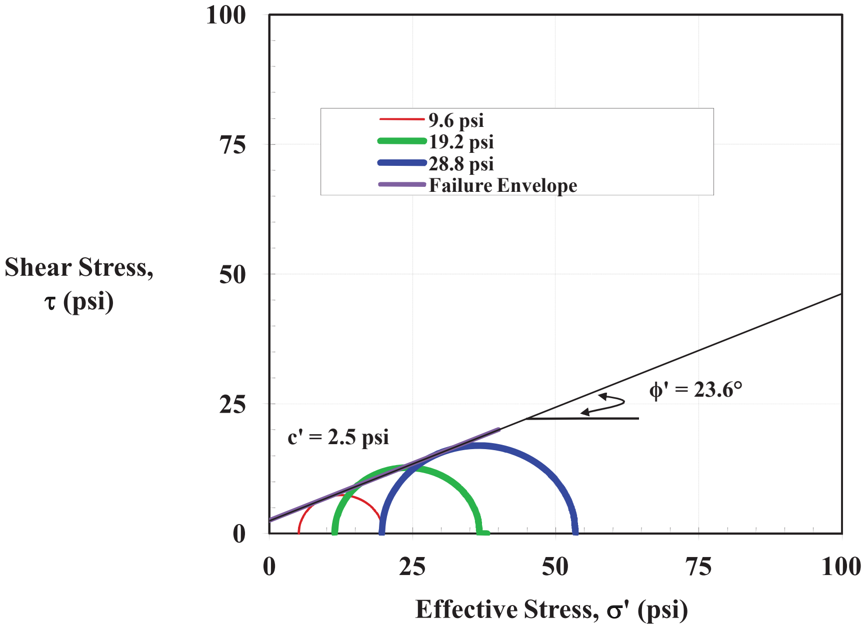
Triaxial Compression Test Appendix 2

Client:	Arias & Associates	TRI Log No.:	E2365-91-06
Project:	San Miguel Electric Cooperative	Test Method:	ASTM D 4767
Specimen:	B-10 (23 - 25 ft)	Test Date:	10/04/12

Mohr's Circles (Total Stress)



Mohr's Circles (Effective Stress)

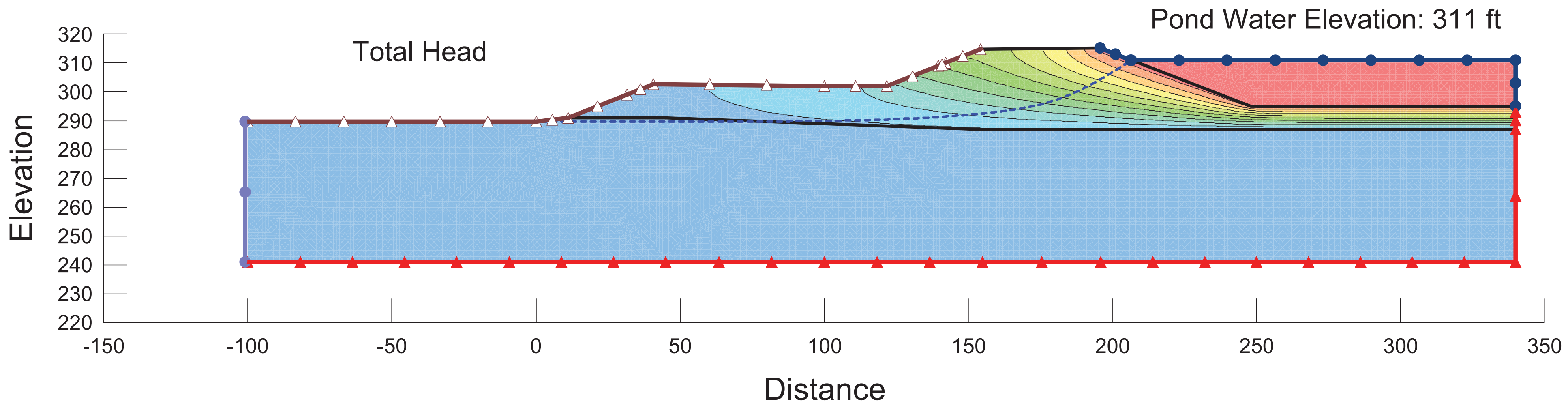


APPENDIX F: SEEPAGE AND SLOPE STABILITY RESULTS

San Miguel Ash Pond Section A-A.gsz
SEEP/W Analysis - Normal Operating Pool
11/20/2012

Computed By: GRA

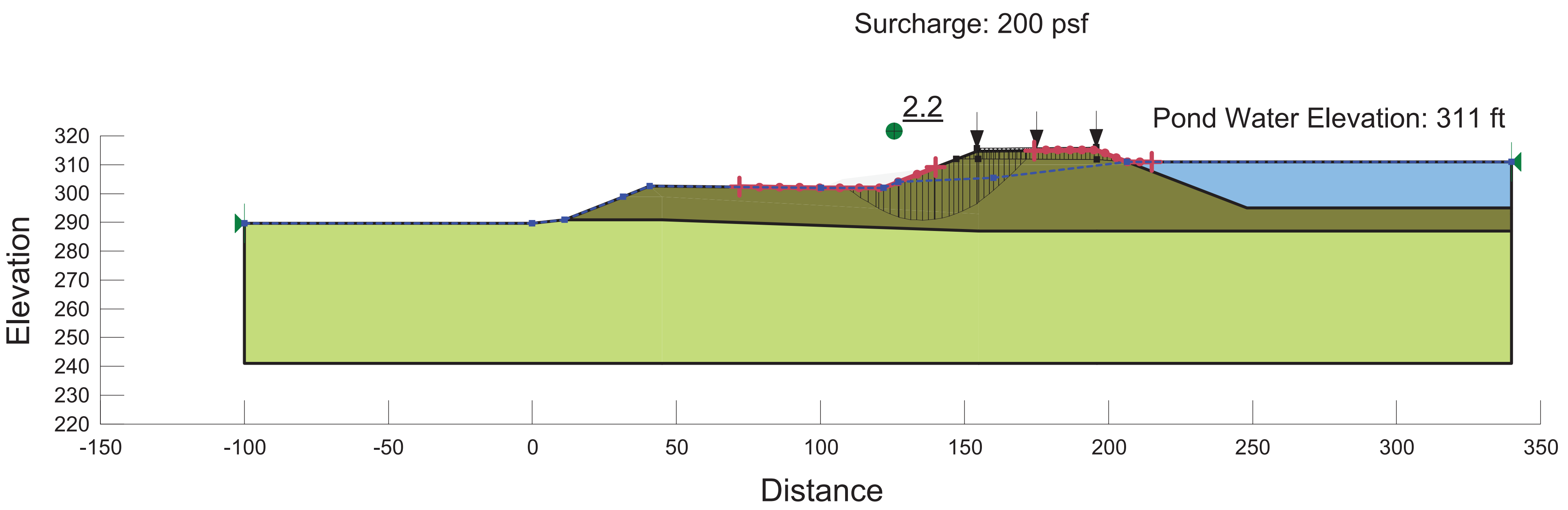
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Ash Waste	Model: Saturated Only	K-Sat: 0.00033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Ash Pond Section A-A.gsz
Steady State Seepage - Entry Exit A
11/20/2012

Computed By: GRA

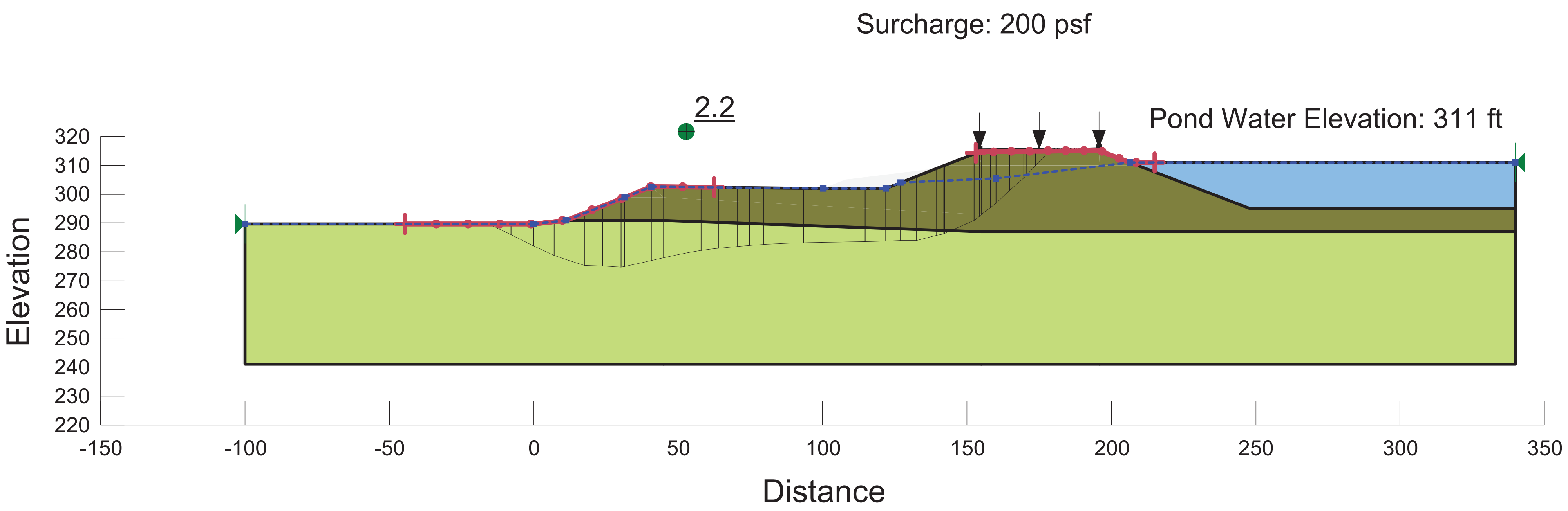
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: Clay Nat/Fill - S	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 288 psf	Phi: 20.3 °	Phi-B: 11 °
Name: Ash Waste	Model: Mohr-Coulomb	Unit Weight: 110 pcf	Cohesion: 0 psf	Phi: 25 °	Phi-B: 0 °



San Miguel Ash Pond Section A-A.gsz
Steady State Seepage - Entry Exit A - Far
11/20/2012

Computed By: GRA

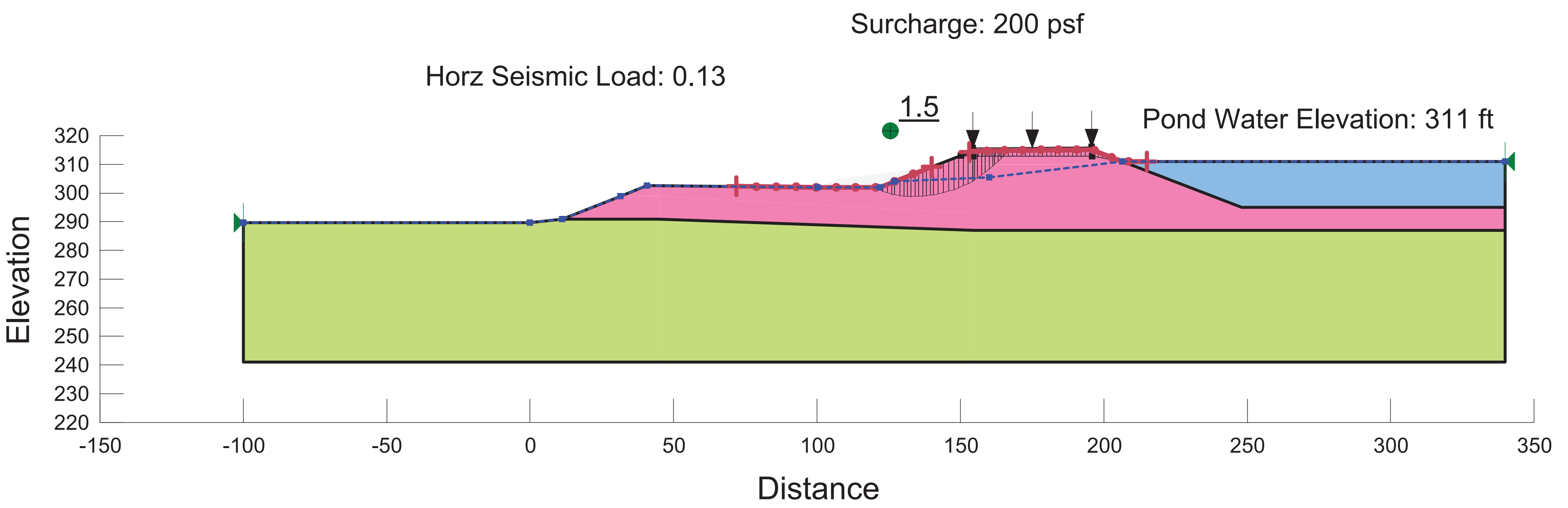
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: Clay Nat/Fill - S	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 288 psf	Phi: 20.3 °	Phi-B: 11 °
Name: Ash Waste	Model: Mohr-Coulomb	Unit Weight: 110 pcf	Cohesion: 0 psf	Phi: 25 °	Phi-B: 0 °



San Miguel Ash Pond Section A-A.gsz
Seismic - Entry Exit A
11/20/2012

Computed By: GRA

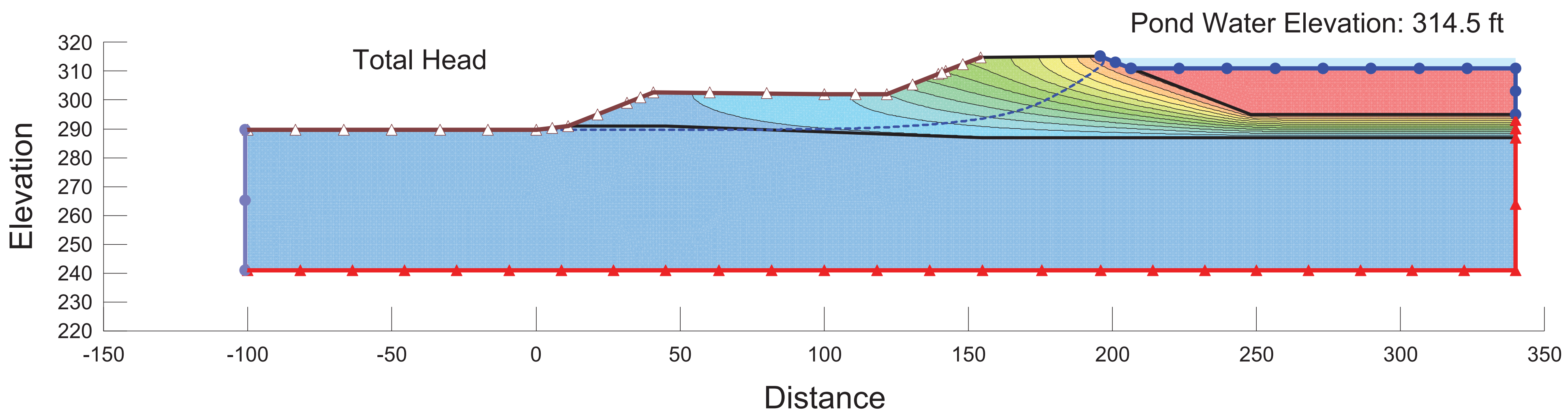
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 10 °
Name: Ash Waste	Model: Mohr-Coulomb	Unit Weight: 110 pcf	Cohesion: 0 psf	Phi: 25 °	Phi-B: 0 °



San Miguel Ash Pond Section A-A.gsz
SEEP/W Analysis - Maximum Surcharge Pool
11/20/2012

Computed By: GRA

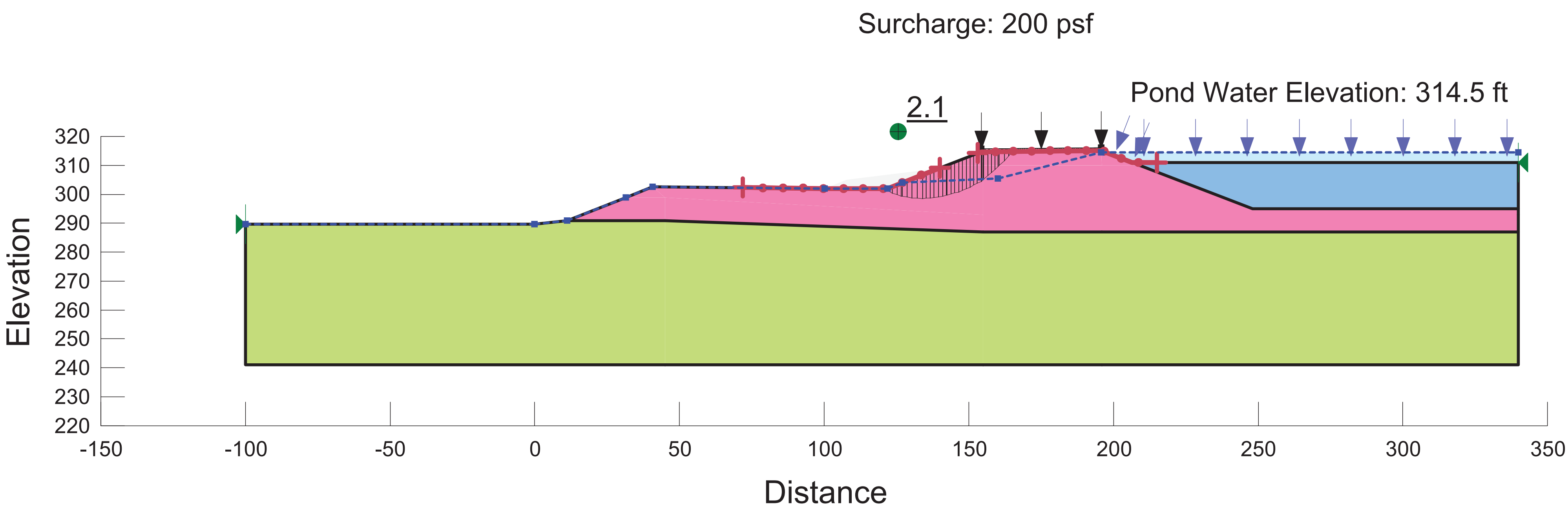
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Ash Waste	Model: Saturated Only	K-Sat: 0.00033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Ash Pond Section A-A.gsz
Maximum Surcharge Pool - Entry Exit A
11/20/2012

Computed By: GRA

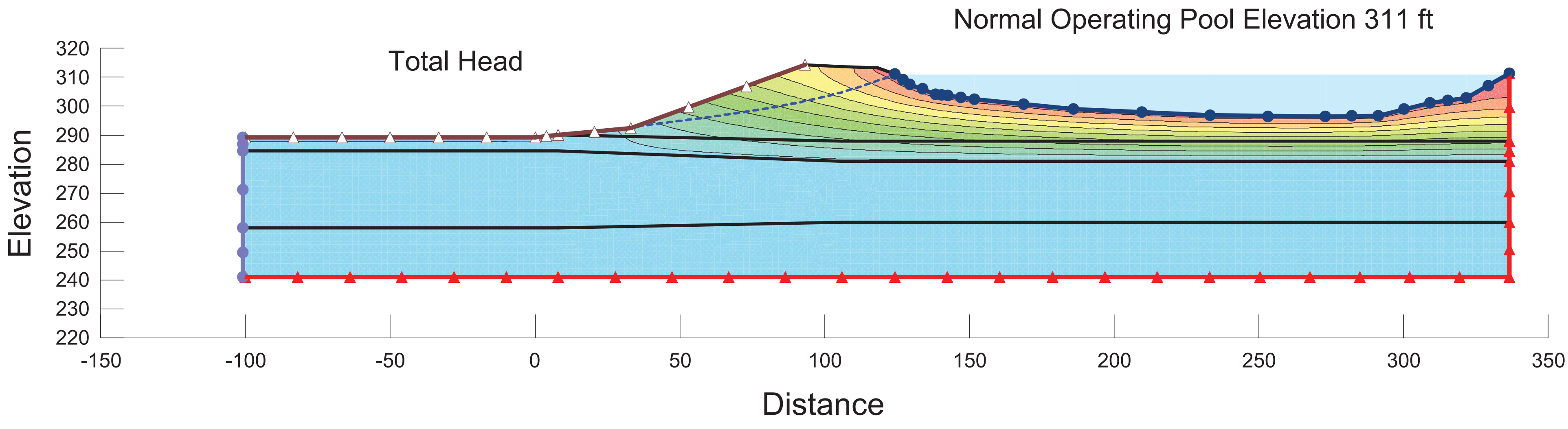
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 10 °
Name: Ash Waste	Model: Mohr-Coulomb	Unit Weight: 110 pcf	Cohesion: 0 psf	Phi: 25 °	Phi-B: 0 °



San Miguel Ash Pond Section B-B.gsz
SEEP/W Analysis - Normal Operating Pool
11/20/2012

Computed By: GRA

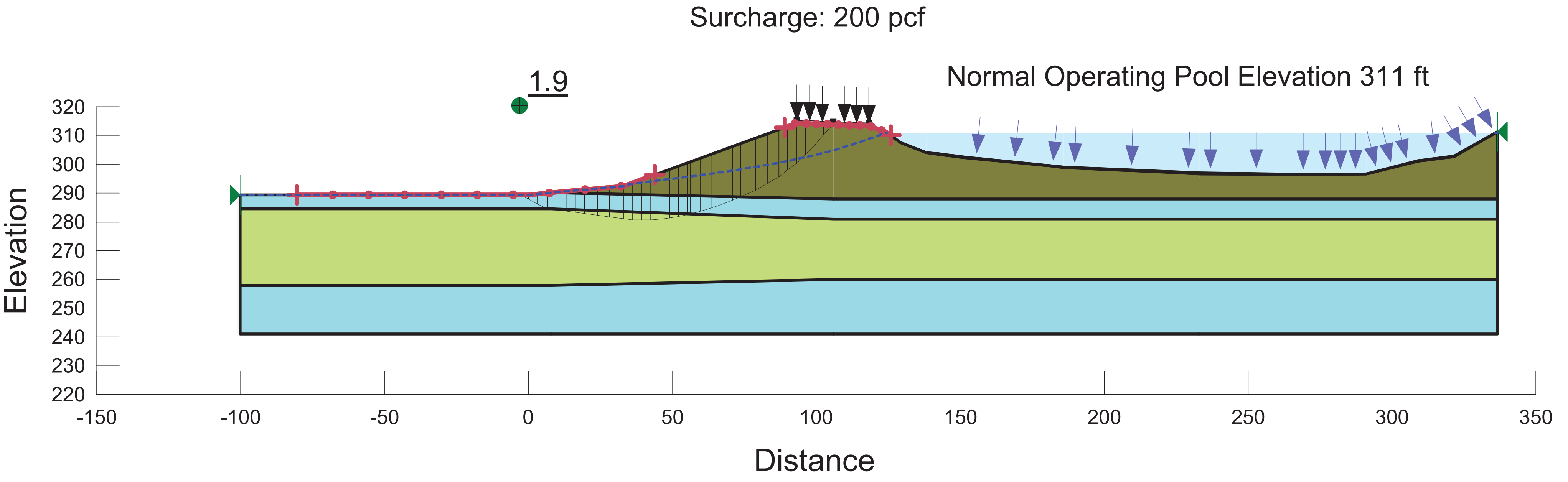
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: (CL-SC) - S	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Blanket	Model: Saturated Only	K-Sat: 0.00033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Ash Pond Section B-B.gsz
Steady State Seepage - Entry Exit A
11/20/2012

Computed By: GRA

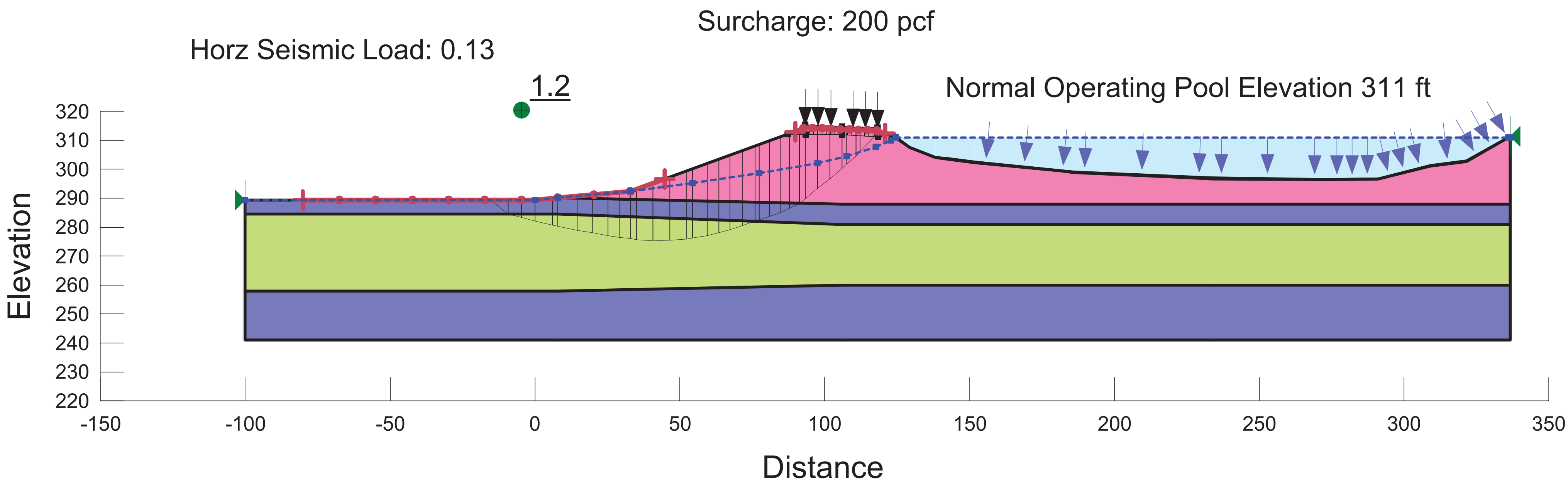
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: (CL-SC) - S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 200 psf	Phi: 24 °	Phi-B: 0 °
Name: Clay Nat/Fill - S	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 288 psf	Phi: 20.3 °	Phi-B: 0 °
Name: Blanket	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf		



