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2.5.4 Stability of Subsurface Materials and Foundations

This subsection provides the details of subsurface materials present at, and foundations constructed for, the VCS site, including safety-related structures in the power block area (see Figure 2.5.4-1) and the adjoining nonsafety-related cooling basin (see Figure 2.5.4-2).

The information presented in this subsection is based on the results of a site-specific subsurface investigation, conducted between October 2007 and February 2008, and on an evaluation of the collected data, unless noted otherwise. Note that the site-specific subsurface investigation reported on here accommodates a typical two-unit Light Water Reactor (LWR) power block arrangement (with integral Ultimate Heat Sink [UHS]) and includes a cooling basin to the south. The detailed data for the power block and the cooling basin areas collected from this site-specific subsurface investigation is contained in References 2.5.4-1 and 2.5.4-2, respectively. Copies of References 2.5.4-1 and 2.5.4-2 are provided in Part 5 of the ESP application. For the bounding analyses for excavation and backfill (Subsection 2.5.4.5) and stability of foundations (Subsection 2.5.4.10), a typical LWR with an independent UHS was also considered.

Supplemental site-specific subsurface investigation was performed in early 2009 (Reference 2.5.4-3) Refer to Appendix 2.5.4-A for a comparison of subsurface profiles and design properties updated with the additional data, to the subsurface profiles and design properties used in the main body of this subsection. A copy of Reference 2.5.4-3 is provided in Part 5 of the ESP application.

This subsection has been prepared with references to “Unit 1” and “Unit 2.” “Unit 1” refers to the western half of the power block area, while “Unit 2” refers to the eastern half of the power block area.

2.5.4.1 Geologic Features

Subsection 2.5.1 addresses the geologic setting of the VCS site, including regional and site-specific physiography and geomorphology, geologic history, stratigraphy, tectonic and neo-tectonic conditions, and potential geologic hazards, and presents related maps, cross sections, and references. The potential geologic hazards assessed in Subsection 2.5.1 include, among other things, subsidence, solutioning/karst, zones of irregular weathering, seismic sources, zones of structural weakness, and unrelieved residual stresses.

A brief summary of the geologic conditions described in Subsection 2.5.1 follows. As shown in Figures 2.5.1-1 and 2.5.1-3, the site lies within the Coastal Prairies subprovince of the Gulf Coastal Plains physiographic province. The surficial soils present at the site consist of Beaumont Formation underlain by the Lissie Formation sediments. These Pleistocene-age soils were deposited by ancestral rivers during a period of glacial recession and high sea level. The Beaumont Formation extends to a depth of approximately 400 feet below ground surface, and the Lissie Formation has a combined thickness of roughly 200 feet beneath the VCS site. These formations are underlain by deposits of Pliocene to Oligocene age, and extend to a depth of approximately 8400 feet below ground surface, where they transition to the underlying earlier tertiary sediments, with a base depth of approximately 20,000 feet below ground surface. These Cenozoic deposits are underlain by Mesozoic bedrock, and then by Proterzoic rock (basement rock), which occurs at a top depth of approximately 41,000 feet below ground surface. Refer to Subsection 2.5.1 and Figures 2.5.1-10 and 2.5.1-15 for additional detail on the stratigraphic column briefly described above. The uppermost 600 feet of Beaumont Formation and Lissie Formation (Pleistocene) sediments are the subject of the site-specific subsurface investigation described here.

Pre-loading (overconsolidation) influences on site soils, including estimates of consolidation properties, overconsolidation ratios, preconsolidation pressures, and methods used for their estimation, are addressed in Subsection 2.5.4.2. Related maps and subsurface profiles specific to the site are presented in Subsection 2.5.4.3.

The stability of site soils and their response to dynamic loading is addressed in Subsection 2.5.4.7. The stability of site soils and their response to static (foundation) loading, including the stability of foundations for seismic Category I structures, is addressed in Subsection 2.5.4.10.

2.5.4.2 Properties of Subsurface Materials

This subsection addresses the properties of subsurface materials, and the methods of determining these properties. Subsection 2.5.4.2.1 addresses the properties of subsurface materials encountered at the VCS site, while Subsection 2.5.4.2.2 describes the subsurface investigation and laboratory testing program conducted in obtaining these properties.

2.5.4.2.1 Description of Subsurface Materials

This subsection addresses the properties of subsurface materials as follows:

- Subsection 2.5.4.2.1.1 provides an introduction to the soil strata encountered at the VCS site.
- Subsection 2.5.4.2.1.2 describes each soil stratum encountered.
- Subsection 2.5.4.2.1.3 describes the evaluation of in situ properties of soil strata investigated (i.e., soils extending to a depth of approximately 600 feet below ground surface), and presents tables and figures of these properties.
- Subsection 2.5.4.2.1.4 describes the evaluation of properties of structural fill, embankment fill, and drainage sand materials, and presents tables and figures of these properties.
- Subsection 2.5.4.2.1.5 describes the subsurface materials below a depth of 600 feet (i.e., below the maximum depth of this subsurface investigation).

2.5.4.2.1.1 Summary of Soil Strata

As noted above, subsurface materials at the VCS site consist of deep Gulf Coastal Plains sediments underlain by Pre-Cretaceous bedrock (basement rock), which is estimated to occur at a depth of approximately 41,000 feet below ground surface (Reference 2.5.4-4). The uppermost 600 feet of site soils, consisting of Beaumont and Lissie Formation soils, are the subject of this subsurface investigation. These soils are divided into 20 individual soil strata, consisting of nine predominantly clay strata and 11 predominantly sand strata. The 20 soil strata are described in Subsection 2.5.4.2.1.2, and their properties are evaluated and presented in Subsection 2.5.4.2.1.3.

Subsurface conditions deeper than 600 feet are characterized using information from the geologic literature, most notably Reference 2.5.4-5, and from deeper borings drilled in the area for oil and gas exploration (Reference 2.5.4-5). While the depth to competent bedrock (basement rock) is significant at the site (approximately 41,000 feet, as noted above), layers and lenses of sandstone, siltstone, limestone, caliche, and hard shale can be present intermittently to this depth.

Identification and characterization of the soil strata investigated is based on physical and engineering characteristics. Methods used in identification and characterization are described in detail in Subsections 2.5.4.2.2 and 2.5.4.4, and include standard penetration testing (SPT) in borings, cone penetration testing (CPT), test pits (TP), geophysical downhole P-S suspension logging to measure compression (P, V_p) and shear (S, V_s) wave velocities, field electrical resistivity testing (ER), and groundwater observation well (OW) installations and related field testing, as well as extensive laboratory testing.

The natural ground surface at and around the power block area at the time of this subsurface investigation is generally level, ranging from approximately elevation 78 feet to elevation 81 feet, with an average elevation of 80 feet. Note that all references to elevations given in this subsection are to the North American Vertical Datum of 1988 (NAVD 88). During construction, the power block area finish grade elevation is raised approximately 15 feet to elevation 95 feet.

The natural ground surface at the cooling basin at the time of this subsurface investigation is gently sloping downward from northwest to southeast, ranging from approximately elevation 80 feet to elevation 42 feet, with an average of elevation 70 feet.The base level of the cooling basin is elevation 69 feet. An embankment dam with crest at elevation 102 feet surrounds the cooling basin. The cooling basin also has interior dikes with crest at elevation 99 feet.

2.5.4.2.1.2 Description of Soil Strata

The following is a description of each soil stratum encountered in the subsurface investigation to the maximum investigated depth of 600 feet in the power block area and 300 feet in the cooling basin. The stratum thickness indicated in each description for the power block area is the calculated average within the two power block units (Unit 1 and Unit 2). For the cooling basin, the stratum thickness indicated in each description is the calculated average. Note that the stratum thickness at a particular boring or CPT is only included in the average calculation when the stratum is encountered and fully penetrated by the boring or CPT. The Unified Soil Classification System (USCS) (References 2.5.4-6 and 2.5.4-7) classifications included in each of the descriptions are based mainly on the results of Atterberg limit tests and grain size analyses. Most of the strata are present in each boring and CPT within the depth investigated, except as noted.

2.5.4.2.1.2.1 Stratum Clay 1

This stratum consists primarily of dark gray fat clay, or lean clay, with varying amounts of silt, sand, and gravel. It has a stiff to very stiff consistency with some weaker zones and trace organics near the ground surface. USCS classification is CL for Stratum Clay 1 (Top) and CH for Stratum Clay 1 (Bottom).

Stratum Sand 1 (described next) subdivides Stratum Clay 1 in the Unit 2 area and in the cooling basin (i.e., Stratum Sand 1 is overlain by Stratum Clay 1 [Top] and underlain by Stratum Clay 1 [Bottom]). Stratum Clay 1 (Top) is about 29 feet thick in the power block area, and about 11 feet thick in the cooling basin. Stratum Clay 1 (Bottom) is about 18 feet thick in the power block area and about 17 feet thick in the cooling basin.

2.5.4.2.1.2.2 Stratum Sand 1

This stratum consists of pale brown, light gray, and light brown, medium dense to dense, fine poorly graded clayey and silty sand. The USCS classification is SC.

As noted above, Stratum Sand 1 subdivides Stratum Clay 1 throughout most of the Unit 2 area, except at ten borings. It also subdivides Stratum Clay 1 throughout the majority of the cooling basin, except at 20 borings. This stratum is absent in the Unit 1 area. Stratum Sand 1 is about 9 feet thick in the Unit 2 area and about 15 feet thick in the cooling basin.

2.5.4.2.1.2.3 Stratum Sand 2

This stratum consists of light gray to brown, medium dense to very dense (occasionally loose), fine clayey sand, with varying amounts of silt and/or clay. The USCS classification is SC.

Stratum Sand 2 is present below Stratum Clay 1 within the power block area, except at ten borings, and within the cooling basin, except at nine borings. Eight CPTs in the cooling basin terminate in Stratum Sand 2. This stratum is about 13 feet thick in the power block area and about 18 feet thick in the cooling basin.

2.5.4.2.1.2.4 Stratum Clay 3

This stratum consists of pale yellow, pale brown, or yellowish brown to olive gray, stiff to hard fat clay, with varying amounts of silt and/or sand in the form of isolated seams and layers. The USCS classification is CH with some CL.

Stratum Clay 3 is present below Stratum Sand 2 at all locations investigated in the power block area, but is not present in five borings in the cooling basin. One CPT in the power block area and six CPTs in the cooling basin terminate in Stratum Clay 3. This stratum is about 25 feet thick in the power block area and about 19 feet thick in the cooling basin.

2.5.4.2.1.2.5 Stratum Sand 4

This stratum consists of pale brown or light gray to pinkish gray, dense to very dense (occasionally loose), fine to medium clayey sand, mostly poorly-graded. The USCS classification is SC or SP-SC. Stratum Sand 4 contains some clay seams and layers, with some samples comprising more than 50 percent fines and indicating some plasticity.

Stratum Sand 4 is present below Stratum Clay 3 at all locations investigated in the power block area and at all but one boring in the cooling basin. The remaining power block area CPTs, and eight CPTs at the cooling basin, terminate in this stratum. Stratum Sand 4 is about 25 feet thick in all areas investigated.

2.5.4.2.1.2.6 Stratum Clay 5

This stratum consists of light gray and brownish yellow to mottled brownish yellow or pale brown, medium to hard fat clay, with small amounts of silt and/or sand. The USCS classification is CH with some CL.

Stratum Clay 5 is present in all borings that extend below Stratum Sand 4 in the power block area, but is absent at three borings in the cooling basin. Stratum Sand 5 (described next) subdivides Stratum Clay 5 (i.e., Stratum Sand 5 is overlain by Stratum Clay 5 [Top] and underlain by Stratum Clay 5 [Bottom]). One CPT in the cooling basin terminates in Stratum Clay 5 (Top). Stratum Clay 5 (Top) is about 19 feet thick in the power block area, and about 14 feet thick in the cooling basin. The corresponding thicknesses for Stratum Clay 5 (Bottom) are about 16 feet and about 13 feet.

2.5.4.2.1.2.7 Stratum Sand 5

This stratum consists of pale to yellowish brown or light gray, dense to very dense (occasionally loose), fine to medium silty or clayey sand, with minor amounts of silt and/or clay. The USCS classification is SC or SM.

As noted above, Stratum Sand 5 subdivides Stratum Clay 5. For borings that extend below Stratum Clay 5 (Top), Stratum Sand 5 is not present at 17 borings in the power block area and at one boring in the cooling basin. All of the remaining CPTs in the cooling basin terminate in this stratum. Stratum Sand 5 is about 13 feet thick in all areas investigated.

2.5.4.2.1.2.8 Stratum Sand 6

This stratum consists of light gray to pale brown, medium dense to very dense, fine to medium silty sand, with varying amounts of silt and/or clay. The USCS classification is SC or SM.

Stratum Sand 6 is present below Stratum Clay 5 in all the borings that extend below Stratum Clay 5. Stratum Sand 6 is about 50 feet thick in the power block area and about 24 feet thick in the cooling basin.

2.5.4.2.1.2.9 Stratum Clay 7

This stratum consists of pale yellow to pale brown and light gray, very stiff to hard clay, with minor amounts of silt and/or sand. The USCS classification is CH or CL.

In borings that extend below Stratum Sand 6, Stratum Clay 7 is present in all of the borings at the Unit 1 area, in only one boring at the Unit 2 area (i.e., it is largely absent in the Unit 2 area), and in all but two borings at the cooling basin. Stratum Clay 7 is about 41 feet thick in the power block area and about 27 feet thick in the cooling basin.

2.5.4.2.1.2.10 Stratum Sand 8

This stratum consists of pale yellow and light gray, dense to very dense, fine to medium silty or clayey sand, with varying amounts of silt and/or clay. The USCS classification is SC or SM.

Stratum Sand 8 is present below Stratum Clay 7 at the Unit 1 area and at the cooling basin, and is present below Stratum Sand 6 at the Unit 2 area. Stratum Sand 8 is about 51 feet thick in the power block area and about 27 feet thick in the cooling basin.

2.5.4.2.1.2.11 Stratum Clay 9

This stratum consists of pale brown and light gray stiff to hard fat clay, with minimal amounts of silt and/or sand. The USCS classification is CH.

Stratum Clay 9 is present below Stratum Sand 8 in all borings that extend below Stratum Sand 8. Stratum Clay 9 is about 41 feet thick in all areas investigated.

2.5.4.2.1.2.12 Stratum Sand 10

This stratum consists of light gray dense to very dense fine silty sand, with varying amounts of silt and/or clay. The USCS classification is SM.

Stratum Sand 10 is present below Stratum Clay 9 at all but one of the power block area borings that extend below Stratum Clay 9. Stratum Sand 10 is approximately 27 feet thick in the power block area and about 33 feet thick in the cooling basin.

2.5.4.2.1.2.13 Stratum Clay 11

This stratum consists of light brown to light gray stiff to hard fat clay, with minimal amounts of silt and/or sand. The USCS classification is CH.

At the power block area, the five 400-foot-deep borings terminate in Stratum Clay 11. The two deepest borings at the cooling basin also terminate in Stratum Clay 11. Only the two 600-foot-deep power block area borings fully penetrate the stratum, where Stratum Clay 11 is approximately 54 feet thick.

Note that the deeper Strata Sand 12 through Clay 17 are investigated and fully penetrated only in the 600-foot-deep boring at the Unit 1 area and in the 600-foot-deep boring at the Unit 2 area.

2.5.4.2.1.2.14 Stratum Sand 12

This stratum consists of light gray, dense to very dense, fine clayey sand, containing significant clay layers. The USCS classification is SC. Stratum Sand 12 is approximately 21 feet thick.

2.5.4.2.1.2.15 Stratum Clay 13

This stratum consists of light brown stiff to hard fat clay. The USCS classification is CH. Stratum Clay 13 is approximately 76 feet thick.

2.5.4.2.1.2.16 Stratum Sand 14

This stratum consists of olive brown, dense to very dense, fine silty sand. The USCS classification is SM. Stratum Sand 14 is approximately 40 feet thick.

2.5.4.2.1.2.17 Stratum Clay 15

This stratum consists of light gray stiff to hard fat clay. The USCS classification is CH. Stratum Clay 15 is approximately 12 feet thick.

2.5.4.2.1.2.18 Stratum Sand 16

This stratum consists of light gray dense to very dense fine silty sand, and includes some clay layers. The USCS classification is SM. Stratum Sand 16 is approximately 17 feet thick.

2.5.4.2.1.2.19 Stratum Clay 17

This stratum consists of pinkish gray stiff to hard clay. The USCS classification is CL. Stratum Clay 17 is about 21 feet thick.

2.5.4.2.1.2.20 Stratum Sand 18

This stratum consists of light gray dense to very dense fine silty sand. The USCS classification is SM. The 600-foot-deep boring at the Unit 1 area penetrates about 14 feet, and the 600-foot deep boring at the Unit 2 area penetrates approximately 4 feet into Stratum Sand 18.

2.5.4.2.1.3 Evaluation of Properties of In Situ Materials

Properties of in situ materials are evaluated using the results of field and laboratory testing for both the power block area and cooling basin. These results, in the form of boring logs, CPT records, test pit logs, laboratory test results, etc., are contained in References 2.5.4-1 and 2.5.4-2, and are presented in summary tables and figures in the following subsections. The majority of the average property values for each stratum presented in the following subsections are given in the *Geotechnical Engineering Parameters Selected for Design* summary tables, namely Table 2.5.4-32 for the power block area and Table 2.5.4-33 for the cooling basin.

Generally, the results from the power block area and from the cooling basin are similar. Where results differ, differences can be attributed to the much larger area covered by the subsurface investigation for the cooling basin and the greater concentration of investigation work in the power block area.

2.5.4.2.1.3.1 Stratum Thickness

The thickness of each stratum is estimated from borings that penetrate the particular stratum. CPTs also provide an estimate of thickness for the shallower strata. The thickness and base elevation of each stratum from all the borings and CPTs performed are averaged and presented in Table 2.5.4-3 for the power block area, and in Table 2.5.4-4 for the cooling basin. Note that the thicknesses and base elevations given in Table 2.5.4-3 are for four defined areas, namely the Unit 1 area, the Unit 2 area, the area inside the power block area (which is the average of the values from investigations made within the Unit 1 area and the Unit 2 area), and outside the power block area. Note that only data from borings and CPTs that encounter and fully penetrate the stratum is considered in evaluating the stratum thickness and in selecting the stratum base elevation in Tables 2.5.4-3 and 2.5.4-4.

2.5.4.2.1.3.2 SPT N-Values

As detailed in Subsection 2.5.4.2.2.3.1, 153 borings were performed for this subsurface investigation: 86 borings in the power block area, seven borings outside the power block area (B-08, B-10, B-2185, B-2301, B-2301A, B-2307, and B-2307A), and 60 borings at the cooling basin. SPT samples were taken at approximately 2.5-foot intervals to 15 feet depth below ground surface, at 5-foot intervals from 15 feet to 100 feet depth, at 10-foot intervals from 100 feet to 200 feet depth, and at 20-foot intervals from 200 feet to the maximum depth sampled at 600 feet. To ensure that all strata were sampled, sampling intervals were decreased from 20-foot to 10-foot intervals in selected borings. Also, in the two deepest power block area borings (B-2174A and B-2274A) sampling intervals from 400 feet to 600 feet below ground surface were offset by 10 feet (e.g., in one boring the sampling depths are 400 feet, 420 feet, 440 feet, etc., while in the other boring, the sampling depths were 410 feet, 430 feet, 450 feet, etc.).

2.5.4.2.1.3.2.1 Uncorrected N-Values

A summary of all N-values measured in the field (uncorrected) is presented in Table 2.5.4-5 for the power block area and in Table 2.5.4-6 for the cooling basin. These uncorrected N-values are shown on: Figure 2.5.4-21 for borings within Unit 1, Figure 2.5.4-22 for the deep boring within Unit 1 (B-2174A), Figure 2.5.4-23 for borings within Unit 2, Figure 2.5.4-24 for the deep boring within Unit 2 (B-2274A), Figure 2.5.4-25 for borings performed outside the power block area, and Figure 2.5.4-26 for the cooling basin.

2.5.4.2.1.3.2.2 N-Value Correction

Field SPT N-values are adjusted for overburden pressure and other factors. This adjusted N-value, N_1, is determined using the following equation (Reference 2.5.4-8):

$$N_1 = N\, C_n\, C_r\, C_b\, C_s \qquad \text{Equation 2.5.4-1}$$

where, N_1 = adjusted N-value (blows per foot [bpf])

N = field SPT value (bpf)

C_r = correction factor for rod length

C_b = correction factor for boring diameter

C_s = correction factor for soil sampler

C_n = overburden correction factor which varies with depth

The correction factors for rod length, boring diameter, and soil sampler are typically close to 1.0. Additional information on each of these correction factors is provided in Reference 2.5.4-8. The correction factor for overburden pressure can vary considerably. The effective overburden pressure is determined for each SPT sample interval using the average unit weights for the individual soil strata as determined by laboratory testing, and the soil strata thicknesses at individual borings, according to the equation below (Reference 2.5.4-8):

$C_n = 2.2/(1.2 + \sigma_v')$ Equation 2.5.4-2

where, C_n = the depth correction factor, which is applied together with the other factors, above, to the uncorrected SPT N-value to yield the normalized SPT N_1-value. The value of C_n is limited to a maximum of 1.7. C_n decreases with depth, becoming less than 1.0 at $\sigma_v' > 1$ ton per square foot (tsf), and has a minimum value of 0.4 (Reference 2.5.4-9)

σ_v' = the effective overburden pressure at the depth of the SPT sample interval in tsf

Reference 2.5.4-69 gives a slight variation on this equation, which is used herein, to make it nondependent on units:

$c_n = 2.2/(1.2 + \sigma_v'/P_a)$ where P_a = atmospheric pressure = 100 kPa (2.09 ksf).

Note that the current (preconstruction) groundwater levels selected in Subsection 2.5.4.6.1 are used in the calculation of the effective overburden pressure.

In addition to the correction factors included in Equation 2.5.4-1, a further correction to the field-measured N-value is made for hammer energy. The SPT N-value used in correlations with engineering properties is a value traditionally based on 60 percent hammer efficiency. All nine of the drill rigs employed in this subsurface investigation used automatic hammers, which typically have efficiencies greater than 60 percent. SPT hammer energy measurements were made for each drilling rig/hammer employed, in accordance with ASTM D 4633 (Reference 2.5.4-10), and the hammer energy measurements (expressed as energy transfer ratios, or ETRs) were obtained. As shown in Table 2.5.4-7, average ETRs range from 73–91 percent. The resulting energy correction factor, C_e, (expressed as ETR/60 percent) ranges from 1.21 to 1.51, also as shown in Table 2.5.4-7. N_1-values (from Equation 2.5.4-1) from each boring are corrected using the appropriate C_e value. The resulting fully corrected SPT N-values are termed $(N_1)_{60}$. These fully corrected STP $(N_1)_{60}$-values are a significant factor in liquefaction evaluation (see Subsection 2.5.4.8.2).

2.5.4.2.1.3.2.3 Corrected N-Values

A summary of all $(N_1)_{60}$ values is presented in Table 2.5.4-8 for the power block area and in Table 2.5.4-9 for the cooling basin. These corrected N-values are shown on: Figure 2.5.4-27 for borings within Unit 1, Figure 2.5.4-28 for the deep boring within Unit 1 (B-2174A), Figure 2.5.4-29 for borings within Unit 2, Figure 2.5.4-30 for the deep boring within Unit 2 (B-2274A), Figure 2.5.4-31 for borings performed outside the power block area, and Figure 2.5.4-32 for the cooling basin.

2.5.4.2.1.3.2.4 Design N-Values

Table 2.5.4-10 presents $(N_1)_{60}$ values selected for design for each stratum at the power block area. Note that the $(N_1)_{60}$ values shown for each stratum in the power block area *Geotechnical Engineering Parameters Selected for Design* summary table (Table 2.5.4-32) are the same values as those shown under the heading Inside Power Block Area in Table 2.5.4-8. Table 2.5.4-11 presents (N1)60 values selected for design for each stratum at the cooling basin.These corrected N-values are also included in the cooling basin *Geotechnical Parameters Selected for Design* summary table (Table 2.5.4-33).

2.5.4.2.1.3.3 CPT Values

As detailed in Subsection 2.5.4.2.2.3.2, 65 CPTs were performed for this subsurface investigation: 37 CPTs at the power block area, one CPT outside the power block area (C-2216), and 27 CPTs at the cooling basin. These CPT results are used (among other results) to estimate the angle of internal friction of sand strata penetrated (Subsection 2.5.4.2.1.3.7) and the undrained shear strength of clay strata penetrated (Subsection 2.5.4.2.1.3.8). Seismic CPT measurements are used to calculate shear wave velocity values of both sand and clay strata penetrated (Subsection 2.5.4.2.1.3.13).

CPT corrected (q_t) and normalized (q_{c1n}) tip resistance values are also significant factors in liquefaction evaluation (see Subsection 2.5.4.8.3). Note that the terms “corrected” and “normalized” used here are as described in Subsection 2.5.4.8.3. Summaries of all of the corrected and normalized CPT tip resistance values, as well as the sleeve friction (f_s) and friction ratio (R_f) values, are given in Table 2.5.4-12 for the power block area and in Table 2.5.4-13 for the cooling basin. Figures 2.5.4-33 through 2.5.4-36 illustrate the corrected CPT tip resistance versus elevation at Unit 1, at Unit 2, outside the power block area, and at the cooling basin, respectively. Figures 2.5.4-37 through 2.5.4-40 illustrate the corresponding normalized CPT tip resistance versus elevation for each of the areas listed above.

2.5.4.2.1.3.4 Natural Moisture Content and Atterberg Limits

The results of natural moisture content and Atterberg limits laboratory tests on samples from all of the soil strata tested are shown in the *General Physical and Chemical Properties Test Results* summary tables, namely Table 2.5.4-16 for the power block area and Table 2.5.4-17 for the cooling basin.

Atterberg limits test results (i.e., liquid limit [LL] values and plastic limit [PL] values) and natural moisture contents are plotted against elevation on Figure 2.5.4-41 for the power block area and on Figure 2.5.4-42 for the cooling basin. Figures 2.5.4-43 and 2.5.4-44 show the Atterberg limit results on a plasticity chart for the power block area and cooling basin, respectively.

2.5.4.2.1.3.5 Grain Size Distribution

The results of grain size distribution tests performed on all of the samples tested are shown in the *General Physical and Chemical Properties Test Results* summary tables, namely Table 2.5.4-16 for the power block area and Table 2.5.4-17 for the cooling basin. These tables show the percentage (by dry weight) of gravel, sand, silt, and clay, and also the percentage fines, (i.e., the percentage passing the standard number 200 sieve; silt plus clay). Specific gravity measurements are also included.

Average fines contents are summarized for each stratum encountered at the power block area and the cooling basin in Tables 2.5.4-32 and 2.5.4-33, respectively.

2.5.4.2.1.3.6 Unit Weight

Unit weight is recorded for each sample tested for shear strength and for consolidation in the laboratory. The results for all samples tested, expressed in terms of dry unit weight and natural moisture content, are included in Tables 2.5.4-18 (strength tests) and 2.5.4-22 (consolidation tests) for the power block area, and in Tables 2.5.4-19 (strength tests) and 2.5.4-23 (consolidation tests) for the cooling basin.

Total unit weights recommended for use in each stratum are summarized in Table 2.5.4-32 for the power block area, and in Table 2.5.4-33 for the cooling basin.

2.5.4.2.1.3.7 Angle of Internal Friction

The drained/effective angle of internal friction (ϕ') of each sand stratum is estimated from corrected SPT $(N_1)_{60}$-values, corrected CPT tip resistances (q_t), and laboratory direct shear test results.

The empirical correlation used to obtain ϕ' from corrected $(N_1)_{60}$-value (Reference 2.5.4-11) is:

$$\phi' = 27.1 + 0.3(N_1)_{60} - 0.00054(N_1)_{60}^2 \qquad \text{Equation 2.5.4-3}$$

The empirical correlation used to obtain ϕ' from corrected CPT tip resistance (Reference 2.5.4-12) is:

$$\phi' = \text{arctangent}\ (\log [q_t/\sigma_v'] + 0.29)/2.68 \qquad \text{Equation 2.5.4-4}$$

where, q_t = the corrected CPT tip resistance

σ_v' = the effective overburden pressure at the depth of the CPT test interval

Values of ϕ' measured in direct shear tests on samples of the various sand strata are given in Tables 2.5.4-18 and 2.5.4-19 for the power block area and for the cooling basin, respectively.

Figure 2.5.4-61 plots ϕ' (estimated from CPT results and Equation 2.5.4-4) versus elevation for Unit 1. Figures 2.5.4-62, 2.5.4-63, and 2.5.4-64 are the corresponding plots for Unit 2, outside the power block area, and for the combined Unit 1, Unit 2, and outside the power block area, respectively. Figure 2.5.4-65 is the corresponding plot for the cooling basin. Refer to Subsection 2.5.5.1.9.1.3 for a description on the selection of ϕ' for foundation sand strata in the cooling basin.

Recommended values of ϕ' derived from the different correlations/test methods (i.e., from SPT correlation, from CPT correlation, from laboratory direct shear testing), and for each stratum, are shown in Table 2.5.4-32 for the power block area, and in Table 2.5.4-33 for the cooling basin.