San Miguel Ash Pond Section B-B.gsz
Seismic - Entry Exit A
11/20/2012

Computed By: GRA

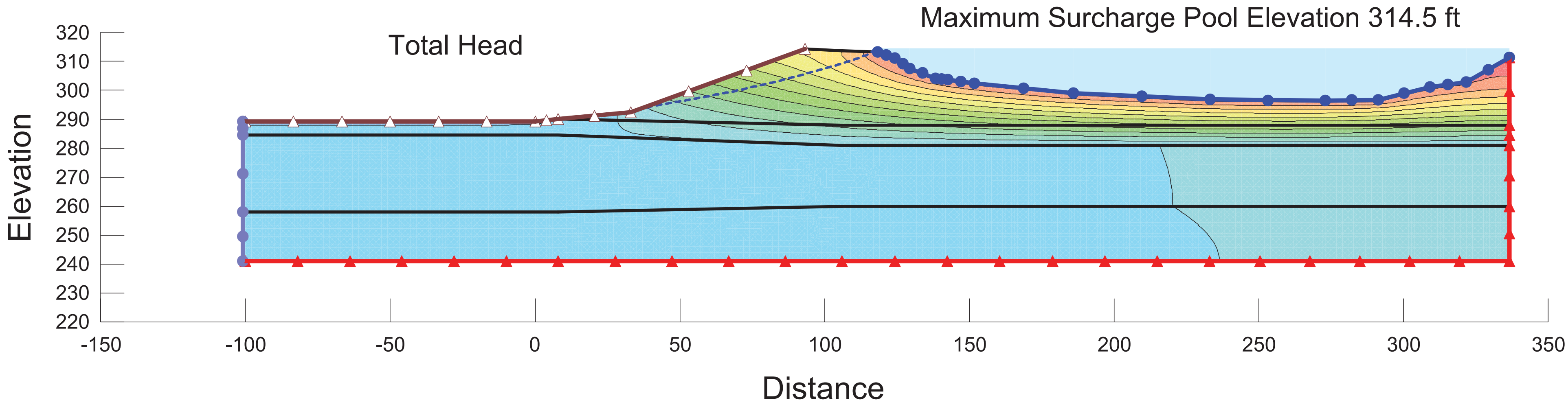
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: (CL-SC) - U	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 1000 psf	Phi: 0 °	Phi-B: 0 °	
Name: Blanket	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



San Miguel Ash Pond Section B-B.gsz
SEEP/W Analysis - Maximum Surcharge Pool
11/20/2012

Computed By: GRA

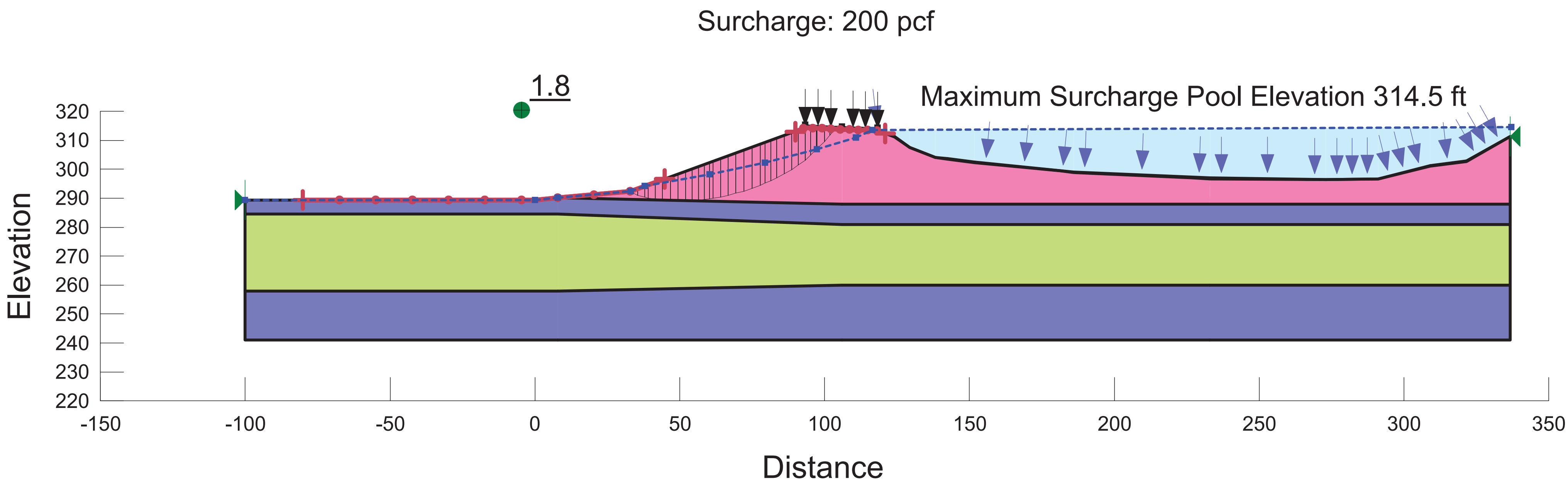
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: (CL-SC) - S	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Blanket	Model: Saturated Only	K-Sat: 0.00033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Ash Pond Section B-B.gsz
Maximum Surcharge Pool - Entry Exit A
11/20/2012

Computed By: GRA

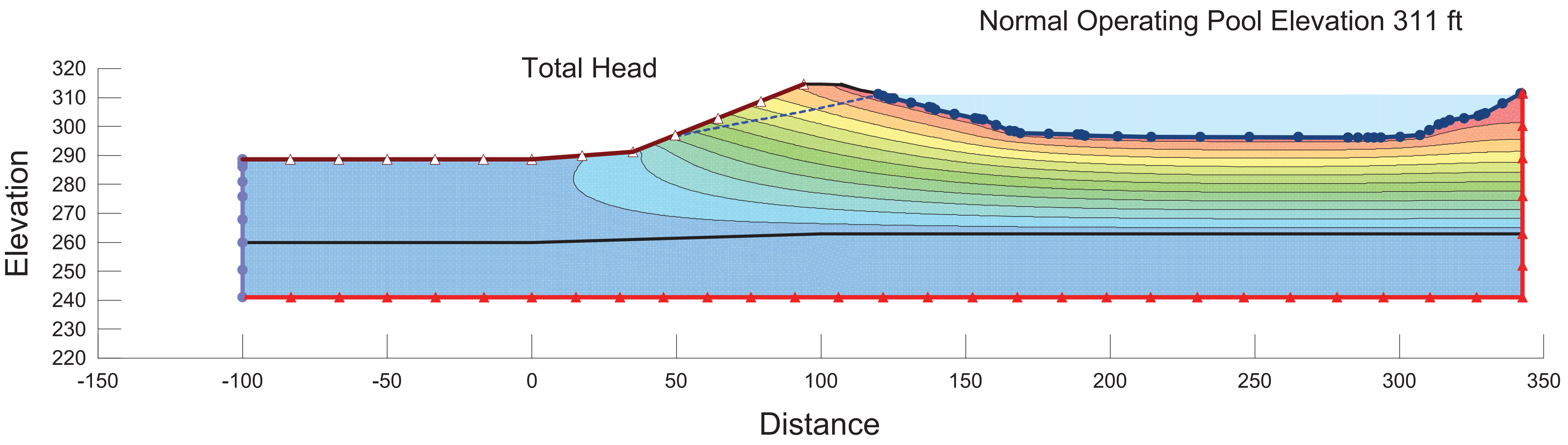
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: (CL-SC) - U	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 1000 psf	Phi: 0 °	Phi-B: 0 °	
Name: Blanket	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



San Miguel Ash Pond Section C-C.gsz
SEEP/W Analysis - Normal Operating Pool
11/20/2012

Computed By: GRA

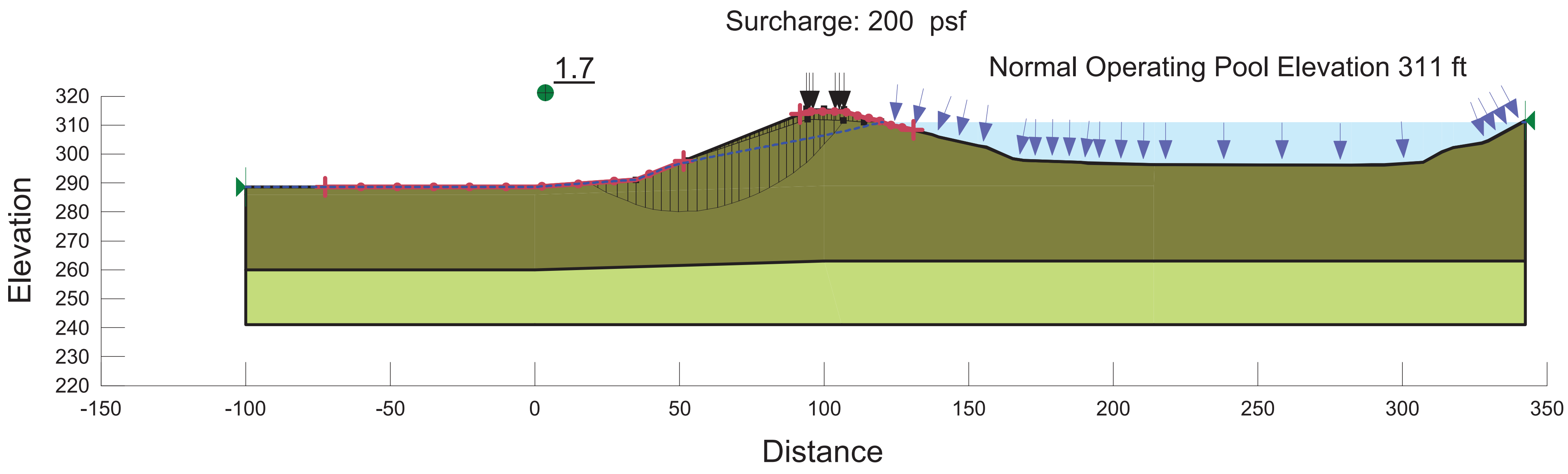
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 7e-009 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Surficial	Model: Saturated Only	K-Sat: 0.00033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Ash Pond Section C-C.gsz
Steady State Seepage - Entry Exit A
11/20/2012

Computed By: GRA

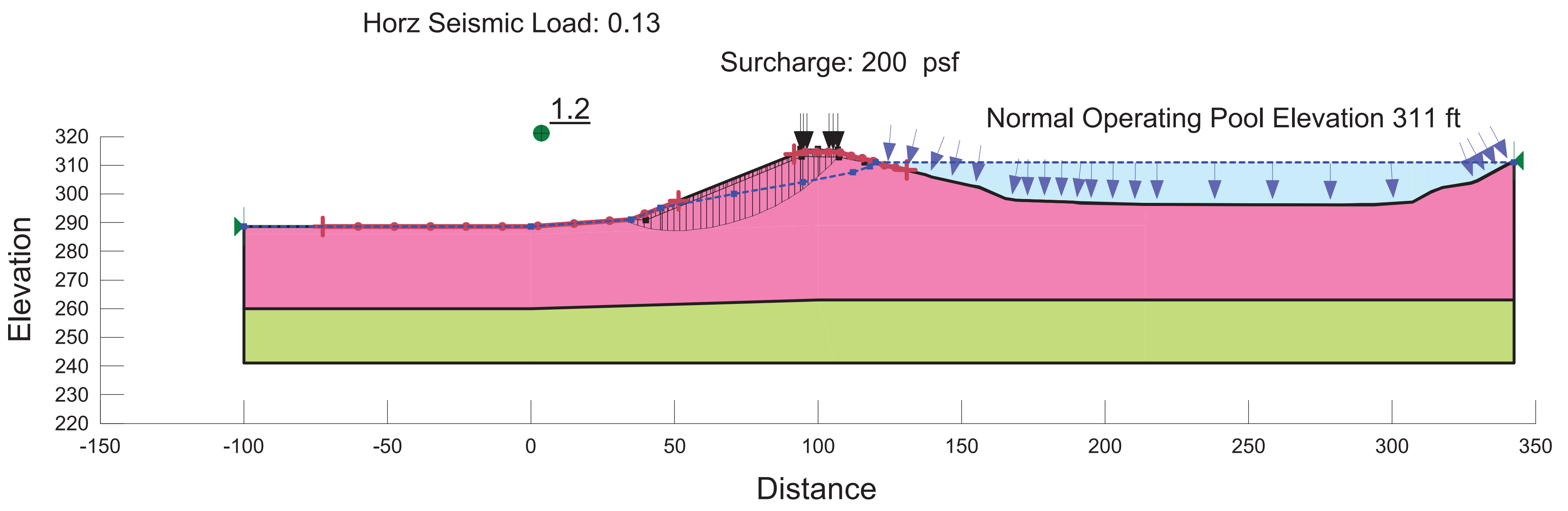
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: Clay Nat/Fill - S	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 288 psf	Phi: 20.3 °	Phi-B: 0 °
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf		



San Miguel Ash Pond Section C-C.gsz
Seismic - Entry Exit A
11/20/2012

Computed By: GRA

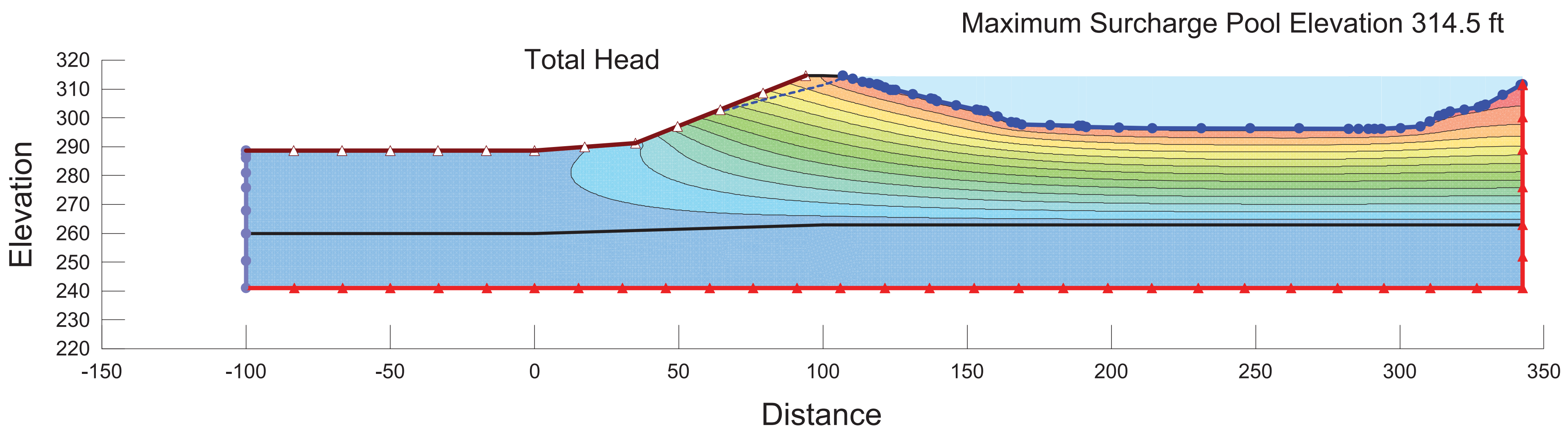
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



San Miguel Ash Pond Section C-C.gsz
SEEP/W Analysis - Maximum Surcharge Pool
11/20/2012

Computed By: GRA

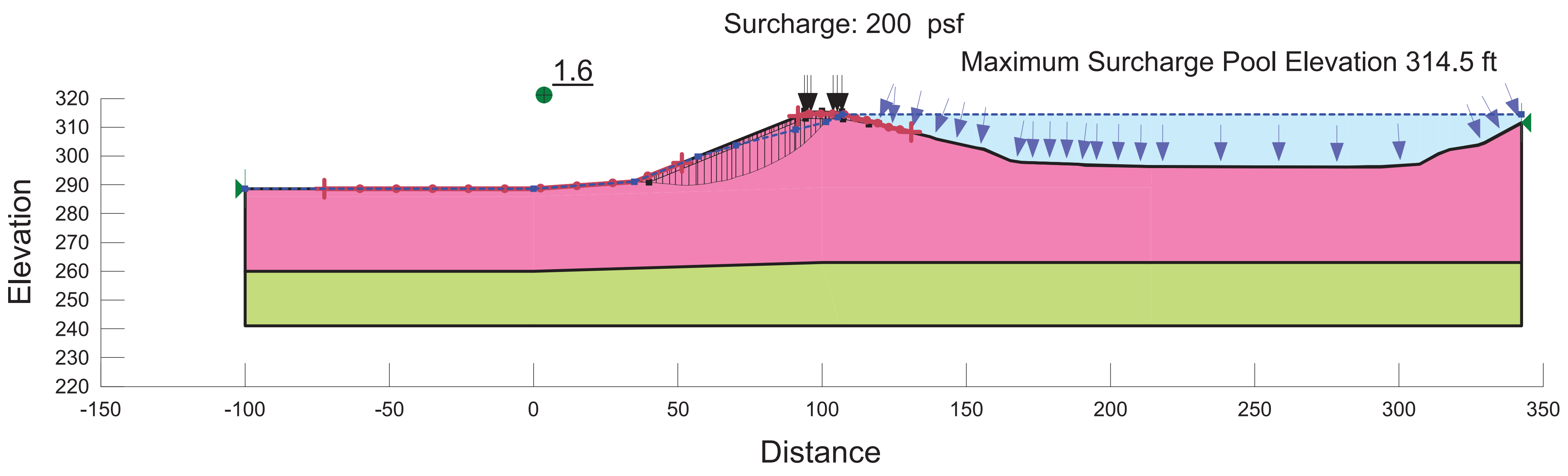
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 7e-009 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Surficial	Model: Saturated Only	K-Sat: 0.00033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Ash Pond Section C-C.gsz
Maximum Surcharge Pool - Entry Exit A
11/20/2012

Computed By: GRA

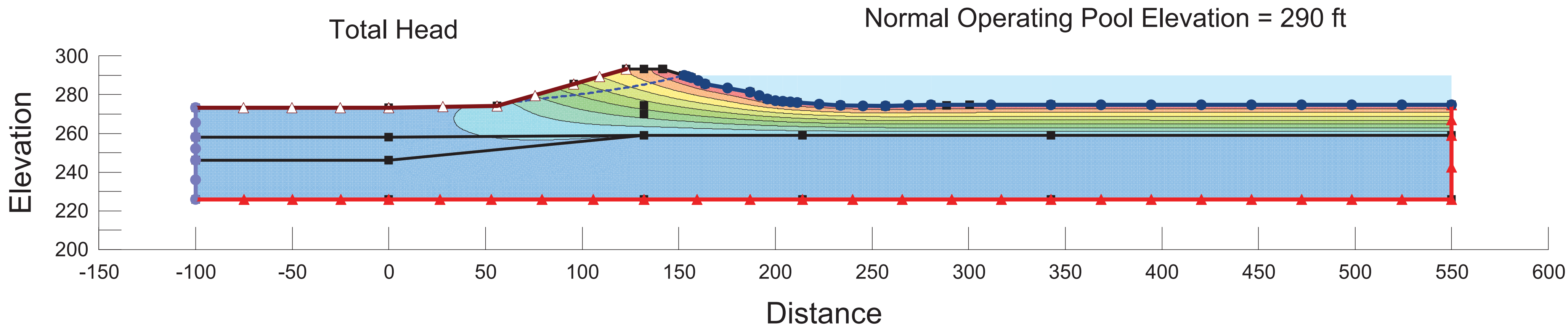
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



San Miguel Sludge Pond Section D-D.gsz
SEEP/W Analysis - Normal Operating Pool
11/20/2012

Computed By: GRA

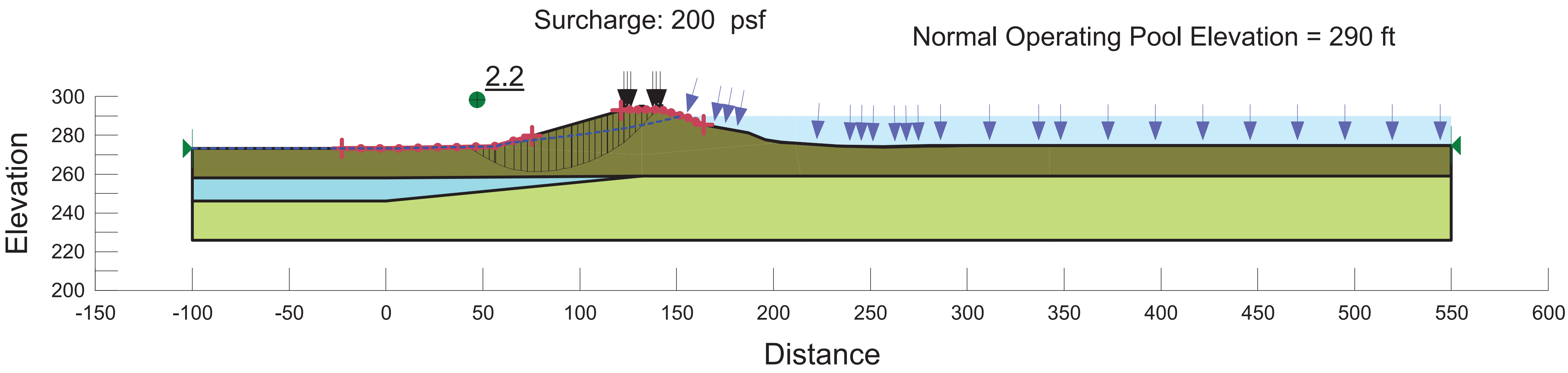
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: (CL-SC) - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Clay Nat/Fill - S	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Surficial	Model: Saturated Only	K-Sat: 0.0033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Sludge Pond Section D-D.gsz
Steady State Seepage - Entry Exit A
11/20/2012

Computed By: GRA

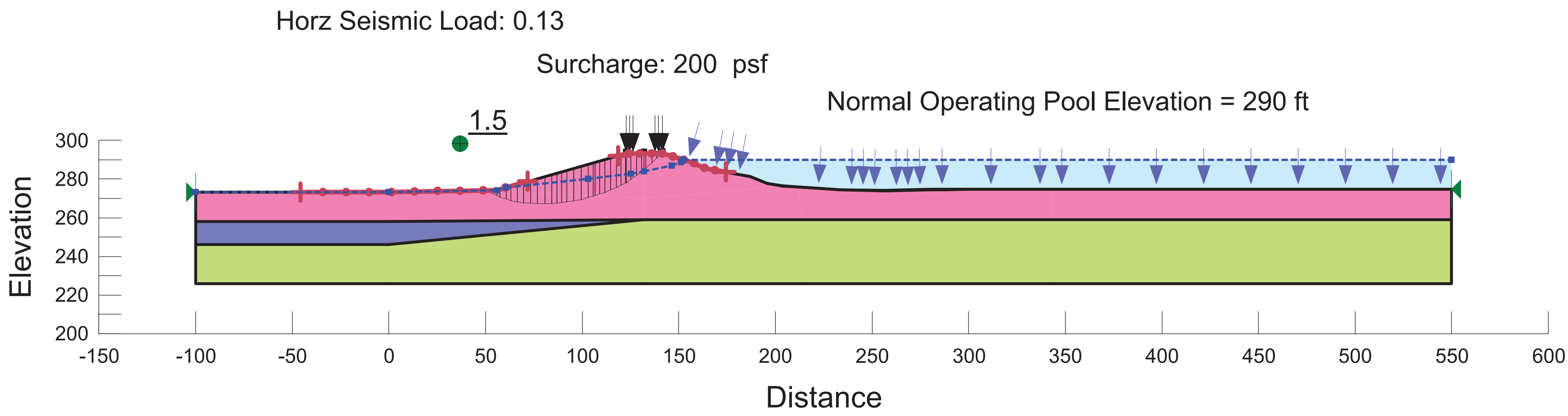
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: (CL-SC) - S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 200 psf	Phi: 24 °	Phi-B: 0 °
Name: Clay Nat/Fill - S	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 288 psf	Phi: 20.3 °	Phi-B: 0 °
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf		