Note that values of ϕ' for foundation clay strata in the cooling basin area are calculated from direct simple shear tests. There were 22 tests on clay samples that range in depth from 5 feet to 145 feet below ground surface. Based on these results, and as described in Subsection 2.5.5.1.9.1.2, ϕ' = 28 degrees is selected for the upper clay strata (Strata Clay 1 [Top], Clay 1 [Bottom], Clay 3, and Clay 5 [Top]).

2.5.4.2.1.3.8 Undrained Shear Strength

The undrained shear strength (s_u) of each clay stratum is estimated from laboratory unconsolidated-undrained (UU) triaxial compression test results, corrected SPT $(N_1)_{60}$-values, and corrected CPT tip resistances (q_t).

The values of s_u derived from UU triaxial tests are given in Tables 2.5.4-18 and 2.5.4-19 for the power block area and for the cooling basin, respectively. Figures 2.5.4-45 and 2.5.4-46 also plot these results against elevation for the power block area and for the cooling basin, respectively. These figures identify each tested stratum.

The empirical correlation used to obtain s_u from the corrected $(N_1)_{60}$–value (Reference 2.5.4-13) is:

$s_u = (N_1)_{60}/8$ Equation 2.5.4-5

The empirical correlation used to obtain s_u from the corrected CPT tip resistance (q_t) (Reference 2.5.4-14) is:

$s_u = (q_t - \sigma_v)/N_{kt}$ Equation 2.5.4-6

where, q_t = the corrected CPT tip resistance

σ_v = the total overburden pressure at the depth of the CPT test interval

N_{kt} = the cone factor

N_{kt} often falls in the range of 10 to 20 (Reference 2.5.4-14). For estimating undrained shear strength at the VCS site, correlations are made between CPT results and laboratory shear strength tests measured on undisturbed samples collected at borings close-in to the respective CPT. Making this correlation at several CPT/boring pairs, a site-specific N_{kt} = 25 is calculated.

Figure 2.5.4-47 plots s_u (estimated from CPT results and Equation 2.5.4-6) versus elevation for Unit 1. Figures 2.5.4-48, 2.5.4-49, and 2.5.4-50 are the corresponding plots for Unit 2, outside the power block area, and for the combined Unit 1, Unit 2, and outside the power block area, respectively. Figure 2.5.4-51 is the corresponding plot for the cooling basin.

Table 2.5.4-20 is a summary of s_u values obtained by the various methods and contains a recommended value for each clay stratum at the power block area. Table 2.5.4-21 is the corresponding table for the cooling basin.

Values of s_u for foundation clay strata (Strata Clay 1 [Top], Clay 1 [Bottom], Clay 3, and Clay 5 [Top]) at the cooling basin are calculated from direct simple shear tests. As noted in Subsection 2.5.4.2.1.3.7, there were 22 tests on clay samples that range in depth from 5 feet to 145 feet below ground surface. The results of these tests are contained in Table 2.5.4-19, are plotted as shear strength versus depth in Figure 2.5.5-11, and are plotted as a best-fit line of shear strength versus effective vertical stress in Figure 2.5.5-12. Refer to Subsection 2.5.5.1.9.1.2 for a description on the selection of s_u for foundation clay strata in the cooling basin.

2.5.4.2.1.3.9 Consolidation Properties

Consolidation properties and stress history of clay strata are assessed by laboratory testing and by an evaluation of CPT results. The results of laboratory consolidation tests made on selected samples are presented in Tables 2.5.4-22 and 2.5.4-23 for the power block area and for the cooling basin, respectively. Table 2.5.4-24 is a summary of consolidation test results in terms of consolidation properties, namely compression index (C_c), recompression index (C_r), void ratio (e_0), preconsolidation pressure (P_c'), and overconsolidation ratio (OCR) for each clay stratum in the power block area. The corresponding summary for the cooling basin is contained in Table 2.5.4-25.

Figures 2.5.4-52 and 2.5.4-53 plot the preconsolidation pressures of clay strata measured in laboratory consolidation tests against elevation for the power block area and for the cooling basin, respectively. Similarly, Figures 2.5.4-54 and 2.5.4-55 plot the values of OCR of clay strata measured in laboratory consolidation tests against elevation for the power block area and for the cooling basin, respectively. All of these figures identify each tested stratum.

OCR can also be derived from CPT data using a correlation with undrained shear strength (s_u) and vertical effective stress (σ_v') presented in Reference 2.5.4-12. A best-fit line for the correlation of OCR versus s_u/σ_v' from the reference (Figure 5.12 for Plasticity Index [PI] = 40 percent) is

$$OCR = -0.0962\,(s_u/\sigma_v')^3 + 1.009\,(s_u/\sigma_v')^2 + 2.6184\,(s_u/\sigma_v') - 0.1202 \qquad \text{Equation 2.5.4-7}$$

Figure 2.5.4-56 plots OCR (estimated from CPT results and using Equation 2.5.4-7) versus elevation for Unit 1. Figures 2.5.4-57, 2.5.4-58, and 2.5.4-59 are the corresponding plots for Unit 2, outside the power block area, and the combined Unit 1, Unit 2, and outside the power block area, respectively.

Figure 2.5.4-60 is the corresponding plot for the cooling basin. Table 2.5.4-26 contains a summary of the calculated OCR and selected design OCR for the power block area, and Table 2.5.4-27 provides the same for the cooling basin.

2.5.4.2.1.3.10 Elastic Modulus and Shear Modulus (High Strain)

Elastic Modulus:

For clay soils, the high strain (static) elastic modulus (E or E_H) is evaluated using the following relationship (Reference 2.5.4-15):

$E = 600\ s_u$ Equation 2.5.4-8

where, s_u = undrained shear strength

A second relationship pertaining to E for clay soils is based on the relationship between high strain modulus and low strain modulus derived from shear wave velocity. (Reference 2.5.4-16):

$E = 2\ G\ (1 + \mu)$ Equation 2.5.4-9

$G_{0.0001\%} = \gamma\ /g\ (V_s)^2$ Equation 2.5.4-10

$G_{0.0001\%}\ /G_{0.375\%} = 21/\sqrt{PI}$ Equation 2.5.4-11

where, E = static (or large strain) elastic modulus

μ = Poisson's ratio

γ = total unit weight of soil

g = acceleration of gravity = 32.2 feet/second/second

V_s = shear wave velocity

G = shear modulus

$G_{0.0001\%}$ = small strain shear modulus (i.e., strain in the range of 10^{-4} percent), also denoted as G_{max}

$G_{0.375\%}$ = large strain (static) shear modulus (i.e., strain in the range of 0.25 to 0.50 percent)

PI = Plasticity Index

For sands, E is evaluated using the following relationship (Reference 2.5.4-15):

E = 36 N (in kips per square foot [ksf]) Equation 2.5.4-12

where, N = average corrected SPT $(N_1)_{60}$–value in bpf

A second relationship pertaining to E for sands is based on the relationship between high strain modulus and low strain modulus derived from shear wave velocity (Reference 2.5.4-16), using Equations 2.5.4-9 and 2.5.4-10, and:

$G_{0.0001\%}/G_{0.375\%} = 10$ Equation 2.5.4-13

Table 2.5.4-28 gives high strain E values for each stratum, derived from s_u (clay strata), $(N_1)_{60}$ (sand strata), and V_s (both clay strata and sand strata) for the power block area. The values of E recommended for each stratum are also included in the table. Table 2.5.4-29 gives the corresponding values of E recommended for each stratum at the cooling basin.

Shear Modulus:

Shear modulus, G, is related to elastic modulus, E, as follows (Reference 2.5.4-15):

$G = E/(2\,[1 + \mu])$ Equation 2.5.4-14

with the terms as defined before.

Values of G for each stratum are calculated from the E values recommended for use in Tables 2.5.4-28 and 2.5.4-29. A Poisson's ratio of 0.30 is used for sand strata, and a Poisson's ratio of 0.45 is used for clay strata. The resulting high strain G values are given in Table 2.5.4-30 for the power block area and Table 2.5.4-31 for the cooling basin.

2.5.4.2.1.3.11 Static Earth Pressure Coefficients

Active, passive, and at-rest static earth pressure coefficients, K_a, K_p, and K_0, are estimated assuming frictionless vertical walls and horizontal backfill using Rankine's theory, and based on the following relationships (Reference 2.5.4-17):

$K_a = \tan^2 (45 – \phi'/2)$ Equation 2.5.4-15

$K_p = \tan^2 (45 + \phi'/2)$ Equation 2.5.4-16

$K_0 = 1 – \sin (\phi')$ Equation 2.5.4-17

where, ϕ' = drained/effective friction angle of the soil

Calculated static earth pressure coefficients are given in Table 2.5.4-32 for the power block area and in Table 2.5.4-33 for the cooling basin. Because foundations are unlikely to be constructed deeper than Stratum Sand 5, earth pressure coefficients are not calculated below this stratum. For each sand stratum, ϕ' is taken as the value recommended for use in Table 2.5.4-32 for the power block area and in Table 2.5.4-33 for the cooling basin. For all clay strata, Clay 1, Clay 3, and Clay 5, ϕ' is taken as 20 degrees to compute static earth pressure coefficients.

Coefficients used for seismic lateral earth pressure calculations are described in Subsection 2.5.4.10.4.2.

2.5.4.2.1.3.12 Coefficient of Sliding

The coefficient of sliding is termed tangent δ, where δ is the friction angle between the soil and the foundation material bearing against it, in this case concrete.

Based on Reference 2.5.4-18, tangent δ = 0.30 is selected for clay strata, tangent δ = 0.40 is selected for Strata Sand 1 and Sand 2, and tangent δ = 0.45 is selected for Strata Sand 4 and Sand 5. Because it is unlikely that foundations are constructed deeper than Stratum Sand 5, the coefficient of sliding is not calculated below this stratum.

2.5.4.2.1.3.13 Shear Wave Velocity, Compression Wave Velocity, and Poisson's Ratio

The measurement and interpretation of shear wave velocities are described in detail in Subsections 2.5.4.4 and 2.5.4.7, respectively, and are briefly summarized here. At both Unit 1 and Unit 2, shear and compression wave velocities were measured with P-S suspension logging in four borings each (Subsection 2.5.4.4.1) and with seismic CPTs at four locations each (Subsection 2.5.4.4.2). Figures 2.5.4-67 and 2.5.4-68 are plots of all of the measured shear wave velocities to depths of 600 feet at Unit 1 and Unit 2, respectively. Figure 2.5.4-70 is a plot of all measured shear wave velocities at the cooling basin. An analysis of the data in these plots is described in Subsection 2.5.4.7.

Table 2.5.4-51 provides recommended shear wave velocity values for each stratum in each of four areas; namely, at Unit 1; at Unit 2; inside the power block area, which is an average of the values at Unit 1 and at Unit 2; and outside the power block area, which is an average of the values from the two P-S suspension logging borings (B-2301 and B-2307) made outside the power block area. Note that the value of shear wave velocity for each stratum shown for the power block area in Table 2.5.4-32 is the shear wave velocity value for the inside power block area shown in Table 2.5.4-51.

Table 2.5.4-53 provides recommended shear wave velocity values for each stratum in the cooling basin.

2.5.4.2.1.3.14 Elastic Modulus and Shear Modulus (Low Strain)

The low strain shear modulus (G_L, normally assumed to be the shear modulus at 10^{-4} percent shear strain) is derived directly from the shear wave velocity using Equation 2.5.4-10. The value of low strain shear modulus for each stratum shown for the power block area in Table 2.5.4-32 is derived from the shear wave velocity value for the inside power block area in Table 2.5.4-51. The value of low strain shear modulus for each stratum shown for the cooling basin in Table 2.5.4-33 is derived from the shear wave velocity value in Table 2.5.4-53.

The low strain elastic modulus (E_L) can be obtained from the low strain shear modulus (G_L) value using Equation 2.5.4-9, and applying a suitable value of low strain Poisson's ratio. Values of 0.30 for sand strata and 0.45 for clay strata are reasonable.

2.5.4.2.1.3.15 Shear Modulus Degradation and Damping Ratio

Sixteen resonant column torsional shear (RCTS) tests were performed on undisturbed samples from cohesive Strata Clay 1 (Top), Clay 3, Clay 5 (Top), Clay 7, Clay 9, Clay 11, Clay 13, and Clay 17, and from cohesionless Strata Sand 4, Sand 5, Sand 6, Sand 8, Sand 10, Sand 12, Sand 14, and Sand 18. Each of these undisturbed samples was from the power block area. Two RCTS tests were also performed on recompacted composite samples representative of embankment fill at the cooling basin (see Subsections 2.5.4.2.1.4.2 and 2.5.4.5.1).

In each RCTS test, values of shear modulus (G) measured at increasing shear strain levels are compared to the value of G_{max}, the shear modulus measured at 10^{-4} percent shear strain. The shear modulus degradation (ratio of G/G_{max}) is plotted against shear strain, and a curve of G/G_{max} from the literature that best fits the test data is selected. Literature curves are used rather than an actual best-fit curve through the RCTS test data because the literature curves typically extend over a greater range of shear strain than the test data. This is described further in Subsections 2.5.4.7.3.1 and 2.5.4.7.3.2.

Tables 2.5.4-54 and 2.5.4-55 show the selected values of G/G_{max} versus shear strain for each stratum at the power block area and for the two composite samples at the cooling basin (refer to Subsections 2.5.4.2.1.4.2 and 2.5.4.5.1), respectively. Plots of G/G_{max} versus shear strain (shear modulus degradation) for each RCTS test are presented on Figures 2.5.4-93 through 2.5.4-110. Test results are also tabulated in Tables 2.5.4-58 through 2.5.4-75.

Each RCTS test also provides measured values of damping (D) at increasing shear strain levels. The same procedure used for G/G_{max} is employed to obtain a best-fit D versus shear strain curve from the literature. Tables 2.5.4-56 and 2.5.4-57 show the selected values of D versus shear strain for each stratum at the power block area and for the two composite samples at the cooling basin, respectively. Plots of D versus shear strain for each RCTS test are presented on Figures 2.5.4-111 through 2.5.4-128. Test results are also tabulated in Tables 2.5.4-58 through 2.5.4-75. Note that damping ratio versus shear strain curves extend to a maximum 15 percent damping ratio.

2.5.4.2.1.3.16 Electrical Resistivity

Two field electrical resistivity test arrays were performed at the power block area switch yards, with each having electrode spacings (“A”) ranging from three feet to 300 feet. Test results are summarized in Table 2.5.4-34, and are further described in Subsection 2.5.4.2.2.3.5. The inferred strata noted in the table assume that the depth of the reading is approximately one-half of the “A” spacing. The minimum resistivity measured is about 120 ohm-meters and the maximum resistivity measured is about 350 ohm-meters. Guidelines for the interpretation of electrical resistivity with respect to corrosion are given in Table 2.5.4-35. Based on these guidelines, measured electrical resistivity results indicate that site soils in the uppermost 150 feet are not corrosive towards buried steel.

2.5.4.2.1.3.17 Chemical Properties

Fifty-nine sets of chemical tests, consisting of pH, chloride content, and sulphate content, were performed on samples from the power block area ranging from nearly ground surface to about 160 feet depth, from Strata Clay 1 (Top), Clay 1 (Bottom), Sand 1, Sand 2, Clay 3, Sand 4, Clay 5 (Top), Clay 5 (Bottom), and Sand 5. Test results are summarized in Table 2.5.4-16.

Measured pH values range from 7.2 to 9.0, with an average of 8.5. These results indicate the soil to be mildly corrosive based on Table 2.5.4-35 guidelines.

Measured chloride contents for the same soils tested range from about 4 to 680 parts per million (ppm), with an average of about 50 ppm. These results indicate the soil to be mostly mildly corrosive based on Table 2.5.4-35 guidelines, with some tests indicating a more corrosive environment.

Measured sulphate content for the same soils tested range from about 7 to 4290 ppm, with an average of about 40 ppm. These results indicate the soil to be mostly non-aggressive towards concrete based on Table 2.5.4-35 guidelines, with only two tests indicating a more aggressive environment.

2.5.4.2.1.4 Evaluation of Properties of Fill Materials

Structural fill is required at the power block area and embankment fill and drainage sand are required for the embankment dams and interior dikes at the cooling basin. Laboratory test results on the various fill materials are contained in References 2.5.4-1 and 2.5.4-2, as described below. Fill properties are described in the following subsections, and additionally in Subsections 2.5.4.5.1 and 2.5.5.1.9.1.1.

2.5.4.2.1.4.1 Fill Materials Required in the Power Block Area

Although the selection of structural fill has not been finalized, it is expected to be similar to the well-graded gravel and sand with trace amounts of fines produced by a local supplier in Victoria, Texas; material processed to meet Texas Department of Transportation (DOT), Grade 4 requirements. Refer to Subsection 2.5.4.5.1 for additional detail and to Reference 2.5.4-1 for complete test results. Additional testing will be performed once the structural fill source and material have been selected. Fill properties for the material noted above are summarized in Table 2.5.4-32, and are additionally described below.

Description: Red well-graded gravel with clay

Constituents: Gravel –50 percent; Sand –43 percent; Fines –7 percent

USCS Classification: GW-GC

Specific Gravity: 2.67

Unit Weight:

Based on compaction to 95 percent modified Proctor (ASTM D 1557; Reference 2.5.4-19) maximum dry density, total unit weight (γ_t) is 138 pounds per cubic foot (pcf) at the optimum moisture content of 5.5 percent.

Angle of Internal Friction:

Based on direct shear tests, the measured ϕ' for this material is 42°. For conservatism, the recommended ϕ' is 39° (being the lowest measured value from other similar sampled and tested materials).

Elastic and Shear Modulus:

The estimated high strain elastic modulus is 1100 ksf, and the estimated low strain shear modulus varies from 2100 to 4280 ksf.

Shear Wave Velocity:

The conservatively estimated average shear wave velocity for this surficial compacted material, based on relative density, is about 700 feet per second in the upper 15 feet and increasing to 1000 feet per second for the depth from 15 feet to 110 feet, which is the assumed deepest excavation (refer to Subsection 2.5.4.4.1). Actual shear wave velocity depends not only on relative density, but also on confining pressure, and thus the shear wave velocity of the fill is lower at or near the ground surface, and higher with depth.

Earth Pressure Coefficients and Coefficient of Sliding:

Active, passive, and at-rest static earth pressure coefficients, K_a, K_p, and K_0, are estimated assuming frictionless vertical walls and horizontal backfill using Rankine's theory and based on the relationships below (Reference 2.5.4-17). Note that ϕ' = 39°, except for the K_0 case, where ϕ' is conservatively assumed as 30°.

$K_a = \tan^2 (45 - \phi'/2) = 0.23$ Equation 2.5.4-15

$K_p = \tan^2 (45 + \phi'/2) = 4.4$ Equation 2.5.4-16

$K_0 = 1 - \sin(\phi') = 0.50$ Equation 2.5.4-17

For sliding against concrete, tangent $\delta = 0.55$ is recommended.

Chemical Properties:

The measured pH of 5.7 indicates that the material is mildly corrosive towards buried steel. The measured chloride content and sulphate content are both below 10 ppm, indicating the fill to be noncorrosive towards buried steel and nonaggressive towards buried concrete (Table 2.5.4-35).

2.5.4.2.1.4.2 Fill Materials Required in the Cooling Basin

Excavated site soils from the cooling basin northern interior are used for construction of embankment dams and interior dikes, while imported sand is used for construction of drainage blankets (embankment dams only). Refer to Subsection 2.5.4.5.1 for additional detail and to References 2.5.4-1 (drainage sand) and 2.5.4-2 (composite samples representative of embankment fill) for complete test results. Fill properties are summarized in Table 2.5.4-33, and are additionally described below.

Composite samples representative of embankment fill were obtained from cooling basin test pits as described in Subsection 2.5.4.5.1. Two composite samples were tested, namely Composite "A," a sand material, and Composite "B," a clay material. For drainage sand, bulk samples are collected from a local concrete aggregate supplier in Victoria, Texas, including a material processed to meet ASTM C 33 (Reference 2.5.4-20), fine aggregate for concrete requirements, and a material processed to meet ASTM C 144 (Reference 2.5.4-21), mortar sand requirements. The properties of the composite samples, and of the drainage sand samples, are summarized in Table 2.5.4-33.

Results of RCTS tests on the Composite "A"/Sand sample (Table 2.5.4-74, Figures 2.5.4-109 and 2.5.4-127), and on the Composite "B"/Clay sample (Table 2.5.4-75, Figures 2.5.4-110 and 2.5.4-128) are described in more detail in Subsections 2.5.4.7.3.1 and 2.5.4.7.3.2.

Shear Strength of Fill Materials:

Drained and undrained shear strength values of the composite samples are important in the evaluation of dam slope stability, as presented in Subsection 2.5.5. Drained/effective friction angles (ϕ') of the composite samples were obtained from a series of direct simple shear tests, while drained/effective friction angles of the drainage sand samples were obtained from a series of direct shear tests.

Refer to Subsection 2.5.5.1.9.1.1 for a detailed description of material properties derived for the composite samples. Similarly, refer to Subsection 2.5.5.1.9.2 for a detailed description of material properties derived for the drainage sand materials. For design purposes, the drained/effective friction angles derived for the tested materials are:

Embankment fill (both Composite “A”/Sand and Composite “B”/Clay):

$\phi' = 30°$

Drainage sand (ASTM C 33 fine aggregate for concrete):

$\phi' = 37°$

Drainage sand (ASTM C 144 mortar sand):

$\phi' = 36°$

Also for design purposes, the undrained shear strength (s_u) values derived for the composite samples (both Composite “A”/Sand and Composite “B”/Clay) are based on the plot of undrained shear strength versus vertical effective stress given in Figure 2.5.5-10.

Unit Weight of Fill Materials:

For design purposes, the total unit weights (γ_t) of the tested materials are:

Embankment fill (Composite “A”/Sand):

γ_t = 137 pcf

Embankment fill (Composite “B”/Clay):

γ_t = 134 pcf

Drainage sand (ASTM C 33 fine aggregate for concrete):

γ_t = 111 pcf

Drainage sand (ASTM C 144 mortar sand):

γ_t = 108 pcf

Note that total unit weights (γ_t) for the composite samples (embankment fill materials) are based on compaction to 95 percent modified Proctor (ASTM D1557; Reference 2.5.4-19) maximum dry density at 4 percent above optimum moisture content. Total unit weights (γ_t) for drainage sand materials are based on compaction to 95 percent modified Proctor maximum dry density at optimum moisture content.

2.5.4.2.1.5 Properties of Subsurface Materials Deeper Than Approximately 600 Feet Below Existing Ground Surface

As noted above, the maximum depth explored during this site-specific subsurface investigation is 600 feet. To perform necessary seismic ground response analyses (refer to Subsection 2.5.4.7), shear wave velocity values to appreciably greater depths are required. To accommodate this requirement, six sonic logs performed for oil field exploration borings from sites within Victoria County (Figure 2.5.4-66) were collected and analyzed. The collected sonic logs, which report compression wave velocities (V_p), begin at an upper depth of approximately 200 feet to 1600 feet, and range in total depth from approximately 8000 feet to 16,000 feet. Compression wave velocities from the sonic logs are converted to shear wave velocities (V_s) using the following equation (Reference 2.5.4-22):

$$V_s = V_p / [2(1 - \mu)/(1 - 2\mu)]^{1/2} \qquad \text{Equation 2.5.4-18}$$

Poisson's ratio (μ) is assumed to decrease with increasing depth as the soil becomes more confined/compressed. The value of μ is assumed to decrease linearly from a measured value of 0.46 at 600 feet depth, to a lower bound value of 0.30 at and below 5500 feet depth. Table 2.5.4-52 provides average shear wave velocities (and related statistics) for calculated 200-foot depth intervals to the maximum sonic log depth. Figure 2.5.4-73 plots the average shear wave velocities, and the average shear wave velocities plus or minus one standard deviation, versus depth. The average shear wave velocity calculated from the six sonic logs increases from about 2090 feet per second at 700 feet depth to about 6000 feet per second at 10,500 feet depth, and then reduces slightly to about 5000 feet per second at 15,500 feet depth. Note that the average shear wave velocities for Sand 18 at approximately 600 feet depth is measured at about 2000 feet per second at Unit 1, and about 1985 feet per second at Unit 2 (averaging 1995 feet per second between the two units).

2.5.4.2.2 Subsurface Investigation/Exploration

RG 1.132 (Reference 2.5.4-23) describes site investigation for nuclear power plants, and addresses the objectives of subsurface investigation with respect to the design of foundations and associated critical structures. Because subsurface investigations need to be site-specific, there is recognition in Reference 2.5.4-23 that flexibility and adjustments to the overall program, applying sound engineering judgment, are necessary to tailor to site-specific conditions. Consequently, adjustments are made to the subsurface investigation (including adjustments to field testing locations, and adjustments to the types, depths, and frequencies of sampling) during field operations, resulting in a more comprehensive subsurface investigation.

Subsurface investigation work at the VCS site is performed under an approved quality assurance program with site-specific work procedures, including subsurface investigation plans and technical specification, prepared by Bechtel.

Figure 2.5.4-1 for the power block area and Figure 2.5.4-2 for the cooling basin show the plan locations of field tests made for this subsurface investigation.

2.5.4.2.2.1 Planning the Field Testing Program

Reference 2.5.4-23 also provides guidance on spacing and depths of borings, sampling procedures, in situ testing procedures, and geophysical investigation methods. This guidance is employed in preparing the technical specification for a particular project, addressing the bases for site-specific subsurface investigation. References to industry standards used for field testing at the VCS site are shown in Tables 2.5.4-1 and 2.5.4-2 for the power block area and for the cooling basin, respectively. Field testing details and results are also contained in References 2.5.4-1 and 2.5.4-2 for the power block area and for the cooling basin, respectively.

For the power block area, the quantities of borings and CPTs for major structures (including seismic Category I structures) are generally based on a minimum of one boring or one CPT per typical structure and one boring or one CPT per 10,000-square feet of structure plan area. Reference 2.5.4-23 also includes a recommendation that borings for seismic Category I structures extend to a depth approximately equal to the width of the structure below the planned foundation level. This criterion is met at the power block area for borings B-2174A, B-2174A Offset, B-2174UDR, B-2274A, B-2274A Offset, and B-2274UD made at assumed centers of containment or reactor buildings. Each of these borings was advanced to 600 feet below ground surface (ground surface at the time of this subsurface investigation is elevation 80 feet). At each containment/reactor building, 11 additional borings were made to approximately 150 feet, 200 feet, 300 feet, or 400 feet depth below ground surface. These borings were terminated in either stiff to very stiff clays or dense to very dense sands that become stronger with increasing depth. At the nonsafety-related cooling basin, 60 borings were made to approximately 60 feet to 300 feet below ground surface.

The sampling intervals employed in borings made for this subsurface investigation vary slightly from the guidance document (Reference 2.5.4-23), but are in accordance with the technical specification, and are reasonable for characterizing site subsurface conditions, as follows. The number of SPT samples taken in the uppermost 15 feet below ground surface was increased, with typically six SPT samples taken. Below 15 feet and up to a depth of 100 feet, SPT samples were taken at 5-foot intervals; from 100 feet to 200 feet depths, samples were taken at 10-foot intervals; and samples were taken at 20-foot intervals from 200 feet to the maximum depth of 600 feet below ground surface. As noted in Subsection 2.5.4.2.1.3.2, to ensure that all strata were sampled, sampling intervals were decreased from 20-foot to 10-foot intervals in selected borings. Also, in the two deepest power block area borings (B-2174A and B-2274A), sampling intervals from 400 feet to 600 feet were offset by 10 feet (e.g., in one boring the sampling depths were 400 feet, 420 feet, 440 feet, etc., while in the other boring, the sampling depths were 410 feet, 430 feet, 450 feet, etc.). In addition, two borings (B-2177 and B-2277) were continuously sampled (at 2.5-foot centers) to a depth of 150 feet within the assumed building footprints. In the power block area, undisturbed samples were taken in five borings dedicated for this purpose, namely; B-2174UD, B-2174UDR, B-2182UD, B-2269UD, and B-2274UD. Similarly, in the nonsafety-related cooling basin, undisturbed samples were taken in six dedicated borings, namely; B-2302UD, B-2304UD, B-2319UD, B-2321UD, B-2352UD, and B-2359UD. Finally, CPTs, providing continuous subsurface data to a maximum depth of 100 feet, were made at both the power block area and the nonsafety-related cooling basin.

For the power block area, vertical deviation surveys were conducted in the eight suspension P-S velocity logging borings, including the two deepest borings (B-2174A Offset and B-2274A Offset). Similarly, outside the power block area and in the nonsafety-related cooling basin, deviation surveys were performed in the two and five suspension P-S velocity logging borings, respectively, which were the deepest borings made in those areas. All borings and field tests were advanced as vertically as possible by starting the drilling rigs/field test equipment in a level position, and by regularly observing the verticality of the drilling rig masts, the drilling rods, etc., as the work progressed.

SPT samples and bulk soil samples from test pits were photographed for the VCS site subsurface investigation. Undisturbed soil samples were sealed in metal Shelby or Pitcher tubes, and could not be photographed. X-ray imaging, however, was made on undisturbed samples selected for RCTS testing.

2.5.4.2.2.2 Planning the Laboratory Testing Program

The laboratory testing for this site subsurface investigation was planned according to guidance provided in RG 1.138 (Reference 2.5.4-24). References to industry standards used for laboratory testing of collected samples are shown in Tables 2.5.4-14 and 2.5.4-15 for the power block area and for the cooling basin, respectively. Laboratory testing details and results are also contained in References 2.5.4-1 and 2.5.4-2 for the power block area and for the cooling basin, respectively.

Soil samples assigned for laboratory testing were shipped under chain-of-custody from the onsite storage area to the testing laboratories. Laboratory testing for this site subsurface investigation was performed at multiple laboratories including: MACTEC Engineering and Consulting, Inc. (MACTEC) (Atlanta, Georgia), MACTEC (Raleigh, North Carolina), Severn Trent Laboratories (St. Louis, Missouri), Fugro (Houston, Texas), and the University of Texas—Austin Soils Laboratory (Austin, Texas). Both the Fugro and the University of Texas—Austin laboratories perform specialty RCTS testing.

2.5.4.2.2.3 Field Testing

The site-specific subsurface investigation, described here, was conducted between October 2007 and February 2008. As noted in the opening paragraphs of this subsection, additional site-specific subsurface investigation conducted in early 2009 is addressed separately in Appendix 2.5.4-A. Field test locations are shown on Figures 2.5.4-1 and 2.5.4-2 for the power block area and for the cooling basin, respectively. The scope of work and investigation methods used by the subsurface investigation subcontractor, MACTEC, and its subcontractors, are as follows:

- Surveying the horizontal coordinates and vertical elevations of the field testing locations.
- Evaluating the potential presence of underground utilities at the field testing locations.
- Drilling 153 borings, most with SPT sampling, and some additionally collecting undisturbed samples (207 undisturbed samples) using a Shelby push sampler or a Pitcher sampler, depending on the material sampled, to a maximum depth of 600 feet.
- Performing 65 CPTs to a maximum depth of approximately 100 feet. Seismic tests and pore water pressure dissipation tests at selected depths are performed in selected CPTs. Two CPT locations (C-2106 and C-2206) are additionally advanced intermittently to 300 feet below ground surface for qualitative evaluation.
- Excavating 20 test pits to a maximum depth of approximately 10 feet below ground surface, and collecting bulk soil samples.
- Installing and developing 54 groundwater observation wells (27 well pairs, each having an upper (U) screened interval and a lower (L) screened interval) to a maximum depth of 150 feet, including slug testing each well to verify well quality and to estimate in situ hydraulic conductivity.
- Performing 32 borehole permeameter tests at 16 test locations (cooling basin), and at each test location performing a shallow upper (U) test and a deeper lower (L) test to estimate hydraulic conductivity.
- Installing and developing two test wells, each with four companion observation wells (cooling basin), and conducting groundwater pump testing to estimate strata transmissivity and storativity.
- Performing borehole geophysical logging in 17 dedicated borings, consisting of all, or some, of the following geophysical tests: suspension P-S velocity logging, natural gamma, long and short normal resistivity, single point resistance, spontaneous potential, three-leg caliper, and deviation survey.

- Conducting field electrical resistivity testing at two array locations in the switch yard (each array consisting of two orthogonal survey lines).
- Conducting SPT hammer energy measurements for each of the nine drilling rigs employed at the site.

As noted earlier, this subsurface investigation was performed according to guidelines outlined in Reference 2.5.4-23. The field work was performed under an audited and approved quality assurance program and work procedures developed specifically for the project. The subsurface investigation and sample collection was directed by a site manager, who was present full-time during the investigation period. A designated project quality assurance/quality control manager regularly visited the site to audit the work and the work of the subcontractors. A Bechtel geotechnical engineer and/or geologist was also onsite full-time during the field work. Additionally, field boring logs, well logs, test pit logs, etc., were prepared by field engineers and/or geologists who were present full-time during the investigation period. A visit to the site during the subsurface investigation work was also attended by the NRC and by Exelon representatives in December 2007.

Each field test location was checked for the presence of underground utilities before work at the location began. The locations of several field test points were revised because of their proximity to utilities or equipment inaccessibility. For environmental purposes, the ground occupied by each drilling or CPT rig was temporarily covered by plastic sheeting to prevent accidental discharge of hydraulic fluid and or oil onto the ground.

An onsite storage facility for soil sample retention was established before the subsurface investigation began. Each sample was logged into an inventory system, and samples removed from the facility were noted in an inventory log book. A chain-of-custody form was also completed for all samples removed from the facility. Material storage and handling was in accordance with ASTM D 4220 (Reference 2.5.4-25).

Complete results of this subsurface investigation are presented in References 2.5.4-1 and 2.5.4-2 for the power block area and for the cooling basin, respectively. Additional details related to field test activities are summarized below.

2.5.4.2.2.3.1 Boring and Sampling

One hundred fifty-three borings were performed at the VCS site: 86 borings at the power block area; seven borings outside the power block area (B-08, B-10, B-2185, B-2301, B-2301A, B-2307, and B-2307A); and 60 borings at the cooling basin.

Borings were advanced using mud-rotary drilling methods with a bentonite-based drilling mud. Nine drilling rigs were used to advance the borings, including both truck-mounted and all-terrain vehicle

(ATV) rigs, with each rig employing an automatic SPT hammer. The make and model of each rig used in the work is given in Table 2.5.4-7. Boring locations are shown on Figure 2.5.4-1 for the power block area and Figure 2.5.4-2 for the cooling basin. Tables 2.5.4-36 and 2.5.4-37 summarize boring locations and other details for the power block area and for the cooling basin, respectively. Boring logs are contained in References 2.5.4-1 and 2.5.4-2 for the above noted areas. Upon completion, each boring was tremie-grouted to the ground surface with a cement-bentonite grout.

Soils were sampled using a standard SPT sampler in accordance with ASTM D 1586 (Reference 2.5.4-26) and ASTM D 6066 (Reference 2.5.4-27). Refer to Subsection 2.5.4.2.2.1 for SPT sampling intervals. The recovered soil samples were visually described and classified by the field engineer and/or geologist in accordance with ASTM D 2488 (Reference 2.5.4-7). A representative portion of the SPT sample was placed in a moisture-sealed glass jar, which was labeled, placed in a box, and transported to the onsite storage facility.

Three-inch-diameter undisturbed tube samples were also obtained in accordance with ASTM D 1587 (Reference 2.5.4-28), using either a Shelby push sampler or a rotary Pitcher sampler depending on the material being sampled. After retrieval, any disturbed materials at the ends of the sample were removed and the ends are trimmed square to aid moisture sealing with wax. For fine-grained cohesive soils, a pocket penetrometer measurement was taken on the trimmed ends of the sample. Both ends of the sample tube were then sealed with hot wax, covered with plastic caps, and sealed once again using electrical tape and wax. The sample tubes were labeled and transported to the onsite storage facility. Table 2.5.4-38 for the power block area and Table 2.5.4-39 for the cooling basin summarize the undisturbed soil samples collected during this subsurface investigation. Undisturbed sample details are also given on the boring logs contained in References 2.5.4-1 and 2.5.4-2 for the above noted areas.

Energy measurements, in accordance with ASTM D 4633 (Reference 2.5.4-10), were made on the SPT hammer-rod systems on each of the nine drilling rigs employed in this subsurface investigation. A pile-driving analyzer (PDA) PAK model, together with calibrated accelerometers and strain gages, was used to acquire and process the data. A summary of measured hammer energies and related data is provided in Table 2.5.4-7. A minimum of three hammer energy measurements were made for each drilling rig with each size of drill rods used. Energy transfer to the PDA gauge positions was estimated using the Case Method, in accordance with ASTM D 4633 (Reference 2.5.4-10). Average energy transfer ratios range from 73–91 percent. Detailed test results are contained in Reference 2.5.4-1 for both the power block area and the cooling basin.

2.5.4.2.2.3.2 Cone Penetration Testing

Sixty-five CPTs were performed at the VCS site, with 37 CPTs in the power block area, one CPT outside the power block area (C-2216), and 27 CPTs in the cooling basin.

CPTs were advanced using an electronic seismic piezocone compression model with a 15-square-centimeter tip area and a 225-square-centimeter friction sleeve area. CPTs were performed in accordance with ASTM D 5778 (Reference 2.5.4-29). CPT equipment was mounted on either a 25-ton truck-mounted rig or a 15-ton track-mounted rig, each of which were dedicated to CPT work. Cone tip resistance (q_c), sleeve friction (f_s), and pore water pressure were recorded a minimum of every 2 centimeters as the cone was advanced into the ground. Shear wave velocity measurements were also made at selected CPTs using a geophone mounted above the cone. An anchored beam, struck at the ground surface with a sledge hammer, served as the vibration source. Pore pressure dissipation data was also obtained in selected CPTs.

CPTs were advanced to termination depths ranging from approximately 36 feet to 100 feet below ground surface. These include 11 seismic CPTs (C-2102S, C-2104S, C-2106S, C-2109S, C-2202S, C-2204SB, C-2206S, C-2209S, C-2301S, C-2303S, and C-2323S). Pore pressure dissipation tests were also conducted in 13 CPTs (C-2104S, C-2106, C-2203, C-2204SA, C-2206, C-2207, C-2213, C-2303S, C-2311, C-2311A, C-2213, C-2321, and C-2323S). Two CPT locations (C-2106 and C-2206) were additionally advanced intermittently to 300 feet below ground surface for qualitative evaluation (i.e., these two CPTs both reached initial refusal at approximately 80 feet below ground surface; for qualitative evaluation, they were advanced beyond initial refusal by alternating between drilling ahead through deeper sand strata that could not be penetrated by the cone, and pushing through deeper clay strata that could be penetrated by the cone). A summary of the CPT locations and other details is presented in Table 2.5.4-40 for the power block area and Table 2.5.4-41 for the cooling basin. CPT locations are shown on Figures 2.5.4-1 and 2.5.4-2 for the power block area and for the cooling basin, respectively. CPT logs, shear wave velocity measurements, and pore pressure dissipation test results are contained in References 2.5.4-1 and 2.5.4-2 for the above noted areas.

2.5.4.2.2.3.3 Test Pits

Twenty test pits were performed at the VCS site, with eight test pits in the power block area and twelve test pits in the cooling basin.

Test pits were excavated to a maximum depth of 10 feet below ground surface using a mechanical excavator. Bulk samples were collected from selected soil strata for laboratory testing. A summary of test pits completed and bulk soil samples collected is included in Table 2.5.4-42 for the power block area and Table 2.5.4-43 for the cooling basin. Test pits were numbered according to their adjacent boring or CPT. For example, Test Pit TP-2310 was made adjacent to boring B-2310. Reference 2.5.4-1 for the power block area and Reference 2.5.4-2 for the cooling basin contain test pit records and related information.

2.5.4.2.2.3.4 Groundwater Observations and Field Testing

A series of groundwater tests were performed for this subsurface investigation. Tests included the monitoring of groundwater levels in observation wells installed at selected locations, and hydraulic conductivity tests of the various soil strata by slug tests, borehole permeameter tests, and pump tests.

2.5.4.2.2.3.4.1 Observation Wells and Slug Testing

Observation wells were installed in 54 borings (27 well pairs, each having an upper [U] screened interval and a lower [L] screened interval), with well depths ranging from 45 feet to 150 feet. Six observation well pairs were installed at the power block area; five observation well pairs were installed outside the power block area; and 16 observation well pairs were installed at the cooling basin. The observation wells were installed under the full-time supervision of a field geotechnical engineer and/or geologist in dedicated borings offset from SPT borings, with installation in accordance with ASTM D 5092 (Reference 2.5.4-30). Observation well borings were advanced using the rotary drilling method and a biodegradable drilling fluid, with an effective well diameter of eight inches. Each well was developed by pumping and/or flushing with clean water. Table 2.5.4-46 for the power block area and Table 2.5.4-47 for the cooling basin provide a summary of the observation well locations and other details. Observation well locations are shown on Figures 2.5.4-1 and 2.5.4-2 for the power block area and for the cooling basin, respectively. Complete observation well details are included in References 2.5.4-1 and 2.5.4-2 for the above noted areas and are described further in Subsection 2.4.12.

Slug tests to measure hydraulic conductivities of in situ soil strata were performed in all installed observation wells. Slug tests were conducted using the falling head method, in accordance with Section 8 of ASTM D 4044 (Reference 2.5.4-31). Slug testing included establishing the static water level, lowering a solid cylinder (slug) into the well to cause an increase in water level in the well, and recording the time for the well water to return to the pre-test static level. Electronic transducers and data loggers were used to measure the water levels and times during the test. Table 2.4.12-8 provides a summary of the slug test results for the power block area and cooling basin. Complete slug testing details are contained in References 2.5.4-1 and 2.5.4-2 for the above noted areas and are described further in Subsection 2.4.12.

2.5.4.2.2.3.4.2 Borehole Permeameter Testing

Borehole permeameter tests were performed at 16 test locations at the cooling basin. At each test location a shallow upper (U) test and a deeper lower (L) test was performed. The tests estimated hydraulic conductivities of the various soil strata in the unsaturated zone. The test was performed using the Guelph downhole permeameter in accordance with ASTM D 5126 (Reference 2.5.4-32). After preparation of the test hole, the test was performed in two stages. Initially, the flow rate required to maintain a 2-inch head in the test hole was measured until a constant rate was recorded. The test was then repeated with a 4-inch head.

Table 2.5.4-48 provides a summary of the borehole permeameter test locations and other test details for the cooling basin. Complete borehole permeameter test details are contained in Reference 2.5.4-2 for the above noted area and are described further in Subsection 2.4.12.

2.5.4.2.2.3.4.3 Pump Testing

Aquifer pump tests were performed at two locations at the cooling basin (TW-2320U and TW-2359L) in accordance with ASTM D 4050 (Reference 2.5.4-33). The test involved pumping water from a well at a constant rate and measuring the drawdown in both the pumping well and in nearby observation wells. Four companion observation wells were installed for each pump test. After completion of the pumping phase, the recovery of the water levels was also measured.

Table 2.5.4-49 provides a summary of the pump test locations and other details for the cooling basin. Complete pump test details are contained in Reference 2.5.4-2 for the above noted area, and are described further in Subsection 2.4.12.

2.5.4.2.2.3.5 Field Electrical Resistivity Testing

Field electrical resistivity testing was performed at two locations in the switchyard to obtain apparent resistivity values of near-surface soil strata. Table 2.5.4-50 provides a summary of the field electrical resistivity test locations and other details. Electrical resistivity testing was conducted using a MiniRes HP earth resistivity meter, a Wenner four-electrode array, and electrode spacings ("A") of 3 feet, 5 feet, 7.5 feet, 10 feet, 15 feet, 30 feet, 50 feet, 100 feet, 200 feet, and 300 feet, in accordance with ASTM G 57 (Reference 2.5.4-34) and IEEE 81 (Reference 2.5.4-35). Test arrays were centered on each of the staked locations, namely R-2101/R-2102 and R-2201/R-2202, as shown on Figure 2.5.4-1 for the power block area. Electrodes were positioned using a 300-foot measuring tape, and set on the appropriate bearings using a Brunton compass. Electrical resistivity test results are summarized in Table 2.5.4-34 for the power block area. Raw electrical resistivity test data is contained in Reference 2.5.4-1.

2.5.4.2.2.3.6 Geophysical Surveys

Geophysical logging was performed in 17 borings (8 borings in the power block area; 2 borings outside the power block area (B-2301 and B-2307); and 7 borings in the cooling basin), consisting of all, or some of the following geophysical tests: suspension P-S velocity logging, natural gamma, long and short normal resistivity, single point resistance, spontaneous potential, three-leg caliper, and deviation survey. Detailed geophysical logging results are contained in Reference 2.5.4-1 for the power block area and Reference 2.5.4-2 for the cooling basin. Suspension P-S velocity logging results are described further in Subsection 2.5.4.4.

2.5.4.2.2.4 Laboratory Testing

Laboratory testing work for this subsurface investigation was performed under an audited and approved quality assurance program and work procedures developed specifically for the project. As noted earlier, RG 1.138 (Reference 2.5.4-24) addresses laboratory testing of soil and rock for nuclear power plants. This guidance document describes the requirements for: laboratory equipment (including calibration), handling and storage of samples, selection and preparation of test specimens, and testing procedures for determining static and dynamic soil and rock properties. The laboratory tests listed in Reference 2.5.4-24 are common tests performed in geotechnical testing laboratories, and are covered by ASTM and related standards. Some tests not covered in Reference 2.5.4-24 were also performed for this site-specific subsurface investigation (e.g., the RCTS test method was used in lieu of resonant column tests and/or cyclic triaxial tests to obtain shear modulus degradation and damping over a range of shear strains).

Reference 2.5.4-24 does not provide specific guidance on the quantities of laboratory tests to conduct. The numbers of laboratory tests made for this subsurface investigation were based on engineering judgment, and on experience with similar projects, to obtain necessary data for characterizing engineering properties of materials that impact ground stability and the suitability of construction for critical foundations. Laboratory test assignments were prepared based on information developed from the subsurface investigation, such as the numbers and positions of soil strata, their thicknesses, strengths, vertical and lateral uniformity, and relevance to planned foundations, and on an understanding of plant construction at the time.

ASTM D 4220 (Reference 2.5.4-25) provides guidance on standard practices for preserving and transporting soil samples, and was adopted for use in this subsurface investigation.

Laboratory testing undertaken for this subsurface investigation included testing of soil and groundwater samples recovered from the field test locations (e.g., borings, observation wells, test pits, etc.). Laboratory testing of groundwater samples is addressed in Subsection 2.4.12. Laboratory testing of soil samples consisted of index and engineering property tests performed on selected SPT, undisturbed, and bulk soil samples. SPT and undisturbed soil samples were recovered from borings, and bulk soil samples were recovered from test pits. Specific laboratory testing on recovered soil samples included natural moisture content, Atterberg limits, particle size analysis by sieve and hydrometer, specific gravity, unit weight, unconsolidated-undrained (UU) triaxial compression strength testing, consolidated-undrained (CU) triaxial compression strength testing with pore water pressure measurement, direct shear strength testing, direct simple shear strength testing, consolidation, moisture-density relationship (modified Proctor compaction), California Bearing Ratio

(CBR), and chemical analyses (pH, chloride content, and sulphate content). RCTS tests were also performed on selected samples.

Laboratory tests were performed in accordance with the following standards:

- Classification and Index Testing
    - Unified Soil Classification System — ASTM D 2487 (Reference 2.5.4-6) and ASTM D 2488 (Reference 2.5.4-7)
    - Moisture Content — ASTM D 2216 (Reference 2.5.4-36)
    - Atterberg Limits — ASTM D 4318 (Reference 2.5.4-37)
    - Sieve and Hydrometer Analysis — ASTM D 422 (Reference 2.5.4-38) and ASTM D 6913 (Reference 2.5.4-39)
    - Specific Gravity — ASTM D 854 (Reference 2.5.4-40)
    - Unit Weight — (included as a part of related ASTM standards)
- Strength Testing
    - Unconsolidated-Undrained Triaxial Compression — ASTM D 2850 (Reference 2.5.4-41)
    - Consolidated-Undrained Triaxial Compression with Pore Water Pressure Measurement — ASTM D 4767 (Reference 2.5.4-42)
    - Direct Shear — ASTM D 3080 (Reference 2.5.4-43)
    - Direct Simple Shear — ASTM D 6528 (Reference 2.5.4-44)
- RCTS Testing — Stokoe, et al. (Reference 2.5.4-45)
- Compressibility Testing
    - Load Controlled Consolidation — ASTM D 2435 (Reference 2.5.4-46)
    - Constant Rate-of-Strain Consolidation — ASTM D 4186 (Reference 2.5.4-47)
- Compaction and Related Testing
    - Modified Proctor Moisture-Density Relationship — ASTM D 1557 (Reference 2.5.4-19)

    - California Bearing Ratio - ASTM D 1883 (Reference 2.5.4-48)
- Chemical Testing of Soils
    - pH — ASTM D 4972 (Reference 2.5.4-49)
    - Chloride Content — EPA 300.0 (Reference 2.5.4-50)
    - Sulphate Content — EPA 300.0 (Reference 2.5.4-50)
- Hydraulic Conductivity — ASTM D 5084 (Reference 2.5.4-51)

2.5.4.3 Foundation Interfaces

Subsurface profiles depicting inferred stratigraphy at the power block area are presented on Figures 2.5.4-5, 2.5.4-6, 2.5.4-9, and 2.5.4-10. A subsurface profile legend is shown in Figure 2.5.4-3, and power block area subsurface profile locations are shown on Figure 2.5.4-4. Note that subsurface profiles shown on Figures 2.5.4-5 and 2.5.4-6 illustrate typical conditions at Unit 1, and subsurface profiles shown on Figures 2.5.4-9 and 2.5.4-10 illustrate typical conditions at Unit 2.

Subsurface profiles depicting inferred stratigraphy at the cooling basin are presented on Figures 2.5.4-14 through 2.5.4-20. A subsurface profile legend is shown in Figure 2.5.4-3, and cooling basin subsurface profile locations are shown on Figure 2.5.4-13. Note that subsurface profiles shown on Figures 2.5.4-14 through 2.5.4-16 illustrate typical conditions along major north-south trending embankment dams and along a line east of the cooling basin, roughly parallel with Linn Lake, and subsurface profiles shown on Figures 2.5.4-17 through 2.5.4-20 illustrate typical conditions along major east-west trending embankment dams and through the cooling basin interior.

A plan and profiles illustrating power block area foundation excavation geometries and the locations and depths of Unit 1 and Unit 2 major structures (including seismic Category I structures), as well as the relationship of structure foundations to the various subsurface strata, are addressed in Subsection 2.5.4.5.

Similarly, a plan and profiles illustrating cooling basin mass excavation geometry and the locations and heights of major embankment dams, as well as the relationship of embankment dam foundations to the various subsurface strata, are also addressed in Subsection 2.5.4.5.

2.5.4.4 Geophysical Surveys

This subsection provides a summary of the geophysical survey methods undertaken for this subsurface investigation. Refer to Subsection 2.5.4.7 for a description of results.

2.5.4.4.1 Suspension P-S Velocity Logging

Suspension P-S velocity logging was performed at the VCS site in 17 dedicated borings offset from SPT borings (8 borings in the power block area, 2 borings outside the power block area [B-2301 and B-2307], and 7 borings in the cooling basin). These 17 P-S velocity logging borings are listed as follows; B-2162A Offset, B-2174A Offset, B-2176A Offset, B-2182A Offset, B-2262A Offset, B-2274A Offset, B-2276A Offset, B-2282A Offset, B-2301, B-2302, B-2303, B-2304, B-2305, B-2306, B-2307, B-11, and B-12. Borings B-2174A Offset and B-2274A Offset were logged to 600 feet depth, while the remaining borings were logged to 200 to 400 feet depth. During logging, borings were uncased and filled with drilling fluid. The OYO/Robertson Model 3403 unit and the OYO Model 3331A suspension logging recorder and probe were employed. Details of the equipment are described in Reference 2.5.4-52, and the velocity measurement technique used is briefly described below. Results are provided as tables and graphs in Reference 2.5.4-1.

As no ASTM standard is available for the suspension P-S velocity logging method at this time; therefore, a brief description follows here. Suspension P-S velocity logging uses a 23-foot- (approximately 7-meter) long probe containing a source near the bottom and two geophone receivers spaced 3.3 feet (approximately one meter) apart, all suspended by a cable. The probe is lowered into the boring to a specified depth where the source generates a pressure wave in the drilling fluid. The pressure wave is converted to seismic waves (compression, P-waves, and shear, S-waves) at the boring wall. At each receiver position, the P- and S-waves are converted to pressure waves in the fluid and received by the geophones mounted in the probe, which in turn send the data to a recorder at the surface. At each measurement depth, two opposite horizontal records and one vertical record are obtained. This procedure is typically repeated every 1.6 feet (0.5 meters) as the probe is raised incrementally from the bottom of the boring to the ground surface. The elapsed time between wave arrivals at the geophone receivers is used to determine the average velocity of a 1.6-foot-high (0.5 meter) column of soil surrounding the boring. As a verification, analysis is also performed on source-to-receiver data.

P-S velocity measurements obtained are sorted by soil stratum through a review of the stratigraphic changes on the boring logs, and on the geophysical records, especially for depths where soil samples are collected less frequently, i.e., the deeper soil strata.

Compression wave velocity (P, V_p) and shear wave velocity (S, V_s) results from this subsurface investigation, including results from both the suspension P-S velocity logging method and from the seismic CPT method (refer to Subsection 2.5.4.4.2), are tabulated below.

Minimum, maximum, and average V_s values measured in the various soil strata at the power block area are as follows:

Shear Wave Velocities, V_s (Power Block Area)

	Unit 1 Shear Wave Velocity, V_s[a]			Unit 2 Shear Wave Velocity, V_s[a]		
Stratum	Minimum (ft/sec)	Maximum (ft/sec)	Average (ft/sec)	Minimum (ft/sec)	Maximum (ft/sec)	Average (ft/sec)
Clay 1 (Top)	276	1100	736	167	1160	608
Sand 1	—	—	—	738	1350	1080
Clay 1 (Bottom)	470	1560	858	550	1300	950
Sand 2	570	1282	979	750	1470	1158
Clay 3	710	1600	1031	490	1670	960
Sand 4	687	5380	1826	900	1850	1351
Clay 5 (Top)	700	1650	1063	790	2870	1219
Sand 5	870	1290	1038	1140	2490	1498
Clay 5 (Bottom)	850	1640	1153	790	1740	1119
Sand 6	920	3120	1533	490	3400	1421
Clay 7	800	2010	1445	—	—	—
Sand 8	980	2300	1539	1140	3000	1737
Clay 9	990	1510	1253	990	1750	1250
Sand 10	1160	2220	1667	1270	2020	1645
Clay 11	820	1750	1173	910	1280	1102
Sand 12	1580	2030	1821	1610	2190	1866
Clay 13	1020	2310	1410	1050	2270	1312
Sand 14	1540	2040	1780	1370	2400	1885
Clay 15	1100	1800	1523	1360	1560	1436
Sand 16	1720	1980	1814	1540	1980	1765
Clay 17	1180	2030	1632	1950	2120	2050
Sand 18	1830	2380	2022	1940	2040	1993

(a) Shear wave velocity values for strata shown "—" denote strata that are either too thin to measure at boring/seismic CPT locations, or are absent in the particular area investigated.

Minimum, maximum, and average V_s values measured in the various soil strata at the cooling basin are as follows:

Shear Wave Velocities, V_s (Cooling Basin)

	Shear Wave Velocity, V_s		
Stratum	Minimum (ft/sec)	Maximum (ft/sec)	Average (ft/sec)
Clay 1 (Top)	194	1045	740
Sand 1	294	1204	778
Clay 1 (Bottom)	475	1465	903
Sand 2	559	1691	1015
Clay 3	585	2063	1019
Sand 4	866	3281	1224
Clay 5 (Top)	741	2711	1134
Sand 5	894	3528	1399
Clay 5 (Bottom)	656	2038	1173
Sand 6	831	2711	1349
Clay 7	877	2294	1314
Sand 8	1038	3038	1663
Clay 9	974	2412	1506
Sand 10	1193	3010	1733
Clay 11	1465	1465	1465

Minimum, maximum, and average V_p values measured in the various soil strata at the power block area are as follows:

Compression Wave Velocities, V_p (Power Block Area)

Stratum	Unit 1 Compression Wave Velocity, V_p (a)			Unit 2 Compression Wave Velocity, V_p (a)		
	Minimum (ft/sec)	Maximum (ft/sec)	Average (ft/sec)	Minimum (ft/sec)	Maximum (ft/sec)	Average (ft/sec)
Clay 1 (Top)	1520	3170	2279	1290	4900	3168
Sand 1	—	—	—	2140	6800	4180
Clay 1 (Bottom)	2220	6410	4474	3120	6230	5634
Sand 2	2490	6170	4991	5380	6350	5924
Clay 3	4420	6410	5705	5380	6800	5935
Sand 4	5250	9950	6696	5650	6800	6105
Clay 5 (Top)	5130	6940	5917	5560	8030	6118
Sand 5	5560	6410	5872	5750	6540	6072
Clay 5 (Bottom)	5330	6470	5784	5420	6600	5893
Sand 6	5010	9260	6165	5250	8440	5991
Clay 7	5010	7020	6155	—	—	—
Sand 8	5510	7250	6247	5600	9130	6496
Clay 9	5460	6670	5885	5650	6540	5884
Sand 10	5700	6800	6196	5750	6870	6239
Clay 11	5250	6470	5688	5250	5900	5585
Sand 12	6060	6800	6392	5900	6540	6263
Clay 13	5460	7020	6050	5210	6540	5795
Sand 14	5950	6470	6146	5950	7020	6374
Clay 15	5950	6600	6206	6060	6290	6126
Sand 16	6010	6230	6123	6230	6470	6339
Clay 17	5800	7580	6521	6540	7090	6896
Sand 18	6120	6940	6497	6290	6470	6390

(a) Compression wave velocity values for strata shown "—" denote strata that are either too thin at boring/seismic CPT locations, or are absent in the particular area investigated.

Minimum, maximum, and average V_p values measured in the various soil strata at the cooling basin are not evaluated.

Figures 2.5.4-67, 2.5.4-68, and 2.5.4-70 illustrate V_s measurements at Unit 1, Unit 2, and the cooling basin, respectively. Measurements are made to 600-foot depths at the power block area and 300-foot depths at the cooling basin. Figures 2.5.4-71, 2.5.4-72, and 2.5.4-74 are average V_s profiles by soil stratum for the same areas and depths indicated above. These latter figures also include profiles of average V_s values plus or minus one standard deviation.