San Miguel Sludge Pond Section D-D.gsz
Seismic - Entry Exit A
11/20/2012

Computed By: GRA

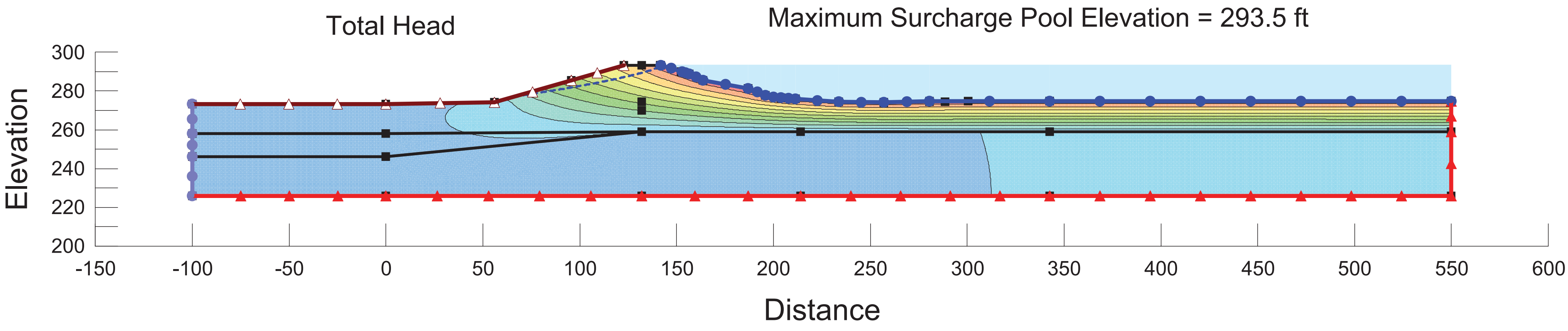
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: (CL-SC) - U	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 1000 psf	Phi: 0 °	Phi-B: 0 °	
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



San Miguel Sludge Pond Section D-D.gsz
SEEP/W Analysis - Maximum Surcharge Pool
11/20/2012

Computed By: GRA

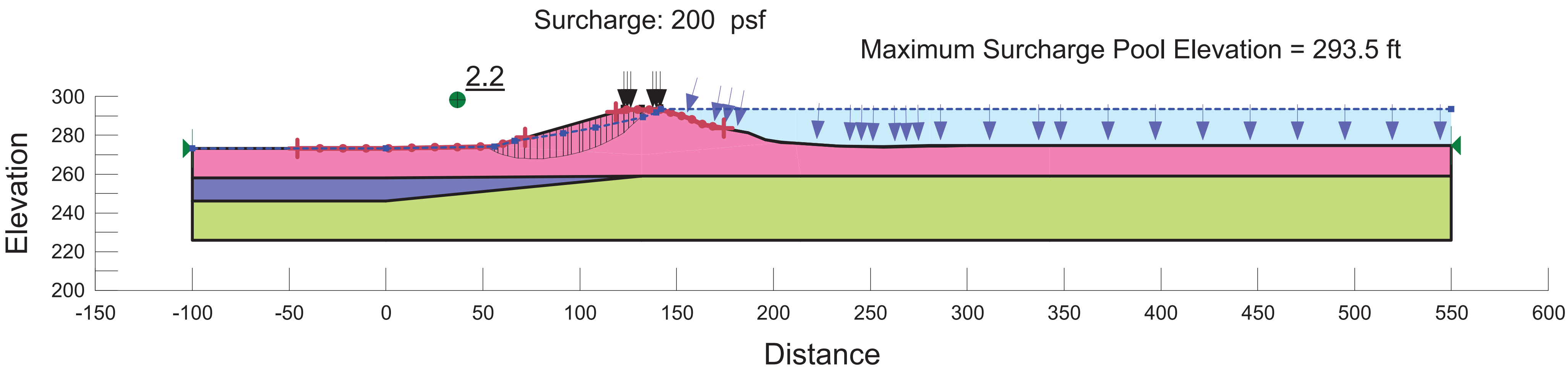
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft^3/ft^3	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: (CL-SC) - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft^3/ft^3	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Clay Nat/Fill - S	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft^3/ft^3	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Surficial	Model: Saturated Only	K-Sat: 0.0033 ft/sec	Volumetric Water Content: 0 ft^3/ft^3	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Sludge Pond Section D-D.gsz
Maximum Surcharge Pool - Entry Exit A
11/20/2012

Computed By: GRA

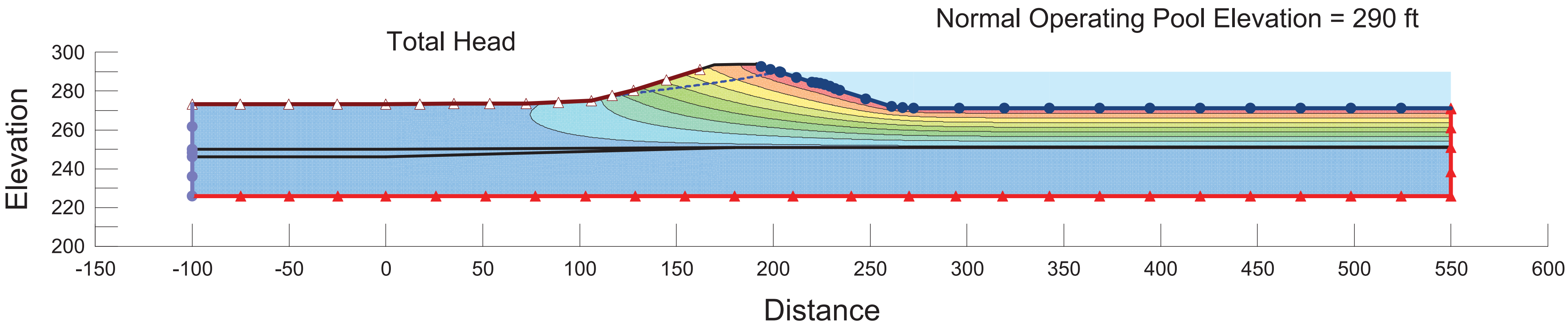
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: (CL-SC) - U	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 1000 psf	Phi: 0 °	Phi-B: 0 °	
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



San Miguel Sludge Pond Section E-E.gsz
SEEP/W Analysis - Normal Operating Pool
11/20/2012

Computed By: GRA

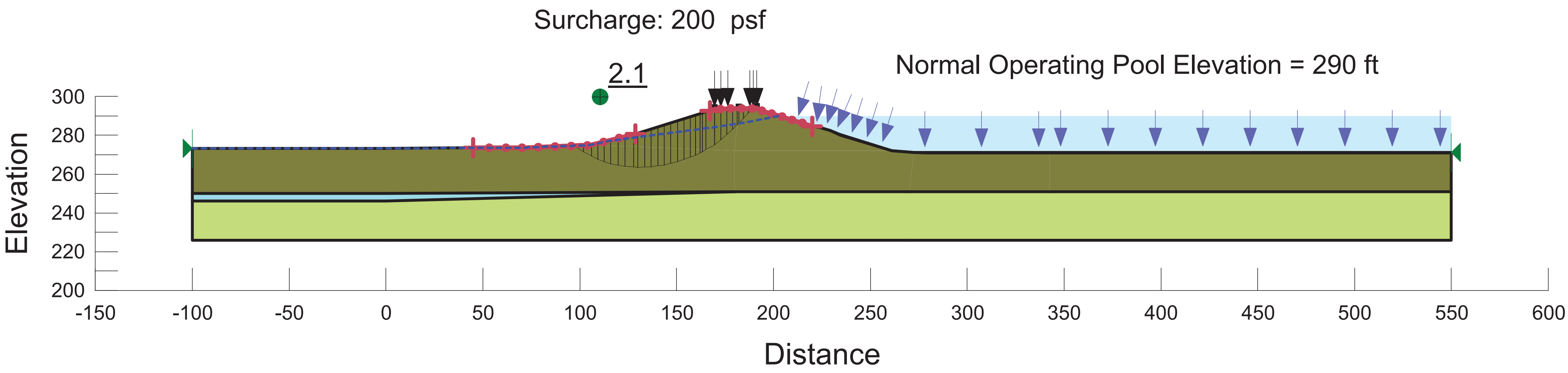
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 7e-009 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: (CL-SC) - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Surficial	Model: Saturated Only	K-Sat: 0.0033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Sludge Pond Section E-E.gsz
Steady State Seepage - Entry Exit A
11/20/2012

Computed By: GRA

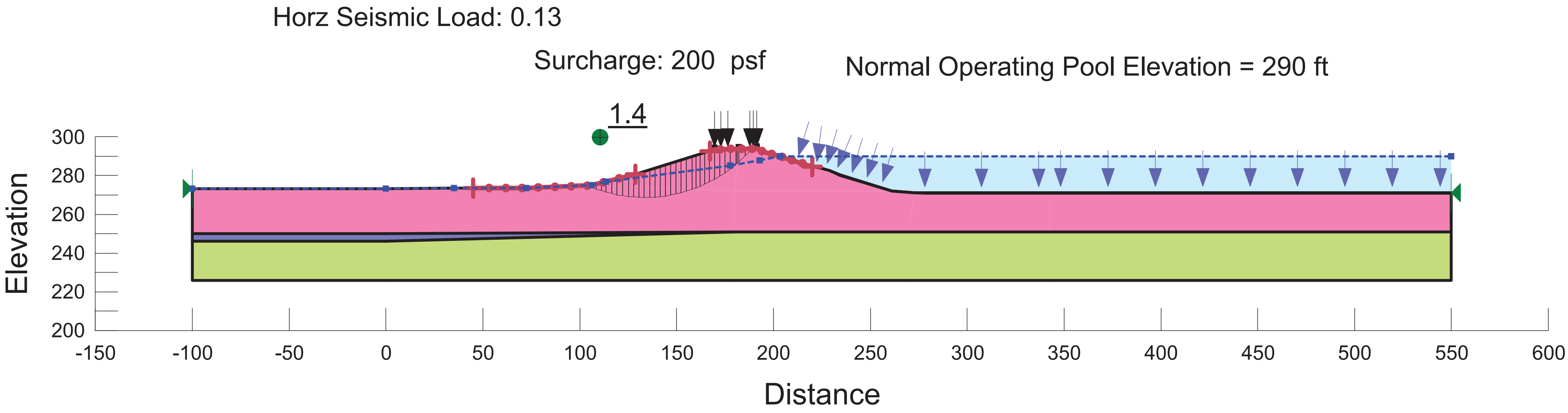
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °
Name: (CL-SC) - S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 200 psf	Phi: 24 °	Phi-B: 0 °
Name: Clay Nat/Fill - S	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 288 psf	Phi: 20.3 °	Phi-B: 0 °
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf		



San Miguel Sludge Pond Section E-E.gsz
Seismic - Entry Exit A
11/20/2012

Computed By: GRA

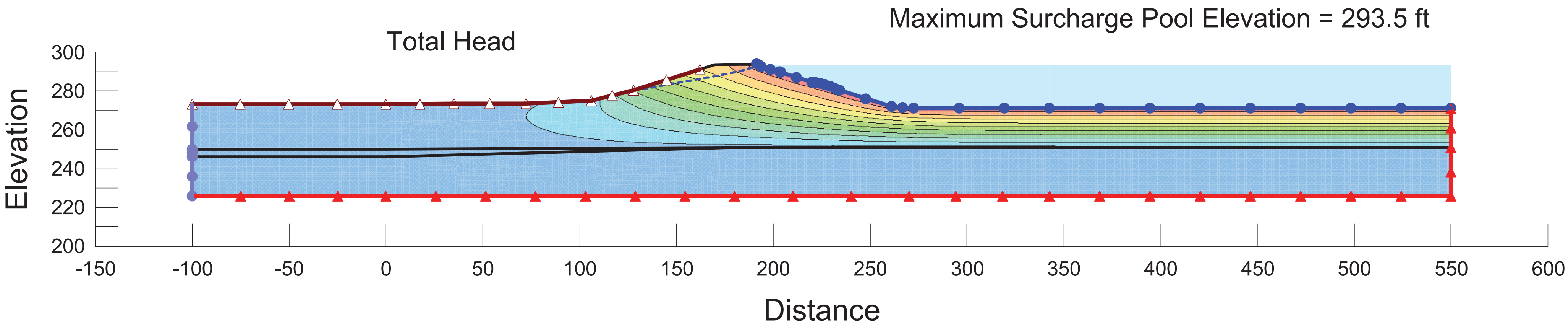
Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: (CL-SC) - U	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 1000 psf	Phi: 0 °	Phi-B: 0 °	Piezometric Line: 1
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



San Miguel Sludge Pond Section E-E.gsz
SEEP/W Analysis - Maximum Surcharge Pool
11/20/2012

Computed By: GRA

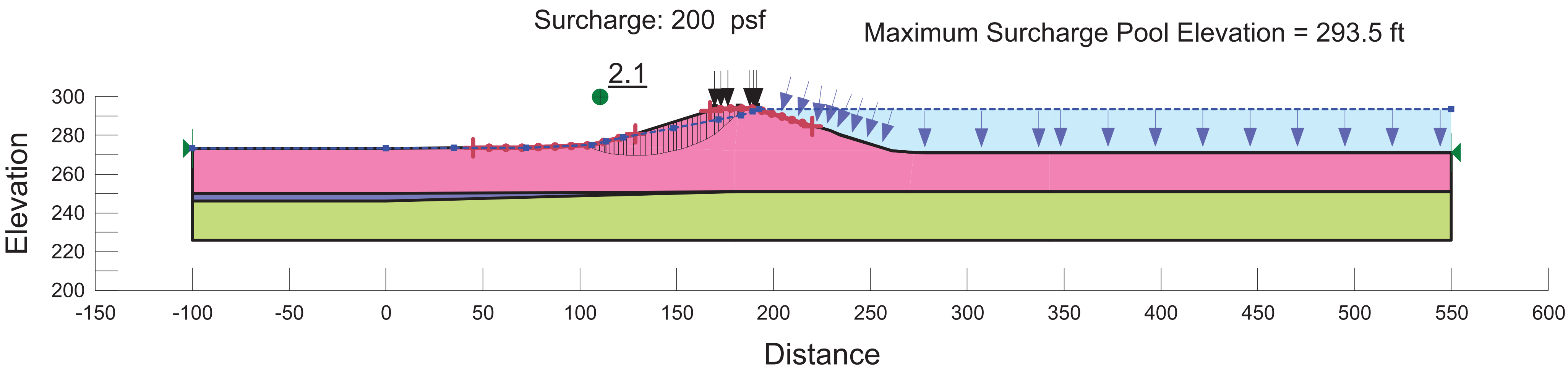
Name: (SM-ML) - U,S	Model: Saturated Only	K-Sat: 3.3e-005 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.4	K-Direction: 0 °
Name: Clay Nat/Fill - U	Model: Saturated Only	K-Sat: 7e-009 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: (CL-SC) - U	Model: Saturated Only	K-Sat: 3.3e-008 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 0.1	K-Direction: 0 °
Name: Surficial	Model: Saturated Only	K-Sat: 0.0033 ft/sec	Volumetric Water Content: 0 ft³/ft³	Mv: 0 /psf	K-Ratio: 1	K-Direction: 0 °



San Miguel Sludge Pond Section E-E.gsz
Maximum Surchage Pool - Entry Exit A
11/20/2012

Computed By: GRA

Name: (SM-ML) - U,S	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 30 °	Phi-B: 0 °	Piezometric Line: 1
Name: Clay Nat/Fill - U	Model: Mohr-Coulomb	Unit Weight: 112 pcf	Cohesion: 216 psf	Phi: 17.2 °	Phi-B: 0 °	
Name: (CL-SC) - U	Model: Mohr-Coulomb	Unit Weight: 120 pcf	Cohesion: 1000 psf	Phi: 0 °	Phi-B: 0 °	Piezometric Line: 1
Name: Surficial	Model: Undrained (Phi=0)	Unit Weight: 1 pcf	Cohesion: 1 psf	Piezometric Line: 1		



APPENDIX G: 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 C

USEPA Checklists

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: San Miguel
Date: 08/30/2012
Unit Name: Ash Water Transport Pond
Operator's Name: San Miguel
Unit I.D.:
Hazard Potential Classification: High [✓ Significant] Low
Inspector's Name: Jamal Daas, Bevin Barringer

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Weekly		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	313.5		19. Major erosion or slope deterioration?	X	
3. Decant inlet elevation (operator records)?	305.0		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	315.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	See	Note	Is water exiting outlet flowing clear?	See	Note
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	X		From underdrain?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?	X	
10. Cracks or scarps on crest?	X		At natural hillside in the embankment area?	X	
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A;See	Note	From downstream foundation area?	X	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?	X	
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

6.Water level is measured six times daily from a float referenced to 18" freeboard.

9.Largest tree approximately 3 inches in diameter.

10.Tension cracks observed on east embankment crest.

12.Outlet piping was submerged. No trashracks were observed.

17.Erosion rills located on south embankment interior slope.

19.Slope erosion into crest at east embankment interior slope, due to nearby pipe leakage. Pipe had been repaired at the time of assessment.

20. Outlet pipe submerged so outlet could not be observed, but water was being siphoned out of the pond.

21. Area of ponded water and change in vegetation located on west embankment exterior toe.

23. Coal pile runoff pond located downstream of west embankment.

N/A = Not Available
DNA = Does Not Apply

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # N/A

INSPECTOR Jamal Daas, Bevin Barringer

Date 08/30/12

Impoundment Name Ash Water Transport Pond

Impoundment Company San Miguel Electric Cooperative, Inc

EPA Region 6

State Agency (Field Office) Addresss Texas Commission on Environmental Quality
12110 Park 35 Circle, Austin, TX 78753

Name of Impoundment Ash Water Transport Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Stores water from ash dewatering bins, cooling tower blowdown, plant sumps, and sludge basin

Nearest Downstream Town : Name Whitsett, TX

Distance from the impoundment 13 miles

Impoundment Location:

Longitude 98 Degrees 28 Minutes 30 Seconds

Latitude 28 Degrees 42 Minutes 00 Seconds

State TX County Atascosa

Does a state agency regulate this impoundment? YES X NO

If So Which State Agency? Texas Commission on Environmental Quality

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

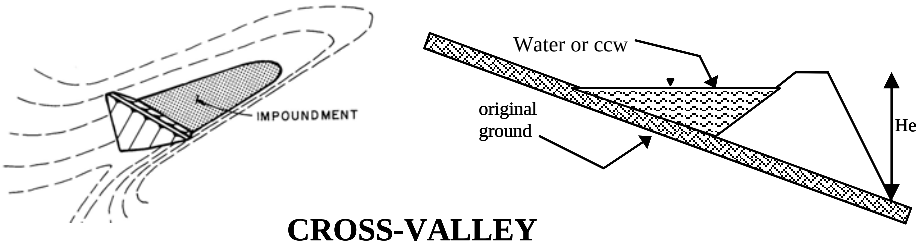
______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

__X___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

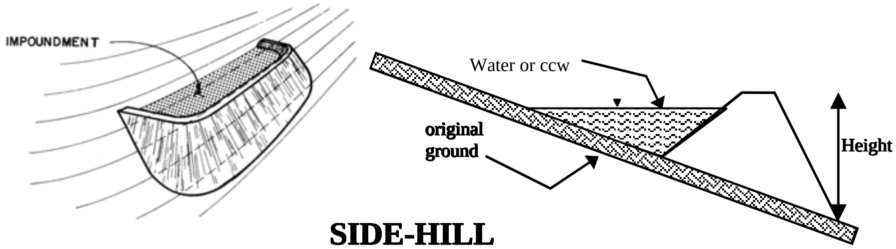
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:
Failure or misoperation of the impoundment would result in economic loss and environmental damage. Impoundment is located near facility boundary. Discharge would likely flow towards the normally dry creeks located south of the impoundment and onto adjacent property. Portions of the adjacent property are used for cattle grazing and other is leased by the local mining company. The creeks adjacent to the Plant discharge to La Parita Creek, approximately 4.2 stream miles from the Plant. La Parita Creek flow ultimately enter the Atascosa River, situated approximately 16.5 stream miles from the Plant. Also, structures supporting high Voltage overhead power line could be impacted by failure of impoundment.

CONFIGURATION:

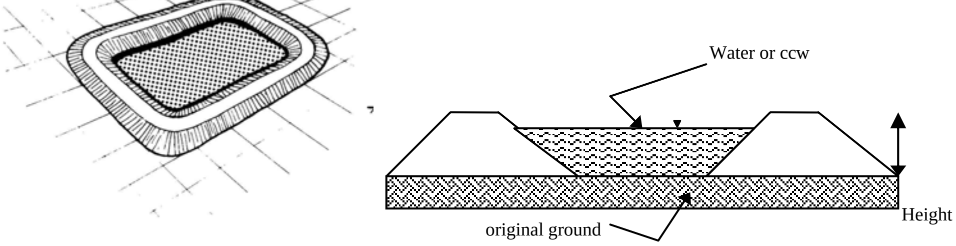


CROSS-VALLEY

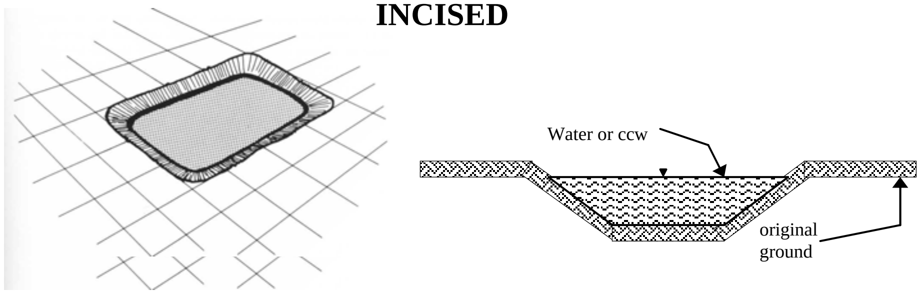


SIDE-HILL

DIKED



INCISED



______ Cross-Valley

__X__ Side-Hill

______ Diked

______ Incised (form completion optional)

______ Combination Incised/Diked

Embankment Height 20 feet Embankment Material Clay

Pool Area 30.5 acres Liner 3-foot-thick clay liner

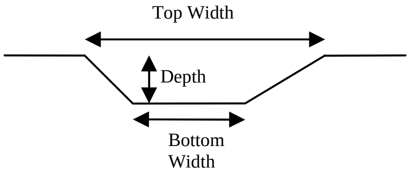
Current Freeboard 1.5 feet Liner Permeability 1x10-7 cm/sec

TYPE OF OUTLET (Mark all that apply)

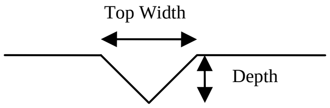
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

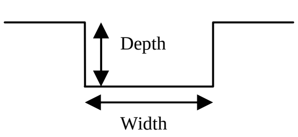
TRAPEZOIDAL



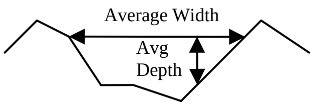
TRIANGULAR



RECTANGULAR

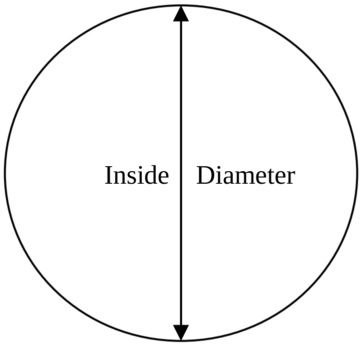


IRREGULAR



__X__ **Outlet**

_30"_ inside diameter



Material
_____ corrugated metal
__X__ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES __X__ NO _______

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By _Tippett & Gee, Inc., San Antonio_
____

Has there ever been a failure at this site? YES ____________ NO X

If So When? ______________________________

If So Please Describe : ______________________________

Has there ever been significant seepages at this site? YES X NO

If So When? 1983 and presently

IF So Please Describe:

I 1983 leakage was observed by the Texas Department of Water Resources (TDWR) during a routine inspection. Leaking was observed on the west and east embankment exterior slopes. An assessment was done and the liner was reconstructed in 1984. The top 2 feet of liner was removed, then the remaining 12" of clay liner was scarified and new liner was constructed.

During our assessment ponded water was observed at the toe of the west embankment exterior slope. The water appeared to be clear no apparent sloughs were observed near the suspected seepage location. A change in vegetation was observed near the ponded water. The owner was not aware of the problem and he was alerted that the suspected seepage should be investigated.

Has there ever been any measures undertaken to monitor/lower
Phreatic water table levels based on past seepages or breaches
at this site? YES _________NO ___x____

If so, which method (e.g., piezometers, gw pumping,...)? ______________________

If so Please Describe : ____

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

It does not appear the Ash Pond embankments were constructed over wet ash, slag or other unsuitable materials. Soil borings performed in 1978 indicate the existing subsurface soils, in the vicinity of th Ash Pond, consist of stiff to hard clay with various amounts of silt and sand underlain by a layer of dense to very dense clayey fine sand and sandy silt. Boring logs from a subsurface investigation completed in 2012 indicate similar soils were encountered.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

The assessor did not meet with, or have documentation from the design Engineer of Record concerning foundation preparation.

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

Major rehabilitation of the Ash Pond embankments was completed in 1983. The work was performed to address seepage observed by the Texas Department of Water Resources. Rehabilitation included recompacting the top 2 feet of embankment fill on interior embankment slopes of the Ash Pond to obtain a permeability of less than 1x10-7 cm/second. There were no other indications of prior releases, failures or patchwork on the embankments.

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: San Miguel	Date: 08/30/2012
Unit Name: Sludge Disposal Basin	Operator's Name: San Miguel Electric Coop
Unit I.D.:	Hazard Potential Classification: High [✓ Significant] Low
Inspector's Name: Jamal Daas, Bevin Barringer	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Weekly		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	287.0		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	See Note		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	X	
5. Lowest dam crest elevation (operator records)?	295.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	See	Note	Is water exiting outlet flowing clear?	DNA	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	X		From underdrain?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?	X		At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place? N/A;	See	Note	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked? N/A;	See	Note	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

3. Two oulets in pond. One near SW corner includes a 6-in-dia rubber pipe with invert El 290 ft. One near SE corner includes a 6-in-dia PVC pipe with unknow invert elevation, inlet was submerged during assessment.