Note that Figures 2.5.4-71 and 2.5.4-72 illustrate average V_s values for Strata Clay 1 (Top) through Sand 18 at Unit 1 and Unit 2, respectively. These figures also include the 15-foot-thick structural fill layer that is required to raise the power block area to finish grade (i.e., from existing ground surface at elevation 80 feet to finish grade at elevation 95 feet). The surficial structural fill layer has estimated average shear wave velocity of 700 feet per second (upper 15 feet), and 1000 feet per second (for the depths from 15 feet to 110 feet): values that are considered conservative for a well-compacted granular fill material. Refer to Subsection 2.5.4.5.1 for additional details on power block area structural fill. Figure 2.5.4-74, similarly illustrates average V_s values for Strata Clay 1 (Top) through Clay 11 at the cooling basin.

Poisson's ratio (μ) values (small strain) are determined for the power block area based on the V_p and the V_s measurements. Average Poisson's ratios are approximately 0.44 at depths above the current groundwater level (elevation 48 feet) and approximately 0.46 below the current groundwater level. Average Poisson's ratio values are summarized as follows:

Poisson's Ratios, μ
(Power Block Area)

Stratum	Unit 1 Poisson's Ratio, μ[(a)]	Unit 2 Poisson's Ratio, μ[(a)]
Clay 1 (Top)	0.40	0.47
Sand 1	—	0.44
Clay 1 (Bottom)	0.46	0.48
Sand 2	0.47	0.48
Clay 3	0.48	0.48
Sand 4	0.45	0.47
Clay 5 (Top)	0.48	0.48
Sand 5	0.48	0.47
Clay 5 (Bottom)	0.48	0.48
Sand 6	0.47	0.47
Clay 7	0.47	—
Sand 8	0.47	0.46
Clay 9	0.48	0.48
Sand 10	0.46	0.46
Clay 11	0.48	0.48
Sand 12	0.46	0.45
Clay 13	0.47	0.47
Sand 14	0.45	0.45
Clay 15	0.47	0.47
Sand 16	0.45	0.46
Clay 17	0.47	0.45
Sand 18	0.45	0.45

(a) Poisson's ratio values for strata shown "—" denote strata that are either too thin at boring/seismic CPT locations, or are absent in the particular area investigated.

Note that the above V_p, V_s, and μ values (at small strain) can be assumed to reflect the VCS site subsurface profile to a depth of 600 feet below original ground surface (i.e., to approximately 600 feet below elevation 80 feet, or elevation –520 feet). Information available for deeper subsurface soils is described in Subsection 2.5.4.7.

2.5.4.4.2 Seismic Cone Penetration Testing

Shear wave velocity values were also measured at 11 locations at the VCS site using the seismic CPT (C-2102S, C-2104S, C-2106S, C-2109S, C-2202S, C-2204SB, C-2206S, C-2209S, C-2301S, C-2303S, and C-2323S). The maximum depth tested by seismic CPTs was 100 feet. As noted above, seismic CPT V_s results are included together with the suspension P-S velocity logging V_s results on Figures 2.5.4-67, 2.5.4-68, and 2.5.4-70, and are additionally accounted for in the average V_s profiles on Figures 2.5.4-71, 2.5.4-72, and 2.5.4-74. Seismic CPT results are typically within the range of the suspension P-S velocity logging results.

2.5.4.4.3 Regional/Oil Field Sonic Logging

Figures 2.5.4-69 and 2.5.4-73 illustrate V_s measurements and the average V_s profile, respectively, derived from sonic logs performed for oil field exploration borings at locations within Victoria County (Figure 2.5.4-66). Figure 2.5.4-73 also includes profiles of average V_s values plus or minus one standard deviation. Figure 2.5.4-73 is used to extend the power block area average V_s profiles (Figures 2.5.4-71 and 2.5.4-72) to depths greater than 600 feet below ground surface for use in seismic ground response analyses. Note that the sonic logs collected/analyzed begin at an upper depth of approximately 200 feet to 1600 feet, and range in total depth from approximately 8000 feet to 16,000 feet. Refer to Subsection 2.5.4.2.1.5 for additional description.

2.5.4.4.4 S-Wave Velocity Profile Selection

Suspension P-S velocity logging results and seismic CPT measurements are combined to develop the average V_s velocity profiles shown on Figures 2.5.4-71 and 2.5.4-72 for the power block area and 2.5.4-74 for the cooling basin. The data collected at individual suspension P-S velocity logging borings and at individual seismic CPTs is sorted by soil stratum and averaged. The average thickness/base elevation of each soil stratum is also determined at each of the boring and CPT test locations, and averaged. The average V_s profiles (Figures 2.5.4-71, 2.5.4-72, 2.5.4-74) plot the calculated average V_s values (plus or minus one standard deviation) versus the calculated average strata thicknesses/base elevations. These figures illustrate design V_s profile for site soils from ground surface to 600 feet below ground surface at the power block area (i.e., to elevation -520 feet), and from ground surface to 300 feet below ground surface at the cooling basin (i.e., to elevation -220 feet).

As noted above, Figure 2.5.4-73 extends the power block area average V_s profiles (Figures 2.5.4-71 and 2.5.4-72) to depths greater than 600 feet for use in seismic ground response analyses.

Tables 2.5.4-51 through 2.5.4-53 contain the numerical values that enter into the average V_s profile figures noted above.

2.5.4.4.5 Equivalent Shear Wave Velocities

Equivalent shear wave velocities (V_{eq}) vary depending on reactor technology, due to differing calculation methods, foundation sizes, and foundation depths. Representative equivalent shear wave velocities are evaluated here for a typical LWR (with an integral UHS) based on the information in Reference 2.5.4-53. Values of Veq are calculated for each of the Unit 1 and Unit 2 buildings, using the design V_s profiles derived above, and the statistics (especially the standard deviation) of V_s values for each stratum. From Reference 2.5.4-53, V_{eq} is calculated using lower bound V_s values and thicknesses of corresponding strata, and is evaluated to a depth equivalent to two times the largest structure dimension plus the structure embedment below power block area finish grade (elevation 95 feet).

"Lower bound V_s values" as used in Reference 2.5.4-53 are considered the average V_s values minus one standard deviation determined for each stratum. For the upper and lower structural fill layers noted above (Subsection 2.5.4.4.1), the standard deviation is taken as -18.4 percent and +22.5 percent of the estimated V_s values (equivalent to a variation of G_{max}/1.5 and G_{max} x 1.5). "Lower bound V_s values" are further adjusted for seismic strain; preliminarily a reduction of 10 percent is used. Final seismic strains are determined on a site-specific basis as described in Subsection 2.5.2.5.4.

Equivalent shear wave velocities (V_{eq}) are calculated using the equation given in Reference 2.5.4-53 (Table 2.0-1, Note 8):

$$V_{eq} = \Sigma d_i / \Sigma d_i/V_i \qquad \text{Equation 2.5.4-19}$$

where, d_i = thickness of soil stratum

V_i = lower bound V_s (reduced for seismic strain) of soil stratum

The resulting equivalent shear wave velocities (V_{eq}) for Unit 1 and Unit 2 seismic Category I structures are as follows:

Representative Equivalent Shear Wave Velocities, Veq
Seismic Category I Structures (Power Block Area)

Structure	Unit 1	Unit 2
	Equivalent Shear Wave Velocity, V_{eq} [(a)]	
	(ft/sec)	(ft/sec)
Reactor/Fuel Building	884	915
Control Building	757	767
Fire Water Service Complex	798	806

(a) Assumes 10 percent reduction to individual values of V_i to account for seismic strain.

Because representative site-specific V_{eq} values fall below the required minimum 1000 feet per second value, site-specific soil-structure interaction modeling will most likely be required as part of a future COL application. This will be confirmed for the selected reactor technology as part of the COL application.

2.5.4.5 Excavation and Backfill

2.5.4.5.1 Sources and Quantities of Backfill

Significant earthwork is required to establish finish grades at the VCS site, especially to provide for the embedment of major power block area structures (including seismic Category I structures) (deepest excavation to elevation -15 feet), to achieve cooling basin base level (excavation to elevation 69 feet), to raise the power block area to finish grade (fill to elevation 95 feet), and to provide for cooling basin embankment dams (fill to elevation 102 feet) and interior dikes (fill to elevation 99 feet). The deepest excavation depth in the power block area is dependent on the reactor technology selected and will be confirmed at the COL stage.

2.5.4.5.1.1.1 Power Block Area

At the power block area, assuming a typical dual-unit LWR (with an independent UHS) as the bounding configuration, current estimates are that up to approximately one million cubic yards of material are excavated, up to one-half million cubic yards of structural fill (from offsite sources) are required to backfill major structures, and two million cubic yards of material are required to establish finish grades (of which material excavated onsite provides about one-half of the fill to finish grade requirement).

Power block area materials excavated during site grading are primarily the upper soils of Strata Clay 1 through Clay 3, consisting of clays (Strata Clay 1 and Clay 3) and clayey or silty fine sands (Strata Sand 1 and Sand 2). To evaluate the uppermost soil stratum (Stratum Clay 1) for construction purposes, eight test pits were excavated at the power block area, as shown on Figure 2.5.4-1 and summarized in Table 2.5.4-42. The maximum depth of test pits was 10 feet below ground surface. The results of laboratory testing on bulk samples collected from the test pits for moisture-density (modified Proctor compaction), California bearing ratio (CBR), and other index tests are summarized in Table 2.5.4-44, with details included in Reference 2.5.4-1. These tests show that Stratum Clay 1 soils are low to high plasticity, with an average fines content of 80 percent, and occur at natural moisture contents typically 4–6 percent above their optimum moisture contents. Stratum Clay 1, as well as the other upper clay stratum excavated (Stratum Clay 3), in their natural states are unsuitable for use as structural fill, but are suitable for reuse as common fill. Similarly, upper sand strata excavated (Strata Sand 1 and Sand 2) are unsuitable for use as structural fill, but are suitable for reuse as common fill. For proper reuse as common fill, clay materials and sand materials are separated during excavation, and are typically dried-back to between 2 percent below and 2 percent above optimum moisture content before placement in fill areas. Note that the upper sand strata excavated (Strata Sand 1 and Sand 2) have natural moisture contents in a similar range to those measured for Stratum Clay 1, which may similarly be higher than their respective optimum moisture contents.

For the power block area, preliminary structural fill sources from local suppliers are identified as follows:

- A material processed to meet Texas DOT, Grade 4 requirements. The tested bulk sample is a well-graded gravel with trace amounts of fines (USCS classification, GW-GC)
- A material processed to meet Texas DOT, Grade 6 requirements. The tested bulk sample is a slightly finer well-graded gravel with trace amounts of fines (USCS classification, GP-GC)
- Raw material sampled at the conveyor. The tested bulk sample is a slightly finer sand with gravel and trace amounts of fines (USCS classification, SP)

Of the above, the Texas DOT Grade 4 material is the most well-graded material and is preferred. Note that in the case of the third coarse aggregate material, above, the local supplier of this material mainly manufactures to meet ASTM C 33 (Reference 2.5.4-20) coarse aggregate for concrete requirements, which are typically too poorly graded for structural fill. Note that the structural fill material tested from this supplier is unprocessed quarried “raw” material sampled at the conveyor, and leading directly from the pit.

The results of laboratory index tests (natural moisture content, gradation), chemical tests (pH, sulphate content, chloride content), moisture-density relationship tests (modified Proctor compaction), and strength tests (direct shear) for these materials are contained in Reference 2.5.4-1 and summarized in Subsection 2.5.4.2.1.4.1. Note, however, that once the final backfill source(s) for structural fill is determined, additional static and/or dynamic testing will be required if the materials selected are markedly different from those already tested.

Note also that structural fill below and/or surrounding major power block area structures alternatively consists of lean concrete fill, or concrete fill. The selection of structural fill, lean concrete fill, and/or concrete fill is determined during detailed design.

2.5.4.5.1.1.2 Cooling Basin

At the cooling basin, current estimates are that approximately 27 million cubic yards of material are moved during earthwork to establish site grades, comprised of 20 million cubic yards of clay to construct the embankment dam and dikes, 1 million cubic yards of sand (from offsite sources) for a sand drainage blanket at the outside toe of the embankment dam and 7 million cubic yards of topsoil that will be moved to a spoils area or throughout the site to reestablish vegetation in disturbed areas.

Cooling basin area materials excavated during site grading are primarily the upper soils of Strata Clay 1-Top and Sand 1, consisting of clays (Stratum Clay 1-Top) and clayey or silty fine sands (Stratum Sand 1). To evaluate the uppermost soil strata (Strata Clay 1-Top and Sand 1) for construction purposes, 12 test pits were excavated at the cooling basin, as shown on Figure 2.5.4-2 and summarized in Table 2.5.4-43. The maximum depth of test pits was 10 feet below ground surface. The results of laboratory testing of bulk samples collected from the test pits for moisture-density (modified Proctor compaction) and other index tests are summarized in Table 2.5.4-45, with details included in Reference 2.5.4-2. These tests show that Stratum Clay 1-Top soils are low plasticity, with an average fines content of 70 percent, and occur at natural moisture contents typically 2 percent to 6 percent above their optimum moisture contents. These tests also show that Stratum Sand 1 soils are clayey or silty, with an average fines content of 34 percent, and occur at natural moisture contents typically 2 percent below to 2 percent above their optimum moisture contents. Both the sand soils and the clay soils in their natural states are unsuitable for use as drainage materials, but are suitable for reuse as fill for embankment dams and for interior dikes. For proper reuse as embankment fill, clay materials and sand materials are separated during excavation, and are moisture conditioned, normally to between 2 percent and 6 percent above their optimum moisture contents, prior to placement in fill areas.

For the cooling basin, test pit bulk samples representative of the sand soils and clay soils excavated and reused for embankment fill are selected and combined for laboratory testing of recompacted specimens, as follows:

- Composite “A”/Sand: a blend of bulk samples having similar properties obtained from two test pits (test pit TP-2319, bulk sample 2 and test pit TP-2334, bulk sample 2), and representative of the coarser-grained soils used for embankment fill. The combined/tested bulk sample is a clayey sand (USCS classification, SC) with fines content of 46 percent.

- Composite “B”/Clay: a blend of bulk samples having similar properties obtained from two test pits (test pit TP-2317, bulk sample 1 and test pit TP-2334, bulk sample 1), and representative of the finer-grained soils used for embankment fill. The combined/tested bulk sample is a lean clay with sand (USCS classification, CL) with fines content of 74 percent.

Of the above, either material is suitable for reuse as embankment fill. Refer to Subsections 2.5.4.2.1.4 and 2.5.5.1.9.1 for additional descriptions of the properties of cooling basin embankment fill soils.

The results of laboratory index tests (natural moisture content, Atterberg limits, gradation), chemical tests (pH, sulphate content, chloride content), moisture-density relationship tests (modified Proctor compaction), consolidation tests, and strength tests (direct simple shear and triaxial compression) for these materials are contained in Reference 2.5.4-2 and summarized in Subsection 2.5.4.2.2.4. Note that recompacted specimens prepared for consolidation and strength testing from these combined/ tested samples were compacted to 95 percent of modified Proctor (Reference 2.5.4-19) maximum dry density at 4 percent above optimum moisture content.

Also for the cooling basin, preliminary drainage sand sources are identified, as follows:

- A material processed to meet ASTM C 33 (Reference 2.5.4-20) fine aggregate for concrete requirements. The tested bulk sample is a poorly graded sand (USCS classification, SP).
- A material processed to meet ASTM C 144 (Reference 2.5.4-21) mortar sand requirements. The tested bulk sample is a slightly finer poorly graded sand (USCS classification, SP).

Of the above, either material is suitable for use as drainage sand (for internal drainage of embankment dams). Refer to Subsections 2.5.4.2.1.4 and 2.5.5.1.9.2 for additional descriptions of the properties of cooling basin drainage sand materials, including an analysis of drainage sand versus foundation clay and foundation sand filter criteria.

The results of laboratory index tests (natural moisture content, Atterberg limits, gradation), chemical tests (pH, sulphate content, chloride content), moisture-density relationship tests (modified Proctor compaction), and strength tests (direct shear) for these materials are similarly contained in Reference 2.5.4-1.

2.5.4.5.2 Extent of Excavations, Fills, and Slopes

The natural ground surface elevation in the power block area ranges from approximately elevation 78 feet to elevation 81 feet, with an average of elevation 80 feet. The power block area finish grade elevation is raised approximately 15 feet to elevation 95 feet, using a compacted structural fill to backfill structure excavations and below shallower founded structures, and using a common fill in nonstructure areas.

Power block area foundation excavations result in removing approximately one million cubic yards of soils. The extent of excavation, filling, temporary slopes, and the approximate limits of temporary ground support for typical power block area structures, using a typical LWR (with an independent UHS) as the bounding configuration, are shown in plan on Figure 2.5.4-75 and in profile on Figures 2.5.4-76 through 2.5.4-79 (note that the profiles are taken at locations identified on Figure 2.5.4-75). These figures show that the excavations for foundations result in all major structures being founded either directly on stiff to very stiff clay strata, dense to very dense sand strata, or on compacted structural fill.

As noted in the table below, the deepest excavation assumed in the power block area is approximately 110 feet below finish grade (elevation 95 feet).

Deepest Structure	Planned Depth of Excavation (feet)
Typical LWR (with an Integral UHS) Reactor/ Fuel Buildings	87.0 (including overexcavation of 21.4)
Typical LWR (with an Independent UHS) Reactor Building	110.0 (including overexcavation of 25.0)

The subsurface investigation made at the power block area (refer to Reference 2.5.4-1) shows that the subsurface strata to support foundations are relatively horizontal. However, it should be noted that the extent of excavation to final subgrade and/or to final overexcavation level is determined during construction, based on the selected plant/technology, observation of actual subsurface conditions encountered, and verification of their suitability for foundation support. Once subgrade suitability at the proposed bearing stratum is confirmed, excavations are backfilled with compacted structural fill up to the foundation level of structures. Following construction of structure foundations and other underground features, compacted structural fill is extended to the proposed finish grade, or near the proposed finish grade, as defined during detailed design. Compaction and quality control/ quality assurance programs for filling are addressed in Subsection 2.5.4.5.3.

There are no permanent safety-related excavation or fill slopes created by power block area site grading. Temporary excavation slopes, such as those for foundation excavation and/or overexcavation, are graded to an inclination not exceeding 2 horizontal: 1 vertical (2H:1V). Note that the excavation plan and profiles, Figures 2.5.4-75 and 2.5.4-76 through 2.5.4-79, respectively, are based on this temporary slope inclination. During detailed design, slope stability analyses are conducted to show that temporary slopes have an adequate factor of safety (typically at least 1.30 for nonsafety-related temporary slopes under static conditions), including, among other things, the effects of surcharge loading from construction equipment, and the effects of construction dewatering. Where factor of safety needs to be increased, measures such as flattening the slope, providing intermittent benches, etc., can be considered.

The plan arrangement of the cooling basin is shown in Figure 2.5.4-2. The natural ground surface elevation at the cooling basin area ranges from approximately elevation 42 feet to elevation 80 feet, with an average of elevation 70 feet. The base level of the cooling basin is elevation 69 feet, and the normal operating water level is elevation 91.5 feet. The north portion of the cooling basin area is mainly cut to achieve the elevation 69 feet base level, while the south and east portions of the cooling basin area have natural ground surface below the elevation 69 feet base level, and are neither cut nor filled. An embankment dam having crest at elevation 102 feet surrounds the cooling basin area. The cooling basin also has interior dikes with crest at elevation 99 feet to lengthen the flow path of cooling water through the basin from outfall to intake. All embankment dams and interior dikes are constructed of compacted clay and/or clayey sand embankment fill excavated from the north portion of the cooling basin area.

As noted above, cooling basin excavations result in removing approximately 27 million cubic yards of soil. The extent of excavation, and filling for embankment dams and interior dikes, are shown in plan on Figure 2.5.4-80 and in profile on Figures 2.5.4-81 through 2.5.4-85 (note that the profiles are taken at locations identified on Figure 2.5.4-80). These figures illustrate a water level for the design of embankment dams at elevation 96 feet. Note, however, that the normal maximum water level in the cooling basin is typically elevation 91.5 feet.

Refer to Subsection 2.5.5 for description of nonsafety-related embankment fill slopes pertaining to the cooling basin.

2.5.4.5.3 Compaction of Backfill

For both the power block area and the cooling basin, at initiation of earthwork, samples of the various required fill materials (i.e., power block area structural fill and common fill; cooling basin embankment fill and drainage sand) are obtained and tested for index properties, chemical properties, and engineering properties (i.e., grain size and plasticity characteristics, soil pH, sulphate content, and chloride content characteristics, and moisture-density relationships). The following compaction criteria apply:

- At power block area structure areas and for backfill against underground structures, structural fill is compacted to a minimum of 95 percent of modified Proctor (Reference 2.5.4-19) maximum dry density and within plus or minus 2 percent of optimum moisture content.
- At power block area nonstructure areas, common fill is compacted to a minimum of 92 percent of modified Proctor (Reference 2.5.4-19) maximum dry density and within plus or minus 4 percent of optimum moisture content.
- At cooling basin embankment dams and interior dikes, embankment fill is compacted to a minimum of 95 percent of modified Proctor (Reference 2.5.4-19) maximum dry density and within plus 2 percent and plus 4 percent of optimum moisture content.
- At cooling basin embankment dam drainage blankets, drainage sand is compacted to a minimum of 95 percent of modified Proctor (Reference 2.5.4-19) maximum dry density and within plus or minus 2 percent of optimum moisture content.

Fill placement and compaction control procedures are addressed in a technical specification prepared during detailed design. The specification includes requirements for suitability of the various required fill materials, sufficient testing to address potential material variations, and in-place density and moisture content testing frequency (e.g., typically a minimum of one test per 10,000 square feet of fill placed per lift). The specification also includes requirements for an onsite testing firm for quality control to ensure specified material gradation and plasticity characteristics, the achievement of specified moisture-density criteria, fill placement/compaction, and other requirements to ensure that earthwork operations conform to design requirements. The onsite testing firm is required to be independent of the earthwork contractor and is to have an approved quality assurance/quality control program. A sufficient number of laboratory tests are required to ensure that any variations in the various required fill materials are accounted for. A materials testing laboratory is established onsite to exclusively serve the VCS site work.

A trial fill program is normally conducted for purposes of determining the optimum number of compactor passes/coverages, the maximum loose and/or compacted lift thickness, and other relevant data for optimum achievement of the specified moisture-density (compaction) criteria for power block area structural fill and for cooling basin embankment fill. Refer also to Subsection 2.5.5.4.3 regarding the requirement for a surveyed trial fill established in the early construction period at the cooling basin. The need for and/or details of a trial fill for power block area structural fill is determined once the material source(s) is identified.

2.5.4.5.4 Dewatering and Excavation Methods

Groundwater control in major power block area structure excavations is required during construction. The deepest assumed excavation level (elevation -15 feet) extends approximately 63 feet below the existing groundwater level (approximately elevation 48 feet) (refer to Subsection 2.5.4.6.1), requiring a complete construction dewatering system. Power block area groundwater conditions and construction dewatering requirements are addressed in more detail in Subsection 2.5.4.6.

Groundwater control in the cooling basin excavations is not required during construction. With the deepest excavation level (elevation 69 feet) approximately 30 feet above the highest existing groundwater level (approximately elevation 39 feet) (refer to Subsection 2.5.4.6.1), an extensive construction dewatering system is not required. If minor areas of overexcavation, encounter seasonally elevated groundwater, seepage is removed from the earthwork area by localized ditching and/or sumping.

Given the subsurface conditions of the VCS site, excavations in general are made using conventional earth-moving equipment, especially self-propelled scrapers with push dozers for loading, and excavators and dump trucks in the more confined areas and for final slope trimming. Note that scrapers are ideally loaded by pushing down a slight incline in the excavation surface. This practice makes separating horizontally bedded strata (e.g., like the interlayered clay soils and sand soils present at the VCS site) more challenging, requiring close monitoring onsite (refer to Subsection 2.5.4.5.1 for additional description).

Power block area excavations are primarily open cuts, with limited temporary ground support, as described above. The cooling basin excavations are open cuts excavated directly to final line, grade, and slope.

Upon reaching final excavation levels (i.e., structure foundation subgrade, embankment dam foundation subgrade, or required over-excavation level), all excavations are cleaned of loose material by either removing or compacting in-place. Final subgrades are inspected and approved prior to being covered by compacted structural fill, common fill, embankment fill, or drainage sand. Inspection and approval procedures are addressed in the foundation and earthwork technical specifications developed during detailed design. These specifications include, among other things, measures such as: proof-rolling, over-excavation and replacement of unsuitable soils, and protection of surfaces from deterioration. Excavations additionally comply with applicable OSHA regulations (Reference 2.5.4-54).

Foundation subgrade rebound (or heave) is monitored in excavations for selected major power block area structures. Subgrade rebound estimates are addressed in Subsection 2.5.4.10.

Major power block area structures are monitored during and following construction for:

- Groundwater levels, both interior and exterior to temporary excavations
- Horizontal and vertical movement of temporary slopes
- Loads in temporary ground support anchorages and/or struts
- Earth pressures acting on underground structures
- Excavation/subgrade heave and foundation settlement

Cooling basin embankment dams are monitored during and following construction for:

- Groundwater levels, especially outboard of the embankment dams following construction
- Pore water pressures occurring within embankment fills
- Embankment settlement

An instrumentation and monitoring technical specification is developed during detailed design. The specification addresses issues such as the proper installation of a sufficient number of instruments to measure the parameters of interest, monitoring and recording frequency, and reporting requirements. The specification also establishes alert, action, and alarm levels for each of the parameters of interest, together with predefined plans of action in the event a reference level is met or exceeded.

2.5.4.6 Groundwater Conditions

Groundwater data collection is currently in progress, following-on from the installation of multiple observation well pairs during the site-specific subsurface investigation. Refer to Subsection 2.4.12 for complete details on the existing groundwater conditions at the VCS site.

Refer to Subsection 2.5.4.10 for additional detail on groundwater conditions relative to the foundation stability of seismic Category I structures.

Refer to Subsection 2.5.5.1.6 for additional detail on groundwater conditions relative to the stability of cooling basin embankment dams.

2.5.4.6.1 Site-Specific Groundwater Measurements

Groundwater levels at the VCS site are measured at a series of 27 observation well pairs, installed as part of this subsurface investigation, each having an upper (U) screened interval and a lower (L) screened interval. There are 6 observation well pairs installed at the power block area, 5 observation well pairs installed outside the power block area, and 16 observation well pairs installed at the cooling basin. Measured groundwater levels, generally from the period late January 2008 through August 2009 (ongoing), are shown on Figure 2.5.4-86 for the power block area, Figure 2.5.4-87 outside the power block area, and Figures 2.5.4-88 through 2.5.4-92 for the cooling basin. Note that some observation well pairs outside the power block area and in the cooling basin (i.e., B-01U/B-01L through B-10U/B-10L) were installed/monitored earlier, with groundwater level measurements reported between late October 2007 and August 2009 (ongoing).

A shallow groundwater level, primarily measured in the uppermost saturated sand stratum (Stratum Sand 2), generally overlies progressively deeper hydrostatic surfaces contained within the lower sand strata (especially Strata Sand 4, Sand 5, and Sand 6). Note that a higher elevation sand stratum, Stratum Sand 1, occurs in the unsaturated zone above the current groundwater level. Also, based on the available data, the flow of groundwater at the VCS site at present is generally downward through the site subsurface profile and from west to east, towards the low-lying Linn Lake area east of the cooling basin. For engineering purposes, the following current (i.e., before the conditions expected during operation) groundwater levels are selected:

- Power Block Area: elevation 48 feet

- Outside the Power Block Area: elevation 48 feet
- Cooling Basin (West): elevation 39 feet
- Cooling Basin (Central): elevation 32 feet
- Cooling Basin (East): elevation 28 feet
- East of the Cooling Basin (Linn Lake Area): elevation 15 feet

These are based on the highest groundwater levels measured in the upper (U) screened intervals of the observation well pairs at each of the noted areas.

As described in Subsection 2.4.12, the normal maximum operating water level in the cooling basin following plant construction is elevation 91.5 feet. The effect of this contained water is a general rise in groundwater levels site-wide, including a rise to approximately elevation 85 feet at the power block area (i.e., slightly above the level of the original ground surface at approximately elevation 80 feet). As such, the following post-construction groundwater elevations are defined:

- Power Block Area: elevation 85 feet (10 feet below finish grade)
- Outside the Power Block Area: elevation 80 feet (original ground surface)
- Cooling Basin: elevation 91.5 feet (normal maximum operating water level)

Foundations for major power block area structures are within both the shallow and the deep water-bearing soils, and as such, both the shallow and deep preconstruction groundwater conditions can impact foundation subgrade stability during construction if not properly controlled. Loss of subgrade density, bearing capacity, and equipment trafficability can result.

Foundations for major cooling basin embankment dams are generally above both the shallow and the deep water-bearing soils, and as such, preconstruction groundwater conditions are unlikely to affect foundation subgrade stability during construction.

2.5.4.6.2 Construction-Stage Dewatering

Temporary dewatering at excavations for major power block area structures is required for groundwater control during construction. A detailed analysis of groundwater conditions at the VCS site is described in Subsection 2.4.12. Based on the defined subsurface groundwater conditions, groundwater control/construction dewatering measures are needed at the VCS site for excavation of major power block area structures. Construction-stage dewatering likely includes both a system of deep wells and/or well-points to dewater water-bearing sand strata in advance of excavation, and a system of shallow drains and/or ditches to collect and direct minor seepage. Generally, groundwater levels are maintained a minimum of 3 feet below final excavation levels. Additionally, water-bearing sand strata below final excavation levels (e.g., especially Strata Sand 4, Sand 5, and Sand 6) that are overlain by more impermeable clay strata are depressurized to ensure the base stability of excavations. A construction-stage dewatering design and specification is developed during detailed design.

2.5.4.6.3 Analysis and Interpretation of Seepage

As noted above, a detailed analysis of groundwater conditions at the VCS site is described in Subsection 2.4.12. During detailed design, this data is analyzed to obtain final estimates of seepage into major power block area structure excavations, and to design/size construction dewatering system elements.

As described in Subsection 2.4.12, a complete groundwater model was prepared for the VCS site to evaluate post-construction groundwater levels resulting from the maximum water level in the cooling basin. The effect of this contained water is a general rise in groundwater levels site-wide. Overall seepage losses from the cooling final basin are estimated from the groundwater model, as described in Subsection 2.4.12. Seepage losses through cooling basin dam embankments are estimated by flow net and are described in Subsection 2.5.5.1.6.

2.5.4.6.4 Permeability Testing

The hydraulic conductivities (permeabilities) of site soils were measured in situ by slug test, by borehole permeameter test, and by pump test, as described in Subsection 2.5.4.2.2.3.4. A detailed description of test methods and test results is included in Subsection 2.4.12. Summaries of hydraulic conductivity values calculated from in situ tests are provided in Tables 2.4.12-8 (slug test), 2.4.12-14 (borehole permeameter tests), and 2.4.12-9 (pump tests).

2.5.4.6.5 History of Groundwater Fluctuations

A detailed description of groundwater conditions at the VCS site is included in Subsection 2.4.12.

2.5.4.7 Response of Soil and Rock to Dynamic Loading

Detailed descriptions of the development of the Ground Motion Response Spectrum (GMRS) and the associated Probabilistic Seismic Hazard Assessment (PSHA), as well as the geologic characteristics of the site, are addressed in Subsection 2.5.2. Refer also to Subsection 2.5.4.4 for additional descriptions on site-specific geophysical methods and results.

2.5.4.7.1 Site Seismic History

The seismic history of the area and of the site, including any prior history of seismicity and any evidence of liquefaction or boiling, is addressed in Subsection 2.5.2.

2.5.4.7.2 P- and S-Wave Velocity Profiles

Because of the extreme thickness of sediments at the site (refer to Subsection 2.5.4.1) compared to the depth of compression and shear wave velocity measurements made during the subsurface investigation (i.e., to 600 feet depth), additional information is required to complete the velocity profile for the site for use in seismic ground response analyses. Velocities in the upper 600 feet are measured at the site, and velocities deeper than 600 feet are obtained from available references. Additional descriptions follow.

2.5.4.7.2.1 Seismic Velocities in the Upper Approximately 600 Feet of Site Soils

Geophysical measurements in the upper 600 feet of site soils were obtained by suspension P-S velocity logging methods, and by seismic CPT methods, as described in Subsections 2.5.4.4.1 and 2.5.4.4.2, respectively. Average shear wave velocity profiles for the upper 600 feet of site soils at the power block area are shown on Figures 2.5.4-71 and 2.5.4-72. The average shear wave velocity profile for the upper 300 feet of site soils at the cooling basin is shown on Figure 2.5.4-74. Average shear wave velocities (V_S) are summarized in Tables 2.5.4-51 and 2.5.4-53 for the power block area and for the cooling basin, respectively.

Suspension P-S velocity logging was performed in 17 dedicated borings (8 borings in the power block area, 2 borings outside the power block area [B-2301 and B-2307], and 7 borings in the cooling basin), with depths ranging from 200 feet to 600 feet, and at the locations shown on Figures 2.5.4-1 and 2.5.4-2. Shear wave velocities were also measured at 11 seismic CPTs (8 seismic CPTs in the power block area [4 each in Unit 1 and Unit 2]; and 3 seismic CPTs in the cooling basin), with depths ranging from 35 feet to 100 feet, and at the locations shown on Figures 2.5.4-1 and 2.5.4-2. The suspension P-S logging data and the seismic CPT data are contained in Reference 2.5.4-1.

In general, comparison of measured V_S results between the power block area and the cooling basin indicate relatively consistent results, ignoring variations of about 100 feet per second, except in Strata Sand 1, Sand 4, Clay 9, and Clay 11, where greater differences of the order of 250 to 350 feet per second are noted. Note that comparison between the power block area and the cooling basin is only for the upper approximately 300 feet of site soils, as the cooling basin data (shown on Figures 2.5.4-70 and 2.5.4-74) only extend to that depth. The measured V_S results between Unit 1 and Unit 2 at the power block area are also similar, except at Stratum Sand 4 which has higher shear wave velocity at Unit 1. The Unit 2 area is also slightly more sandy.

The design/average shear wave velocity (V_s) and Poisson's ratio (μ) values are summarized in Subsection 2.5.4.4.4. Note that these design/average values are developed considering the variation in strata base elevations and thicknesses from boring to boring and from CPT to CPT.

2.5.4.7.2.2 Seismic Velocities Deeper than Approximately 600 Feet Below Existing Ground Surface

Refer to Subsection 2.5.4.1 for a brief description of geologic conditions at depths greater than 600 feet, a key point being that pre-Cretaceous bedrock (basement rock) occurs at a depth of approximately 41,000 feet below ground surface (Reference 2.5.4-4). Subsurface soils at the VCS site therefore extend well below the 600 feet maximum depth investigated by this subsurface investigation. Additional subsurface data, in the form of sonic logs performed for oil field exploration borings, was obtained to characterize conditions below this depth. Six sonic logs, taken at borings drilled within the vicinity of the VCS site (Figure 2.5.4-66), were collected, having sonic data ranging in depth from approximately 200 feet to approximately 16,000 feet.

Shear wave velocities are derived from the sonic log data using the relationship given in Subsection 2.5.4.2.1.5 (Equation 2.5.4-18). Refer to Figure 2.5.4-69 for calculated values versus elevation for each of the six sonic log locations. Average shear wave velocities are calculated across all six sonic logs, and generally considering 200-foot depth intervals. These average shear wave velocity values are presented in Table 2.5.4-52 and are plotted on Figure 2.5.4-73. This figure also includes profiles of average Vs values plus or minus one standard deviation. Note that shear wave velocities of soils deeper than 600 feet below ground surface increase in the range of approximately 2090 feet per second to 6000 feet per second.

2.5.4.7.3 Static and Dynamic Laboratory Testing

Extensive static laboratory testing of representative soil samples obtained from this subsurface investigation was conducted, with results described in detail in Subsection 2.5.4.2.1.

Dynamic laboratory RCTS tests obtain data on shear modulus degradation and damping characteristics of site soils over a wide range of strains, and were performed on samples recovered in this subsurface investigation. Sixteen undisturbed samples from depths of 18 to 593 feet, and two re-compacted fill samples (Composite “A”/Sand and Composite “B,”/Clay as described in Subsection 2.5.4.5.1), were assigned for RCTS testing. The results of these tests are described in Subsection 2.5.4.2.1.3.15 and briefly below in Subsections 2.5.4.7.3.1 and 2.5.4.7.3.2.

2.5.4.7.3.1 Selected Shear Modulus Degradation Curves for Soils

As described in Subsection 2.5.4.2.1.3.15, 16 RCTS tests were performed on undisturbed samples from cohesive Strata Clay 1 (Top), Clay 3, Clay 5 (Top), Clay 7, Clay 9, Clay 11, Clay 13, and Clay 17, and from cohesionless Strata Sand 4, Sand 5, Sand 6, Sand 8, Sand 10, Sand 12, Sand 14 and Sand

18. Each of these undisturbed samples is from the power block area. Two RCTS tests were also performed on recompacted composite samples representative of embankment fill at the cooling basin (refer to Subsection 2.5.4.2.1.4.2).

In each RCTS test, values of shear modulus (G) measured at increasing strain levels are compared to the value of G_{max}, the shear modulus measured at 10^{-4} percent shear strain. The shear modulus degradation (ratio of G/G_{max}) is plotted against shear strain, and a curve of G/G_{max} from the literature that best fits the test data is selected. Literature curves are used rather than an actual best-fit curve through the test data because the literature curves typically extend over a greater range of shear strain than the test data.

The following literature curves were employed:

- Curves recommended by the Electric Power Research Institute (EPRI) for cohesive sands/ soils having plasticity indices up to 70 percent (Reference 2.5.4-55).
- Curves recommended by Vucetic and Dobry for cohesive soils having plasticity indices up to 200 percent (Reference 2.5.4-56).
- Curves recommended by Brookhaven National Laboratory for cohesionless/sand soils ("Peninsular" range curves) (Reference 2.5.4-57).
- Curves recommended by Seed, et. al., for cohesionless/gravel soils (Reference 2.5.4-58).

Tables 2.5.4-54 and 2.5.4-55 show the selected values of G/G_{max} versus shear strain for each stratum in the power block area, and for the composite samples in the cooling basin, respectively. The modulus degradation curves (plots of G/G_{max} versus shear strain) from RCTS tests are presented on Figures 2.5.4-93 through 2.5.4-110. Test results are also tabulated in Tables 2.5.4-58 through 2.5.4-75.

Shear modulus degradation curves for cohesive Strata Clay 1 (Top), Clay 3, Clay 5 (Top), Clay 7, Clay 9, Clay 11, Clay 13, and Clay 17 are best-fit literature curves (References 2.5.4-55 and 2.5.4-56). Shear modulus degradation curves for untested cohesive Strata Clay 1 (Bottom), Clay 5 (Bottom), and Clay 15 use shear modulus degradation curves for tested Strata Clay 1 (Top), Clay 5 (Top), and Clay 13, respectively, because of similarities in properties. Note that in all cases, VCS site clay strata have plasticity indices less than the plasticity indices associated with the best-fit curves to the RCTS test data taken from the literature. This may be due to the state of overconsolidation of site clay soils, or to the advanced geologic age of the materials.

Shear modulus degradation curves from RCTS tests on cohesionless Strata Sand 4, Sand 5, Sand 6, Sand 8, Sand 10, Sand 12, Sand 14, and Sand 18 are similarly best-fit to literature curves

(Reference 2.5.4-57). Shear modulus degradation curves for untested cohesionless Strata Sand 2 and Sand 16 use shear modulus degradation curves from tested Strata Sand 4 and Sand 18, respectively, because of similarities in properties. Note that in all cases, the “Peninsular” range curve having depth greater than 50 feet is best-fit to all of the RCTS test data for VCS site sand strata. The shear modulus degradation curve for Stratum Sand 1 uses the slightly more conservative “Peninsular” range curve having depth less than 50 feet. The shear modulus degradation curve for structural fill (refer to Subsections 2.5.4.2.1.4.1, 2.5.4.4.1, and 2.5.4.5.1) uses the Seed Italy. literature curve for gravel (Reference 2.5.4-58).

Shear modulus degradation curves from RCTS tests on the cohesionless Composite A/Sand material and from the cohesive Composite “B”/Clay material (materials representative of fill materials for embankment dams) are similarly best fit to literature curves (Reference 2.5.4-55), as shown on Figures 2.5.4-109 and 2.5.4-110.

2.5.4.7.3.2 Selected Damping Curves for Soils

Each RCTS test also provides measured values of damping (D) at increasing shear strain levels. The same procedure used for shear modulus degradation (G/G_{max} versus shear strain) is employed to obtain a best-fit D versus shear strain curve from the literature. Tables 2.5.4-56 and 2.5.4-57 show the selected values of D versus shear strain for each stratum in the power block area, and for the composite samples in the cooling basin (refer to Subsections 2.5.4.2.1.4.2 and 2.5.4.5.1), respectively. Plots of D versus shear strain for each RCTS test are presented on Figures 2.5.4-111 through 2.5.4-128. Test results are also tabulated in Tables 2.5.4-58 through 2.5.4-75. As above, note that the damping ratio curve for structural fill (refer to Subsection 2.5.4.5) uses the Seed et. al. literature curve for gravel (Reference 2.5.4-58).

Note that in the referenced figures and tables, damping ratios are provided at values exceeding 15 percent, although damping is frequently cut off at this value. For the purpose of seismic ground response analyses, damping is limited to 15 percent, and the portions of the referenced figures and tables above this value are not considered.

2.5.4.7.3.3 Shear Modulus and Damping for Rock

Refer to Subsection 2.5.4.1 for a brief description of geologic conditions at depths greater than 600 feet, a key point being that pre-Cretaceous bedrock (basement rock) occurs at a depth of approximately 41,000 feet below ground surface (Reference 2.5.4-4).

Refer also to Subsection 2.5.4.7.2.2 for a description of deep shear wave velocity profiles pertinent to the site and derived from sonic logging data.

It should be noted that hard rock is considered to have damping, but is not strain-dependent. For site-specific work, damping of 1 percent is adopted for bedrock, and bedrock shear modulus is considered to remain constant (i.e., no degradation), in the shear strain range of 10^{-4} percent to 1 percent.

2.5.4.7.3.4 Dynamic Properties of Structural Fill

Power block area structures require overexcavation and placement of structural fill below their foundations. Refer to Subsection 2.5.4.5.1 for structural fill requirements. Refer to Subsection 2.5.4.2.1.4.1 for recommended static and dynamic properties for structural fill. Refer to Subsections 2.5.4.7.3.1 and 2.5.4.7.3.2 for shear modulus degradation and damping relationships for structural fill.

2.5.4.7.4 Small Strain Shear Modulus Estimation

With shear wave velocity and other parameters established, small strain shear modulus values can be calculated from Equation 2.5.4-10. Note that shear wave velocity values for use in the equation are given in Tables 2.5.4-51 through 2.5.4-53, and unit weight values for use in the equation are given in Tables 2.5.4-32 and 2.5.4-33. Refer to Subsection 2.5.4.2 for a stratum-by-stratum description of the derivation of shear modulus (G) and other geotechnical engineering parameters for use in design.

2.5.4.7.5 Seismic Parameters for Liquefaction Evaluation

Using the site-specific soil column extended to ground surface, the amplification factor, and the performance-based hazard methodology employed to develop the GMRS (refer to Subsections 2.5.2.5 and 2.5.2.6), results in a peak horizontal ground surface acceleration of 0.10 times the acceleration of gravity (g). This acceleration and a moment magnitude 7.6 characteristic earthquake are selected for use in liquefaction potential analysis. Refer in particular to Subsection 2.5.2, Table 2.5.2-25 titled *Controlling Magnitudes and Distances from Deaggregation,* regarding the selection of the earthquake magnitude for use in liquefaction potential analysis.

2.5.4.8 Liquefaction Evaluation

The potential for soil liquefaction at the VCS site is evaluated following guidance given in RG 1.198 (Reference 2.5.4-59). Current state-of-the-art deterministic methods, outlined in Reference 2.5.4-8, are followed. The subsurface conditions and soil properties employed are those described in Subsection 2.5.4.2.1. A peak horizontal ground surface acceleration of 0.10g and a Moment Magnitude 7.6 characteristic earthquake are used, as described in Subsection 2.5.4.7.5.

As noted in Subsection 2.5.4.3, subsurface stratigraphy of the VCS site is shown in part on the subsurface profiles, Figures 2.5.4-5, 2.5.4-6, 2.5.4-9, and 2.5.4-10 (shown in plan on Figure 2.5.4-4) for the power block area, and Figures 2.5.4-14 through 2.5.4-20 (shown in plan on Figure 2.5.4-13) for the cooling basin. As described in Subsection 2.5.1, the site soils, primarily Beaumont Formation and Lissie Formation deposits, are geologically old (Pleistocene age). Conventionally, only younger deposits, especially Holocene age and Recent age deposits, are considered potentially liquefiable. To be complete and conservative, a comprehensive liquefaction analysis for all SPT, CPT, and shear wave velocity (V_s) data is made.

For the purpose of liquefaction analysis, as well as for general subsurface stratification, each individual boring and CPT made at the VCS site is divided according to the various subsurface strata detailed in Subsection 2.5.4.2.1. As such, the soils in the upper 600 feet of the site are evaluated for liquefaction using test results from the site-specific subsurface investigation. Soils deeper than 600 feet are geologically old and are nonliquefiable, as described further in Subsection 2.5.4.8.5.

2.5.4.8.1 Liquefaction Evaluation Methodology

Liquefaction is the transformation of a granular soil material from a solid to a liquefied state as a consequence of increased pore water pressure and reduced effective stress (Reference 2.5.4-59). Soil liquefaction occurrence (or lack thereof) depends on geologic age, state of soil saturation, density, gradation, plasticity, and earthquake intensity and duration. The liquefaction analysis presented here employs state-of-the-art deterministic methods (Reference 2.5.4-8).

In brief, the current state-of-the-art considers an evaluation of data from SPT, CPT, and shear wave velocity (V_s) measurements, with the SPT method being the most well-developed and well-recognized. Initially, a measure of the stress imparted to the soils by seismic ground motion, referred to as the cyclic stress ratio (CSR), is calculated. Then, a measure of the resistance of the soil to seismic ground motion, referred to as the cyclic resistance ratio (CRR), is calculated. Finally, a factor of safety (FOS) against liquefaction is calculated as the ratio of resisting stress, CRR, to driving stress, CSR. Details of the liquefaction methodology and the relationships for calculating CSR, CRR, FOS, and other intermediate parameters such as the stress reduction coefficient (r_d), the magnitude scaling factor (MSF), the K_σ correction factor accounting for liquefaction resistance with increasing confining pressure, the K_α correction factor accounting for sloping ground, and a number of other correction factors, can be found in Reference 2.5.4-8.

As noted in Subsection 2.5.4.6.1, groundwater levels selected as representative of the conditions at the time of the site-specific subsurface investigation (i.e., prior to the conditions expected during operation; at the time SPT, CPT, and V_s measurements are made) are:

- Power Block Area: elevation 48 feet
- Outside the Power Block Area: elevation 48 feet

- Cooling Basin (West): elevation 39 feet
- Cooling Basin (Central): elevation 32 feet
- Cooling Basin (East): elevation 28 feet
- East of the Cooling Basin (Linn Lake Area): elevation 15 feet

These conditions are used in calculating basic soil parameters and “resisting-side” factors (i.e., CRR) in liquefaction analysis (Reference 2.5.4-8).

Also as noted in Subsection 2.5.4.6.1, the effect of the contained water in the cooling basin is a general rise in groundwater levels site-wide to approximately elevation 85 feet at the power block area (i.e., slightly above the level of the original ground surface at approximately elevation 80 feet). As such, in the post-construction condition, all soils are conservatively assumed as fully saturated/buoyant (i.e., groundwater level at or above the ground surface of individual borings and CPTs). These conditions are used in calculating “driving-side” factors (i.e., CSR) in liquefaction analysis.

A review of the results of liquefaction potential analysis using the available SPT, CPT, and V_s data for the whole of the VCS site follows.

2.5.4.8.2 Factors of Safety Against Liquefaction Based on SPT Data

Uncorrected SPT N-values versus elevation are presented on Figures 2.5.4-21 through 2.5.4-24, 2.5.4-25, and 2.5.4-26 for the power block area, outside the power block area, and the cooling basin, respectively. Corrected SPT $(N_1)_{60}$-values versus elevation are similarly presented on Figures 2.5.4-27 through 2.5.4-30, 2.5.4-31, and 2.5.4-32 for the power block area, outside the power block area, and the cooling basin, respectively. SPT data for all 71 SPT borings made within the power block area, all 5 SPT borings made outside the power block area, and all 47 SPT borings made within or adjoining the cooling basin are evaluated for liquefaction potential. For completeness, all data points are included in the FOS calculation.

The equivalent clean sand $CRR_{7.5}$ value, based on the SPT clean sand equivalent $(N_1)_{60cs}$, is calculated following recommendations in Reference 2.5.4-8 (i.e., by step-wise proceeding from uncorrected SPT N-value, to normalized N_1, to hammer energy corrected $(N_1)_{60}$, to clean sand equivalent $(N_1)_{60cs}$, and then calculating $CRR_{7.5}$ based on $(N_1)_{60cs}$). Refer to Figure 2.5.4-129 for an example of this step-wise approach from uncorrected SPT N-value to clean sand equivalent $(N_1)_{60cs}$. Reference 2.5.4-8 notes that clean sands and/or clean sand equivalents, having $(N_1)_{60cs} \geq 30$ blows per foot, are considered too dense to liquefy, and are classified as nonliquefiable. At the power block area and outside the power block area, 1159 tests of 2505 total tests (including 156 tests outside the power block area), or approximately 46.3 percent of tests, have $(N_1)_{60cs} \geq 30$ blows per foot. At the cooling basin, 520 tests of 1171 total tests, or approximately 44.4 percent of tests, have $(N_1)_{60cs} \geq 30$ blows per foot.

2.5.4.8.2.1 Power Block Area

At the power block area and outside the power block area, of the 2505 SPT N-values, all but 9 tests have FOS ≥1.10 (refer to Subsection 2.5.4.11 for a description of the selection of this minimum FOS). The nine tests having FOS <1.10 amount to 0.4 percent of all the tests evaluated: 99.6 percent of calculated FOS values by this method exceed 1.10. For completeness, an examination of each FOS <1.10 is provided in Table 2.5.4-76. From the table, one of the nine tests is in an area with no structures, and seven of the nine tests are made on fine-grained soils that are nonliquefiable.

Of the remaining test:

- This single test (boring B-2277; El. –55.4 feet; Stratum Sand 5; FOS = 0.98) occurs in the Unit 2 area, where a safety-related structure may be located. Note, however, that the FOS calculated for a test in the same stratum immediately below this test is FOS = “nonliquefiable” (i.e., $(N_1)_{60cs} \geq 30$ blows per foot). As such, the test described here represents an isolated occurrence which does not present a risk to safety-related structures.

Therefore, the low FOS values from the SPT method are not an issue with respect to the power block area.

2.5.4.8.2.2 Cooling Basin

At the cooling basin, of the 1171 SPT N-values, all but 17 tests have FOS ≥ 1.10. The 17 tests having FOS <1.10 amount to 0.5 percent of all the tests evaluated: 99.5 percent of calculated FOS values by this method exceed 1.10. For completeness, an examination of each FOS < 1.10 is provided in Table 2.5.4-77. From the table, 3 of the 17 tests are within areas/depths excavated for mass earthwork, 9 of the 17 tests are interior or exterior to the basin with no structure, and 3 of the 17 tests are made on fine-grained soils that are nonliquefiable.

Of the remaining 2 of the total 17 tests:

- One test (boring B-2337; elevation 8.7 feet; Stratum Sand 4; FOS = 0.93) occurs at the east embankment dam of the cooling basin. Note, however, that the FOS value calculated for the test in the same stratum immediately below this test is FOS = 2.14. As such, the test described here represents an isolated occurrence.

- One test (boring B-2351; elevation 60.1 feet; Stratum Sand 1; FOS = 1.01) occurs at the south embankment dam of the cooling basin. Note, however, that the FOS value calculated for the test in the same stratum immediately below this test is FOS = 1.54. As such, the test described here represents an isolated occurrence.

Therefore, the low FOS values from the SPT method are not an issue with respect to the nonsafety-related cooling basin.

2.5.4.8.3 Factors of Safety Against Liquefaction Based on Cone Penetration Test Data

CPT testing at the VCS site included the recording of both commonly-measured cone parameters (e.g., cone tip resistance [q_c], friction sleeve resistance [f_s], and pore pressure), and less-frequently-measured shear wave velocity (V_s). The evaluation of liquefaction potential based on commonly measured cone parameters is addressed here. The evaluation of liquefaction potential based on shear wave velocity (V_s) is addressed in Subsection 2.5.4.8.4.

Corrected CPT tip resistance (q_t) profiles versus elevation are presented on Figures 2.5.4-33 and 2.5.4-34, 2.5.4-35, and 2.5.4-36 for the power block area, outside the power block area, and the cooling basin, respectively. Normalized CPT q_{c1n} profiles versus elevation are similarly presented on Figures 2.5.4-37 and 2.5.4-38, 2.5.4-39, and 2.5.4-40 for the power block area, outside the power block area, and the cooling basin, respectively. CPT data for all 28 CPTs made within the power block area, 1 CPT made outside the power block area, and all 27 CPTs made within or adjoining the cooling basin are evaluated for liquefaction potential. For completeness, all data points are included in the FOS calculation.

The equivalent clean sand $CRR_{7.5}$ value, based on the CPT clean sand equivalent $(q_{c1n})_{cs}$, is calculated following recommendations in Reference 2.5.4-8 (i.e., by step-wise proceeding from uncorrected CPT q_c, to corrected q_t, to normalized q_{c1n}, to clean sand equivalent $(q_{c1n})_{cs}$, and then calculating $CRR_{7.5}$ based on $(q_{c1n})_{cs}$). Refer to Figure 2.5.4-130 for an example of this stepwise approach from uncorrected CPT q_c to clean sand equivalent $(q_{c1n})_{cs}$. Reference 2.5.4-8 notes that clean sands and/or clean sand equivalents, having $(q_{c1n})_{cs} \geq 160$ (dimensionless), are considered too dense to liquefy and are classified as nonliquefiable. At the power block area and outside the power block area, 1383 tests of 5367 total tests (including 193 tests outside the power block area), or approximately 25.7 percent of tests, have $(q_{c1n})_{cs} \geq 160$. At the cooling basin, 1463 tests of 3629 total tests, or approximately 40.3 percent of tests, have $(q_{c1n})_{cs} \geq 160$. Reference 2.5.4-8 also notes that soils, having soil behavior type index $I_c \geq 2.60$, under certain conditions, are considered too clay rich to liquefy, and are also classified as nonliquefiable. At the power block area and outside the power block area, 3096 tests of 5367 total tests (including 193 tests outside the power block area), or approximately 57.7 percent of tests, have $I_c \geq 2.60$. At the cooling basin, 1185 tests of 3629 total tests, or approximately 32.7 percent of tests, have $I_c \geq 2.60$.

2.5.4.8.3.1 Power Block Area

At the power block area and outside the power block area, of the 5367 CPT values measured, all but 99 tests have FOS ≥1.10. The 99 tests having FOS <1.10 amount to 1.8 percent of all the tests evaluated: 98.2 percent of calculated FOS values by this method exceed 1.10. For completeness, an examination of each FOS <1.10 is provided in Table 2.5.4-78. From the table, all of the 99 tests are made on fine-grained soils that are nonliquefiable.

Therefore, the low FOS values from the CPT method are not an issue with respect to the power block area.

2.5.4.8.3.2 Cooling Basin

At the cooling basin, of the 3629 CPT values measured, all but 128 tests have FOS ≥1.10. The 128 tests having FOS <1.10 amount to 3.5 percent of all the tests evaluated; 96.5 percent of calculated FOS values by this method exceed 1.10. For completeness, an examination of each FOS <1.10 is provided in Table 2.5.4-79. From the table, 32 of the 128 tests are within areas/ depths excavated for mass earthwork, 68 of the 128 tests are interior or exterior to the basin with no structure, and 18 of the 128 tests are made on fine-grained soils that are nonliquefiable.

Of the remaining 10 of the total 128 tests:

- One test (CPT C-2301S; elevation 67.83 feet; Stratum Sand 1; FOS = 0.98) occurs at the north embankment dam of the cooling basin. Note, however, that the FOS value calculated for the test in the same stratum immediately below this test is FOS = 1.19. As such, the test described here represents an isolated occurrence.

- Five tests (C-2312; elevation 52.74 feet to elevation 50.74 feet; Stratum Sand 1; FOS = 0.89 to 1.01) occur at the west embankment dam of the cooling basin. Note, however, that the FOS values calculated for the tests in the same stratum immediately above and below these tests are FOS = 1.11 and FOS = 1.23, respectively. As such, the tests described here represent an isolated occurrence.

- One test (C-2321S; elevation 54.05 feet; Stratum Sand 1; FOS = 0.99) occurs at the south embankment dam of the cooling basin. Note, however, that the FOS value calculated for the test in the same stratum immediately below this test is FOS = 2.45. As such, the test described here represents an isolated occurrence.

- Two tests (C-2321S; elevation 47.55 feet to elevation 46.05 feet; Stratum Sand 1; FOS = 1.03 to 1.08) occur at the south embankment dam of the cooling basin. Note, however, that the FOS values calculated for the tests in the same stratum immediately above and below these tests are FOS = “nonliquefiable” (i.e., $(q_{c1n})_{cs}$ ≥160) and FOS = 4.72, respectively. As such, the tests described here represent an isolated occurrence.

- One test (C-2322; elevation 18.56 feet; Stratum Sand 5; FOS = 0.95) occurs at the south embankment dam of the cooling basin. Note, however, that the FOS value calculated for the test in the same stratum immediately below this test is FOS = 1.28. As such, the test described here represents an isolated occurrence.

Therefore, the low FOS values from the CPT method are not an issue with respect to the nonsafety-related cooling basin.