6. Water levels are manually measured six times daily from a float referenced to 18" freeboard.

9. Largest tree approximately 3 inches in diameter.

12. Trashracks were not observed at either decant pipe

16.Oulet at SW corner includes a submersible pump which was above the water level during assessment. Outlet near SE was below the water level and pump located on crest was not turned on.

17. Erosion rills on west embankment interior slope.

23. West embankment is common to waterwell pond

N/A = Not Available
DNA = Does Not Apply

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # N/A

INSPECTOR Jamal Daas, Bevin Barringer

Date 08/30/12

Impoundment Name Sludge Disposal Basin

Impoundment Company San Miguel Electric Cooperative, Inc

EPA Region 6

State Agency (Field Office) Addresss Texas Commission on Environmental Quality
12110 Park 35 Circle, Austin, TX 78753

Name of Impoundment Sludge Disposal Basin

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update __________

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Stores scrubber discharge, plant sewage, stormwater, and outflow from ash water pond

Nearest Downstream Town : Name Whitsett, TX

Distance from the impoundment 13 miles

Impoundment

Location: Longitude 98 Degrees 28 Minutes 30 Seconds
Latitude 28 Degrees 42 Minutes 00 Seconds
State TX County Atascosa

Does a state agency regulate this impoundment? YES X NO ______

If So Which State Agency? Texas Commission on Environmental Quality

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

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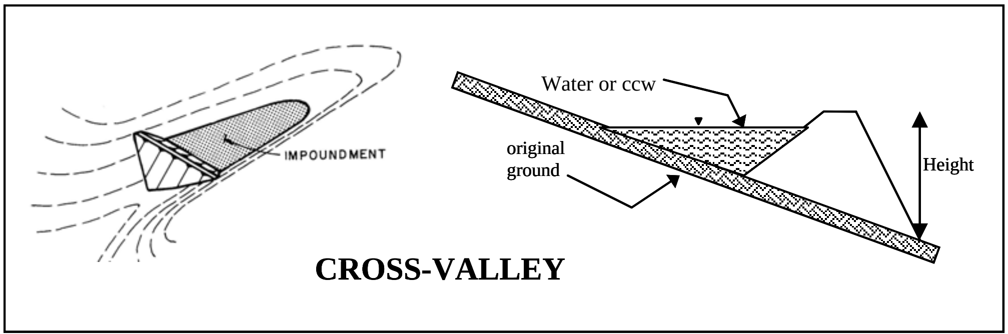
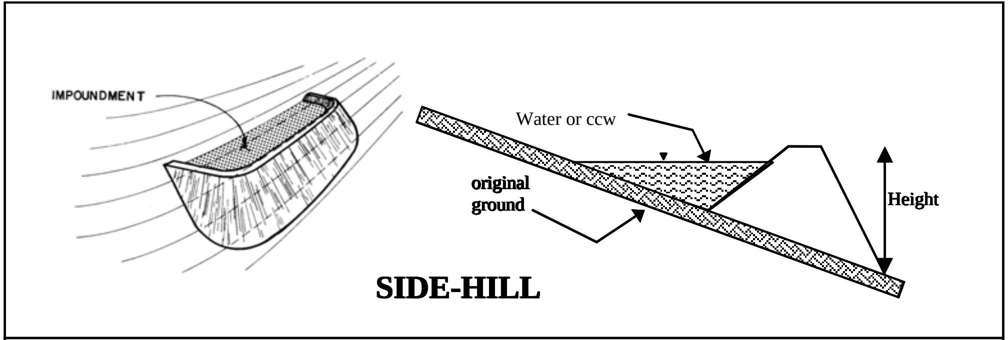
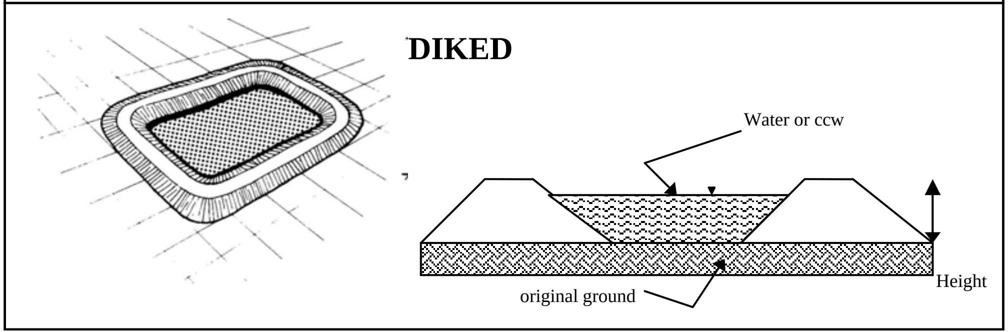
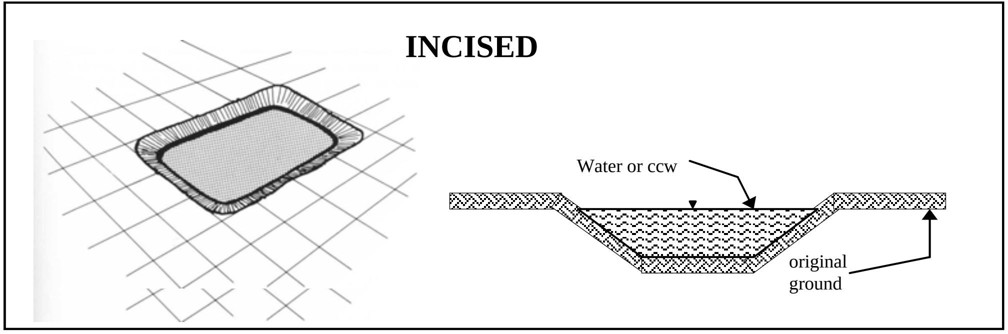
CONFIGURATION:









______ Cross-Valley

______ Side-Hill

__X__ Diked

______ Incised (form completion optional)

______ Combination Incised/Diked

Embankment Height 30 feet Embankment Material Clay

Pool Area 26.5 acres Liner 3-foot-thick clay liner

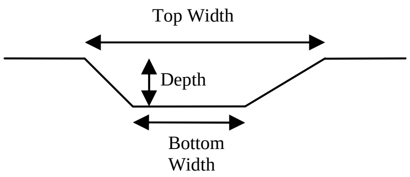
Current Freeboard 8 feet Liner Permeability 1x10-7 cm/sec

TYPE OF OUTLET (Mark all that apply)

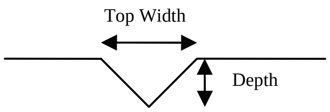
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

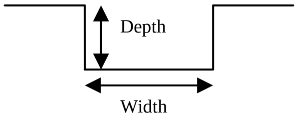
TRAPEZOIDAL



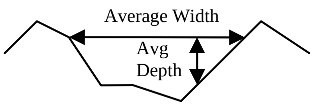
TRIANGULAR



RECTANGULAR

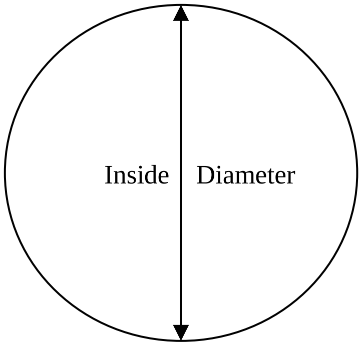


IRREGULAR



__X__ **Outlet**

_30"_ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_18"_ plastic (hdpe, pvc, etc.)
_18"_ other (specify) ______________________

Is water flowing through the outlet? YES _______ NO __X__

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ____________________________________

The Impoundment was Designed By Tippett & Gee, Inc., San Antonio
____

Has there ever been a failure at this site? YES ___________ NO X

If So When? ______________________________

If So Please Describe : ______________________________

Has there ever been significant seepages at this site? YES ________ NO __X______

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO ___x____

If so, which method (e.g., piezometers, gw pumping,...)? ______________________

If so Please Describe : ____

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

It does not appear the Sludge Basin embankments were constructed over wet ash, slag, or other unsuitable materials. Soil borings performed in the vicinity of the Sludge Basin found soils consisting of stiff to hard clay with various amounts of silt and sand underlain by a layer of dense to very dense clayey fine sand and sandy silt. Boring logs from a subsurface investigation completed in 2012 indicate similar soils were encountered.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

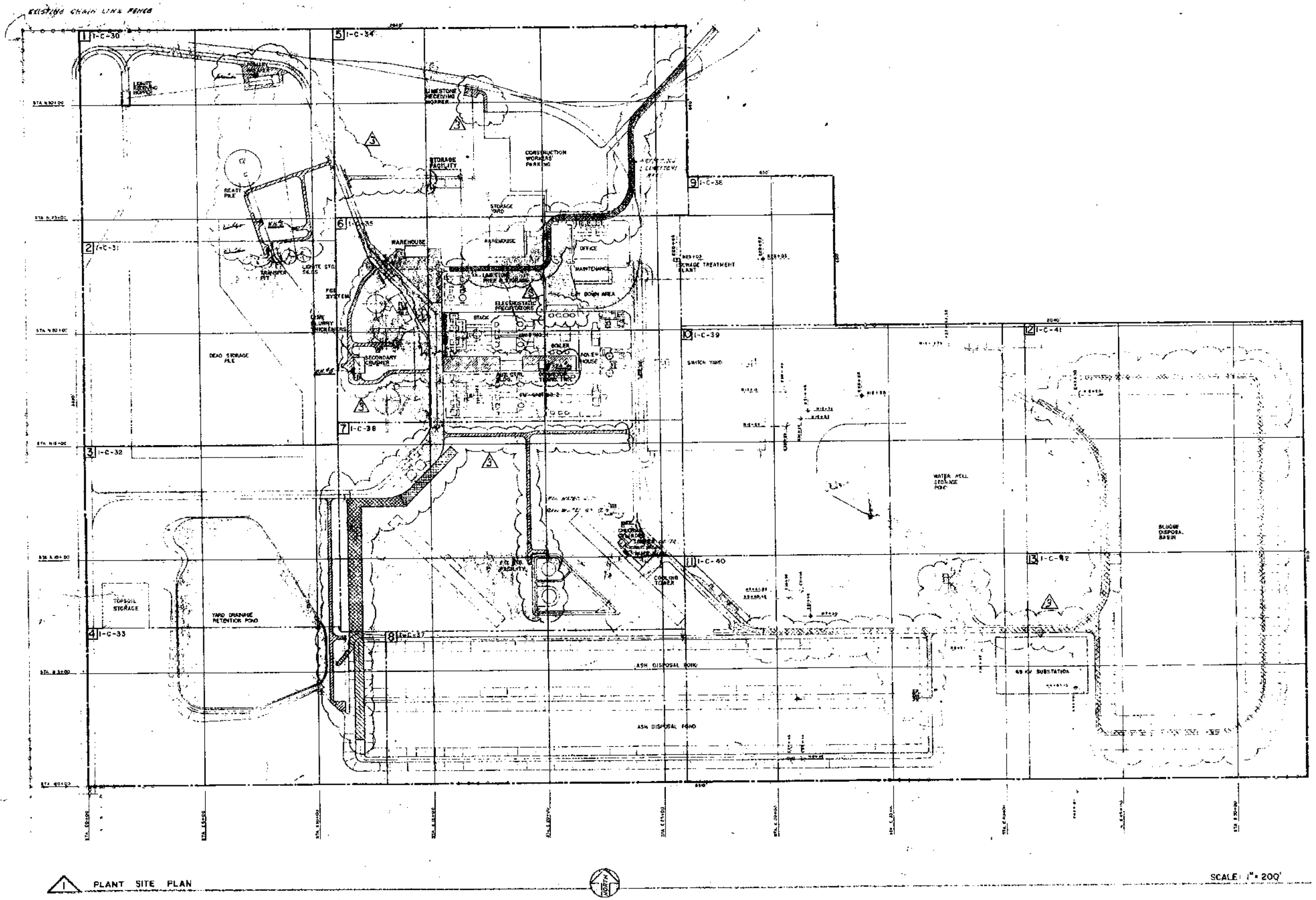
The assessor did not meet with, or have documentation from the design Engineer of Record concerning foundation preparation.

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

There was no indication of prior releases, failures or patchwork on the embankments.

Appendix D

Documentation from San Miguel



1 PLANT SITE PLAN

SCALE: 1" = 200'

2 VICINITY MAP

NO SCALE

LEGEND

	EXISTING CONTOURS, EXISTING STRUCTURES
	FINISH CONTOURS, FINISH [illegible]
	PAVING & BASE AS SPEC. THIS CONTRACT
	TYPE "A" FLEX. BASE ROADS BY THIS CONTRACTOR
	EXISTING TYPE "A" FLEX. BASE ROADS
	ASPHALT PAVING ON EXISTING BASE
	CONCRETE PAVING & BASE AS SPEC. THIS CONTRACT

3

REV	DATE	BY	DESCRIPTION
A	5-18-77	NL	REVISED PER ADDENDUM NO. 1
B	7-?-77		REVISED PER ADDENDUM NO. 4
0	8-15-77		FINAL BID SET
1	[illegible]	R.L.K.	EXTENDED ROAD AT WAREHOUSE
2	[illegible]	LW	CORRECTED [illegible] ACRES W/OTHER DWGS. ADDED [illegible]
3	[illegible]	WB	ADD TYPE "A" FLEX. BASE ROAD, NOTED EXISTING FLEX. BASE RDS. REV. LEGEND & ADDED SOUTH OF BOILER SLAB.

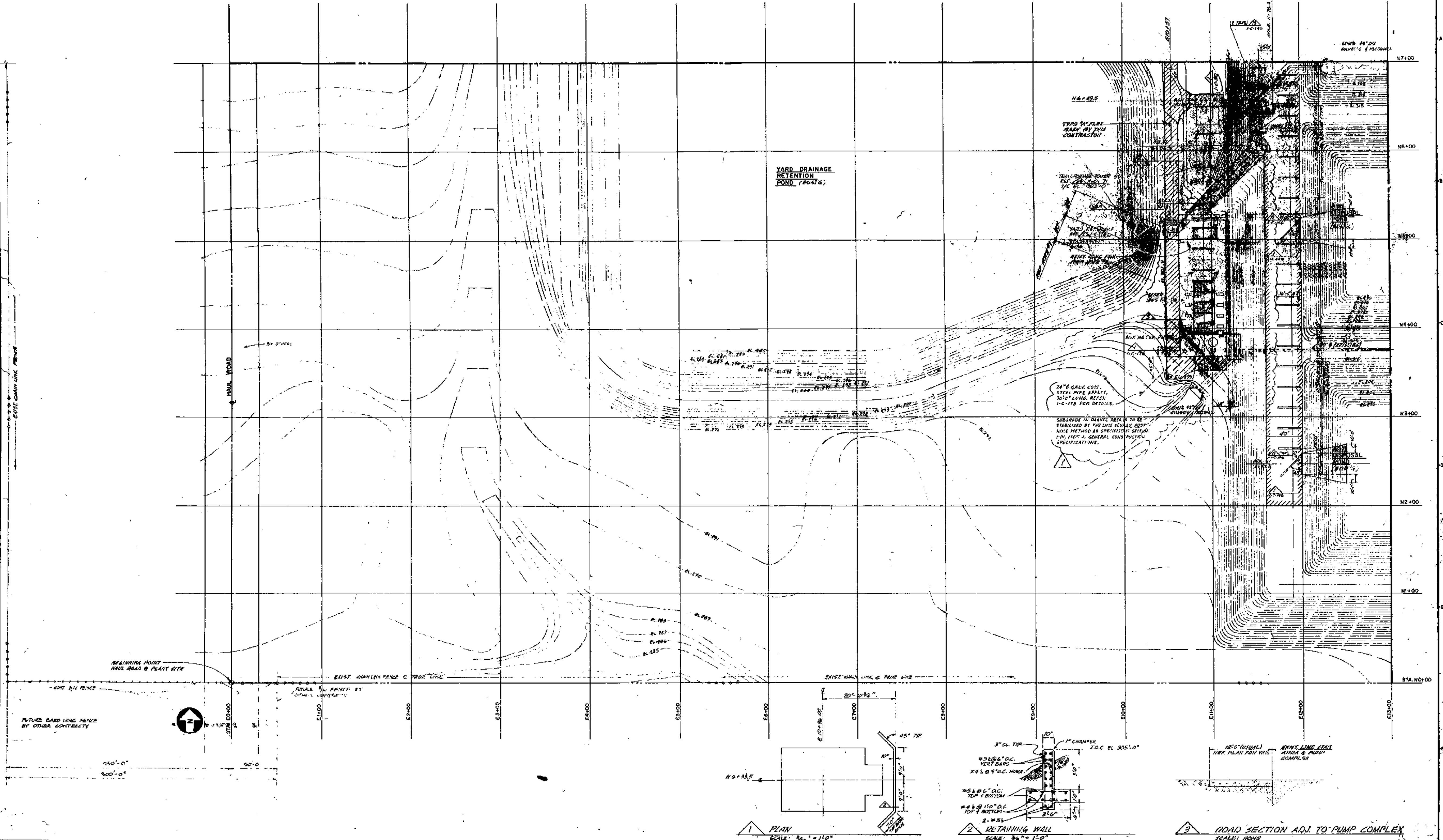
SCALE AS NOTED
DRAWN [illegible]
DATE 4-1-77
CHECKED C.A.J.
APPROVED [illegible]

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

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

PLANT SITE PLAN
AND
VICINITY MAP

JOB NO. SM-406
REV. 3
DRAWING NUMBER 1-0-1-C



1 PLAN
SCALE: 3/32" = 1'-0"

2 RETAINING WALL
SCALE: 3/8" = 1'-0"

3 ROAD SECTION ADJ. TO PUMP COMPLEX
SCALE: NONE

NOTES

1. THIS CONTRACTOR TO FURNISH & INSTALL 12" RIPRAP ALONG SLOPE AROUND CONC. PUMP SUPPORT STRUCT. AS SHOWN. RIPRAP SHALL EXTEND FULL HT. OF SLOPE EL. 285' TO EL. 300'.
2. EXISTING CONC. FOUNDATION TO BE REMOVED TO TOP OF PIER, EL. 299'-0"

REV.	DATE	BY	DESCRIPTION
6	4-14-80	JB	REV. CONTOURS @ YARD RETENTION POND, ADDED TYPE "A" FLEX BASE ROAD, INDICATED FLEX BASE BY THIS CONTR. @ ASH POND DIKE, DEFINED & NOTED AREA TO RECEIVE RIPRAP, INDICATED & NOTED FDN. TO BE REMOVED, ADD.
7	5-13-81	LB	REV. CONTOURS & ADDED RETAINING WALL, ADDED FLEX BASE ROAD

REV.	DATE	BY	DESCRIPTION
A	5-18-77		REVISED PER ADDENDUM NO. 1
B	6-3-77	JLF	REVISED PER ADDENDUM NO. 5
C	7-7-77	JLF	REVISED PER ADDENDUM NO. 4
0	8-18-77		FINAL BID SET
1	1-23-77	RLH	REVISED REF. NOTE, ADDED REF. NOTE
2	6-9-78	GHM	REVISED PIPE FOUNDATIONS
3	10-26-78	LK	CORRECTED PULLBOX LOCATION.
4	6-1-79	LB	CHG'D. 3 TO 4. REVISED ELEV. OF TRANSFORMER POWER STA. REMOVED MOTOR CONTROL CENTER FDN.; REVISED STATION COORDINATE
5	1-23-80	LB	REV. PIPE SUPPORTS AS NOTED.

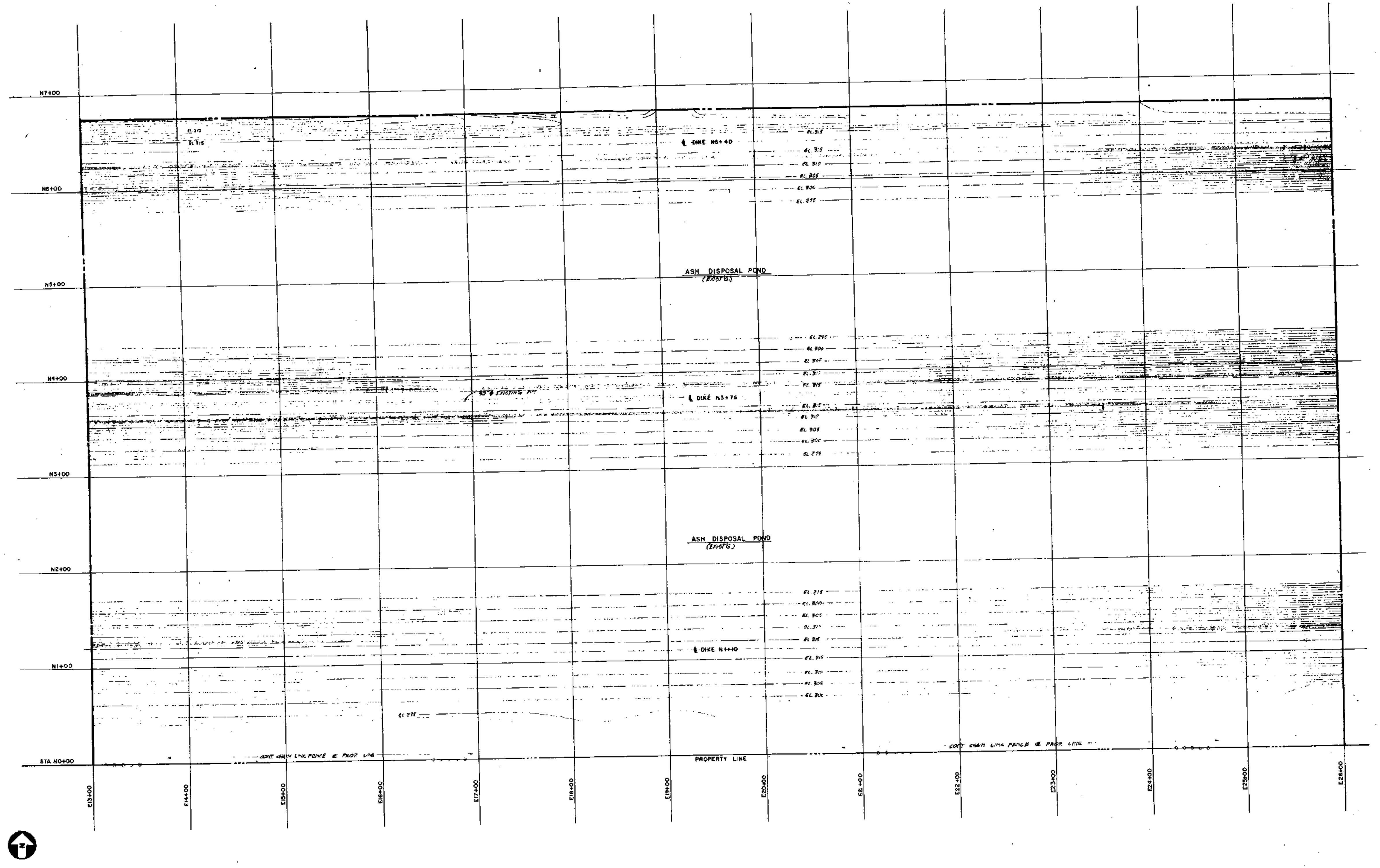
SCALE 1" = 40'
DRAWN F.G.M.
DATE 4-1-77
CHECKED C.A.C.
APPROVED M.R., W.G.H.