2.5.4.8.4 Factors of Safety Against Liquefaction Based on S-Wave Velocity Data

Shear wave velocity (V_s) data for all eight suspension P-S velocity logging borings and all eight seismic CPTs made within the power block area, both suspension P-S velocity logging borings made outside the power block area, and all seven suspension P-S velocity logging borings and all three seismic CPTs made within the cooling basin is evaluated for liquefaction potential. For completeness, all data points are included in the FOS calculation.

The equivalent clean sand $CRR_{7.5}$ value, based on the normalized V_{s1}, is calculated following recommendations in Reference 2.5.4-8 (i.e., by step-wise proceeding from uncorrected V_s, to normalized V_{s1}, and then calculating $CRR_{7.5}$ based on the threshold value of V_{s1}*). Note that the threshold value of V_{s1}* depends on fines content, and varies linearly from 215 meters per second (705 feet per second) for soils having fines content of ≤5 percent, to 200 meters per second (656 feet per second) for soils having fines contents of 35 percent. Reference 2.5.4-8 notes that soils having V_{s1} ≥V_s* are considered too dense to liquefy and are classified as nonliquefiable. At the power block area and outside the power block area, 1683 tests of 3385 total tests (including 356 tests outside the power block area), or approximately 49.7 percent of tests, have V_{s1} ≥V_{s1}*. At the cooling basin, 1017 tests of 1236 total tests, or approximately 82.2 percent of tests, have V_{s1} ≥V_{s1}*.

2.5.4.8.4.1 Power Block Area

At the power block area, of the 2149 V_s values, all but 109 tests have FOS ≥1.10. The 109 tests having FOS <1.10 amount to 5.0 percent of all the tests evaluated; 95.0 percent of calculated FOS values by this method exceed 1.10. For completeness, an examination of each FOS <1.10 is provided in Table 2.5.4-80. From the table, 99 of the 109 tests are made on fine-grained soils that are nonliquefiable.

Of the remaining 10 of the total 109 tests:

- One test (C-2102S; elevation -9.6 feet; Stratum Sand 4; FOS = 0.86). Note that FOS values calculated by the SPT method for borings surrounding this CPT at a similar depth interval are: FOS = 1.96 (boring B-2150 at elevation –8.1 feet), FOS = 2.76 (boring B-2151 at elevation –9.1 feet), FOS = 1.81 (boring B-2155 at elevation –8.1 feet), and FOS = 1.67 (boring B-2156 at elevation –9.8 feet). As such, the test described here represents an isolated occurrence.

- Two tests (boring B-2174A Offset; El. 25.2 feet to El. 23.5 feet; Straturn Sand 2; FOS = 0.61 to 1.03. Note that FOS values calculated by the SPT method for the same boring/similar depth interval are FOS = 2.59 at El. 26.4 feet and FOS = "nonliquefiable" (i.e. $(N_1)_{60cs}$ ≥30 blows per foot) at El. 21.4 feet. As such, the tests described here represent an isolated occurrence.
- Five tests (B-2262A Offset; elevation –81.8 feet to elevation –88.4 feet; Stratum Sand 6; FOS = 0.29 to 0.94). Note that FOS values calculated by the SPT method for the same boring/ similar depth interval are: FOS = "nonliquefiable" (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) at elevation –78.1 feet and FOS = "nonliquefiable" (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) at elevation –88.1 feet. As such, the tests described here represent an isolated occurrence.
- Two tests (boring B-2274A Offset; elevation –82.1 feet to elevation –83.7 feet; Stratum Sand 6; FOS = 0.68 to 0.81). Note that FOS values calculated by the SPT method for the same boring/similar depth interval are FOS = 1.87 at elevation –80.7 feet and FOS = "nonliquefiable" (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) at elevation –90.7 feet. As such, the tests described here represent an isolated occurrence.

Therefore, the low FOS values from the shear wave velocity method are not an issue with respect to the power block area.

2.5.4.8.4.2 Cooling Basin

At the cooling basin, of the 1236 V_s values, all but 31 tests have FOS ≥1.10. The 31 tests having FOS <1.10 amount to 2.5 percent of all the tests evaluated; 97.5 percent of calculated FOS values by this method exceed 1.10. For completeness, an examination of each FOS <1.10 is provided in Table 2.5.4-81. From the table, 1 of the 31 tests is within an area/depth excavated for mass earthwork, 9 of the 31 tests are interior or exterior to the basin with no structure, and 17 of the 31 tests are made on fine-grained soils that are nonliquefiable.

Of the remaining 4 of the total 31 tests:

- Two tests (B-2302; elevation 17.3 feet to elevation 16.0 feet; Stratum Sand 2; FOS = 0.55 to 1.09) occur at the west embankment dam of the cooling basin. Note also that the FOS value calculated by the SPT method for the same boring/similar depth interval is FOS = "nonliquefiable" (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) at elevation 16.8 feet. As such, the tests described here represent an isolated occurrence.

- One test (B-2303; elevation -108.2 feet; Stratum Sand 6; FOS = 0.97) occurs at the west embankment dam of the cooling basin. Note also that FOS values by the SPT method calculated for the same boring/similar depth interval are: FOS = “nonliquefiable” (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) at elevation -103.1 feet and FOS = “nonliquefiable” (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) at elevation -113.1 feet. As such, the test described here represents an isolated occurrence.

- One test (C-2301S; elevation 67.8 feet; Stratum Sand 1; FOS = 0.42) occurs at the north embankment dam of the cooling basin. Note also that the FOS values calculated by the SPT method for borings adjoining this CPT at a similar depth interval are: FOS = “nonliquefiable” (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) (boring B-2302A at elevation 66.8 feet) and FOS = “nonliquefiable” (i.e., $(N_1)_{60cs}$ ≥30 blows per foot) (boring B-2317 at elevation 57.2 feet). As such, the test described here represents an isolated occurrence.

Therefore, the low FOS values from the shear wave velocity method are not an issue with respect to the nonsafety-related cooling basin.

2.5.4.8.5 Liquefaction Resistance of Soils Deeper than Approximately 600 Feet Below Existing Ground Surface

The liquefaction evaluation described above focuses on VCS site soils in the upper 600 feet investigated. Site soils, however, are much deeper, with the Pleistocene Beaumont Formation extending to depths of approximately 400 feet below ground surface (underlain by the older Lissie Formation), and with the top depth of pre-Cretaceous bedrock (“basement rock”) estimated at approximately 41,000 feet below ground surface (Reference 2.5.4-4). Refer to Subsection 2.5.4.1 for a brief description of geologic conditions at depths greater than 600 feet.

Geologic information on soils below 600 feet is gathered from the available literature. Note that even the uppermost soils, including the Beaumont and Lissie Formations, are geologically old (at approximately 100,000 to 24 million years for Pleistocene, Pliocene, and Miocene deposits). Liquefaction resistance increases markedly with geologic age, with Pleistocene soils having more resistance than Holocene age and Recent age soils, and pre-Pleistocene soils being generally immune to liquefaction (Reference 2.5.4-8). On this basis, deeper VCS site soils are geologically too old to be prone to liquefaction. Additionally, the degree of compaction and strength of deeper VCS site soils likely increase with depth, compared to the overlying soils which are analyzed, leading to higher liquefaction resistance. Finally, liquefaction analysis by the shear wave velocity method for soils at the maximum 600 feet depth investigated (V_s values of approximately 1995 feet per second being an average for the deepest investigated soil stratum, Stratum Sand 18) does not indicate the potential for liquefaction, with calculated FOS values = “nonliquefiable” (i.e., $V_{s1} > V_{s1}^*$). With shear wave velocities of soils deeper that 600 feet below ground surface increasing in the range of approximately 2090 feet per second to 6000 feet per second, as noted in Subsection 2.5.4.7.2.2, even higher liquefaction resistance is expected from these deeper soils. Considering the above three cases, liquefaction of VCS site soils below a depth of 600 feet below ground surface is not considered possible.

2.5.4.8.6 Concluding Remarks

A liquefaction analysis is performed using the state-of-the-art deterministic methods outlined in Reference 2.5.4-8. At the safety-related power block area: a total of 2505 SPT data points are analyzed from 76 borings, of which 99.6 percent of the calculated FOS values exceed 1.10; a total of 5367 CPT data points are analyzed from 29 CPTs, of which 98.2 percent of the calculated FOS values exceed 1.10; and a total of 2149 V_s data points are analyzed from 10 suspension P-S velocity logging borings and 8 seismic CPTs, of which 95.0 percent of the calculated FOS values exceed 1.10. At the nonsafety-related cooling basin: a total of 1171 SPT data points are analyzed from 47 borings, of which 99.5 percent of the calculated FOS values exceed 1.10; a total of 3629 CPT data points are analyzed from 27 CPTs, of which 96.5 percent of the calculated FOS values exceed 1.10; and a total of 1236 V_s data points are analyzed from 7 suspension P-S velocity logging borings and 3 seismic CPTs, of which 97.5 percent of the calculated FOS values exceed 1.10. A detailed examination of the SPT, CPT, and V_s data points analyzed having FOS <1.10, reveals that the affected soils are not an issue with respect to the safety of the VCS site.

It is also evident from the collected subsurface investigation results and from a review of the geologic literature that VCS site soils are overconsolidated and are geologically old with respect to conventional liquefaction analysis. Moreover, the state-of-the-art methodology used for this liquefaction analysis is intended to be conservative and is not required to encompass every data point; therefore, the presence of a few data points beyond the CRR base curves is acceptable (Reference 2.5.4-8).

2.5.4.8.7 Consultation with Regulatory Guide 1.198

RG 1.198 (Reference 2.5.4-59) was consulted as part of this evaluation. The liquefaction evaluation presented here conforms closely to the referenced guidelines.

Under *Screening Techniques for Evaluation of Liquefaction Potential*, RG 1.198 (Reference 2.5.4-59) lists the most commonly observed liquefiable soils as fluvial-alluvial deposits, eolian sands and silts, beach sands, reclaimed land, and uncompacted hydraulic fills. The geology of the VCS site includes fluvial-alluvial soils, and the liquefaction analysis documented here includes all VCS site soils investigated. In the same section, RG 1.198 (Reference 2.5.4-59) indicates that clay to silt, silty clay to clayey sand, or silty gravel to clayey gravel soils can be considered potentially liquefiable, and the liquefaction analysis documented here treats all VCS site soils as potentially liquefiable, including the fine-grained soils. Note, however, that the finer-grained VCS site soils contain large percentages of fines, generally greatly exceeding soils that are conventionally evaluated according to the state-of-the-art method, and/or are highly plastic, and are generally considered nonliquefiable.

Similarly, RG 1.198 (Reference 2.5.4-59) indicates that potentially liquefiable soils may not pose a liquefaction risk to the facility if they are insufficiently thick and/or of limited lateral extent. For the safety-related power block area, the separately described SPT tests (1 of 9 tests), CPT tests (0 of 99 tests), and Vs tests (10 of 109 tests) having FOS <1.10 are all of limited thickness and/or lateral extent. Similarly, for the nonsafety-related cooling basin, the separately described SPT tests (2 of 17 tests), CPT tests (10 of 128 tests), and V_s tests (4 of 31 tests) having FOS <1.10 are also all of limited thickness and/or lateral extent.

Finally, under *Procedures for Evaluating Liquefaction Potential,* RG 1.198 (Reference 2.5.4-59) lists CPT, SPT, cyclic triaxial, and shear wave velocity tests as acceptable methods. All referenced methods, excepting cyclic triaxial tests (which are not performed, and which given the results of this liquefaction analysis, are not warranted), are employed in analyzing the VCS site soils.

2.5.4.9 Earthquake Site Characteristics

Refer to Subsection 2.5.2.6 for details on development of the site-specific GMRS.

2.5.4.10 Static Stability

As noted above, finish grade at the power block area is approximately elevation 95 feet. This subsection addresses the stability of foundation soils for major safety-related structures to be located within the power block area as shown in Figure 2.5.4-1. Note that the static (and dynamic) stability of a particular plant/technology depends not only on the subsurface conditions, but also on the individual structure loads, plan dimensions, and embedment depths. A specific plant/technology for the VCS site will be selected at a later date, and a detailed stability assessment (including bearing capacities, settlement analyses, liquefaction analyses, and lateral load assessment) for the final selected plant/technology will be performed at COLA stage to ensure that the bearing capacities and settlements meet the minimum value. As such, the analyses presented here are used to: (1) demonstrate the methodologies pertinent to such analyses and (2) provide results pertinent to a typical dual unit LWR plant with an integral UHS, unless noted.

2.5.4.10.1 Foundations, Subsurface Conditions, and Soil Properties

Major site seismic Category I structures associated with the potential reactors, their approximate foundation dimensions, foundation elevations, and static foundation pressures are indicated in the following table.

Structure	Approximate Foundation Dimensions (feet)	Approximate Foundation El. (feet)[a]	Gross Foundation Pressure (ksf)	Net Foundation Pressure (ksf)[b]
Typical LWR (with an Integral UHS) Reactor/Fuel Buildings (Units 1 and 2)	161 by 230	29.4 {8.0}	14.6	11.1
Typical LWR (with an Integral UHS) Control Buildings (Units 1 and 2)	78 by 99	46.1 {25.0}	6.1	3.7
Typical LWR (with an Integral UHS) Fire Water Service Complexes (Units 1 and 2)[c]	66 by 171	87.3	3.5	3.5
Typical LWR (with an Independent UHS) Reactor Buildings	185 by 195	10.0 {-8.0 (Unit 1)} 10.0 {-15.0 (Unit 2)}	15.0	10.3
Typical LWR (with an Independent UHS) Control Buildings	80 by 184	20.0 {-8.0 (Unit 1)} 20.0 {-15.0 (Unit 2)}	15.0	10.9

(a) Foundation elevations designations shown in “{ }“ symbols denote the elevations at the base of significant overexcavation (to reach a suitable bearing stratum) at the particular structure (e.g., at the typical LWR (with an integral UHS) reactor/fuel buildings [Units 1 and 2], in situ soils are overexcavated approximately 21 feet below the underside of foundations, with overexcavation replaced by structural fill; and at the typical LWR (with an integral UHS) control buildings [Units 1 and 2], in situ soils are overexcavated approximately 21 feet below the underside of foundations, with overexcavation replaced by structural fill.

(b) Net foundation pressure is the gross foundation pressure minus buoyancy, with the groundwater level at elevation 85 feet (i.e., the post-construction groundwater level).

(c) Fire Water Service Complexes (Units 1 and 2) bear on approximately 7.3 feet of structural fill over in situ soils (natural ground surface at elevation 80 feet before raising power block area to finish grade).

Power block area subsurface conditions are described in detail in Subsection 2.5.4.2. Geotechnical engineering parameters selected for design for each of the various soil strata occurring at the site are similarly described in Subsection 2.5.4.2, and are summarized in Table 2.5.4-32. The parameters contained in this table are used as the bases for foundation analyses presented here.

For foundation analysis purposes, typical specific subsurface conditions/profiles associated with each of the seismic Category I structures for both Unit 1 and Unit 2 of a typical LWR (with an integral UHS) are developed as shown in the examples in Figures 2.5.4-131 through 2.5.4-133. Associated strata depths and elevations for each of these example structure-specific conditions/profiles are shown in Tables 2.5.4-82, 2.5.4-84, and 2.5.4-86. Below elevation –120 feet, strata boundary and soil property information are taken from the deeper borings (Borings B-2169, B-2173, B-2174A, B-2182A, B-2269, B-2273, B-2274A, B-2282A). Because different soil strata at times occur at the same elevation range below a particular foundation, two soil conditions/profiles are developed for calculation purposes. These are labeled “Clay Preferred” and “Sand Preferred.” For soil conditions/

profiles with the label “Clay Preferred,” the clay stratum below the respective foundation and its characteristic undrained shear strength, s_u, represent the elevation range containing the two soil types. Similarly, for soil conditions/profiles with the label “Sand Preferred,” the sand stratum below the respective foundation and its characteristic friction angle, Φ', represent the elevation range containing the two soil types. The selected clay stratum or sand stratum selected is indicated in Tables 2.5.4-82, 2.5.4-84, and 2.5.4-86. As can be seen from these tables, the “Clay Preferred” and “Sand Preferred” conditions/profiles are mostly the same or very similar given the relative uniformity of subsurface conditions at each of the structures. The two soil conditions/profiles generated through this selection process are used for calculation of structure bearing capacity and settlement.

As noted in Subsection 2.5.4.6.1, based on groundwater observation well measurements, the current (pre-construction) groundwater level at the power block area is approximately elevation 48 feet, while the post-construction groundwater level at the power block area is elevation 85 feet. This rise in groundwater level is a result of the contained water (to approximately elevation 91.5 feet) in the cooling basin. This latter groundwater level is used in foundation analyses.

2.5.4.10.2 Bearing Capacity Evaluations

The ultimate bearing capacity, q_{ult}, of a foundation is calculated using (Reference 2.5.4-60):

$$q_{ult} = c\, N_c\, \zeta_c + q\, N_q\, \zeta_q + 0.5\, \gamma'\, B\, N_\gamma\, \zeta_\gamma \qquad \text{Equation 2.5.4-20}$$

where, c = undrained shear strength of the soil (s_u)

q = effective overburden pressure at the foundation base

γ' = effective unit weight of the soil

B = foundation width

N_c, N_q, and N_γ are bearing capacity factors

ζ_c, ζ_q, and ζ_γ are shape factors

For rectangular foundations, the shape factors are given (Reference 2.5.4-60) as:

$$\zeta_c = 1 + (B/L)\,(N_q/N_c) \qquad \text{Equation 2.5.4-21}$$

$$\zeta_q = 1 + (B/L)\tan(\phi) \qquad \text{Equation 2.5.4-22}$$

$$\zeta_\gamma = 1 - 0.4\,(B/L) \qquad \text{Equation 2.5.4-23}$$

where, B = foundation width

L = foundation length

ϕ = friction angle of the soil

For square or circular foundations, the shape factors are given (Reference 2.5.4-60) as:

$\zeta_c = 1 + (N_q/N_c)$ Equation 2.5.4-24

$\zeta_q = 1 + \tan(\phi)$ Equation 2.5.4-25

$\zeta_\gamma = 0.6$ Equation 2.5.4-26

The allowable bearing capacity, q_a, is:

$q_a = q_{ult}/FOS$ Equation 2.5.4-27

where, FOS=the factor of safety

The above bearing capacity formulation is based assuming that the soil material within the zone of foundation deformation is uniform in terms of shear strength properties. VCS site soils, however, are inter-layered clay strata and sand strata, and as such, this interlayering of the subsurface needs to be considered in the evaluation of foundation bearing capacities. The issue of an interlayered subsurface profile is addressed by several investigators. A simplified but reasonable approach accommodates interlayering by averaging the shear strength parameters in the foundation deformation zone, as proposed in References 2.5.4-61 and 2.5.4-22, and uses the formulation in Reference 2.5.4-60 (Equations 2.5.4-20 through 2.5.4-27). This approach is followed for estimating foundation bearing capacities, as described below.

Figure 2.5.4-134 shows the typical wedge failure developed below a foundation, with the effective shear depth (i.e., the height of the failure wedge) as *H'*. Reference 2.5.4-22 recommends using the weighted average of cohesion (undrained shear strength), *c* (s_u), and friction angle, ϕ, as follows:

$$c = \frac{\sum c_i H_i}{\sum H_i}$$ Equation 2.5.4-28

$$\tan(\phi) = \frac{\sum \tan(\phi_i) H_i}{\sum H_i}$$ Equation 2.5.4-29

where, c_i = cohesion (undrained shear strength) of layer *i*

ϕ_i = friction angle of layer *i*

H_i = thickness of layer *i* within the effective shear depth *H'*

Equations 2.5.4-28 and 2.5.4-29 are used to derive the average shear strength properties of soils below the foundation of each seismic Category I structure of a typical LWR (with an integral UHS). The average material properties derived for each example foundation are shown in Tables 2.5.4-83, 2.5.4-85, and 2.5.4-87. Note that 21.4 feet and 21.1 feet of structural fill immediately below the bases of the reactor/fuel buildings and the control buildings, respectively, are accounted for in these example tables. These depths of in situ soils are required to be removed and replaced with structural fill (thickness determined by a trial and error approach) to obtain adequate bearing capacity. The same approach was used to evaluate required structural fill thicknesses beneath the remaining structures evaluated, but not presented, in these tables.

Foundation bearing capacities for the example structures are estimated using the average material properties in Tables 2.5.4-83, 2.5.4-85, and 2.5.4-87 in Equations 2.5.4-20 through 2.5.4-27. A summary of the allowable and ultimate bearing capacities of all evaluated seismic Category I structures is given in Table 2.5.4-88. Analysis results show that at all evaluated seismic Category I structures, the allowable bearing capacities (using FOS = 3.0) and ultimate bearing capacities are higher than the required static design loads and dynamic design loads.

To demonstrate the effects of groundwater table on bearing capacity, Figures 2.5.4-135 and 2.5.4-136 present calculated bearing capacities (allowable and ultimate) at different groundwater levels for the reactor/fuel buildings and for the control buildings, respectively, as well as the corresponding required design load and effective design load (the effective design load is equal to the design load minus the buoyancy of the particular structure). Assuming a groundwater level varying from the base of foundation up to the post-construction level (elevation 85 feet), this comparison shows that the allowable bearing capacities are maintained higher than the static design loads for all groundwater levels considered, and the ultimate bearing capacities are also maintained higher than the dynamic design loads for all groundwater levels considered. As such, the bearing capacities of all evaluated seismic Category I structures satisfy design requirements, even considering a groundwater level varying over a wide range.

2.5.4.10.3 Settlement Evaluations

Foundation settlements are estimated using pseudo-elastic compression and one-dimensional consolidation. Based on a stress-strain model that computes settlement in discrete layers, the settlement, δ, of shallow foundations due to elastic compression of subsurface materials is estimated as:

$$\delta = \Sigma (\Delta p_i h_i)/E_i \quad \text{Equation 2.5.4-30}$$

where, δ = settlement

i = 1 to n, where n is the number of layers

p_i = vertical applied pressure at the center of layer i

h_i = thickness of layer i

E_i = elastic modulus of layer i

The stress distribution below the corner of a rectangular flexible foundation is based on a Boussinesq-type distribution, as presented in Reference 2.5.4-62:

$$\sigma_z = (p/2\pi) \{\tan^{-1} [l\, b/(z\, R_3)] + (l\, b\, z/R_3)(1/R_1^2 + 1/R_2^2)\}$$

Equation 2.5.4-31

where, σ_z = calculated pressure below the corner at depth z

p = applied foundation pressure

l = length of the foundation

b = width of the foundation

z = depth below the foundation at which the pressure is calculated

$R_1 = (l^2 + z^2)^{0.5}$

$R_2 = (b^2 + z^2)^{0.5}$

$R_3 = (l^2 + b^2 + z^2)^{0.5}$

Note that to calculate σ_z values below the midpoint of an edge and the center of a rectangular foundation, the values of σ_z calculated from Equation 2.5.4-31 are multiplied by two and four, respectively.

As described in Subsections 2.5.4.2.1.3.15 and 2.5.4.7.3.1, shear modulus degradation curves for VCS site soils are developed based on the results of RCTS tests made on site-specific undisturbed soil samples (refer to Figures 2.5.4-93 through 2.5.4-108 for tests made on power block area soils). For the calculation of structure settlement using the elastic method (Equations 2.5.4-30 and 2.5.4-31), the maximum principal strain is the vertical strain (i.e., $\varepsilon_1 = \varepsilon_v$), while the minimum principal strain is assumed to be zero (i.e., $\varepsilon_3 = 0$). Since the maximum shear strain, $\gamma_{max} = \varepsilon_1 - \varepsilon_3 = \varepsilon_1$ (Reference 2.5.4-62) and $E/E_{max} = G/G_{max}$, the elastic modulus reduction curves with respect to vertical strain are the same as the shear modulus degradation (reduction) curves with respect to shear strain.

To calculate structure settlement, beginning with an initial elastic modulus E_0, the corresponding vertical strain ε_{v0} is derived from the shear modulus degradation curves. Based on ε_{v0}, the settlement in the soil layer δ_0 is calculated, and in turn the vertical strain is calculated as $\varepsilon_{v1} = \delta_0/h$, where h is the thickness of the soil layer. If ε_{v1} is different from ε_{v0}, a revised elastic modulus E_1 is derived from ε_{v1} based on the shear modulus degradation curves. This iteration process continues until a compatible elastic modulus and vertical strain are found.

The settlement calculation is extended to a depth where the increase in vertical stress (Δp) due to the applied foundation pressure is less than or equal to 10 percent of the total applied foundation pressure. Also, applying a 1H:2V pressure distribution (refer to Figure 2.5.4-134) through the structural fill, the calculated average applied vertical stress below the foundation is compared to the preconsolidation pressures (P_c') of each of the underlying clay strata. Where more than one soil type is present at a given elevation interval below a foundation, as described previously, for settlement analysis purposes a clay stratum is selected over a sand stratum to conservatively represent the elevation interval. Results show that the preconsolidation pressures of all clay strata exceed the applied vertical stress at the midpoint of each layer, therefore, there is no virgin compression in these soils upon foundation loading. As such, consolidation of clay strata under foundation pressures is due to recompression only, and is estimated using the elastic method outlined above.

Foundation settlements are calculated based on Equations 2.5.4-30 and 2.5.4-31, and the selected subsurface profiles (or similar profiles) as shown in Tables 2.5.4-82, 2.5.4-84, and 2.5.4-86. Table 2.5.4-89 presents settlement estimates for all evaluated seismic Category I structures of a typical LWR (with an integral UHS), including total estimated settlement at the center, the edge, and the corner of each structure, as well as the allowable settlement, if available. Comparison shows that calculated total and differential settlements of each structure foundation are within required tolerance values. Note that higher total settlements can be accommodated when critical connections to adjacent structures, utilities, and pavements are delayed.

Note that actual settlements are less than calculated values (described above), for two principal reasons:

- A significant amount (i.e., typically more than one-half) of foundation settlement is expected to take place by the time superstructures are ready to receive equipment and/or piping.
- Settlement estimates are based on the assumption of flexible mat foundations, and do not include the effects that thick, highly reinforced concrete mat foundations have in mitigating differential settlements. To verify that foundations perform according to estimates, and to provide the ability to make corrections if needed, major structure foundations are monitored for movement during and after construction.

Before construction of major power block area structures, as noted in Subsection 2.5.4.5.2, plant-site ground surface is raised from elevation 80 feet (original ground surface) to elevation 95 feet (plant finish grade) using structural fill. The estimated settlement caused by placement of site fill is about 0.8 inches. As this settlement should occur relatively rapidly, and before construction of seismic Category I structures, it is not included in the calculated settlements of these structures.

Also note that unloading of the soil profile results from mass excavation for power block area major structures (i.e., maximum 72 feet below existing grade, 87 feet below final grade for the structures with calculated settlements presented in Table 2.5.4-89). This unloading results in rebound/heave of the base of excavation, which is monitored/accounted for during construction. Rebound/heave for excavation of major power block area structures included in Table 2.5.4-89 is estimated to be less than or equal to 0.7 inches.

2.5.4.10.4 Earth Pressure Evaluations

The static and seismic active and at-rest lateral earth pressures acting on underground structure below-grade walls are addressed here. The analysis of seismic earth pressure is addressed generically. Passive earth pressures are not addressed. Active lateral earth pressures apply to yielding walls such as steel sheet pile walls, and to a lesser extent more rigid concrete slurry (diaphragm) walls, which are used primarily as temporary ground support in construction. At-rest lateral earth pressures occur in the case of non-yielding walls, such as the rigid, below-grade walls of underground structures (e.g., for reactor buildings, control buildings, etc.).

Increases in lateral earth pressures resulting from compaction close-in to below-grade structures (for at-rest conditions) are considered here. These increases are controlled at the construction stage by limiting the size of compaction equipment and its proximity to below-grade walls. Note that the magnitude of compaction-induced lateral earth pressure increases can only be assessed once a range of allowable equipment sizes and types are selected/specified.

For the seismic active earth pressure case, earthquake-induced horizontal ground accelerations are accounted for by employing the factor $k_h g$; a peak horizontal ground surface acceleration of 0.10g (refer to Subsection 2.5.4.7.5) is applied, and vertical ground accelerations (k_v g) are considered negligible (Reference 2.5.4-63).