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. 4

JOB NO. SMI-406
REV. 7
DRAWING NUMBER 1-C-33



NOTES

REV	DATE	BY	DESCRIPTION
A	5-18-77		REVISED PER ADDENDUM NO. 1
0	5-16-77		FINAL BID SET

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

M.L. HUGHES 28324
William G. Holloway 15137
CHARLES A. DOBY 37905

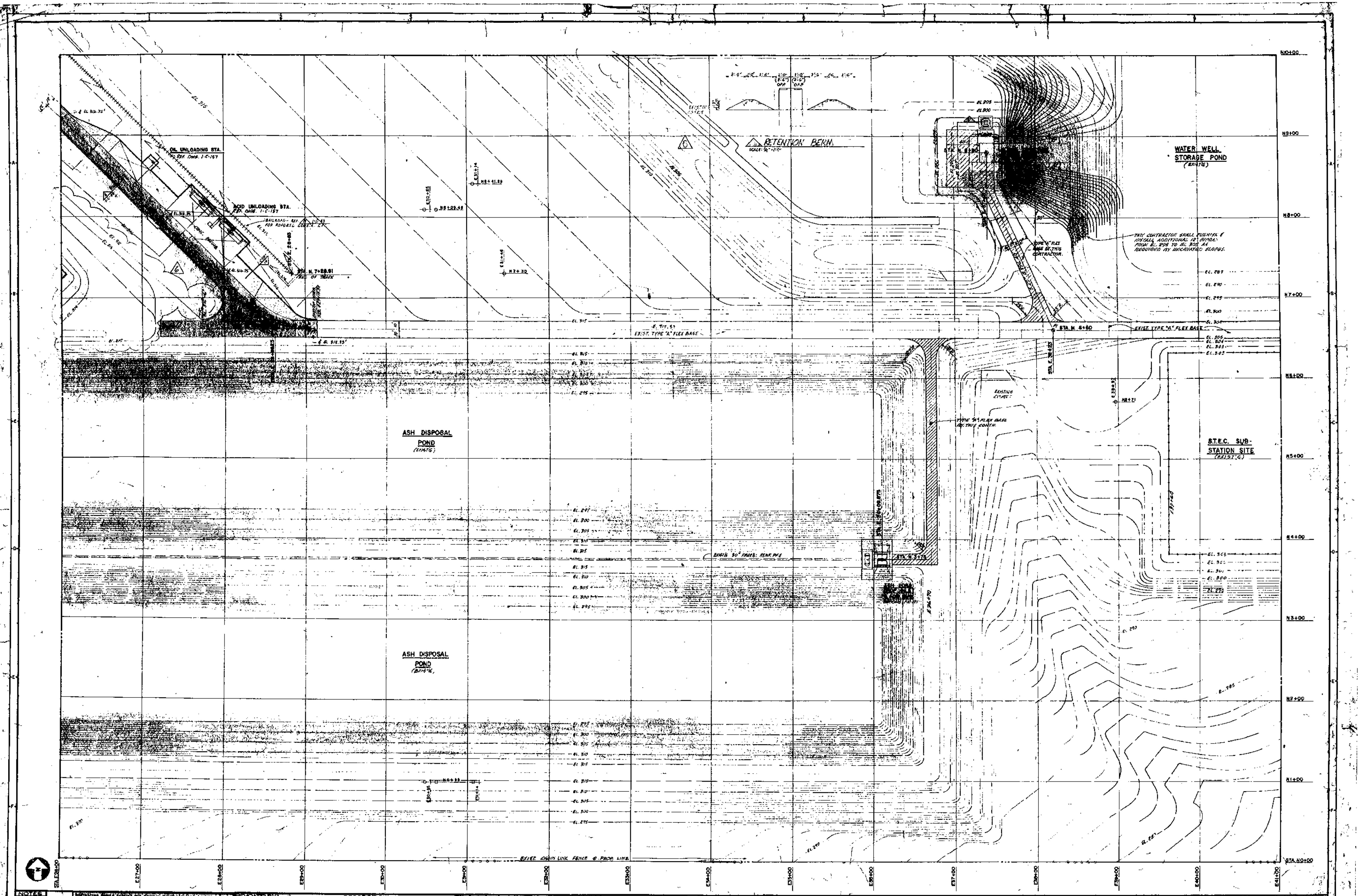
TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

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

SITE PLAN
SECTION NO. 8

JOB NO.	REV.
SMI-406	0

DRAWING NUMBER
1-C-37



NOTES

REV	DATE	BY	DESCRIPTION
6	4-?-80	LS	REVISED CONTOURS AT COOLING TOWER & DRAINAGE DITCH

REV	DATE	BY	DESCRIPTION
A	5-10-77	W.C.	REVISED PER ADDENDUM NO. "1"
B	7-?-77	W.C.	REVISED PER ADDENDUM NO. "2"
C	8-18-77		FINAL BID SET
1	9-23-77	R.L.H.	REVISED CONTOURS, REVISED OR ADDED ELEVATIONS & ELEVATION POINTS, ADDED REFERENCE NOTE
2	12-9-77	R.H.	CORRECTED CONTOURS TO AGREE WITH SMI-401 CONTRACT. DELETED REF. NOTE
3	3-3-78	LW	CORRECTED CONTOURS & E37+00 & N7+00 TO AGREE ON BID SET.
4	7-31-78	LS	ADDED RETENTION BERM ON PLAN & IN SECTION
5	4-16-80	LS	REV. WIDTH & BASE MAT'L ON RD. TO INTAKE STRUCT., INDICATED FENCE.

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

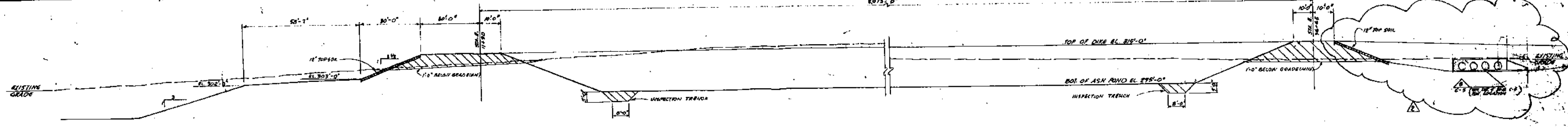
M. L. HUGHES 25524
William G. Holland 31137
CHARLES A. DOBY

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

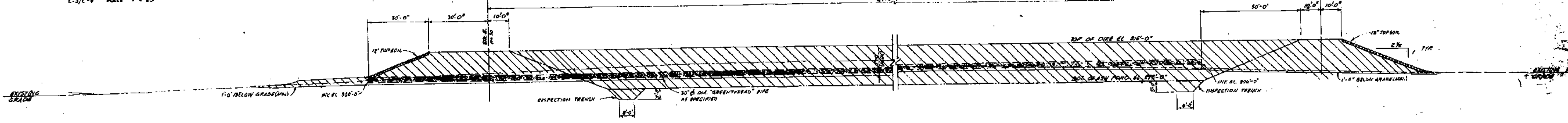
SAN MIGUEL PLANT
UNIT NO. 1
S.E.P.C. S.T.E.C.

SITE PLAN
SECTION NO. 11

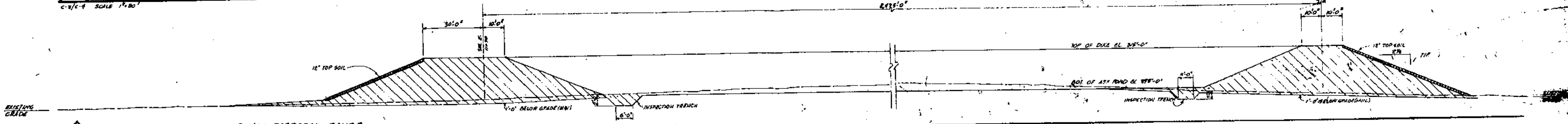
JOB NO. SMI-405
REV. 6
DRAWING NUMBER I-C-40



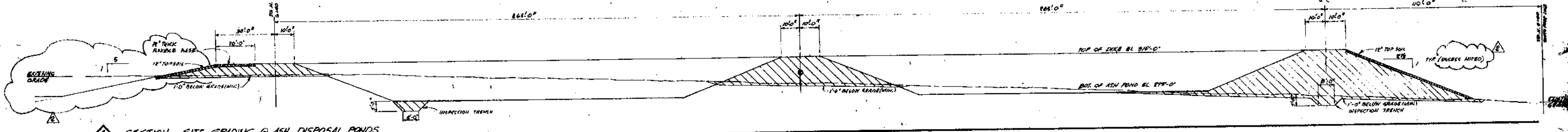
1 SECTION - SITE GRADING @ ASH DISPOSAL PONDS
C-3/C-4 SCALE 1" = 30'



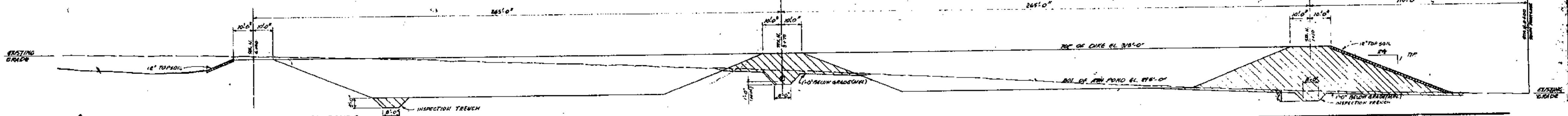
2 SECTION - SITE GRADING @ ASH DISPOSAL PONDS
C-3/C-4 SCALE 1" = 30'



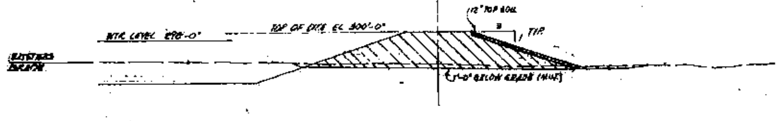
3 SECTION - SITE GRADING @ ASH DISPOSAL PONDS
C-3/C-4 SCALE 1" = 30'



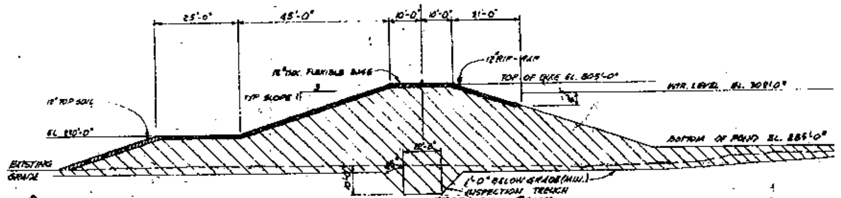
4 SECTION - SITE GRADING @ ASH DISPOSAL PONDS
C-4 SCALE 1" = 30'



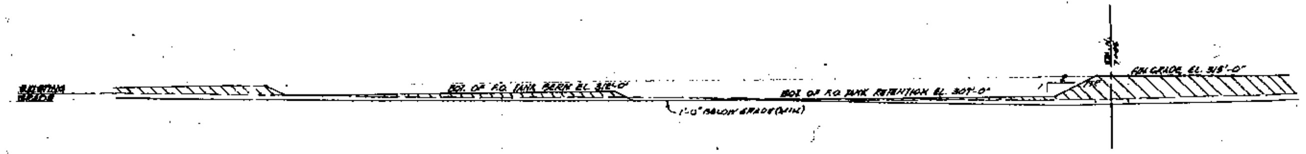
5 SECTION - SITE GRADING @ ASH DISPOSAL PONDS
C-3 SCALE 1" = 30'



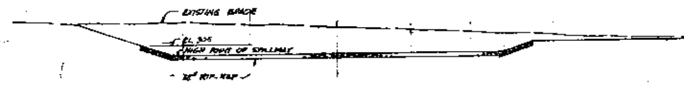
6 SECTION - SITE GRADING @ YARD DRAINAGE RETENTION POND
C-3 SCALE 1" = 30'



7 SECTION - SITE GRADING @ WATER WELL STORAGE POND
C-4 SCALE 1" = 30'



8 SECTION - SITE GRADING @ FUEL OIL TANK RETENTION
C-3 SCALE 1" = 30'



9 SECTION - SITE GRADING @ WATER WELL STG. POND SPILLWAY
C-4 SCALE 1" = 20'

NOTES:
1. ▨ DENOTES FILL AREA
2. ▨ DENOTES TOP SOIL
3. ▨ DENOTES RIP-RAP
4. ▨ DENOTES FLEXIBLE BASE

REV	DATE	BY	DESCRIPTION
1	[illegible]	AF	[illegible], AS PER ADDENDUM NO. 1.
1	21 JUN 76	AF	[illegible] (12" FLEXIBLE BASE), AS PER ADDENDUM NO. 1.
1	[illegible]	AF	ADDED NOTE No. 4, AS PER ADDENDUM No. 1.
1	[illegible]	AF	ADDED DET. No. 9, AS PER ADDENDUM No. 1.
2	7 JUL 76	AF	[illegible] (ADDED NOTE [illegible]), AS PER ADDENDUM No. 2.

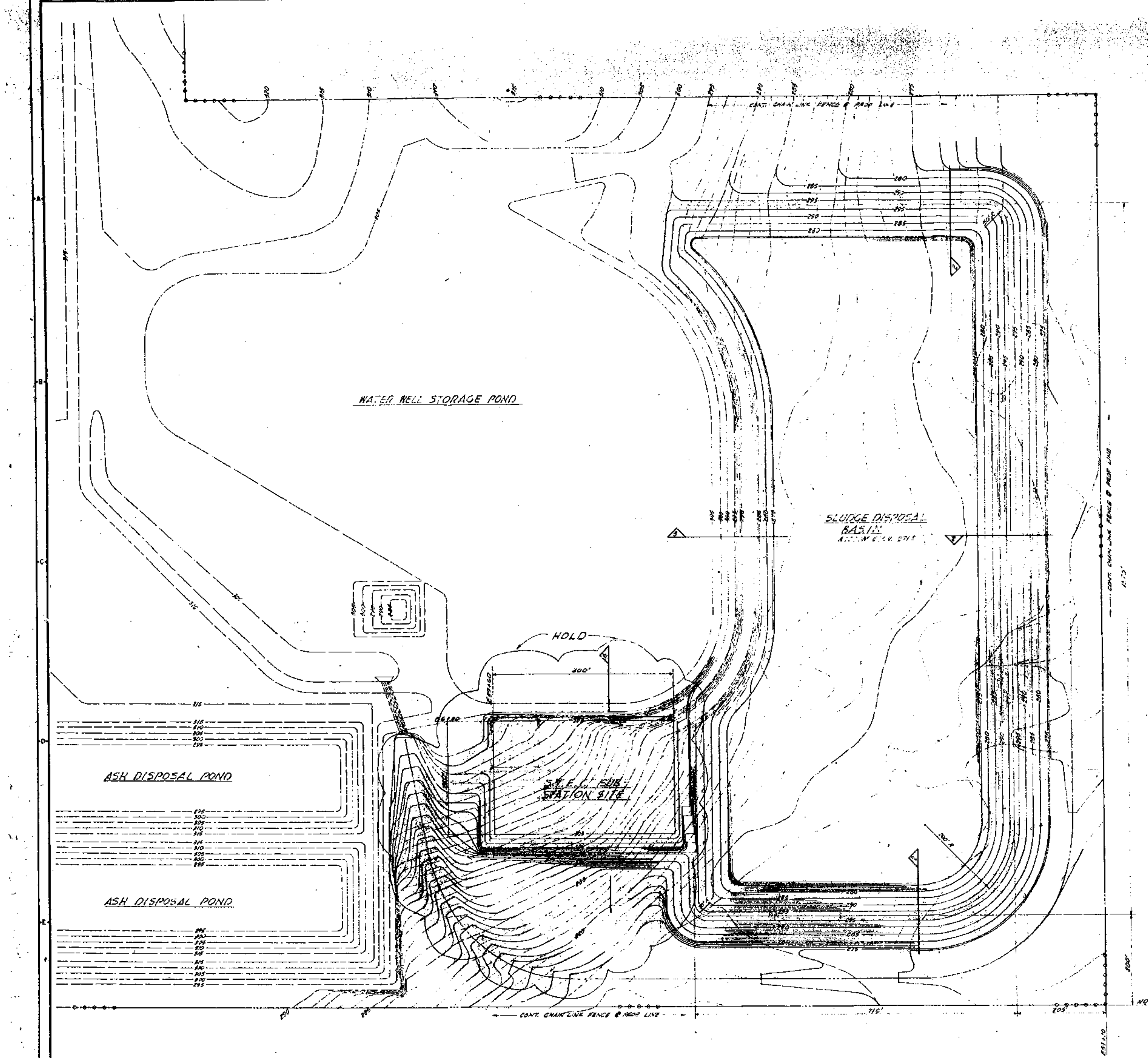
SCALE AS NOTED
DRAWN JLF
DATE 28 MAY 1976
CHECKED JLF
APPROVED WGH
MLH

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

SAN MIGUEL PLANT
[illegible]

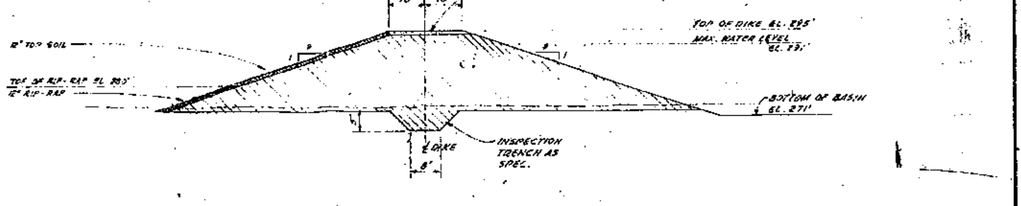
SITE PREPARATION
SECTIONS & DETAILS

JOB NO. SMI-401
REV 2
DRAWING NO. C-[illegible]

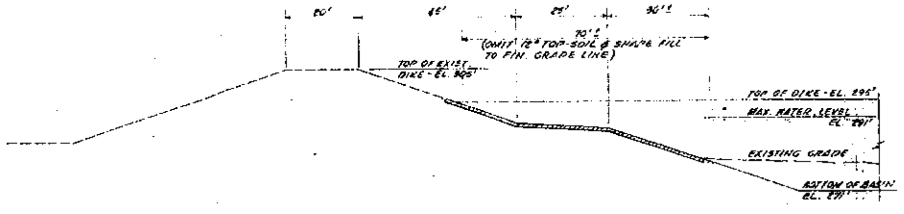


PLAN - SLUDGE DISPOSAL BASIN & SUBSTATION SITE
SCALE: 1" = 100'

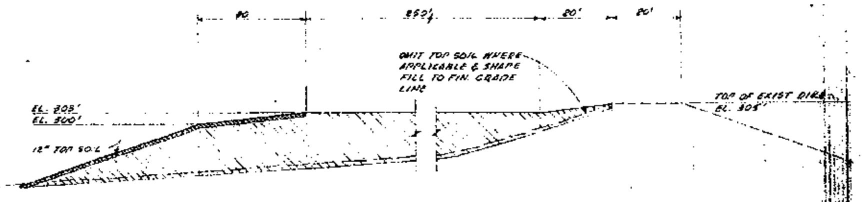
EXIST. CONTOURS PER CONTRACT DWG. C-4, REV. 3
REVISED CONTOURS



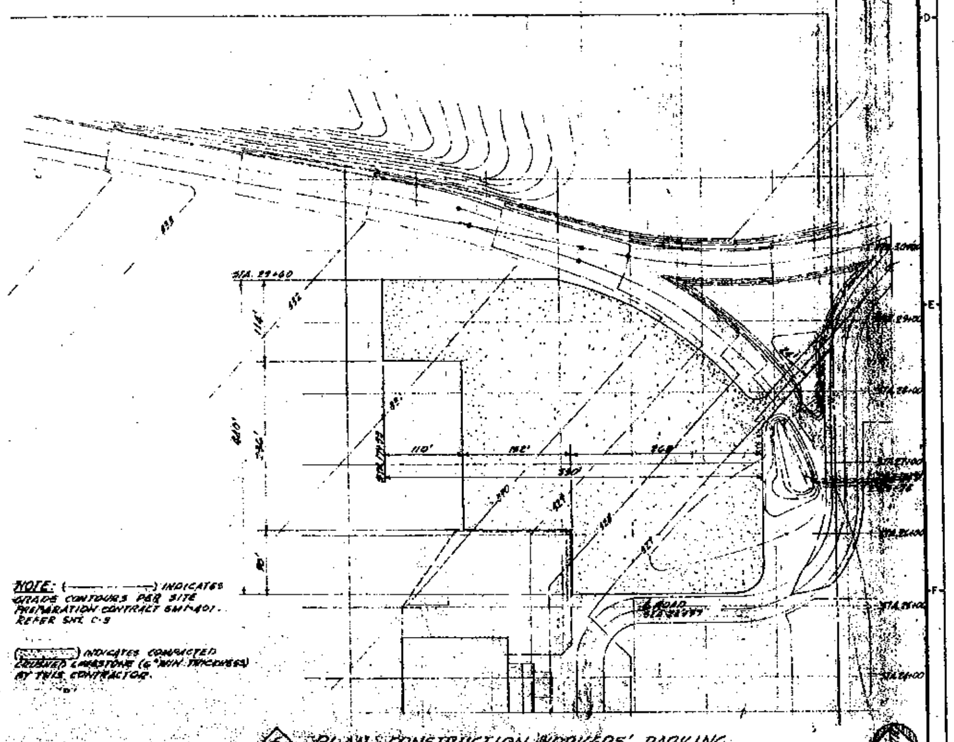
TYPICAL DIKE SECTION
SCALE: 1" = 20'



TYPICAL DIKE SECTION (EXIST. @ WATER WELL STG. POND)
SCALE: 1" = 20'



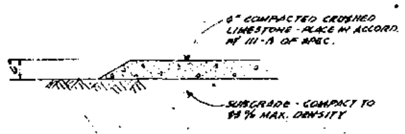
TYPICAL SECTION - SUBSTATION SITE
SCALE: 1" = 20'



NOTE: (————) INDICATES GRADE CONTOURS PER SITE PREPARATION CONTRACT SMI-401. REFER SHT. C-3

(▨) INDICATES COMPACTED CRUSHED LIMESTONE (6" MIN. THICKNESS) BY THIS CONTRACTOR.

PLAN - CONSTRUCTION WORKERS' PARKING
SCALE: 1" = 100'



TYP. SECTION - PARKING AREA

NOTES

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

REV.	DATE	BY	DESCRIPTION
0		P.R.	ADD THIS DRAWING TO CONTRACT DRAWINGS

SCALE AS NOTED
DRAWN P.R.E.
DATE 4-5-77
CHECKED C.A.D.
APPROVED

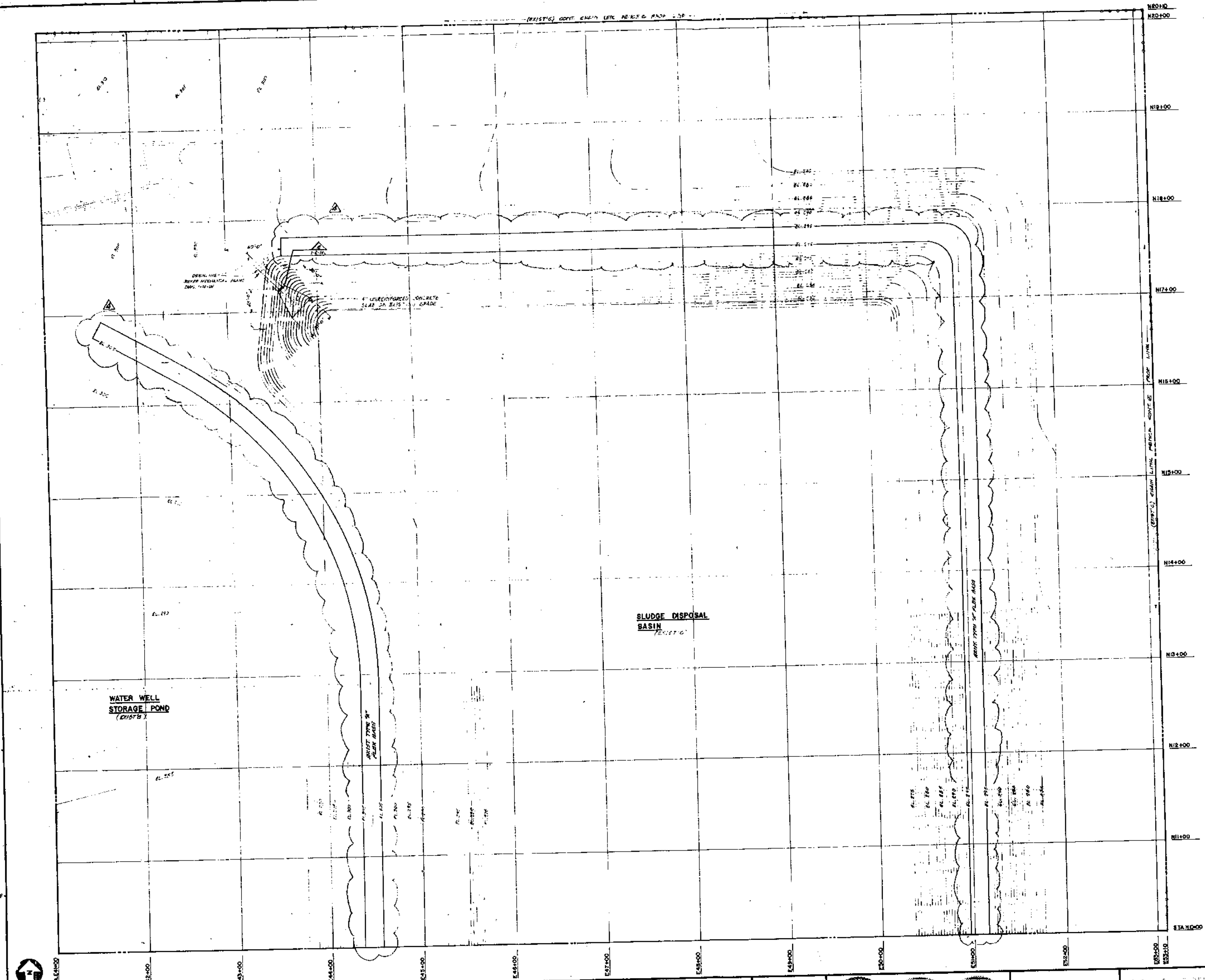
William G. Hollowell 15137
M.L. HUGHES 25324

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



NOTES

REV	DATE	BY	DESCRIPTION
A		WL	REV. PER ADDENDUM NO. "1"
0	8-12-77		FINAL BID SET
1	9-22-77	L.H.	ADDED TWO RIPRAPS WITH DIMENSIONS, NOTES, & REFERENCE SECTION MARKS, REFERENCE NOTES, ADDED 10" DRAINLINE, ADDED 20" WELL WATERLINE
2	11-9-77	L.H.	CHANGED RIPRAP TO CONC. SLAB
3	6-6-79	LW	DELETED (1) SPLASH BLOCK & (3) PIPE SUPPORTS.
4	4-16-80	JB	NOTED EXIST. TYPE "A" FLEX BASE RD.