2.5.4.10.4.1 Static Lateral Earth Pressures

The static active lateral earth pressure, p_{AS}, is calculated using Reference 2.5.4-63:

$p_{AS} = K_{AS} \cdot \gamma \cdot z$ Equation 2.5.4-32

where, K_{AS} = Rankine coefficient of static active lateral earth pressure

γ = unit weight of the structural fill (γ', effective unit weight when below the groundwater level)

z = depth below ground surface

The Rankine coefficient, K_{AS}, is calculated from:

$K_{AS} = \tan^2 (45 - \phi'/2)$ Equation 2.5.4-33

(which is also Equation 2.5.4-15, above)

where, ϕ' = friction angle of the structural fill, in degrees

The static at-rest lateral earth pressure, p_{0S}, is calculated using Reference 2.5.4-17:

$p_{0S} = K_{0S} \cdot \gamma \cdot z$ Equation 2.5.4-34

where, K_{0S} = coefficient of static at-rest lateral earth pressure

The coefficient, K_{0S} is calculated from:

$K_{0S} = 1 - \sin(\phi')$ Equation 2.5.4-35
(which is also Equation 2.5.4-17, above)

Hydrostatic groundwater pressure is considered for both the static active and the static at-rest conditions, calculated by:

$p_w = \gamma_w \cdot z_w$ Equation 2.5.4-36

where, p_w = hydrostatic pressure

z_w = depth below the groundwater level

γ_w = unit weight of water = 62.4 pcf

2.5.4.10.4.2 Seismic Dynamic Lateral Earth Pressures

The active seismic pressure, p_{AE}, is given by the Mononobe-Okabe equation (Reference 2.5.4-63), represented by:

$p_{AE} = \Delta K_{AE} \cdot \gamma \cdot (H - z)$ Equation 2.5.4-37a

where, ΔK_{AE}=coefficient of seismic active earth pressure = $K_{AE} - K_{AS}$

K_{AE}=Mononobe-Okabe coefficient of active seismic earth thrust

H = below-grade height of the wall

The coefficient K_{AE} is calculated from:

$K_{AE} = \cos^2(\phi' - \theta)/\{\cos^2\theta \cdot [1 + (\sin\phi' \sin(\phi' - \theta)/\cos(\theta))^{0.5}]^2\}$

Equation 2.5.4-37b

where, $\theta = \tan^{-1}(k_h)$

k_h = 0.10, as above

Note that ΔK_{AE} can be estimated using $3/4 \cdot k_h$ for k_h values less than about 0.25g, regardless of the angle of shearing resistance of the structural fill (Reference 2.5.4-63).

Note that seismic at-rest lateral earth pressure for non-yielding walls is reported at up to three times the active lateral earth pressure calculated by the Mononobe-Okabe equation (Reference 2.5.4-64).

Recognizing the limitations of the Mononobe-Okabe method for the design of below-grade structural walls, the evaluation of below-grade walls of specific seismic Category I structures uses the ASCE 4-98 method (Reference 2.5.4-65) to estimate seismic at-rest lateral earth pressures (p_{oE}). Reference 2.5.4-65 provides a nomograph with an elastic solution, in which dimensionless normal stress at 1.0g horizontal earthquake acceleration is developed for a normalized depth at a given Poisson's ratio.

The seismic at-rest lateral earth pressure (p_{oE}) is then recalculated for various depth intervals using the site specific horizontal earthquake acceleration by rearranging the dimensionless normal stress equation and multiplying by the site-specific acceleration.

For well-drained backfill materials (i.e., sand/gravel), seismic groundwater pressure is considered only if the pore water is free to move relative to the soil/mineral skeleton (References 2.5.4-64 and 2.5.4-66). Since the VCS site employs highly compacted granular structural fill with relatively low permeability, seismic groundwater pressure need not be considered. Therefore, only the static water level is considered in calculating the hydrostatic groundwater pressure, as given in Equation 2.5.4-36. Note that seismic groundwater thrust greater than 35 percent of hydrostatic thrust can develop for cases when k_h >0.30g (Reference 2.5.4-66). Given the relatively low seismicity of the VCS site (i.e., k_h <0.30g), seismic considerations related to groundwater can similarly be disregarded.

2.5.4.10.4.3 Lateral Earth Pressures Due to Surcharge

Lateral earth pressure resulting from surcharge applied at the ground surface alongside a below-grade structure wall, p_{sur}, is calculated using

$$p_{sur} = K\, q \qquad \text{Equation 2.5.4-41}$$

where, K = earth pressure coefficient; K_{AS} for active; K_0 for at-rest

q = uniform surcharge pressure

Note that under active condition an area-wide surcharge pressure of 500 psf is included to represent temporary construction loading in the earth pressure calculations summarized here. For the at-rest condition, an area-wide surcharge of 2500 psf is used to represent both temporary construction and permanent adjacent building loads. The validity of these pressures is determined during detailed design.

2.5.4.10.4.4 Lateral Earth Pressures Due to Compaction

References 2.5.4-67 and 2.5.4-68 contain a procedure to evaluate the compaction-induced lateral earth pressures for at-rest conditions. These conditions exist for the non-yielding below-grade walls of the power block area structures that are not allowed to rotate away from the backfill. References 2.5.4-67 and 2.5.4-68 provide the dimensions and loads of various compactors including heavy vibratory compactors, walk-behind vibratory rollers, and vibratory plate compactors, and the relevant design charts for compaction-induced lateral earth pressure under various line loads.

The pressure diagrams associated with static or vibratory rollers (other available design charts are for vibratory plates and rammers) are provided in Reference 2.5.4-68. The curves developed for line loads (q) of 200, 400, 600, and 800 lb/in are superimposed on at-rest earth pressure lines. Note that a correction is required in the pressure values using the adjustments factors based on lift thickness, distance from the wall to the edge of the compactor, roller width, and the friction angle of the soil being compacted (Reference 2.5.4-68). The conditions selected in this evaluation are: q = 800 lb/in (the highest available line load); rollerwidth of 7 feet; distance from the wall to the edge of the compactor of 0.5 feet; and lift thickness of 0.5 feet.

2.5.4.10.4.5 Lateral Earth Pressure Diagrams

Using the relationships outlined above and the structural fill properties summarized in Table 2.5.4-32, sample earth pressure diagrams are developed. Sample earth pressure diagrams are provided on Figures 2.5.4-137 and 2.5.4-138 for the maximum 110-foot wall height (reactor buildings) for the deepest/bounding plant/technology, being a typical LWR with an independent UHS (refer to Subsection 2.5.4.5.1.1.1), assuming level ground surface, and with post-construction groundwater at elevation 85 feet. Structural fill properties (granular soils) used have a unit weight (γ_t) of 138 pcf and a drained friction angle (ϕ') of 39° (refer to Table 2.5.4-32). A peak horizontal ground surface acceleration of 0.10g is employed. An area wide surcharge load of 500 psf and 2500 psf are used under active and at-rest conditions, respectively.

2.5.4.10.5 Selected Design Parameters and Results Overview

Field and laboratory testing results from this site-specific subsurface investigation are described in Subsection 2.5.4.2 and the parameters employed for bearing capacity, settlement, and earth pressure evaluations are based on the material characterization addressed in that subsection. The post-construction groundwater level of elevation 85 feet is selected for bearing capacity/settlement analyses and for developing earth pressure diagrams. For seismic earth pressure analysis, a peak horizontal ground surface acceleration of 0.10g is used, based on the site-specific seismologic and soil dynamics analyses, as described in Subsection 2.5.4.7.5.

The FOS values calculated against static bearing capacity failure of each of the foundations for seismic Category I structures of a typical LWR (with an integral UHS) exceeds 3.0; a value of 3.0 is commonly considered adequate for ensuring foundation stability. The calculated ultimate capacities of each of the seismic Category I structures also exceed the required dynamic bearing capacities. Finally, and considering the effects that construction time and foundation rigidity have on mitigating differential settlement, the calculated settlement of seismic Category I structures of a typical LWR (with an integral UHS) are also within required limits.

2.5.4.11 Design Criteria

Geotechnical design criteria are addressed in the individual subsections, above, and also in Subsection 2.5.5, for the particular subject being considered. The design criteria summarized below are geotechnical design criteria and/or geotechnical-related design criteria that pertain to structural design. Refer to the respective subsections, above, and Subsection 2.5.5, for additional detail.

Subsection 2.5.4.8 presents the results of a liquefaction evaluation of VCS soils and presents a minimum acceptable FOS against liquefaction of 1.10. Under *Factor of Safety Against Liquefaction,* RG 1.198 (Reference 2.5.4-59) indicates that FOS <1.10 is generally considered a trigger value. This is consistent with the value selected for the analysis of VCS site soils, especially when also considering the conservatism employed in ignoring overconsolidation, the geologic age of the deposits, and other factors noted earlier.

Subsection 2.5.4.10 describes allowable bearing capacities and estimated settlement values for plant structures of a typical LWR (with an integral UHS), and compares them to threshold values provided by the various reactor vendors.

Table 2.5.4-88 contains calculated bearing capacities, both static and dynamic, for major seismic Category I structures of a typical LWR (with an integral UHS). In the case of static bearing capacity, a minimum FOS = 3.0 is applied against the calculated ultimate bearing capacity in evaluating the static bearing capacity of a structure (i.e., the calculated ultimate bearing capacity of a structure divided by a FOS = 3.0 is not less than the required minimum static bearing capacity of the structure). In the case of dynamic bearing capacity, the calculated ultimate bearing capacity is compared directly against the dynamic bearing capacity of a structure (i.e., the calculated ultimate bearing capacity of a structure is not less than the minimum required dynamic bearing capacity of the structure).

Table 2.5.4-89 contains estimated settlement of major seismic Category I structures of a typical LWR (with an integral UHS) under recommended foundation loads, and compares them against maximum allowable post-construction total and differential settlement. All requirements associated with settlement are satisfied.

Subsection 2.5.4.10 also addresses criteria for static and seismic earth pressure estimation. The calculated lateral earth pressure diagrams shown on Figures 2.5.4-137 and 2.5.4-138 are best estimates, and thus contain a FOS = 1.0. In the analyses of sliding and overturning due to these lateral loads when the seismic component is included, a FOS = 1.10 is recommended.

No pile or pier foundations are used for support of seismic Category I structures. In situations where deep foundations are used for non-seismic Category I structures, as determined at detailed design:

- For axial loading, a minimum FOS = 3.0 is applied against the calculated ultimate end bearing component, and a minimum FOS = 2.0 is applied against the calculated ultimate skin friction component.

- For lateral loading, the maximum allowable lateral load is taken as one-half of the load that produces 1 inch of lateral movement at the pile head, adjusted for pile spacing and for pile head fixity.

Finally, Subsection 2.5.5.2.2.7 specifies and describes minimum factors of safety for stability of nonsafety-related cooling basin embankment dams, under the following conditions:

- End of Construction: 1.30
- Steady-State Seepage: 1.50
- Rapid Drawdown: 1.30
- Pseudo-static: 1.15

2.5.4.12 Techniques to Improve Subsurface Conditions

As noted in Subsections 2.5.4.5 and 2.5.4.10, major power block area structures (including seismic Category I structures) derive support from stiff to very stiff clay subgrade soils, dense to very dense sand subgrade soils, or compacted structural fill. Given the depths of structure foundations and the subsurface conditions that occur at those depths, as shown in part on Figures 2.5.4-75 through 2.5.4-79, special ground improvement measures are not warranted. Ground treatment is limited to localized overexcavation of unsuitable soils, such as minor zones of less competent soils occurring at foundation subgrades, and their replacement with compacted structural fill.

Overexcavations will be required for some structures to replace soils that are not adequate to directly bear the high foundation loads of these structures, with the required FOS. Overexcavations at these structures are backfilled with compacted structural fill. In addition, general overexcavations of approximately 2 feet, also backfilled with compacted structural fill, at various structures not requiring significant over excavation, will ensure firm subgrades for construction activities. For all affected structures, structural fill is placed according to engineering specifications and quality control/quality assurance testing procedures established at the detailed design stage.

As noted in Subsections 2.5.4.5 and 2.5.5, the cooling basin embankment dams mainly derive support from stiff to very stiff clay subgrade soils and dense to very dense sand subgrade soils. Given the subsurface conditions that occur along the alignment of the embankment dams, as shown in part on Figures 2.5.4-80 through 2.5.4-85, special ground improvement measures are not warranted. Ground treatment is limited to localized over-excavation of unsuitable soils, such as minor zones of less competent soils occurring at embankment dam foundation subgrades, and their replacement with compacted embankment fill.

Ground improvement measures also include proof-rolling of structure and embankment dam foundation subgrades for the purpose of identifying any unsuitable soils for additional overexcavation and replacement. The primary focus is on maintaining the integrity of the existing stiff to very stiff clay and dense to very dense sand structure foundation subgrade soils and embankment dam foundation subgrade soils during earthwork, and continuing on to subgrade preparation to receive structure foundations and embankment fill. These measures include such steps as groundwater and surface water control, the use of appropriate measures and equipment for excavation and compaction, subgrade protection, and other similar measures.

2.5.4.13 References

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Table 2.5.4-1
Field Testing Summary (Power Block Area)[a]

Field Test	Industry Standard	No. of Tests
Borings	Reference 2.5.4-26 Reference 2.5.4-28	93
Standard Penetration Test Hammer Energy Measurements	Reference 2.5.4-10 Reference 2.5.4-27	42[b]
Cone Penetration Tests	Reference 2.5.4-29	38
Observation Wells	Reference 2.5.4-30 Reference 2.5.4-31	11
Test Pits	—	8
Field Electrical Resistivity Arrays	Reference 2.5.4-34 Reference 2.5.4-35	2
Suspension P-S Velocity Logging	Reference 2.5.4-52	10

(a) Includes field tests made at Unit 1, at Unit 2, and Outside the Power Block Area.
(b) Measurements made on drilling rigs/SPT hammers employed at all site areas.

Table 2.5.4-2
Field Testing Summary (Cooling Basin)

Field Test	Industry Standard	No. of Tests
Borings	Reference 2.5.4-26 Reference 2.5.4-27	60
Standard Penetration Test Hammer Energy Measurements	Reference 2.5.4-10 Reference 2.5.4-29	42[a]
Cone Penetration Tests	Reference 2.5.4-29	27
Observation Wells	Reference 2.5.4-30 Reference 2.5.4-31	16
Test Pits	—	12
Field Electrical Resistivity Arrays	Reference 2.5.4-34 Reference 2.5.4-35	—
Suspension P-S Velocity Logging	Reference 2.5.4-52	7
Borehole Permeameter Tests	Reference 2.5.4-32	16
Groundwater Pump Tests	Reference 2.5.4-33	7

(a) Measurements made on drilling rigs/SPT hammers employed at all site areas.

Table 2.5.4-3 (Sheet 1 of 3)
Soil Strata Thicknesses and Base Elevations (Power Block Area)

Stratum	Statistics	Unit 1		Unit 2		Inside Power Block Area		Outside Power Block Area	
		Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)
Clay 1 (Top)	Minimum	48.9	23.5	36.9	22.8	36.9	22.8	44.9	12.4
	Maximum	57.0	31.3	57.6	43.5	57.6	43.5	68.2	34.6
	Average	51.6	28.3	51.5	29.0	51.6	28.6	59.0	20.6
Sand 1	Minimum	Absent	Absent	28.4	0.5	28.4	0.5	Absent	Absent
	Maximum	Absent	Absent	54.2	20.0	54.2	20.0	Absent	Absent
	Average	Absent	Absent	42.8	9.0	42.8	9.0	Absent	Absent
Clay 1 (Bottom)	Minimum	11.9	7.0	12.8	2.0	11.9	2.0	32.3	8.0
	Maximum	42.9	40.0	39.3	35.0	42.9	40.0	56.4	27.5
	Average	33.1	18.5	27.3	17.4	30.5	18.0	40.2	18.8
Sand 2	Minimum	–3.0	0.5	–7.5	2.5	–7.5	0.5	13.4	7.6
	Maximum	26.5	35.5	33.1	28.5	33.1	35.5	24.9	43.0
	Average	19.3	14.2	17.9	10.8	18.6	12.6	19.0	21.2
Clay 3	Minimum	–18.3	5.0	–18.2	3.0	–18.3	3.0	–10.1	22.1
	Maximum	15.3	50.0	2.6	45.0	15.3	50.0	–2.3	35.0
	Average	–4.4	24.5	–6.4	25.1	5.4	24.8	–7.0	26.0
Sand 4	Minimum	–40.2	2.7	–39.6	19.0	–40.2	2.7	–31.2	7.0
	Maximum	–13.8	51.0	–30.5	37.8	–13.8	51.0	–15.3	28.9
	Average	–28.2	23.3	–36.1	27.3	–32.0	25.2	–23.9	16.5
Clay 5 (Top)	Minimum	–65.0	9.5	–65.6	2.2	–65.6	2.2	–50.1	5.0
	Maximum	–41.2	32.0	–41.0	31.0	–41.0	32.0	–23.6	22.0
	Average	–49.4	21.3	–52.3	16.3	–50.8	18.9	–39.7	15.8
Sand 5	Minimum	–79.2	1.0	–78.5	5.0	–79.2	1.0	–61.2	7.0
	Maximum	–48.9	28.9	–58.2	31.2	–48.9	31.2	–33.6	18.0
	Average	–60.9	11.5	–65.9	14.4	–63.7	13.2	–46.4	11.7
Clay 5 (Bottom)	Minimum	–89.0	5.7	–91.3	8.8	–91.3	5.7	–75.2	4.0
	Maximum	–54.9	40.0	–72.7	21.7	–54.9	40.0	–45.6	14.0
	Average	–70.2	17.3	–79.1	13.3	–73.4	15.8	–56.7	9.4
Sand 6	Minimum	–148.9	30.0	–139.1	11.0	–148.9	11.0	–113.2	38.0
	Maximum	–109.8	77.0	–98.3	65.5	–98.3	77.0	–112.6	67.0
	Average	–126.5	52.1	–128.6	47.6	–127.3	50.4	–112.9	52.5
Clay 7	Minimum	–189.3	23.0	Absent	Absent	–189.3	23.0	–159.2	46.0
	Maximum	–150.8	65.5	Absent	Absent	–150.8	65.5	–159.2	46.0
	Average	–172.5	40.7	Absent	Absent	–172.5	40.7	–159.2	46.0

Table 2.5.4-3 (Sheet 2 of 3)
Soil Strata Thicknesses and Base Elevations (Power Block Area)

Stratum	Statistics	Unit 1		Unit 2		Inside Power Block Area		Outside Power Block Area	
		Base El. (feet)[a]	Thickness (feet)	Base El. (feet)[a]	Thickness (feet)	Base El. (feet)[a]	Thickness (feet)	Base El. (feet)[a]	Thickness (feet)
Sand 8	Minimum	–209.3	20.0	–221.4	40.0	–221.4	20.0	–184.2	25.0
	Maximum	–204.5	54.1	–177.9	100.1	–177.9	100.1	–161.8	49.2
	Average	–206.4	33.8	–204.0	70.3	–205.3	50.6	–173.0	37.1
Clay 9	Minimum	–268.9	37.2	–253.3	20.8	–268.9	20.8	–211.2	27.0
	Maximum	–241.7	64.0	–242.2	46.0	–241.7	64.0	–205.6	43.8
	Average	–252.4	47.7	–248.1	36.7	–249.9	41.4	–208.4	35.4
Sand 10	Minimum	–293.5	8.0	–292.7	33.9	–293.5	8.0	>–233.6	>18.0
	Maximum	–254.5	24.6	–287.2	42.0	–254.5	42.0	>–229.2	>28.0
	Average	–267.8	15.4	–289.1	39.0	–278.4	27.2	>–231.4	>23.0
Clay 11	Minimum	–327.5	72.1	–323.1	35.8	–327.5	35.8	—	—
	Maximum	–327.5	72.1	–323.1	35.8	–323.1	72.1	—	—
	Average	–327.5	72.1	–323.1	35.8	–325.3	54.0	—	—
Sand 12	Minimum	–345.6	18.1	–346.1	23.0	–346.1	18.1	—	—
	Maximum	–345.6	18.1	–346.1	23.0	–345.6	23.0	—	—
	Average	–345.6	18.1	–346.1	23.0	–345.9	20.6	—	—
Clay 13	Minimum	–421.1	75.5	–422.1	76.0	–422.1	75.5	—	—
	Maximum	–421.1	75.5	–422.1	76.0	–421.1	76.0	—	—
	Average	–421.1	75.5	–422.1	76.0	–421.6	75.8	—	—
Sand 14	Minimum	–453.9	32.8	–468.7	46.6	–468.7	32.8	—	—
	Maximum	–453.9	32.8	–468.7	46.6	–453.9	46.6	—	—
	Average	–453.9	32.8	–468.7	46.6	–461.3	39.7	—	—
Clay 15	Minimum	–465.1	11.2	–481.1	12.4	–481.1	11.2	—	—
	Maximum	–465.1	11.2	–481.1	12.4	–465.1	12.4	—	—
	Average	–465.1	11.2	–481.1	12.4	–473.1	11.8	—	—
Sand 16	Minimum	–480.1	15.0	–499.1	18.0	–499.1	15.0	—	—
	Maximum	–480.1	15.0	–499.1	18.0	–480.1	18.0	—	—
	Average	–480.1	15.0	–499.1	18.0	–489.6	16.5	—	—
Clay 17	Minimum	–506.4	26.3	–515.1	16.0	–515.1	16.0	—	—
	Maximum	–506.4	26.3	–515.1	16.0	–506.4	26.3	—	—
	Average	–506.4	26.3	–515.1	16.0	–510.8	21.2	—	—
Sand 18	Minimum	>–520.3	>13.9	>–519.5	>4.4	>–519.5	>4.4	—	—
	Maximum	>–520.3	>13.9	>–519.5	>4.4	>–520.3	>13.9	—	—
	Average	>–520.3	>13.9	>–519.5	>4.4	>–519.9	>9.1	—	—

Table 2.5.4-3 (Sheet 3 of 3)
Soil Strata Thicknesses and Base Elevations (Power Block Area)

Stratum	Unit 1		Unit 2		Inside Power Block Area		Outside Power Block Area	
	Base El. (feet)(a)	Thickness (feet)	Base El. (feet)(a)	Thickness (feet)	Base El. (feet)(a)	Thickness (feet)	Base El. (feet)(a)	Thickness (feet)
Values for Use								
Clay 1(Top)	51.6	28.3	51.5	29.0	51.6	28.6	59.0	20.6
Sand 1	Absent	Absent	42.8	8.7	42.8	8.8	Absent	Absent
Clay 1 (Bottom)	33.1	18.5	27.3	15.4	30.5	12.3	40.2	18.8
Sand 2	19.3	13.9	17.9	9.5	18.6	11.9	19.0	21.2
Clay 3	–4.4	23.6	–6.4	24.3	–5.4	24.0	–7.0	26.0
Sand 4	–28.2	23.8	–36.1	29.7	–32.0	26.6	–23.9	16.9
Clay 5 (Top)	–49.4	21.3	–52.3	16.2	–50.8	18.8	–39.7	15.8
Sand 5	–60.9	11.5	–65.7	13.4	–63.9	12.9	–46.4	6.7
Clay 5 (Bottom)	–70.2	9.2	–79.1	13.3	–73.4	9.6	–56.7	10.3
Sand 6	–126.5	56.3	–128.6	49.6	–127.3	54.0	–112.9	56.3
Clay 7	–172.5	46.0	Absent	Absent	–172.5	45.2	–159.2	46.3
Sand 8	–206.4	33.8	–204.0	75.3	–205.3	32.7	–173.0	13.8
Clay 9	–252.4	46.0	–248.1	44.1	–249.9	44.7	–208.4	35.4
Sand 10	–267.8	15.4	–289.1	41.0	–278.4	28.5	>–231.4	>23.0
Clay 11	–327.5	59.7	–323.1	34.1	–325.3	46.9	—	—
Sand 12	–345.6	18.1	–346.1	23.0	–345.9	20.6	—	—
Clay 13	–421.1	75.5	–422.1	76.0	–421.6	75.8	—	—
Sand 14	–453.9	32.8	–468.7	46.6	–461.3	39.7	—	—
Clay 15	–465.1	11.2	–481.1	12.4	–473.1	11.8	—	—
Sand 16	–480.1	15.0	–499.1	18.0	–489.6	16.5	—	—
Clay 17	–506.4	26.3	–515.1	16.0	–510.8	21.2	—	—
Sand 18	>–520.3	>13.9	>–519.5	>4.4	>–519.9	>9.1	—	—

(a) Elevations are referenced to NAVD 88.

Table 2.5.4-4 (Sheet 1 of 3)
Soil Strata Thicknesses and Base Elevations (Cooling Basin)

Stratum	Statistics	Base El. (feet)[a]	Thickness (feet)
Clay 1 (Top)	Minimum	–39.1	2.3
	Maximum	74.0	25.0
	Average	59.8	11.1
Sand 1	Minimum	22.0	1.7
	Maximum	64.2	31.5
	Average	47.7	14.6
Clay 1 (Bottom)	Minimum	16.7	2.5
	Maximum	58.5	45.0
	Average	31.7	16.6
Sand 2	Minimum	–5.9	4.8
	Maximum	49.0	42.0
	Average	14.4	17.7
Clay 3	Minimum	–28.5	1.5
	Maximum	15.7	83.5
	Average	1.3	19.1
Sand 4	Minimum	–49.4	1.0
	Maximum	9.2	57.0
	Average	–26.2	24.8
Clay 5 (Top)	Minimum	–68.5	0.8
	Maximum	–18.1	30.7
	Average	–40.6	14.0
Sand 5	Minimum	–80.5	1.5
	Maximum	–20.5	44.8
	Average	–56.7	12.6
Clay 5 (Bottom)	Minimum	–89.9	1.2
	Maximum	–49.4	30.0
	Average	–72.9	13.0
Sand 6	Minimum	–166.9	0.7
	Maximum	–71.2	77.0
	Average	–96.4	23.9
Clay 7	Minimum	–173.2	13.2
	Maximum	–126.7	53.6
	Average	–148.5	27.3
Sand 8	Minimum	–219.9	11.0
	Maximum	–165.5	53.0
	Average	–184.1	26.6

Table 2.5.4-4 (Sheet 2 of 3)
Soil Strata Thicknesses and Base Elevations (Cooling Basin)

Stratum	Statistics	Base El. (feet)[a]	Thickness (feet)
Clay 9	Minimum	–245.3	20.0
	Maximum	–185.5	79.0
	Average	–229.0	40.9
Sand 10	Minimum	–220.5	30.0
	Maximum	–218.3	35.0
	Average	–219.4	32.5
Clay 11	Minimum	–235.5	15.0
	Maximum	–233.3	>15.0
	Average	–234.4	>15.0

Table 2.5.4-4 (Sheet 3 of 3)
Soil Strata Thicknesses and Base Elevations (Cooling Basin)

Stratum	**Base El. (feet)[a]**	**Thickness (feet)**
Values for Use		
Clay 1 (Top)	59.8	11.1
Sand 1	47.7	14.6
Clay 1 (Bottom)	31.7	16.6
Sand 2	14.4	17.7
Clay 3	1.3	19.1
Sand 4	–26.2	24.8
Clay 5 (Top)	–40.6	14.0
Sand 5	–56.7	12.6
Clay 5 (Bottom)	–72.9	13.0
Sand 6	–96.4	23.9
Clay 7	–148.5	27.3
Sand 8	–184.1	26.6
Clay 9	–229.0[b]	40.9
Sand 10	–219.4[b]	32.5
Clay 11	–234.4[b]	>15.0

(a) Elevations are referenced to NAVD 88.

(b) Because of the broad area covered by the cooling basin, the average top and base elevations of certain strata may not be representative of the subsurface conditions present at a particular location. Refer to the detailed information contained in Reference 2.5.4-2 when considering specific subsurface conditions.