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

M.L. HUGHES
26324

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

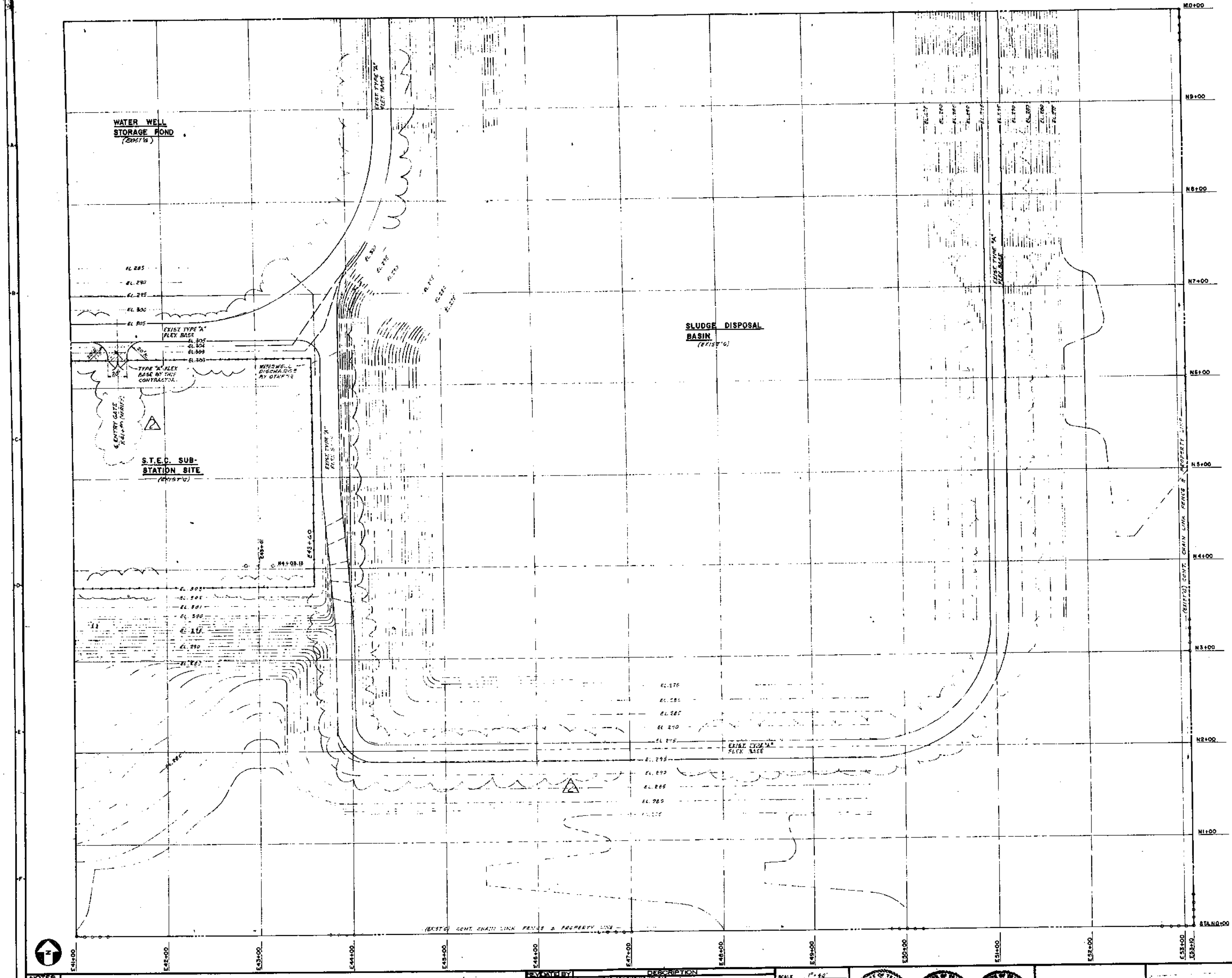
SAN MIGUEL PLANT
UNIT NO. 1
B.E.P.C. S.T.E.C.

SITE PLAN
SECTION NO. 12

CONTRACTOR SHOULD EXAMINE THE GENERAL, MECHANICAL AND ELECTRICAL CONSTRUCTION DRAWINGS, AND ALL PERTINENT [illegible]

JOB NO.	REV.
SMI-406	4

DRAWING NUMBER
1-C-41



NOTES

REV	DATE	BY	DESCRIPTION
A	5-18-77	RL	REVISED PER ADDENDUM NO. "1"
0	5-18-77		FINAL BID SET
1	4-6-78	LW	LOCATED WATERWELL DISCHARGE
2	4-14-80	LB	ADDED FENCE AROUND SUB-STATION SITE, ADDED ACCESS RD. @ SUB-STA. ENTRANCE; REV. EXIST. CONTOURS TO AGREE W/CONTRACT SMI-401; NOTED EXIST. TYPE "A" FLEX BASE RDS.

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

M.L. HUGHES 25394
William G. Hughes 35137
CHARLES A. COX 37980

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. 13

JOB NO. SMI-406
REV. 2
DRAWING NUMBER 1-C-42

4. Excavation for Pipework:

   a. Make excavation for this work true to grade, profile and alignment, and so as to provide full, even and continuous bedding.

5. Disposal of Excavated Materials:

   a. Deposit and spread, or stockpile, excavation materials suitable (in opinion of Consulting Engineers) for fill or backfill in quantities required and approved, on premises.

F. FILL

Fill includes the following two classes, the use of each shall be as indicated on the drawings:

Class 1: Regular compacted fill, RCF.

Class 2: Controlled compacted fill, CCF.

Services of Testing Laboratory: Where controlled compacted fill is specified, Purchaser will furnish services of a Testing Laboratory to determine suitability of fill material, to set optimum moisture contents, and to perform field tests to check on compliance with moisture and density requirements. Contractor shall furnish Testing Laboratory with all required quantities of ~~fill~~ material, from the same source as will be used for the WORK, as required for test purposes.

1. Class 1, Regular Compacted Fill:

   a. Material: This material will consist of the upper layers of clay material which overlay the very dense fine sand material. All material used shall be as approved by Engineer.

   b. Preparation of Subgrade: Prior to placing regular compacted fill, strip areas to be covered of all vegetation or other organic material or other foreign or deleterious material.

   c. Compaction Densities: Build up fill to grade elevations indicated or required, with suitable moisture control and compaction throughout placing, as specified in d. following, to produce a completed fill capable of supporting trucks and other heavy construction equipment.

   d. Placing of Fill: Place as follows, unless otherwise approved or requested:

      1) Place fill, with suitable moisture content, in uniform horizontal layers not over 9" deep before compaction.

      2) For Type RCF cohesive fill, compact by use of sheeps foot roller or with other ramming type equipment, as approved.

      3) In places inaccessible to large equipment, obtain required compaction with mechanical rammers for Type RCF cohesive fill.

2. Class 2, Controlled Compacted Fill:

   a. Material: Same as described for Class 1 regular compacted fill.

   b. Preparation of Subgrade:

      1) Subgrade to receive controlled compacted fill shall be inspected by the Consulting Engineers to determine if it is suitable and has sufficient bearing capacity for the fill material and loads to be placed over it.

      2) Prior to placing controlled compacted fill, strip areas to be covered of all vegetation, top soil and all organic material or other foreign or deleterious materials.

      3) Thoroughly break and turn soil underlying the filled area to depth of 6" before deposition of fill material. Do breaking of ground no more than 200 feet in advance of placing fill.

c. Compaction densities: During the compaction process, the soil moisture content should be near the optimum value to obtain desired fill characteristics. The water content may vary from a minimum of one percent below, to four percent above the optimum value as defined by the Texas Highway Department Compaction Test Procedure, Test Method Tex 113-E, varying the compaction effort in accordance with the plasticity characteristics of the soil. *All Class 2 fill shall be compacted to a minimum of 95 percent of the maximum density obtained using Test Method Tex 113-E.

d. Placing of Fill: Place as follows, unless otherwise approved or requested:

1) Place fill, with optimum moisture content, in uniform horizontal layers not over 9" deep before compaction. Add water, or dry out fill, to maintain optimum moisture content throughout placing and compaction.

2) For Type CCF cohesive fill, compact by use of sheeps foot roller or with other ramming type equipment, as approved.

3) In places inaccessible to large equipment, obtain required compaction with mechanical rammers for Type CCF cohesive fill.

*3. Surplus Fill Material:

Should the dirt balance result in a surplus of fill material, this material shall be stockpiled parallel to the west property line near the southwest corner as directed by the Engineer.

G. BACKFILL:

Backfill includes general backfilling around all work excavated for by Contractor, and also all other backfill indicated on drawings as by Contractor.

1. Material:

Backfill shall be approved materials previously excavated at the site or materials obtained from approved borrow pits and shall be free of sod or other deleterious or foreign matter.

2. Compaction:

Backfill shall be built up to the grade elevations indicated or required, with suitable moisture control and compaction throughout placing, in the same manner as specified in F,1, for Regular Compacted Fill.

3. Backfill Around Underground Piping:

Place backfill around underground piping, drain lines, etc., only after piping, drain lines, etc., have been tested and/or inspected and approved. Use special care in backfilling to see that backfill is free of cinders or other materials which may be injurous, in opinion of Consulting Engineers, to such piping, drain lines, etc. Provide backfill free from rocks, hard lumps or clods larger than 3 inches. Do not use sod. Place backfill below top of piping, drain lines, etc., in alternate layers on each side of piping, drain lines, etc.

H. GRADING:

Consists of rough grading and finish grading, as follows:

1. Rough Grading: Cut, fill, spread and level during course of WORK to elevations indicated.

2. Finish Grading: Fine grade and level to provide a smooth finish grade free of debris, foreign matter, objectionable stones, clods, lumps, pockets or high spots, properly drained and true to indicated elevations. Do finish grading only near completion of WORK or when requested.

I. POND CONSTRUCTION:

Pond construction includes the Ash Disposal Ponds, Well Water Storage Pond and Yard Drainage Retention Pond. Their construction shall conform to the shapes, locations and dimensions as shown on the drawings, to the specifications herein and the items described as follows:

1. Ash Disposal Ponds:

The clays, silty clays, and sandy clays from required plant grading may be used for construction of the embankment. Zoning of the embankment is not necessary; however, only clays with a permeability less than 1.0 X 10^{-7} CM/SEC shall be used in the center third of the structure with the more pervious materials, such as sands, silty sands, and clayey sands, being placed in the outer shell of the earthen structure. The embankment should be constructed in the following manner:

a. All organic material and topsoil shall be removed from the area to be occupied by the embankment and stockpiled.

b. Provide an inspection trench 5 feet deep by 8 feet wide under the center of the north dike and to the inside face of the, last, west and south dikes for the purposes of inspection of the foundation.

c. Scarify the foundation soils to a depth of 12 inches, adjust the moisture content, and recompact to a density of at least 95 percent of the maximum dry unit weight as determined by the Texas Highway Department Test Method Tex 113-E. The moisture content may vary from a minimum of one percent below to four percent above the optimum value.

d. Place embankment soils in thin loose lifts not exceeding nine inches in thickness, adjust moisture, and compact to 95 percent of Texas Highway Department Test Method Tex 113-E, and at a moisture content ranging from one percent below the optimum value to four percent above the optimum value.

e. Use slope ratios of two and one-half horizontal to one vertical (2 1/2:1).

f. Outside faces of the dikes shall be constructed of twelve inches (12") of top soil.

g. Outside faces of the dikes shall be sprigged with Coastal Bermudagrass at the rate of 135 bushels per acre and fertilized.

2. Well Water Storage Pond:

The clays, silty clays, and sandy clays from required plant grading may be used for construction of the embankment. Zoning of the embankment is not necessary; however, only clays with a permeability less than 1.0 X 10^{-7} CM/SEC shall be used in the center third of the structure with the more pervious materials, such as sands, silty sands, and clayey sands being placed in the outer shell of the earthen structure. The embankment should be constructed in the following manner:

a. All organic material and topsoil shall be removed from the area to be occupied by the embankment and stockpiled.

b. Provide an inspection trench under the center of the embankment 12 feet wide at the bottom, and 10 feet deep for purposes of inspection of the foundation.

c. Scarify the foundation soils to a depth of 12 inches, adjust the moisture content, and recompact to a density of at least 95 percent of the maximum dry unit weight as determined by the Texas Highway Department Test Method Tex 113-E. The moisture content may vary from a minimum of one percent below to four percent above the optimum value.

d. Place embankment soils in thin loose lifts not exceeding nine inches in thickness, adjust moisture, and compact to 95 percent of Texas Highway Department Test Method Tex 113-E, and at a moisture content ranging from one percent below the optimum value to four percent above the optimum value.

e. Use slope ratios of three horizontal to one vertical (3:1).

f. Downstream face of the embankment and berm shall be constructed of twelve inches (12") of top soil.

g. Provide a berm at Elev. 290 on the downstream toe. The width of the berm shall be 25 feet. The downstream slope of the berm shall be three horizontal to one vertical (3:1). The berm shall be compacted to the moisture density requirements specified on previous page.

h. The downstream slope of the embankments and the berm shall be sprigged with Coastal Bermudagrass at the rate of 135 bushels per acre and fertilized.

i. The upstream slope shall be protected by a twelve inch (12") thick layer of store riprap placed to the dimensions as shown on the drawings.

j. A twelve inch (12") thick gravel or crushed store cap shall be provided on the crest of the embankment.

k. The crest of the embankment shall be sloped to drain toward the storage pond.

l. Downstream faces of embankments and berm shall be sprigged with Coastal Bermudagrass at the rate of 135 bushels per acre and fertilized.

3. Yard Drainage Retention Pond:

The embankment of the retention pond shall be constructed of clay, sandy clay, or silty clay from the required plant grading.

a. All organic material and topsoil shall be removed from the area to be occupied by the embankment and stockpiled.

b. Scarify the foundation soils to a depth of 12 inches, adjust the moisture content, and recompact to a density of at least 95 percent of the maximum dry unit weight as determined by the Texas Highway Department Test Method Tex 113-E. The moisture content may vary from a minimum of one percent below to four percent above the optimum value.

c. Place embankment soils in thin loose lifts not exceeding nine inches in thickness, adjust moisture and compact to 95 percent of Texas Highway Department Test Method Tex 113-E, and at a moisture content ranging from one percent below the optimum value to four percent above the optimum value.

d. Use slope ratios of three horizontal to one vertical (3:1).

e. Outside face of the embankment shall be constructed of twelve inches (12") of top soil.

f. Outside face of the embankment shall be sprigged with Coastal Bermudagrass at the rate of 135 bushels per acre and fertilized.

J. BROADCAST SPRIGGING:

Broadcast sprigging shall consist of sprigging the outside and downstream faces and berm of the Ash Disposal, Well Water Storage and Yard Drainage Retention Ponds with Coastal Bermudagrass.

1. Planting Season:

All sprigging shall be done between the average date of the last freeze in the Spring (February 24th) and six weeks prior to the average date for the first freeze in the Fall (December 3).

2. Soil Preparation:

Except on areas recently loosened by construction, all ground on which sprigging is to be placed shall be loosened by disking or other approved methods to a depth of not less than four inches (4"). All large clods shall be pulverized and boulders, rocks or other debris shall be removed as directed. Contractor shall take full advantage of weather conditions, but the work may be suspended when, in the judgment of the Engineer, the continuation of the same may result in unfavorable planting conditions.

Professional Service Industries, Inc.
National Soil Services Division

January 27, 1987

San Miguel Electric Cooperative, Inc.
P.O. Box 280
Jourdanton, Texas 78026

Attention: Mr. Clyde Price

Re: Liner Construction
Unit #1 Ash Pond

Dear Mr. Price:

As requested in your letter dated January 20, 1987, Professional Service Industries, Inc. has prepared a sequence of steps which should be performed to obtain a relatively impervious clay lining in the Unit #1 ash pond. In addition, we have enclosed a copy of a proposal, which was previously submitted, for providing testing and quality control services during the referenced construction.

1. Proposed procedure for clay liner construction.

   (a) Remove ash and soils contaminated with ash from the bottom and sides of the pond until natural soils are encountered. It may be necessary to waste several inches of clay to assure that all ash ano any softened clay is removed.

   (b) Excavate at least two feet of natural site clays which do not contain ash and stockpile. It is contemplated that half of the bottom of the pit can be used as a stockpile area.

   (c) The upper 12 inches of the exposed clays should then be scarified and moisture added to develop a moisture content three to four percent above optimum as determined by ASTM D 698 (Standard Proctor). Disc

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MAY 2 2 1997
KENDRICK & [illegible]

EXHIBIT A

to a uniform moisture content and compact to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor).

(d) Place stockpiled fill in maximum nine inch thick loose lifts, add sufficient moisture to increase moisture content to three to four percent above optimum as determined by ASTM D 698 (Standard Proctor). Disc to decrease particle size and develop a uniform moisture content, and compact to a minimum of 95 percent of the maximum dry density as determine by ASTM D 698 (Standard Proctor).

(e) Continue fill placement to develop a minimum three foot thick low permeability clay liner.

General Notes:

1. Operations along slopes that were excavated in natural soils should be parallel to the slope as compared to working up and down the slope.
2. The low permeability clay lining should overlap and bond to previous embankment fill for a distance of three to five feet. An overlap distance of at least three feet should also be planned for each field segment, assuming bottom area and slopes are worked in segments. To achieve the overlap on slopes it may be necessary to overbuild in the overlap area and then grade to a uniform slope. A sketch is attached.
3. The contractor has taken exception to moisture control and in particular to placement of fill at moisture contents above optimum. We cannot agree to construction of a clay liner without moisture

control. It is essential that the fill be placed in a manner which will result in a uniform clay fill with minimum permeability. Bond between soil particles and lifts is more important than compaction to achieve a specified density. Our previous experience with high plasticity clays warrants the conclusion that the clays at this site can be processed to moisture contents three to four percent above optimum and compacted to the desired density (similar clays were compacted at numerous times under our control at moisture contents approaching six to eight percent above optimum). In the event the contractor will not agree to the recommended moisture control then it may be necessary to obtain a proposal from another contractor who is qualified to perform the work. The recommended moisture control should not cause increased cost of the fill.

4. No provision has been made to prevent shrinkage, cracking and drying of the clay lining after construction. It is considered essential that the high plasticity clay lining be maintained at or near placement moisture until the lining is again covered with ash and/or water. A temporary spray irrigation system should be installed along the slopes to maintain moisture conditions in the lining.
5. It is recommended that at least one density test be performed for each 10,000 square feet of surface area for each compacted lift. It is also recommended that tests be performed on samples of the clay liner to verify physical parameters such as liquid limit, plasticity index and permeability.

PSI appreciates the opportunity to be of service on this project. If you have any questions, please contact our office.

Very truly yours,

PSI/NATIONAL SOIL SERVICES DIVISION

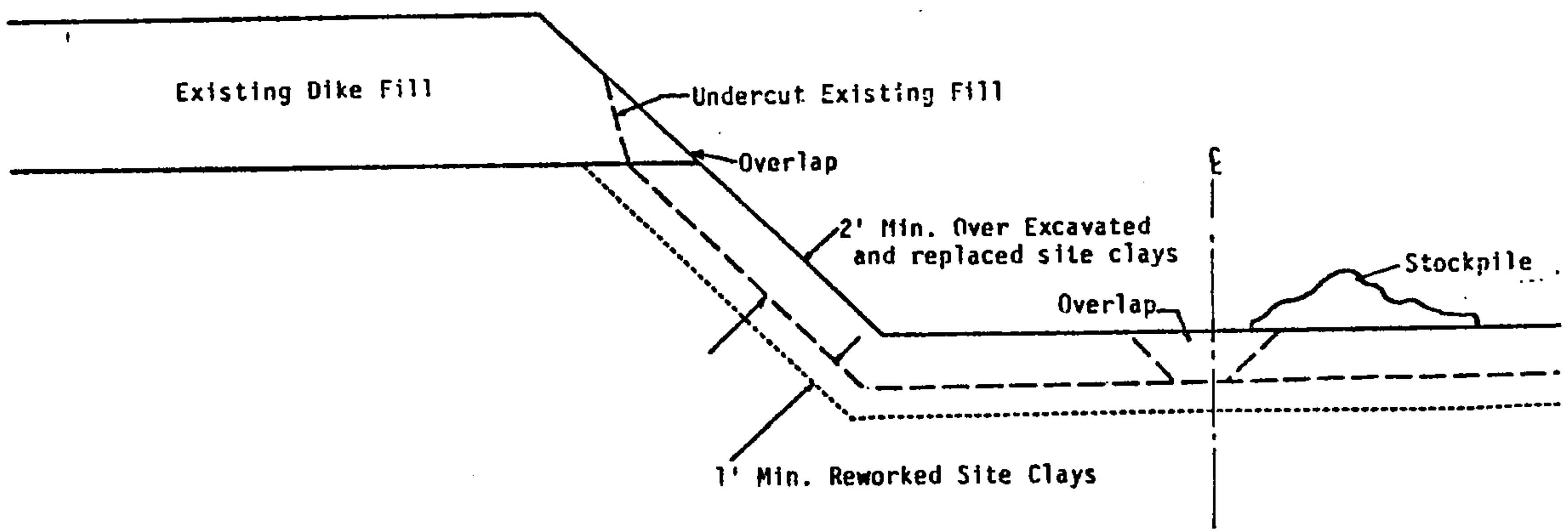
Koi Z Woodson

Koi Z. Woodson
Branch Manager

Ralph F Reuss

Ralph F. Reuss, P.E.
Vice President

/rd



Not To Scale

PLATE

PAPE-DAWSON ENGINEERS

LAND DEVELOPMENT ENVIRONMENTAL TRANSPORTATION WATER RESOURCES SURVEYING

February 1, 2010

Mr. Lane Williams
San Miguel Electric Cooperative, Inc.
PO Box 399
Jourdanton, TX 78026

Re: San Miguel Electric Cooperative
2009 Embankments Inspections

Dear Mr. Williams:

Representatives of Pape-Dawson Engineers completed field inspections of 6 embankments at the San Miguel Electric Cooperative (SMEC) site on December 9, 2009.

All of the embankments appeared to be functioning as designed and we did not identify any issues of concern related to dam or public safety. Inspection reports for each embankment are attached along with a series of photographs for your reference.

Reference the inspection reports for recommendations related to maintenance and follow-up inspections.

Thank you for the opportunity to serve the San Miguel Electric Cooperative and please call me if you have any questions about these inspections.

Sincerely,
Pape-Dawson Engineers, Inc.
Texas Board of Professional Engineers, Firm Registration # 470

Thomas M. Carter, P.E., LEED® AP
Vice President, Land Development

2-8-10

THOMAS MATTHEW CARTER
79272

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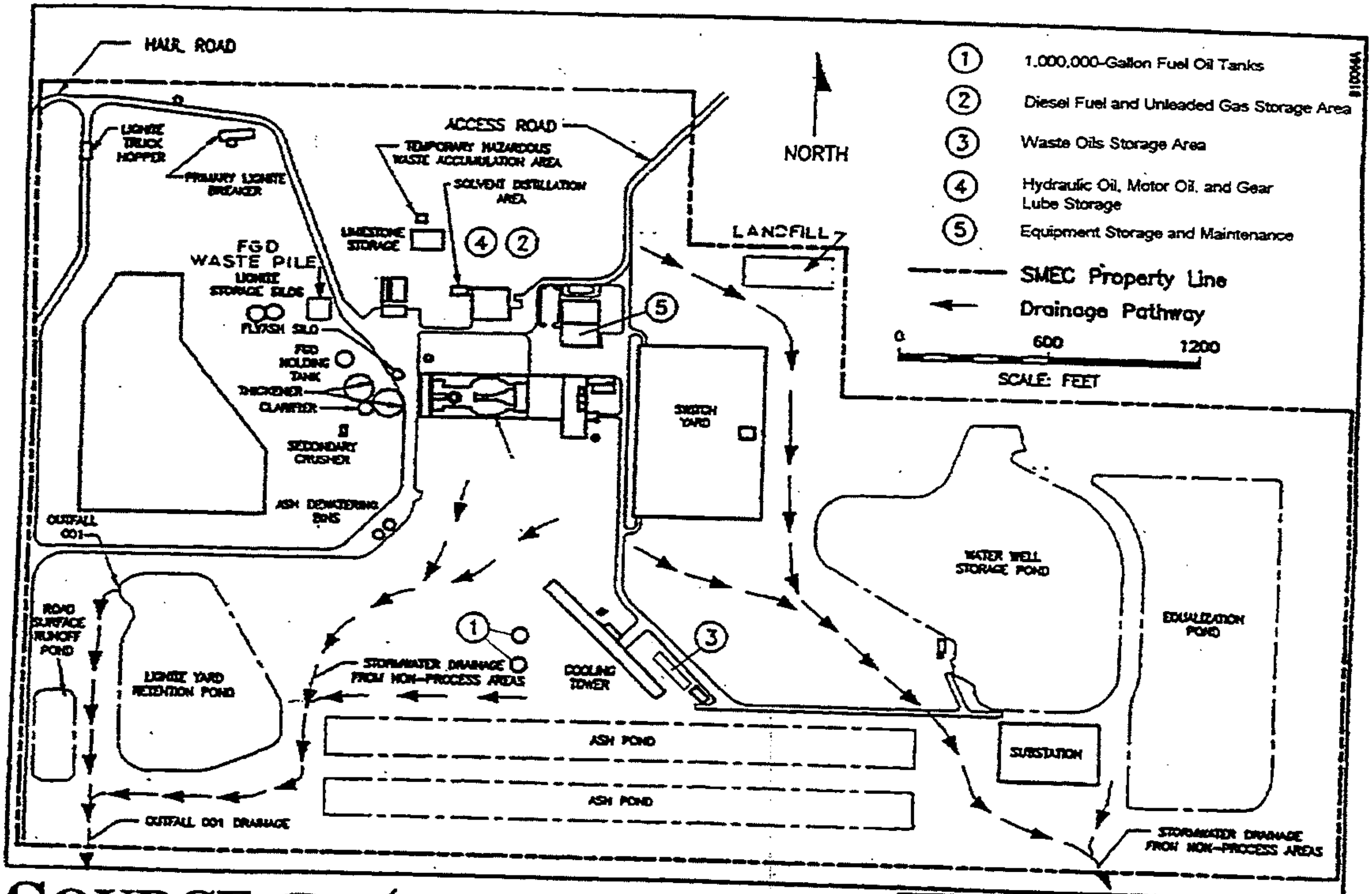

SOURCE
ENVIRONMENTAL SCIENCES, INC.

Figure 2: Facility Plot Plan
San Miguel Electric Company
Christine, TX

PAPE-DAWSON ENGINEERS, INC.

EMBANKMENT INSPECTION REPORT

PROJECT: San Miguel Electric Cooperative

CONTRACTOR: N/A **JOB NO.** 7526.00

DAY: Wednesday **DATE:** 12/09/09 **WORK PERIOD:** 9:15 A.M. **TO:** 10:00 A.M. **REPORT NO:** 1

WEATHER: Overcast **TEMP. MAX** 49 °F **MIN** 38 °F **PRECIPITATION:** None

---

WORK PERFORMED TODAY: Inspection of Lignite Yard Retention Pond

COMMENTS: The interior embankment of the pond had consistent uncut vegetation. No significant erosion was observed. There was some minor standing water along the downstream toe of the pond but we don't think it was from the pond, rather runoff from the drainage channel in front of the dam (Photos 7 & 8). The outlet is broad crested weir with no signs of erosion or flow. Current water surface is significantly below top of dam (+/- 10ft).

There is a structure consisting of 5 culverts underneath the haul road. Below this there was some sediment deposits and some significant erosion where the flow entered the pond. This does not impact the operation of the pond, but we would recommend that the channel be regraded to a slope that will no longer erode (Photos 15-18).

FOLLOW-UP RECOMMENDATIONS:

1. Complete an inspection by SMEC staff after vegetation is cut to confirm that there is no significant erosion on embankment.
2. Consider maintenance of pump system to address corrosion (Photo 1).
3. Consider maintenance of drainage channel flowing into pond (Photos 15-18).
4. Follow-up inspection in late 2010, preferably after vegetation is cut.

PAPE-DAWSON ENGINEERS, INC. REPRESENTATIVE

2-8-10
DATE

STATE OF TEXAS
THOMAS MATTHEW CARTER
79272
LICENSED PROFESSIONAL ENGINEER

PAPE-DAWSON ENGINEERS, INC.

EMBANKMENT INSPECTION REPORT

PROJECT: San Miguel Electric Cooperative

CONTRACTOR: N/A JOB NO. 7526.00

DAY: Wednesday DATE: 12/09/09 WORK PERIOD: 10:00 A.M. TO: 10:25 A.M. REPORT NO: 3

WEATHER: Overcast TEMP. MAX 49 °F MIN 38 °F PRECIPITATION: None

---

WORK PERFORMED TODAY: Inspection of South Ash Pond

COMMENTS: Minor shore erosion observed. Water elevation approximately 10" to 14" below top of pond. Grass approximately 2' to 3' high surrounding the pond. Few low spots were observed along top of bank but no sign of seepage. South embank in good conditions with good grass coverage and approximately 20' to top of bank.

FOLLOW-UP RECOMMENDATIONS:

1. SMEC staff should monitor erosion on top of pond.
2. SMEC staff should walk embankment after vegetation is cut back to confirm that there is no significant erosion on bank.
3. Follow-up inspection in late 2010, preferably after vegetation is cut.

PAPE-DAWSON ENGINEERS, INC. REPRESENTATIVE

2-8-10
DATE

STATE OF TEXAS
THOMAS MATTHEW CARTER
79272
LICENSED PROFESSIONAL ENGINEER

PAPE-DAWSON ENGINEERS, INC.

EMBANKMENT INSPECTION REPORT

PROJECT: San Miguel Electric Cooperative

CONTRACTOR: N/A **JOB NO.** 7526.00

DAY: Wednesday **DATE:** 12/09/09 **WORK PERIOD:** 10:50 A.M. **TO:** 11:30 A.M. **REPORT NO:** 4

WEATHER: Overcast **TEMP. MAX** 49 °F **MIN** 38 °F **PRECIPITATION:** None

---

WORK PERFORMED TODAY: Inspection of Equalization Pond

COMMENTS: Interior embankment with little to no vegetation. Current water surface elevation is 10' to 15' below top of embankment. One 12' and one 18" inflow pipe along east embankment. Erosion observed but not significant enough to be concerned about. Also an 18" pipe with a headwall was also located along the east embankment. Base of head wall is partially eroded and needs to be repaired (Photo 16). There was visible water ponding along the southeast side of the pond. Flow was moving from east to west. Water doesn't seem to come from the pond but will need to be monitored to see if ponding dissipates.

FOLLOW-UP RECOMMENDATIONS:

1. Address erosion under headwall (Photo 16).
2. SMEC staff should monitor erosion on top of pond.
3. SMEC staff should walk embankment after vegetation is cut back to confirm that there is no significant erosion on bank.
4. Follow-up inspection in late 2010, preferably after vegetation is cut.

M.

PAPE-DAWSON ENGINEERS, INC. REPRESENTATIVE

2-8-10

DATE

THOMAS MATTHEW CARTER
79272

PAPE-DAWSON ENGINEERS, INC.

EMBANKMENT INSPECTION REPORT

PROJECT: San Miguel Electric Cooperative

CONTRACTOR: N/A **JOB NO.** 7526.00

DAY: Wednesday **DATE:** 12/09/09 **WORK PERIOD:** 10:50 A.M. **TO:** 11:30 A.M. **REPORT NO:** 5

WEATHER: Overcast **TEMP. MAX** 49 °F **MIN** 38 °F **PRECIPITATION:** None

---

WORK PERFORMED TODAY: Inspection of Water Well Storage Pond

COMMENTS: Rip-rap on upstream side with little or no erosion. Good grass cover. Pipe discharge into pond (Photo 5) appears to be in good working order. Pipe discharge below substation is eroding, but this is not on embankment so not an issue to public or dam safety (Photos 11, 12, 1, 2, 3) Some trees, either cedar or evergreen trees, on the down slope of the pond. Trees need to be removed before they impact the integrity of the embankment. Reference photos 5 and 6.

FOLLOW-UP RECOMMENDATIONS:

1. Address erosion of outfall pipe below substation.
2. Remove trees/shrubs on toe of slope.
3. SMEC staff should monitor erosion on top of pond.
4. SMEC staff should walk embankment after vegetation is cut back to confirm that there is no significant erosion on bank.
5. Follow-up inspection in late 2010, preferably after vegetation is cut.

M.

PAPE-DAWSON ENGINEERS, INC. REPRESENTATIVE

2-8-10

DATE

STATE OF TEXAS
THOMAS MATTHEW CARTER
79272
LICENSED
PROFESSIONAL ENGINEER

PAPE-DAWSON ENGINEERS, INC.

EMBANKMENT INSPECTION REPORT

PROJECT: San Miguel Electric Cooperative

CONTRACTOR: N/A **JOB NO.** 7526.00

DAY: Wednesday **DATE:** 12/09/09 **WORK PERIOD:** 10:00 A.M **TO:** 10:25 A.M. **REPORT NO:** 2

WEATHER: Overcast **TEMP. MAX** 49 °F **MIN** 38 °F **PRECIPITATION:** None

---

WORK PERFORMED TODAY: Inspection of Ash Pond Center Dike and North Pond

COMMENTS: Minor shore erosion observed. Water elevation approximately 10" to 14" below top of pond. Some rill erosion between Pond A and Pond B, but water surfaces are not connecting. Good grass coverage which helps to protect surface pipes and other dredging debris. Equalization weir was in good conditions. The north east side of the pond had a small embankment and was in good conditions. The northwest side of the pond had a taller embankment that was above the pumping equipment. Wet spots were observed where bank has been cut back. No sediment load, ponding or flowing water observed but should monitor.

FOLLOW-UP RECOMMENDATIONS:

1. SMEC staff should monitor erosion on top of pond.
2. SMEC staff should walk embankment after vegetation is cut back to confirm that there is no significant erosion on bank.
3. Follow-up inspection in late 2010, preferably after vegetation is cut.

PAPE-DAWSON ENGINEERS, INC. REPRESENTATIVE

2-8-10

DATE

STATE OF TEXAS
THOMAS MATTHEW CARTER
79272
LICENSED PROFESSIONAL ENGINEER

WEEKLY FACILITY INSPECTION REPORT

PLANT DITCHES AND PONDS

DATE: 8-3-12

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
DITCHES		
EAST SIDE STORM DRAINAGE	YES / [✓ NO]	
WEST SIDE STORM DRAINAGE	YES / [✓ NO]	
LIGNITE YARD DRAINAGE	YES / [✓ NO]	
COOLING TOWER AREA	YES / [✓ NO]	
PONDS		
EQUILIZATION	YES / [✓ NO]	LEVEL: ~77 inches from 18" freeboard
LIGNITE YARD RETENTION	YES / [✓ NO]	LEVEL: ~70 inches from 18" freeboard
ASH DISPOSAL 1A	YES / [✓ NO]	LEVEL: 0 inches from 18" freeboard
ASH DISPOSAL 1B	YES / [✓ NO]	LEVEL: 0 inches from 18" freeboard
WATER WELL STORAGE	YES / [✓ NO]	LEVEL: ~36 inches from 18" freeboard

PLANT PROCESS AREAS

DATE:

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
BOILER AREA EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
PRECIPITATOR EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
SCRUBBER EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
FGD EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
LABORATORY INSIDE OUTSIDE	YES / [✓ NO] YES / [✓ NO]	

WEEKLY FACILITY INSPECTION REPORT

PLANT DITCHES AND PONDS

DATE: 8-10-12

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
DITCHES		
EAST SIDE STORM DRAINAGE	YES / [✓ NO]	
WEST SIDE STORM DRAINAGE	YES / [✓ NO]	
LIGNITE YARD DRAINAGE	YES / [✓ NO]	
COOLING TOWER AREA	YES / [✓ NO]	
PONDS		
EQUILIZATION	YES / [✓ NO]	LEVEL: -80 inches from 18" freeboard
LIGNITE YARD RETENTION	YES / [✓ NO]	LEVEL: -74 inches from 18" freeboard
ASH DISPOSAL 1A	YES / [✓ NO]	LEVEL: -0.5 inches from 18" freeboard
ASH DISPOSAL 1B	YES / [✓ NO]	LEVEL: -0.5 inches from 18" freeboard
WATER WELL STORAGE	YES / [✓ NO]	LEVEL: -36 inches from 18" freeboard

PLANT PROCESS AREAS

DATE:

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
BOILER AREA EQUIPMENT, PUMPS, PIPING SLAB	 YES / [✓ NO] YES / [✓ NO]	
PRECIPITATOR EQUIPMENT, PUMPS, PIPING SLAB	 YES / [✓ NO] YES / [✓ NO]	
SCRUBBER EQUIPMENT, PUMPS, PIPING SLAB	 YES / [✓ NO] YES / [✓ NO]	
FGD EQUIPMENT, PUMPS, PIPING SLAB	 YES / [✓ NO] YES / [✓ NO]	
LABORATORY INSIDE OUTSIDE	 YES / [✓ NO] YES / [✓ NO]	

WEEKLY FACILITY INSPECTION REPORT

PLANT DITCHES AND PONDS

DATE: 8-17-12

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
DITCHES		
EAST SIDE STORM DRAINAGE	YES / [✓ NO]	
WEST SIDE STORM DRAINAGE	YES / [✓ NO]	
LIGNITE YARD DRAINAGE	YES / [✓ NO]	
COOLING TOWER AREA	YES / [✓ NO]	
PONDS		
EQUILIZATION	YES / [✓ NO]	LEVEL: -80 inches from 18" freeboard
LIGNITE YARD RETENTION	YES / [✓ NO]	LEVEL: -74 inches from 18" freeboard
ASH DISPOSAL 1A	YES / [✓ NO]	LEVEL: 0 inches from 18" freeboard
ASH DISPOSAL 1B	YES / [✓ NO]	LEVEL: 0 inches from 18" freeboard
WATER WELL STORAGE	YES / [✓ NO]	LEVEL: -24 inches from 18" freeboard

PLANT PROCESS AREAS

DATE:

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
BOILER AREA EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
PRECIPITATOR EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
SCRUBBER EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
FGD EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
LABORATORY INSIDE OUTSIDE	YES / [✓ NO] YES / [✓ NO]	

WEEKLY FACILITY INSPECTION REPORT

PLANT DITCHES AND PONDS

DATE: 8-24-12

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
DITCHES		
EAST SIDE STORM DRAINAGE	YES / [✓ NO]	
WEST SIDE STORM DRAINAGE	YES / [✓ NO]	
LIGNITE YARD DRAINAGE	YES / [✓ NO]	
COOLING TOWER AREA	YES / [✓ NO]	
PONDS		
EQUILIZATION	YES / [✓ NO]	LEVEL: -92 inches from 18" freeboard
LIGNITE YARD RETENTION	YES / [✓ NO]	LEVEL: -78 inches from 18" freeboard
ASH DISPOSAL 1A	YES / [✓ NO]	LEVEL: +1 inches from 18" freeboard
ASH DISPOSAL 1B	YES / [✓ NO]	LEVEL: +1 inches from 18" freeboard
WATER WELL STORAGE	YES / [✓ NO]	LEVEL: -36 inches from 18" freeboard

PLANT PROCESS AREAS

DATE:

INSPECTION AREA	LEAKS OR DEFICIENCIES	COMMENTS
BOILER AREA EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
PRECIPITATOR EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
SCRUBBER EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
FGD EQUIPMENT, PUMPS, PIPING SLAB	YES / [✓ NO] YES / [✓ NO]	
LABORATORY INSIDE OUTSIDE	YES / [✓ NO] YES / [✓ NO]	

Appendix E

Photographs

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

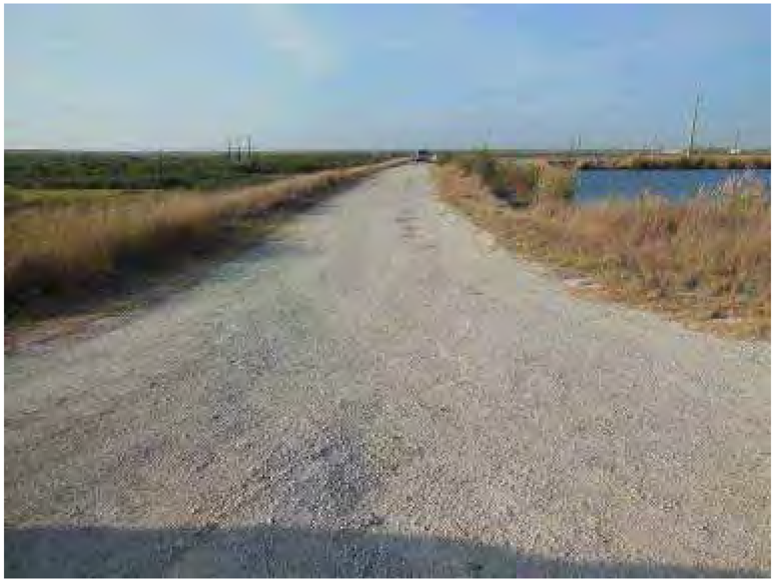

Photo 1: East embankment crest, looking south.

Photo 2: East embankment interior slope, looking south.

Photo 3: East embankment exterior slope, looking south. Note slope erosion.

Photo 4: East embankment exterior slope, looking northeast. Note culvert at northeast corner toe.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 5: East embankment exterior slope, looking south. Piping from water well to water well pond to the left.

Photo 6: East embankment exterior slope approximately 2.5H:1V.

Photo 7: Gate structure between north and south sections of Ash Pond, looking southwest.

Photo 8: Gate structure between north and south sections of Ash Pond, looking west.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 9: Gate structure between north and south sections of Ash Pond, looking west.

Photo 10: East embankment interior slope, looking south. Piping from water well to water well pond to the left.

Photo 11: East embankment exterior slope, looking south.

Photo 12: Stormwater runoff drainage feature at east embankment exterior toe, looking south.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 13: East embankment crest tension or desiccation cracks approximately 15 inches deep.

Photo 14: 6-inch-diameter inlet from Sludge Basin near southeast corner interior slope.

Photo 15: Erosion of east embankment interior slope from leaking water well pipe.

Photo 16: Southeast corner exterior embankment showing animal path and trees, looking southeast.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 17: Approximately 12-inch-deep animal burrow hole at west embankment exterior slope.

Photo 18: Unknown steel pipes near southeast corner exterior slope.

Photo 19: South embankment exterior slope, looking west.

Photo 20: South embankment exterior slope approximately 2.5H:1V.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 21: South embankment crest, looking west.

Photo 22: South embankment interior slope, looking west. Note typical vegetation.

Photo 23: Erosion rills at south embankment interior slope.

Photo 24: Erosion rills at south embankment interior slope.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 25: Erosion rills at south embankment interior slope.

Photo 26: Erosion rills at south embankment interior slope.

Photo 27: Support poles for overhead power lines at south embankment crest, looking west.

Photo 28: Skimmer floats in south section of Ash Pond, looking north.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 29: South embankment exterior slope, looking southeast. Power line support poles to the left.

Photo 30: South embankment interior slope, looking west.

Photo 31: South embankment exterior slope, looking west.

Photo 32: South embankment exterior slope, looking west.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 33: South embankment interior slope, looking west.

Photo 34: South embankment exterior slope, looking northeast. Note remnants of roadway ramp from Ash Pond cleanout in 1987.

Photo 35: Trees at south embankment exterior toe, looking south.

Photo 36: South embankment exterior slope approximately 2.5H:1V.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

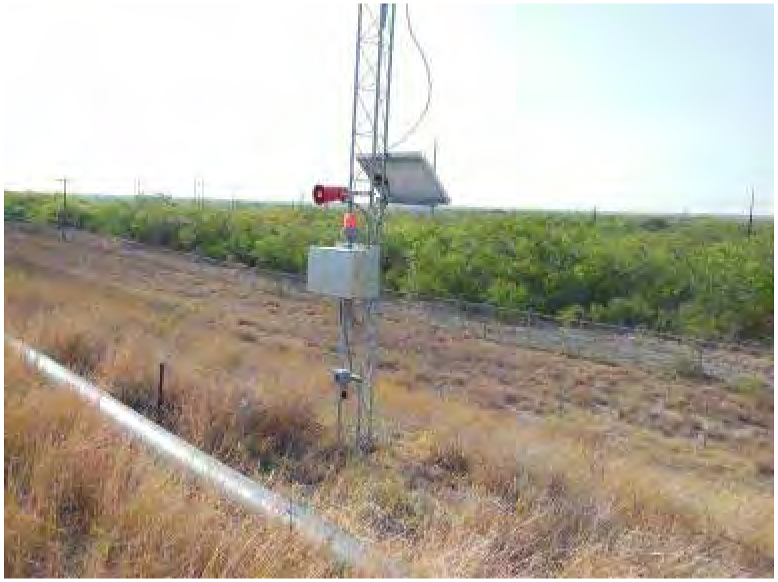

Photo 37: Hydrogen sulfide warning siren at south embankment exterior slope, looking southeast.

Photo 38: South embankment exterior slope, looking west.

Photo 39: South embankment interior slope, looking west.

Photo 40: Berm at south embankment exterior toe, looking east.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 41: Berm at south embankment exterior toe, looking west.

Photo 42: Approximately 6-inch-deep animal burrows on crest near southwest corner.

Photo 43: Southwest corner exterior slope, looking west.

Photo 44: West embankment interior slope, looking north.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 45: West embankment exterior slope, looking north. Abandoned PVC pipe on slope.

Photo 46: West embankment crest, looking north.

Photo 47: West embankment crest, looking northeast. Note abandoned steel and PVC pipe.

Photo 48: Pumps at west embankment exterior toe, looking north. Note coal pile runoff pond to the left.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 49: 24-inch-diamter steel outlet pipe at west embankment interior slope. PVC pipe along center embankment.

Photo 50: 24-inch-diamter steel outlet pipe at west embankment interior slope.

Photo 51: West embankment interior slope, looking north. Note inlet pipes in distance.

Photo 52: West embankment exterior slope, looking north.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 53: Pumps at west embankment exterior toe, looking west.

Photo 54: Inlet pipes at west embankment interior slope, looking east.

Photo 55: Piping from Plant to pumps at west embankment exterior slope, looking southwest.

Photo 56: West embankment exterior slope, looking south. Note cattails and other vegetation growing near toe.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 57: Wet area at west embankment exterior slope.

Photo 58: Cattails and vegetation growing near wet area at west embankment exterior slope.

Photo 59: Minor erosion near wet area at west embankment exterior slope.

Photo 60: Wet area at west embankment exterior slope.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 61: Erosion rill at west embankment exterior slope, looking west.

Photo 62: Erosion rill at west embankment exterior slope, looking east.

Photo 63: North embankment interior slope, looking east. Note vegetation growing on slope.

Photo 64: North embankment exterior slope, looking west.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 65: Drainage feature at north embankment exterior slope, looking east.

Photo 66: North embankment interior slope, looking east.

Photo 67: North embankment crest, looking east.

Photo 68: North embankment interior slope, looking east. Note vegetation growing on interior slope.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 69: Tank retention area at north embankment exterior slope, looking west.

Photo 70: North embankment interior slope, looking east.

Photo 71: 6-inch-diameter pipe inlet from cooling tower at north embankment interior slope.

Photo 72: North embankment crest, looking east.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 73: North embankment interior slope, looking east. Note bollards in embankment at the end of roadway.

Photo 74: 6-inch-diameter inlet pipe from waste treatment sump at north embankment interior slope.

Photo 75: North embankment interior slope, looking east. Note floating skimmers in north section of Ash Pond.

Photo 76: North embankment interior slope, looking east.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 77: North embankment crest, looking east.

Photo 78: Gate structure between north and south sections of Ash Pond, looking west.

Photo 79: Gate structure between north and south sections of Ash Pond, looking west.

Photo 80: Center embankment south slope, looking west. Note vegetation on slope.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 81: Center embankment north slope, looking west. Note vegetation on slope.

Photo 82: Center embankment crest, looking west. Note end of PVC pipe running along center embankment.

Photo 83: PVC pipe at center embankment south slope, looking west.

Photo 84: Center embankment north slope, looking northwest. Note vegetation on slope.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 85: Center embankment crest, looking west.

Photo 86: Center embankment south slope, looking west.

Photo 87: Center embankment crest, looking west. Note PVC pipe running length of center embankment.

Photo 88: Center embankment north slope, looking west.

EPA Assessment, San Miguel Plant - Ash Pond, August 30, 2012

Photo 89: Center embankment crest, looking west.

Photo 90: Center embankment north slope, looking west.

Photo 91: Center embankment south slope, looking west.

Photo 92: Center embankment north slope, looking west. Note 24-inch-diameter steel outlet pipe in distance.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 93: West embankment interior slope, looking north. Submersible pump structure in top right.

Photo 94: West embankment crest, looking north.

Photo 95: West embankment exterior slope, looking north. Electric substation and stormwater vault to left.

Photo 96: Stormwater vault at west embankment exterior slope, looking west.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 97: West embankment interior slope, looking north.

Photo 98: West embankment interior slope approximately 3.5H:1V.

Photo 99: Erosion rill at west embankment interior slope.

Photo 100: Approximately 14-inch-deep erosion rill at west embankment interior slope.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 101: 12-inch-diameter substation stormwater drain inlet at west embankment interior slope.

Photo 102: Approximately 3-ft-high area of erosion or settlement under stormwater inlet.

Photo 103: West embankment interior slope, looking north.

Photo 104: 12-inch-diameter plant stormwater inlet pipe at west embankment interior slope.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 105: West embankment interior slope, looking northwest.

Photo 106: West embankment crest, looking northeast. Water well pond located to left.

Photo 107: West embankment exterior slope, looking northeast. Common embankment with water well pond.

Photo 108: West embankment interior slope, looking east. Note vegetation on slope.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 109: 8-inch-diameter inlet pipe from acid storage area at west embankment interior slope.

Photo 110: West embankment interior slope, looking north.

Photo 111: West embankment interior slope, looking east. Note vegetation on slope.

Photo 112: Mounded earth at west embankment interior slope, looking east. Note vegetation on slope.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 113: Pipe on mounded earth at west embankment interior slope.

Photo 114: West embankment exterior slope, looking north. Common embankment with water well pond.

Photo 115: West embankment interior slope, looking southeast.

Photo 116: West embankment interior slope, looking north.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 117: West embankment interior slope, looking north.

Photo 118: West embankment crest, looking northwest.

Photo 119: Northwest corner crest, looking east.

Photo 120: Exterior slope at northwest corner, looking west.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 121: North embankment crest, looking east.

Photo 122: North embankment exterior slope, looking east.

Photo 123: North embankment interior slope, looking west.

Photo 124: North embankment interior slope approximately 2H:1V.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 125: Cattails and vegetations along drainage feature at north embankment exterior toe, looking west.

Photo 126: North embankment exterior slope approximately 3H:1V.

Photo 127: Cattails and vegetation at north embankment exterior toe, looking northeast.

Photo 128: North embankment interior slope, looking east.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 129: North embankment exterior slope, looking northeast.

Photo 130: Barren area at northeast corner toe, looking east.

Photo 131: Drainage feature near northeast corner toe, looking east.

Photo 132: Northeast corner exterior slope, looking southwest.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 133: East embankment exterior slope, looking south.

Photo 134: East embankment interior slope, looking south.

Photo 135: Sludge deposits near northeast corner of Sludge Basin, looking southwest.

Photo 136: East embankment exterior slope approximately 3.5H:1V.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 137: East embankment crest, looking south.

Photo 138: East embankment interior slope, looking south.

Photo 139: East embankment interior slope, looking south.

Photo 140: Trees at east embankment exterior toe, looking south.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 141: Cattails and vegetation at southeast corner exterior toe, looking south.

Photo 142: Barren area at southeast corner exterior toe, looking west.

Photo 143: Approximately 3-feet-deep animal burrow at south embankment exterior slope.

Photo 144: Barren area at southeast corner exterior toe, looking southeast.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 145: 6-inch-diameter outlet pipe and pump at south embankment interior slope, looking west.

Photo 146: South embankment exterior slope, looking west.

Photo 147: South embankment interior slope, looking west.

Photo 148:South embankment exterior slope, looking southwest.

EPA Assessment, San Miguel Plant – Sludge Basin, August 30, 2012

Photo 149: South embankment exterior slope, looking northwest. Note overhead powerlines and substation in distance.

Photo 150: Reference mark for measuring water level in Sludge Basin. Zero corresponds to 18 inches of freeboard.

Photo 151: Erosion under submersible pump outlet structure at west embankment exterior slope.

Appendix E
Photo GPS Locations

Site: San Miguel Electric Plant
Datum: NAD 1983
Coordinate Units: Degrees Decimal Minutes

Photo No.	Latitude	Longitude
1	N 28 42.042'	W 98 28.279'
2	N 28 42.036'	W 98 28.280'
3	N 28 42.034'	W 98 28.282'
4	N 28 42.029'	W 98 28.279'
5	N 28 42.023'	W 98 28.270'
6	N 28 42.013'	W 98 28.275'
7	N 28 42.008'	W 98 28.282'
8	N 28 42.002'	W 98 28.278'
9	N 28 41.992'	W 98 28.279'
10	N 28 41.989'	W 98 28.280'
11	N 28 41.978'	W 98 28.276'
12	N 28 41.974'	W 98 28.267'
13	N 28 41.963'	W 98 28.281'
14	N 28 41.967'	W 98 28.281'
15	N 28 41.959'	W 98 28.283'
16	N 28 41.952'	W 98 28.280'
17	N 28 41.950'	W 98 28.281'
18	N 28 41.949'	W 98 28.282'
19	N 28 41.945'	W 98 28.286'
20	N 28 41.942'	W 98 28.283'
21	N 28 41.953'	W 98 28.298'
22	N 28 41.954'	W 98 28.301'
23	N 28 41.952'	W 98 28.314'
24	N 28 41.954'	W 98 28.317'
25	N 28 41.953'	W 98 28.331'
26	N 28 41.955'	W 98 28.372'
27	N 28 41.950'	W 98 28.383'
28	N 28 41.955'	W 98 28.398'
29	N 28 41.951'	W 98 28.406'
30	N 28 41.956'	W 98 28.414'
31	N 28 41.949'	W 98 28.437'
32	N 28 41.952'	W 98 28.487'
33	N 28 41.955'	W 98 28.500'
34	N 28 41.947'	W 98 28.512'
35	N 28 41.949'	W 98 28.512'
36	N 28 41.952'	W 98 28.510'
37	N 28 41.954'	W 98 28.602'
38	N 28 41.954'	W 98 28.669'
39	N 28 41.956'	W 98 28.690'
40	N 28 41.946'	W 98 28.724'
41	N 28 41.948'	W 98 28.723'
42	N 28 41.955'	W 98 28.736'
43	N 28 41.954'	W 98 28.734'
44	N 28 41.962'	W 98 28.743'
45	N 28 41.963'	W 98 28.754'
46	N 28 41.972'	W 98 28.747'

Appendix E
Photo GPS Locations

Site: San Miguel Electric Plant
Datum: NAD 1983
Coordinate Units: Degrees Decimal Minutes

Photo No.	Latitude	Longitude
47	N 28 41.976'	W 98 28.748'
48	N 28 41.979'	W 98 28.747'
49	N 28 41.994'	W 98 28.745'
50	N 28 41.998'	W 98 28.735'
51	N 28 42.003'	W 98 28.742'
52	N 28 42.008'	W 98 28.752'
53	N 28 42.010'	W 98 28.748'
54	N 28 42.019'	W 98 28.747'
55	N 28 42.039'	W 98 28.748'
56	N 28 42.031'	W 98 28.754'
57	N 28 42.025'	W 98 28.757'
58	N 28 42.030'	W 98 28.759'
59	N 28 42.024'	W 98 28.756'
60	N 28 42.025'	W 98 28.756'
61	N 28 42.040'	W 98 28.751'
62	N 28 42.044'	W 98 28.757'
63	N 28 42.042'	W 98 28.739'
64	N 28 42.047'	W 98 28.714'
65	N 28 42.047'	W 98 28.713'
66	N 28 42.044'	W 98 28.701'
67	N 28 42.047'	W 98 28.686'
68	N 28 42.042'	W 98 28.570'
69	N 28 42.060'	W 98 28.532'
70	N 28 42.042'	W 98 28.515'
71	N 28 42.041'	W 98 28.483'
72	N 28 42.044'	W 98 28.462'
73	N 28 42.042'	W 98 28.445'
74	N 28 42.041'	W 98 28.415'
75	N 28 42.042'	W 98 28.394'
76	N 28 42.041'	W 98 28.359'
77	N 28 42.044'	W 98 28.344'
78	N 28 41.997'	W 98 28.288'
79	N 28 41.992'	W 98 28.288'
80	N 28 41.993'	W 98 28.297'
81	N 28 41.995'	W 98 28.298'
82	N 28 41.996'	W 98 28.299'
83	N 28 41.996'	W 98 28.363'
84	N 28 41.996'	W 98 28.370'
85	N 28 41.996'	W 98 28.407'
86	N 28 41.995'	W 98 28.438'
87	N 28 41.996'	W 98 28.511'
88	N 28 41.996'	W 98 28.513'
89	N 28 41.998'	W 98 28.575'
90	N 28 41.999'	W 98 28.643'
91	N 28 41.997'	W 98 28.656'
92	N 28 41.998'	W 98 28.706'

Appendix E
Photo GPS Locations

Site: San Miguel Electric Plant
Datum: NAD 1983
Coordinate Units: Degrees Decimal Minutes

Photo No.	Latitude	Longitude
93	N 28 41.972'	W 98 28.143'
94	N 28 41.994'	W 98 28.151'
95	N 28 41.998'	W 98 28.154'
96	N 28 42.000'	W 98 28.152'
97	N 28 41.999'	W 98 28.141'
98	N 28 42.011'	W 98 28.142'
99	N 28 42.012'	W 98 28.142'
100	N 28 42.015'	W 98 28.141'
101	N 28 42.017'	W 98 28.138'
102	N 28 42.020'	W 98 28.139'
103	N 28 42.020'	W 98 28.136'
104	N 28 42.038'	W 98 28.144'
105	N 28 42.038'	W 98 28.146'
106	N 28 42.047'	W 98 28.160'
107	N 28 42.050'	W 98 28.160'
108	N 28 42.064'	W 98 28.138'
109	N 28 42.073'	W 98 28.130'
110	N 28 42.081'	W 98 28.133'
111	N 28 42.115'	W 98 28.131'
112	N 28 42.130'	W 98 28.132'
113	N 28 42.134'	W 98 28.125'
114	N 28 42.144'	W 98 28.139'
115	N 28 42.153'	W 98 28.138'
116	N 28 42.168'	W 98 28.137'
117	N 28 42.186'	W 98 28.157'
118	N 28 42.191'	W 98 28.164'
119	N 28 42.219'	W 98 28.189'
120	N 28 42.234'	W 98 28.180'
121	N 28 42.253'	W 98 28.183'
122	N 28 42.234'	W 98 28.143'
123	N 28 42.227'	W 98 28.137'
124	N 28 42.227'	W 98 28.134'
125	N 28 42.241'	W 98 28.089'
126	N 28 42.232'	W 98 28.096'
127	N 28 42.229'	W 98 28.097'
128	N 28 42.226'	W 98 28.079'
129	N 28 42.228'	W 98 28.055'
130	N 28 42.241'	W 98 28.012'
131	N 28 42.246'	W 98 27.992'
132	N 28 42.239'	W 98 28.000'
133	N 28 42.218'	W 98 28.002'
134	N 28 42.218'	W 98 28.013'
135	N 28 42.196'	W 98 28.011'
136	N 28 42.103'	W 98 28.078'
137	N 28 42.100'	W 98 28.083'
138	N 28 42.070'	W 98 28.057'

Appendix E
Photo GPS Locations

Site: San Miguel Electric Plant
Datum: NAD 1983
Coordinate Units: Degrees Decimal Minutes

Photo No.	Latitude	Longitude
139	N 28 42.028'	W 98 28.012'
140	N 28 42.014'	W 98 28.009'
141	N 28 41.972'	W 98 28.015'
142	N 28 41.959'	W 98 28.015'
143	N 28 41.963'	W 98 28.038'
144	N 28 41.964'	W 98 28.038'
145	N 28 41.970'	W 98 28.032'
146	N 28 41.964'	W 98 28.049'
147	N 28 41.968'	W 98 28.089'
148	N 28 41.965'	W 98 28.103'
149	N 28 41.958'	W 98 28.139'
150	N 28 41.989'	W 98 28.137'
151	N 28 41.989'	W 98 28.141'

Appendix F

CDM Smith Memorandum of Explanation

Draft Report Comments

11 British American Boulevard, Suite 200
Latham, New York 12110
tel: 518-782-4500
fax: 518-783-3810

Memorandum

To: Jana Englander

From: William J. Friers

Date: April 28, 2014

Subject: Round 12, Revised Final Report – San Miguel Electric Plant

Please find attached a copy of the CCW Impoundment Final Report for San Miguel Electric Plant (Round 12, CLIN 020). This Final Report has been revised to address the comments received from the EPA and the Plant Owner, San Miguel Electric Co-op, as noted below.

San Miguel Electric Co-op Comment No. 1 - In numerous places in the report it is stated that the level in the pond was one foot above the target pool elevation. This is incorrect. The Ash Water Transport Pond was below the target pool elevation per the operator log of August 30, 2012.

CDM Smith Action - CDM Smith has revised the report to reflect that the Ash Water Transport Pond was below the target pool elevation.

San Miguel Electric Co-op Comment No. 2 – Appendix C to the report contains an Impoundment Inspection form for both the Ash Water Transport Pond and the Sludge Disposal Basin. Under the heading "Reasoning for Hazard Rating Chosen" for both impoundments, it is incorrectly stated that liquids would likely flow to the Atascosa river located 1.3 miles from the plant site. The Atascosa River is located approximately 16.5 stream miles from the plant. The flow path to get to the Atascosa River would be first to the normally dry Souse Creek, then to the La Parita Creek approximately 4.2 miles stream miles from the power plant and ending at the Atascosa River. We respectfully ask that the distance to the Atascosa River be modified to reflect that the river is approximately 16.5 miles from the plant, and that Hazard Rating be reconsidered.

CDM Smith Action - CDM Smith revised the report to indicate discharges from the impoundments would first enter normally dry creeks adjacent to the plant and then enter La Parita Creek approximately 4.2 stream miles from the plant before reaching the Atascosa River 16.5 stream miles from the Plant.

CDM Smith reevaluated the Hazard Ratings assigned to the Ash Water Transport Pond and the Sludge Disposal Basin and found the assigned Significant Hazard potential classifications to be appropriate for both impoundments. While the failure or misoperation of either CCW impoundment will result in no probable loss of human life, failure or misoperation can cause economic loss, environmental damage or disruption of lifeline facilities.

San Miguel Electric Co-op Comment No. 3 –Section 1.3.1.2: Correct pond elevation to 1 inch below target pool elevation. We believe that this modification would change the hydrologic/hydraulic safety determination to "adequate." Suggested changes follow:

"No hydrologic and hydraulic information was provided by San Miguel to indicate CCW impoundments hydrologic/hydraulic safety. A target pool elevation of at least 18 inches of freeboard at both the Ash Pond and Sludge Basin was the only hydraulic information provided by San Miguel. The Ash Pond was 1 inch below the target pool elevation during the site assessment and no hydrologic/hydraulic documentation was provided, the hydrologic/hydraulic safety is judged to be adequate."

CDM Smith Action - CDM Smith has revised Section 1.3.1.2 of the report to reflect that both the Sludge Basin and the Ash Water Transport Pond were below the target pool elevation.

San Miguel Electric Co-op Comment No. 4 –Section 1.3.1.6: Since the water levels were below the target pool level, everything in the first paragraph after the words "generally adequate" should be deleted. Suggested changes follow: "Current maintenance and operation procedures appear to be generally adequate".

CDM Smith Action - CDM Smith revised Section 1.3.1.6 of the report, stating that current maintenance and operating procedures appear adequate.

San Miguel Electric Co-op Comment No. 5 –Section 1.3.1.7: Add to the first sentence, "by the environmental engineer and levels are checked by the operation department six times daily". Correct the sentence on high water level in the ash pond. Provide information on local level gauges at the ponds. We believe that these modifications change the conclusion regarding more detail and/or frequent inspections and ask that you reconsider that conclusion. Suggested changes follow:

Surveillance and monitoring procedures include checking the impoundments for leaks or deficiencies, and recording pool levels for both the Ash Pond and Sludge Basin once a week by the environmental engineer and levels checks six times daily by the operations department. There is no remote instrumentation only local level gauges for the Ash Pond or and Sludge Basin. Because of erosion into the Ash Pond's east embankment slope from a leaking pipe, the surveillance and monitoring program should be revised to include more-detailed inspections.

CDM Smith Action - CDM Smith revised Section 1.3.1.7 to say pool levels for both the Ash Pond and Sludge Basin are checked once a week by the environmental engineer and levels checks are made six times daily by the operations department.

San Miguel Electric Co-op Comment No. 6 –Section 2.1: 2nd paragraph, sixth line, change to, "Ash Pond was last dredged in2005."

CDM Smith Action - CDM Smith revised Section 2.1, as per Comment No. 6.

San Miguel Electric Co-op Comment No. 7 –Section 2.2: The ash pond does not receive liquids from the scrubber discharge. In the first paragraph second line, delete the words, “scrubber discharge”.

CDM Smith Action - CDM Smith revised Section 2.2, as per Comment No. 7.

San Miguel Electric Co-op Comment No. 8 – Section 2.2.1: The following statement is made: “From the fly ash silo the fly ash can be sold (as a Portland cement substitute) or mixed with the scrubber sludge to be disposed of in the mine.” Modify sentence as follows: “From the fly ash silo the fly ash is sold (as a Portland Cement substitute) or mixed with the scrubber sludge for placement in the mine for reclamation purposes.”

CDM Smith Action - CDM Smith revised Section 2.2.1, as per Comment No. 8.

San Miguel Electric Co-op Comment No. 9 – Section 2.2.2: Modify “The dewater bottom ash is loaded into trucks and disposed of in the mine” to “The dewatered bottom ash is loaded into trucks and placed in the mine for reclamation purposes.”

CDM Smith Action - CDM Smith revised Section 2.2.2, as per Comment No. 9.

San Miguel Electric Co-op Comment No. 10 - Section 2.2.4: Modify “The solids (75 to 80% solid) are then mixed with the fly ash so the dry mixture can be disposed of in the mine” to “The solids (75 to 80% solid) are then mixed with the fly ash so the dry mixture can be placed in the mine for reclamation purposes.”

CDM Smith Action - CDM Smith revised Section 2.2.2, as per Comment No. 10.

San Miguel Electric Co-op Comment No. 11 - Section 2.3, Table 2-3: We do not believe there would be any economic or environmental damage to the Atascosa River. We suggest the wording in the first bullet to be modified as follows: Failure or miss-operation could result in economic and environmental damage to the adjacent creek. Based on the above discussion, we also ask that the Hazard Rating be reconsidered.

CDM Smith Action - CDM Smith deleted reference to the Atascosa River in Section 2.3, Table 2-3. CDM Smith reevaluated the Hazard Ratings assigned to the Ash Water Transport Pond and the Sludge Disposal Basin and found the assigned Significant Hazard potential classifications to be appropriate for both impoundments. While the failure or misoperation of either CCW impoundment will results in no probable loss of human life, failure or misoperation can cause economic loss, environmental damage, or disruption of lifeline facilities.

San Miguel Electric Co-op Comment No. 12 - Section 2.6: In first paragraph, first sentence after “Atascosa River” add, “which is approximately 16.5 stream miles from the Plant.” Change wording in the other paragraphs to delete “Atascosa River”. Suggested changes follow:

Based on available topographic maps, surface drainage in the vicinity of the San Miguel Electric Plant appears to be to the northwest towards creeks that flow to the Atascosa River, which is approximately 16.5 steam miles from the Plant. Critical infrastructure identified within five miles downgradient of the Plant includes overhead high voltage power lines. No schools, hospitals, waterways, roadways and bridges, and other major facilities were identified within five miles of the Plant site. Places of worship shown on Figure 2-1 are more than 5 miles from the Plant and are not downgradient of the impoundments.

Discharge from both impoundments would likely flow directly into the dry creeks located south of the Ash Pond and west of the Sludge Basin. The dry Creeks adjacent to the Plant site discharge into the LaParita Creek approximately 4.2 miles from the Plant. High voltage power lines are located adjacent to both the Ash Pond and Sludge Basin, between the impoundment and creeks.

Liquids discharged from a breach of the impoundment embankments would likely result in economic and limited environmental damage to Plant property, adjacent rural property, adjacent creek and is not expected to result in loss of human life.

CDM Smith Action - CDM Smith has revised Section 2.6 of the report, stating drainage in the vicinity of the San Miguel Electric Plant appears to be to the northwest towards Souse Creek and La Parita Creek and that Souse Creek and La Parita Creek flows ultimately discharge to the Atascosa River, approximately 16.5 stream miles from the plant. CDM Smith cannot assess the extent of environmental damage that may result from a breach of one of both impoundments and therefore did not insert the word" limited" in the last paragraph of the section as suggested by the San Miguel Electric Co-op.

San Miguel Electric Co-op Comment No. 13 - Section 4.2.3: In paragraph following Table 4-1, change the wording in second line to, "in 2010 sludge was partially excavated from the Sludge Basin.

CDM Smith Action - CDM Smith revised Section 4.2.3, as per Comment No. 13.

San Miguel Electric Co-op Comment No. 14 - Section 5.3.4: Please add the following clarification at the end of the paragraph, "Both of these outlets are pumped to the Ash Water Transport Pond for recycling of the water."

CDM Smith Action - CDM Smith revised Section 5.3.4, as per Comment No. 14.

San Miguel Electric Co-op Comment No. 15 - Section 8.1: 2nd paragraph fourth line change, "...Ash Pond or reuse..." to "Ash Pond for reuse..."

CDM Smith Action - CDM Smith revised Section 8.1, as per Comment No. 15.

San Miguel Electric Co-op Comment No. 16 - Section 8.3.1: Since the pond level was below the target pool elevation the last two sentences should be deleted. Suggested changes follow: "Based on CDM Smith's visual observations and review of documents provided by San Miguel, operating procedures appear to be generally adequate for the impoundments".

CDM Smith Action - CDM Smith revised Section 8.1, as per Comment No. 16.

San Miguel Electric Co-op Comment No. 17 - Section 8.3.2: Since there wasn't a high level in the ash pond, the following words should be deleted from the 1st line in the 1st paragraph, "a high water level in the impoundment," The sentence, therefore, should read: "Maintenance issues at the Ash Pond included an area of erosion at the east…"

CDM Smith Action - CDM Smith revised Section 8.3.2, as per Comment No. 17.

San Miguel Electric Co-op Comment No. 18 - Section 9.1: We request modification to the first paragraph to correct the frequency of times the impoundment levels are monitored. Suggested changes follow:

The surveillance procedures include the measurement of water levels and checking for leaks or other deficiencies at each of the impoundments. Water levels are measured and recorded six times daily for the Ash Pond and Sludge Basin by the operations department. Water levels are measured from a reference level at 18 inches of freeboard at each impoundment. Documentation of the water levels includes a checklist report, performed once a week by the Plant Environmental Engineer, with water level and whether leaks or other deficiencies were observed in each impoundment. Checklists from August 2012 are included in Appendix D.

CDM Smith Action - CDM Smith revised Section 9.1, as per Comment No. 18.

San Miguel Electric Co-op Comment No. 19 - Section 9.3.1: 1st line delete the words, "high level in the ash pond and". We do not believe the "more-frequent" inspection in 3rd line is justified so those words should also be deleted. Suggested changes follow:

Because of the erosion into the Ash Pond's east embankment slope from a leaking pipe, the surveillance and monitoring program should be revised to include more-detailed inspections. The area of potential seepage at the west embankment exterior slope of the Ash Pond should be investigated and monitored.

CDM Smith Action - CDM Smith revised Section 9.3.1, as per Comment 19.

San Miguel Electric Co-op Comment No. 20 - Appendix C, checklist for Ash Water Transport Pond: Inspection issue, #6. Should read, "water level is measured six times daily from a float referenced to 18" freeboard"

CDM Smith Action - CDM Smith revised Appendix C, as per Comment No. 20.

San Miguel Electric Co-op Comment No. 21 - Appendix C, Coal Combustion Waste (CCW) Impoundment Inspection, Ash water Transport Pond: page 2, changes to Description for Hazard Rating Chosen: Request the following changes/correction:

Failure or misoperation of the impoundment would result in economic loss and environmental damage. Impoundment is located near facility boundary. Adjacent property includes cattle fields and property leased by the local mining. Liquids would likely flow towards the Atascosa River, situated approximately 16.5 stream miles northeast of the San Miguel Plant. Also, structures supporting high voltage power line would possibly be impacted by failure of impoundment.

CDM Smith Action - CDM Smith revised Appendix C, Coal Combustion Waste (CCW) Impoundment Inspection, Ash water Transport Pond page 2 to indicate discharges from the impoundment would first enter normally dry creeks adjacent to the plant and then enter La Parita Creek approximately 4.2 stream miles from the plant before reaching the Atascosa River 16.5 stream miles from the Plant.

San Miguel Electric Co-op Comment No. 22 - Appendix C, Coal Combustion Waste (CCW) Impoundment Inspection, Ash Water Transport Pond: page 3, current freeboard should be corrected to "-1 inch ".

CDM Smith Action - CDM Smith revised Appendix C, Coal Combustion Waste (CCW) Impoundment Inspection, Ash Water Transport Pond page 3 , "Current Freeboard" to 1.5 feet based on a pool elevation of approximately 313.5' at the time of the inspection and a crest elevation of 315.0'.

San Miguel Electric Co-op Comment No. 23 - Appendix C, checklist for Sludge Disposal Basin: Inspection issue, #6. Should read, "water level is measured six times daily referenced to 18" freeboard"

CDM Smith Action - CDM Smith revised Appendix C, as per Comment No. 23.

San Miguel Electric Co-op Comment No. 24 - Appendix C, Coal Combustion Waste (CCW) Impoundment Inspection, Sludge Disposal Basin: page 2, changes to Description for Hazard Rating Chosen: Request the following changes/correction:

Failure or misoperation of the impoundment would result in economic loss and environmental damage. Impoundment is located near facility boundary. Adjacent property includes cattle fields and property leased by the local mining. Liquids would likely flow towards the Atascosa River, situated approximately 16.5 stream miles northeast of the San Miguel Plant. Also, structures supporting high voltage power line would possibly be impacted by failure of impoundment

CDM Smith Action - CDM Smith revised Appendix C, Coal Combustion Waste (CCW) Impoundment Inspection, Ash water Transport Pond page 2 to indicate discharges from the impoundment would first enter normally dry creeks adjacent to the plant and then enter La Parita Creek approximately 4.2 stream miles from the plant before reaching the Atascosa River 16.5 stream miles from the Plant.

EPA Comment No. 1 - Please document CDM Smith's position that the hydraulic/hydraulic safety of the impoundments is inadequate.

CDM Smith Action – San Miguel Electric Co-op's Environmental Engineer monitors and documents the Ash Water Transport Pond and Sludge Disposal Basin water levels on a weekly basis. Documentation of the water levels includes a checklist report, with water levels and whether leaks or other deficiencies were observed in each impoundment. Additionally, water levels are measured and recorded six times daily for the Ash Pond and Sludge Basin by the operations department. Water levels are measured from a reference level at 18 inches of freeboard at each impoundment. Although the impoundments are monitored on a consistent basis, no hydraulic/hydraulic analysis was provided to confirm the impoundments can store a 50% Probable Maximum Precipitation event without overtopping.

Please call or email with any questions.

Sincerely,

William J. Friers, P.E.
Senior Civil Engineer
CDM Smith