Table 2.5.4-5 (Sheet 1 of 3)
Uncorrected SPT N-Values (Power Block Area)

Stratum	Statistics	Unit 1 N-Value (blows/foot)	Unit 2 N-Value (blows/foot)	Inside Power Block Area N-Value (blows/foot)	Outside Power Block Area N-Value (blows/foot)
Clay 1 (Top)	No. of Tests	284	296	580	26
	Minimum	3	1	1	4
	Maximum	50	36	50	34
	Average	16	14	15	13
Sand 1	No. of Tests	Absent	52	52	Absent
	Minimum	—	12	12	—
	Maximum	—	59	59	—
	Average	—	26	26	—
Clay 1 (Bottom)	No. of Tests	146	115	261	21
	Minimum	9	10	9	10
	Maximum	50	36	50	52
	Average	16	14	15	21
Sand 2	No. of Tests	104	69	173	22
	Minimum	10	9	9	21
	Maximum	80	94	94	167
	Average	32	28	30	47
Clay 3	No. of Tests	177	186	363	26
	Minimum	11	8	8	13
	Maximum	>200	>200	>200	34
	Average	28	21	25	20
Sand 4	No. of Tests	140	143	283	14
	Minimum	10	21	10	11
	Maximum	>200	>200	>200	121
	Average	88	75	82	58
Clay 5 (Top)	No. of Tests	80	62	142	9
	Minimum	11	15	11	14
	Maximum	167	94	167	63
	Average	27	25	26	26
Sand 5	No. of Tests	19	58	77	4
	Minimum	18	7	7	25
	Maximum	87	200	200	162
	Average	48	67	62	77
Clay 5 (Bottom)	No. of Tests	49	28	77	3
	Minimum	11	10	10	24
	Maximum	89	37	89	37
	Average	27	25	26	29

Table 2.5.4-5 (Sheet 2 of 3)
Uncorrected SPT N-Values (Power Block Area)

Stratum	Statistics	Unit 1 N-Value (blows/foot)	Unit 2 N-Value (blows/foot)	Inside Power Block Area N-Value (blows/foot)	Outside Power Block Area N-Value (blows/foot)
Sand 6	No. of Tests	114	82	196	19
	Minimum	16	21	16	27
	Maximum	>200	>200	>200	>200
	Average	86	115	98	90
Clay 7	No. of Tests	19	2	21	3
	Minimum	16	125	16	19
	Maximum	166	>200	>200	43
	Average	53	188	66	31
Sand 8	No. of Tests	12	27	39	3
	Minimum	49	33	33	57
	Maximum	>200	>200	>200	125
	Average	106	123	118	94
Clay 9	No. of Tests	14	14	28	4
	Minimum	31	30	30	35
	Maximum	58	125	125	125
	Average	45	52	50	64
Sand 10	No. of Tests	2	7	9	2
	Minimum	100	26	26	90
	Maximum	125	>200	>200	125
	Average	113	179	164	108
Clay 11	No. of Tests	13	13	26	Not Reached
	Minimum	28	19	19	—
	Maximum	125	90	125	—
	Average	45	46	45	—
Sand 12	No. of Tests	1	1	2	Not Reached
	Minimum	166	33	33	—
	Maximum	166	33	166	—
	Average	166	33	100	—
Clay 13	No. of Tests	4	4	8	Not Reached
	Minimum	33	25	25	—
	Maximum	86	46	86	—
	Average	51	38	44	—
Sand 14	No. of Tests	1	3	4	Not Reached
	Minimum	65	51	51	—
	Maximum	65	166	166	—
	Average	65	114	102	—

Table 2.5.4-5 (Sheet 3 of 3)
Uncorrected SPT N-Values (Power Block Area)

Stratum	Statistics	Unit 1 N-Value (blows/foot)	Unit 2 N-Value (blows/foot)	Inside Power Block Area N-Value (blows/foot)	Outside Power Block Area N-Value (blows/foot)
Clay 15	No. of Tests	2	Absent	2	Not Reached
	Minimum	52	—	52	—
	Maximum	58	—	58	—
	Average	55	—	55	—
Sand 16	No. of Tests	1	1	2	Not Reached
	Minimum	125	97	97	—
	Maximum	125	97	125	—
	Average	125	97	111	—
Clay 17	No. of Tests	1	2	3	Not Reached
	Minimum	46	68	46	—
	Maximum	46	94	94	—
	Average	46	81	69	—
Sand 18	No. of Tests	1	Not Measured	1	Not Reached
	Minimum	166	—	166	—
	Maximum	166	—	166	—
	Average	166	—	166	—

Table 2.5.4-6 (Sheet 1 of 2)
Uncorrected SPT N-Values (Cooling Basin)

Stratum	Statistics	N-Value (blows/foot)
Clay 1 (Top)	No. of Tests	164
	Minimum	2
	Maximum	49
	Average	13
Sand 1	No. of Tests	131
	Minimum	4
	Maximum	80
	Average	23
Clay 1 (Bottom)	No. of Tests	158
	Minimum	5
	Maximum	>200
	Average	20
Sand 2	No. of Tests	149
	Minimum	2
	Maximum	>200
	Average	43
Clay 3	No. of Tests	168
	Minimum	7
	Maximum	97
	Average	20
Sand 4	No. of Tests	219
	Minimum	8
	Maximum	>200
	Average	50
Clay 5 (Top)	No. of Tests	63
	Minimum	12
	Maximum	>200
	Average	35
Sand 5	No. of Tests	42
	Minimum	21
	Maximum	>200
	Average	72
Clay 5 (Bottom)	No. of Tests	22
	Minimum	12
	Maximum	44
	Average	24
Sand 6	No. of Tests	36
	Minimum	18
	Maximum	>200
	Average	70

Table 2.5.4-6 (Sheet 2 of 2)
Uncorrected SPT N-Values (Cooling Basin)

Stratum	Statistics	N-Value (blows/foot)
Clay 7	No. of Tests	7
	Minimum	22
	Maximum	80
	Average	37
Sand 8	No. of Tests	6
	Minimum	12
	Maximum	167
	Average	98
Clay 9	No. of Tests	6
	Minimum	25
	Maximum	73
	Average	41

Table 2.5.4-7
Energy Transfer Ratios/Hammer Energy Corrections (Power Block Area; Cooling Basin)

Drilling Rig	Number of Measurements	Min. ETR (%)[a]	Max. ETR (%)[a]	Average ETR (%)[a]	Hammer Energy Correction (ETR%/60%)
MACTEC Raleigh CME 55LC Track Rig (Serial No. MEC-02)[b]	7	81.1	86.0	84.4	1.41
MACTEC Atlanta CME 550 ATV Rig (Serial No. MEC-03)	4	87.1	92.0	90.7	1.51
MACTEC Atlanta CME 550x ATV Rig (Serial No. MEC-05)[b]	6	81.7	88.9	86.2	1.44
MACTEC Charlotte CME 75 Truck Rig (Serial No. MEC-09)	3	81.1	84.3	82.0	1.37
Miller Drilling CME 85 Truck Rig (Serial No. MEC-10)	3	88.6	90.6	89.3	1.49
Environmental Exploration CME 75 Truck Rig (Serial No. MEC-11)[c]	8	87.4	90.3	88.6	1.48
Mactec Charlotte CME 45 Track Rig (Serial No. MEC-12)	3	72.3	80.6	73.9	1.23
Mactec Raleigh CME 45 Track Rig (Serial No. MEC-13)	3	84.6	86.3	85.2	1.42
Environmental Exploration CME 750 ATV Rig (Serial No. 263048)	5	67.4	76.9	72.5	1.21

(a) Energy Transfer Ratio (ETR) is the percent of measured SPT hammer energy versus the theoretical SPT hammer energy (350 foot-pounds).
(b) Energy measurements made using both AW-J and NW-J drill rods.
(c) Energy measurements made using AW-J and Mayhew drill rods. Energy measurements made using Mayhew rods are not included here.

Table 2.5.4-8 (Sheet 1 of 3)
Corrected SPT $(N_1)_{60}$-Values (Power Block Area)

Stratum	Statistics	Unit 1 $(N_1)_{60}$-Value (blows/foot)	Unit 2 $(N_1)_{60}$-Value (blows/foot)	Inside Power Block Area $(N_1)_{60}$-Value (blows/foot)	Outside Power Block Area $(N_1)_{60}$-Value (blows/foot)
Clay 1 (Top)	No. of Tests	284	296	580	26
	Minimum	5	2	2	7
	Maximum	84	56	84	47
	Average	20	19	19	21
Sand 1	No. of Tests	Absent	52	52	Absent
	Minimum	—	14	14	—
	Maximum	—	69	69	—
	Average	—	29	29	—
Clay 1 (Bottom)	No. of Tests	146	115	261	21
	Minimum	9	9	9	11
	Maximum	53	37	53	64
	Average	20	19	19	21
Sand 2	No. of Tests	104	69	173	22
	Minimum	8	9	8	17
	Maximum	72	79	79	165
	Average	28	24	26	39
Clay 3	No. of Tests	177	186	363	26
	Minimum	7	7	7	8
	Maximum	173	>200	>200	27
	Average	21	17	19	15
Sand 4	No. of Tests	140	143	283	14
	Minimum	6	14	6	5
	Maximum	>200	>200	>200	66
	Average	58	52	55	35
Clay 5 (Top)	No. of Tests	80	62	142	9
	Minimum	6	10	6	9
	Maximum	96	60	96	40
	Average	16	16	16	16
Sand 5	No. of Tests	19	58	77	4
	Minimum	10	4	4	16
	Maximum	54	127	127	75
	Average	29	43	39	38
Clay 5 (Bottom)	No. of Tests	49	28	77	3
	Minimum	6	7	6	11
	Maximum	54	23	54	25
	Average	16	16	16	16

Table 2.5.4-8 (Sheet 2 of 3)
Corrected SPT $(N_1)_{60}$-Values (Power Block Area)

Stratum	Statistics	Unit 1 $(N_1)_{60}$-Value (blows/foot)	Unit 2 $(N_1)_{60}$-Value (blows/foot)	Inside Power Block Area $(N_1)_{60}$-Value (blows/foot)	Outside Power Block Area $(N_1)_{60}$-Value (blows/foot)
Sand 6	No. of Tests	114	82	196	19
	Minimum	10	13	10	16
	Maximum	>200	>200	>200	151
	Average	51	75	61	52
Clay 7	No. of Tests	19	2	21	3
	Minimum	9	79	9	9
	Maximum	88	158	158	20
	Average	32	119	40	15
Sand 8	No. of Tests	12	27	39	3
	Minimum	31	22	22	27
	Maximum	172	>200	>200	75
	Average	66	80	76	54
Clay 9	No. of Tests	14	14	28	4
	Minimum	19	20	19	21
	Maximum	36	77	77	75
	Average	28	34	31	42
Sand 10	No. of Tests	2	7	9	2
	Minimum	60	17	17	42
	Maximum	81	>200	>200	75
	Average	71	117	107	59
Clay 11	No. of Tests	13	13	26	Not Reached
	Minimum	17	12	12	—
	Maximum	81	60	81	—
	Average	28	31	30	—
Sand 12	No. of Tests	1	1	2	Not Reached
	Minimum	100	22	22	—
	Maximum	100	22	100	—
	Average	100	22	61	—
Clay 13	No. of Tests	4	4	8	Not Reached
	Minimum	20	16	16	—
	Maximum	52	30	52	—
	Average	30	25	28	—
Sand 14	No. of Tests	1	3	4	Not Reached
	Minimum	39	33	33	—
	Maximum	39	109	109	—
	Average	39	75	66	—

Table 2.5.4-8 (Sheet 3 of 3)
Corrected SPT $(N_1)_{60}$-Values (Power Block Area)

Stratum	Statistics	Unit 1 $(N_1)_{60}$-Value (blows/foot)	Unit 2 $(N_1)_{60}$-Value (blows/foot)	Inside Power Block Area $(N_1)_{60}$-Value (blows/foot)	Outside Power Block Area $(N_1)_{60}$-Value (blows/foot)
Clay 15	No. of Tests	2	Absent	2	Not Reached
	Minimum	31	—	31	—
	Maximum	35	—	35	—
	Average	33	—	33	—
Sand 16	No. of Tests	1	1	2	Not Reached
	Minimum	75	64	64	—
	Maximum	75	64	75	—
	Average	75	64	69	—
Clay 17	No. of Tests	1	2	3	Not Reached
	Minimum	28	45	28	—
	Maximum	28	62	62	—
	Average	28	53	45	—
Sand 18	No. of Tests	1	Not Reached	1	Not Reached
	Minimum	100	—	100	—
	Maximum	100	—	100	—
	Average	100	—	100	—

Table 2.5.4-9 (Sheet 1 of 2)
Corrected SPT $(N_1)_{60}$-Values (Cooling Basin)

Stratum	Statistics	(N1)60-Value (blows/foot)
Clay 1 (Top)	No. of Tests	164
	Minimum	3
	Maximum	92
	Average	20
Sand 1	No. of Tests	131
	Minimum	6
	Maximum	97
	Average	30
Clay 1 (Bottom)	No. of Tests	158
	Minimum	7
	Maximum	>200
	Average	21
Sand 2	No. of Tests	149
	Minimum	4
	Maximum	>200
	Average	38
Clay 3	No. of Tests	168
	Minimum	5
	Maximum	72
	Average	16
Sand 4	No. of Tests	219
	Minimum	5
	Maximum	>200
	Average	34
Clay 5 (Top)	No. of Tests	63
	Minimum	7
	Maximum	>200
	Average	22
Sand 5	No. of Tests	42
	Minimum	12
	Maximum	>200
	Average	42
Clay 5 (Bottom)	No. of Tests	22
	Minimum	8
	Maximum	33
	Average	14
Sand 6	No. of Tests	36
	Minimum	9
	Maximum	>200
	Average	35

Table 2.5.4-9 (Sheet 2 of 2)
Corrected SPT $(N_1)_{60}$-Values (Cooling Basin)

Stratum	Statistics	(N1)60-Value (blows/foot)
Clay 7	No. of Tests	7
	Minimum	10
	Maximum	34
	Average	17
Sand 8	No. of Tests	6
	Minimum	4
	Maximum	60
	Average	36
Clay 9	No. of Tests	6
	Minimum	9
	Maximum	22
	Average	13

Table 2.5.4-10
Corrected SPT $(N_1)_{60}$-Values Selected for Design (Power Block Area)

Stratum	Average Uncorrected N-Value (blows/foot)	Average Corrected $(N_1)_{60}$-Value (blows/foot)	Selected Corrected $(N_1)_{60}$-Value (blows/foot)[a]
Clay 1 (Top)	15	19	19[b]
Sand 1	26	29	29
Clay 1 (Bottom)	15	19	19[b]
Sand 2	30	26	26
Clay 3	25	19	19
Sand 4	82	55	55
Clay 5 (Top)	26	16	16[c]
Sand 5	62	39	39
Clay 5 (Bottom)	26	16	16[c]
Sand 6	98	61	61
Clay 7	66	40	40
Sand 8	118	76	76
Clay 9	50	31	31
Sand 10	164	107	100
Clay 11	45	30	30
Sand 12	100	61	61
Clay 13	44	28	28
Sand 14	102	66	66
Clay 15	55	33	33
Sand 16	111	69	69
Clay 17	69	45	45
Sand 18	166	100	100

(a) Selected $(N_1)_{60}$ values are limited to 100 blows per foot.
(b) A single $(N_1)_{60}$ value for Clay 1 (Top) and Clay 1 (Bottom) is selected.
(c) A single $(N_1)_{60}$ value for Clay 5 (Top) and Clay 5 (Bottom) is selected.

Table 2.5.4-11
Corrected SPT $(N_1)_{60}$-Values Selected for Design (Cooling Basin)

Stratum	Average Uncorrected N-Value (blows/foot)	Average Corrected $(N_1)_{60}$-Value (blows/foot)	Selected Corrected $(N_1)_{60}$-Value (blows/foot)[(a)]
Clay 1 (Top)	13	20	21[(b)]
Sand 1	23	30	30
Clay 1 (Bottom)	20	21	21[(b)]
Sand 2	43	38	38
Clay 3	20	16	16
Sand 4	50	34	34
Clay 5 (Top)	35	22	20[(c)]
Sand 5	72	42	42
Clay 5 (Bottom)	24	14	20[(c)]
Sand 6	70	35	35
Clay 7	37	17	17
Sand 8	98	36	36
Clay 9	41	13	13

(a) Selected $(N_1)_{60}$ values are limited to 100 blows per foot.
(b) A single $(N_1)_{60}$ value for Clay 1 (Top) and Clay 1 (Bottom) is selected.
(c) A single $(N_1)_{60}$ value for Clay 5 (Top) and Clay 5 (Bottom) is selected.

Table 2.5.4-12
Cone Penetration Test q_t, q_{c1n}, f_s, and R_f-Values (Power Block Area)

Stratum	Statistics	Unit 1				Unit 2				Inside Power Block Area				Outside Power Block Area			
		q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)	q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)	q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)	q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)
Clay 1 (Top)	No. of Tests	898	898	898	898	685	685	685	685	1583	1583	1583	1583	62	62	62	62
	Minimum	3.5	5.6	0.0	0.0	3.1	4.9	0.0	0.1	3.1	4.9	0.0	0.0	10.8	17.3	0.1	0.5
	Maximum	136.2	173.6	6.9	8.0	128.3	146.5	6.1	8.0	136.2	173.6	6.9	8.0	57.6	77.4	2.6	8.0
	Average	43.7	45.6	2.2	5.1	35.6	38.2	1.7	4.8	40.2	42.4	2.0	5.0	40.7	41.6	1.8	4.5
Sand 1[(a)]	No. of Tests	—	—	—	—	189	189	189	189	189	189	189	189	—	—	—	—
	Minimum	—	—	—	—	43.3	21.2	1.5	0.6	43.3	21.2	1.5	0.6	—	—	—	—
	Maximum	—	—	—	—	820.3	555.6	13.2	8.0	820.3	555.6	13.2	8.0	—	—	—	—
	Average	—	—	—	—	211.6	142.7	4.6	2.8	211.6	142.7	4.6	2.8	—	—	—	—
Clay 1 (Bottom)	No. of Tests	465	465	465	465	439	439	439	439	904	904	904	904	35	35	35	35
	Minimum	31.0	12.9	1.1	1.7	35.6	14.1	1.3	1.2	31.0	12.9	1.1	1.2	39.3	17.5	1.3	2.1
	Maximum	194.9	119.3	8.0	7.5	182.4	108.0	8.2	8.0	194.9	119.3	8.2	8.0	168.2	101.0	6.6	8.0
	Average	50.6	23.7	2.1	4.2	65.0	29.9	2.6	4.2	57.6	26.7	2.3	4.2	75.5	34.5	2.6	3.6
Sand 2	No. of Tests	320	320	320	320	236	236	236	236	556	556	556	556	22	22	22	22
	Minimum	42.0	14.9	1.0	0.7	58.8	19.5	1.6	0.5	42.0	14.9	1.0	0.5	119.9	55.3	2.2	1.1
	Maximum	485.2	289.0	11.9	8.0	7.5	414.5	16.0	7.9	485.2	414.5	16.0	8.0	545.9	295.9	12.2	7.0
	Average	165.2	95.4	4.1	2.8	245.7	138.7	5.1	2.4	199.4	113.8	4.5	2.6	305.9	166.7	6.3	2.4
Clay 3	No. of Tests	770	770	770	770	562	562	562	562	1332	1332	1332	1332	52	52	52	52
	Minimum	26.5	8.3	0.6	0.7	30.9	8.3	0.8	1.5	26.5	8.3	0.6	0.7	32.2	8.8	1.4	2.1
	Maximum	584.2	316.3	10.4	8.0	214.3	109.5	9.4	8.0	584.2	316.3	10.4	8.0	126.7	38.6	8.3	8.0
	Average	81.6	31.7	2.6	3.6	54.3	17.2	2.0	3.8	69.4	25.5	2.4	3.7	49.6	13.8	2.4	4.9
Sand 4[(b)]	No. of Tests	280	280	280	280	330	330	330	330	610	610	610	610	22	22	22	22
	Minimum	35.8	9.7	0.8	0.2	45.1	11.7	1.1	0.4	35.8	9.7	0.8	0.2	147.0	42.8	1.9	1.0
	Maximum	795.4	386.5	13.2	8.0	819.8	394.7	17.3	8.0	819.8	394.7	17.3	8.0	506.2	234.9	11.4	5.4
	Average	215.2	100.8	3.7	2.3	280.6	131.8	5.1	2.4	250.6	117.6	4.5	2.3	280.8	130.7	5.7	2.1

(a) Sand 1 is absent at Unit 1. Inside Power Block Area Stratum Sand 1 values use the Unit 2 Stratum Sand 1 values.
(b) Refusal was encountered at all CPT locations within Stratum Sand 4.

Table 2.5.4-13
Cone Penetration Test q_t, q_{c1n}, f_s, and R_f-Values (Cooling Basin)

Stratum	Statistics	q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)
Clay 1 (Top)	No. of Tests	273	273	273	273
	Minimum	5.06	8.13	0.03	0.16
	Maximum	69.44	111.57	5.84	7.99
	Average	22.89	36.52	1.29	5.36
Sand 1	No. of Tests	731	731	731	731
	Minimum	3.51	5.64	0.07	0.46
	Maximum	602.30	435.68	11.63	7.99
	Average	139.45	135.48	2.78	2.67
Clay 1 (Bottom)	No. of Tests	826	826	826	826
	Minimum	5.30	8.51	0.04	0.52
	Maximum	352.31	259.72	8.98	7.99
	Average	51.80	32.87	2.23	4.51
Sand 2	No. of Tests	895	895	895	895
	Minimum	30.60	12.32	0.59	0.20
	Maximum	823.72	519.33	16.71	5.94
	Average	230.31	152.35	4.12	2.03
Clay 3	No. of Tests	334	334	334	334
	Minimum	19.25	5.75	0.58	0.83
	Maximum	228.28	165.24	7.61	6.00
	Average	63.97	25.44	2.03	3.40
Sand 4	No. of Tests	448	448	448	448
	Minimum	23.95	8.50	0.64	0.24
	Maximum	817.34	500.35	12.61	7.36
	Average	238.71	132.75	2.78	1.50
Clay 5 (Top)	No. of Tests	70	70	70	70
	Minimum	24.54	7.20	0.45	0.89
	Maximum	87.08	48.34	4.16	6.13
	Average	45.96	12.20	1.41	2.96
Sand 5	No. of Tests	52	52	52	52
	Minimum	62.90	17.08	0.38	0.37
	Maximum	639.82	356.77	8.37	4.73
	Average	298.76	161.62	3.48	1.25

Table 2.5.4-14
Laboratory Testing Summary (Power Block Area)

Laboratory Test	Industry Standard	No. of Tests[a]
Natural Moisture Content	Reference 2.5.4-36	306 {3}
Atterberg Limits	Reference 2.5.4-37	306
Sieve and Hydrometer Analysis	Reference 2.5.4-38 Reference 2.5.4-39	297 {3}
Specific Gravity	Reference 2.5.4-40	86 {3}
Unit Weight	Included with Related ASTM Standards	71
Unconsolidated Undrained (UU) Triaxial Compressive Strength	Reference 2.5.4-41	31
Consolidated Undrained (CU) Triaxial Compressive Strength	Reference 2.5.4-42	5
Direct Shear Strength	Reference 2.5.4-43	9 {3}
Consolidation/Stress-Controlled	Reference 2.5.4-46	29
Moisture-Density Relationship/Modified Proctor Compaction	Reference 2.5.4-19	8 {6}
California Bearing Ratio	Reference 2.5.4-48	8
pH	Reference 2.5.4-49	59 {3}
Chloride Content	Reference 2.5.4-50	59 {3}
Sulphate Content	Reference 2.5.4-50	59 {3}
Resonant Column Torsional Shear (RCTS)	Reference 2.5.4-45	16

(a) Values shown in "{ }" symbols denote the numbers of tests made on bulk samples of structural fill materials.

Table 2.5.4-15
Laboratory Testing Summary (Cooling Basin)

Laboratory Test	Industry Standard	No. of Tests[a]
Natural Moisture Content	Reference 2.5.4-36	246 {2}
Atterberg Limits	Reference 2.5.4-37	232
Sieve and Hydrometer Analysis	Reference 2.5.4-38 Reference 2.5.4-39	232 {2}
Specific Gravity	Reference 2.5.4-40	104 {2}
Unit Weight	Included with Related ASTM Standards	52
Unconsolidated Undrained (UU) Triaxial Compressive Strength	Reference 2.5.4-41	10
Consolidated Undrained (CU) Triaxial Compressive Strength	Reference 2.5.4-42	9
Direct Shear Strength	Reference 2.5.4-43	9 {2}
Direct Simple Shear Strength	Reference 2.5.4-44	22
Consolidation/Stress-Controlled	Reference 2.5.4-46	13
Consolidation/Constant Rate-of-Strain	Reference 2.5.4-47	22
Moisture-Density Relationship/Modified Proctor Compaction	Reference 2.5.4-19	21 {2}
pH	Reference 2.5.4-49	{2}
Chloride Content	Reference 2.5.4-50	{2}
Sulphate Content	Reference 2.5.4-50	{2}
Resonant Column Torsional Shear (RCTS)	Reference 2.5.4-45	2
Hydraulic Conductivity	Reference 2.5.4-51	14

(a) Values shown in “{ }” symbols denote the numbers of tests made on bulk samples of drainage sand materials.

Table 2.5.4-16 (Sheet 1 of 4)
General Physical and Chemical Properties Test Results (Power Block Area)

Stratum/ Statistics	USCS Group Symbol	Natural Moisture Content (percent)	Total Unit Weight, γ_t (pcf)	Specific Gravity, G_s	Initial Void Ratio, e_0	Liquid Limit (percent)	Plasticity Index (percent)	Gravel (percent)	Sand (percent)	Fines Content/ Silt and Clay (percent)	pH	Chloride Content (mg/kg)	Sulphate Content (mg/kg)
Clay 1 (Top)													
No. of Tests	SC-SM, CL, CH	69	9	12	7	69	69	61	61	63	17	17	17
Minimum		11.1	122.5	2.67	0.43	26	6	0.0	1.1	62.2	7.2	4.4	3.9
Maximum		43.5	134.6	2.75	0.72	84	61	1.0	56.9	98.5	8.7	683	4290
Average		19.3	130.6	2.70	0.53	50	33	0.0	19.8	79.8	8.2	—	—
Sand 1													
No. of Tests	SC	3	—	2	—	3	3	4	4	3	1	1	1
Minimum		13.4	—	2.67	—	25	8	0.0	51.3	33.8	8.9	21.6	43.8
Maximum		19.1	—	2.70	—	30	16	0.0	66.2	48.7	8.9	21.6	43.8
Average		16.0	—	2.68	—	28	13	0.0	56.6	42.3	8.9	—	—
Clay 1 (Bottom)													
No. of Tests	SC, CL, CH	34	10	6	7	34	34	22	22	28	8	8	8
Minimum		14.1	123.5	2.67	0.42	24	8	0.0	0.7	46.7	8.1	5.4	3.8
Maximum		32.6	135.0	2.75	0.78	96	61	0.1	46.8	99.3	9.0	630	573
Average		21.9	127.8	2.70	0.63	60	39	0.0	20.1	81.0	8.4	—	—
Sand 2													
No. of Tests	SM, SC, CL-ML, CL	13	1	6	—	13	13	16	16	17	4	4	4
Minimum		14.3	135.6	2.66	—	16	1	0.0	32.0	13.3	8.8	8.1	3.6
Maximum		22.8	135.6	2.68	—	47	27	12.3	86.7	48.9	9.0	39.0	59.2
Average		18.6	135.6	2.66	—	28	12	0.9	58.4	40.3	8.9	—	—
Clay 3													
No. of Tests	SC, SC-SM, CL, CH	38	6	13	4	38	38	34	34	35	10	10	10
Minimum		14.1	115.2	2.65	0.66	26	7	0.0	2.1	15.3	8.1	7.0	19.5
Maximum		36.8	123.1	2.75	0.84	96	69	18.2	85.6	97.9	8.7	223	135
Average		23.0	118.5	2.69	0.78	53	33	0.7	29.8	73.3	8.5	—	—
Sand 4													
No. of Tests	SP-SM, SP-SC, SM, SC, CL-ML, CL	21	5	14	4	21	21	27	27	26	8	8	8
Minimum		10.8	119.9	2.65	0.38	20	5	0.0	17.6	2.0	8.0	18.6	18.7
Maximum		31.7	141.0	2.73	0.68	80	56	2.0	97.7	51.9	8.8	455	108
Average		17.4	132.2	2.67	0.58	34	18	0.2	63.3	25.3	8.6	—	—

Table 2.5.4-16 (Sheet 2 of 4)
General Physical and Chemical Properties Test Results (Power Block Area)

Stratum/ Statistics	USCS Group Symbol	Natural Moisture Content (percent)	Total Unit Weight, γ_t (pcf)	Specific Gravity, G_s	Initial Void Ratio, e_0	Liquid Limit (percent)	Plasticity Index (percent)	Gravel (percent)	Sand (percent)	Fines Content/ Silt and Clay (percent)	pH	Chloride Content (mg/kg)	Sulphate Content (mg/kg)
Clay 5 (Top)													
No. of Tests	SC, CL, MH, CH	17	4	5	2	17	17	13	13	13	5	5	5
Minimum		16.9	116.6	2.66	0.45	32	18	0.0	4.7	57.1	8.3	34.7	23.8
Maximum		34.9	135.1	2.76	0.52	98	72	1.8	41.1	95.3	8.6	80.3	44
Average		27.1	127.4	2.71	0.49	67	44	0.1	15.5	84.3	8.5	—	—
Sand 5													
No. of Tests	SP-SC, SC SC-SM, CL	6	—	7	—	6	6	9	9	10	3	3	3
Minimum		13.0	—	2.65	—	19	5	0.0	55.9	9.3	8.6	38.1	17
Maximum		22.8	—	2.75	—	29	14	1.9	90.7	44.1	8.8	93.4	22.9
Average		19.7	—	2.67	—	22	9	0.2	76.6	23.2	8.7	—	—
Clay 5 (Bottom)													
No. of Tests	SP-SC, ML, CL, CH	12	4	3	2	12	12	10	10	9	3	3	3
Minimum		15.1	121	2.68	0.60	31	18	0.0	4.6	52.8	8.7	14.6	11.9
Maximum		33.0	128.4	2.72	0.65	84	62	0.0	47.2	95.4	8.9	59.2	24.2
Average		22.3	125.9	2.70	0.63	50	34	0.0	20.3	80.0	8.7	—	—
Sand 6													
No. of Tests	SP-SM, SP-SC, SM, SC	5	—	8	7	5	5	26	26	26	—	—	—
Minimum		15.3	—	2.65	0.48	14	4	0.0	51.2	7.3	—	—	—
Maximum		21.2	—	2.67	0.68	21	9	5.1	91.9	48.8	—	—	—
Average		19.0	—	2.66	0.59	18	7	0.7	83.6	15.7	—	—	—
Clay 7													
No. of Tests	CL, CH	15	1	1	—	15	15	13	13	13	—	—	—
Minimum		13.5	124.9	2.69	—	26	15	0.0	6.2	54.9	—	—	—
Maximum		31.1	124.9	2.69	—	97	67	0.0	45.1	93.8	—	—	—
Average		21.0	124.9	2.69	—	51	31	0.0	22.6	77.4	—	—	—
Sand 8													
No. of Tests	SC-SM, SC, CL, CH	12	4	3	12	12	12	13	13	13	—	—	—
Minimum		14.1	130.5	2.65	0.39	18	6	0.0	45.2	9.5	—	—	—
Maximum		30.3	132.5	2.70	0.62	60	38	0.0	90.5	48.9	—	—	—
Average		20.8	131.9	2.67	0.50	30	16	0.0	70.3	27.6	—	—	—

Table 2.5.4-16 (Sheet 3 of 4)
General Physical and Chemical Properties Test Results (Power Block Area)

Stratum/ Statistics	USCS Group Symbol	Natural Moisture Content (percent)	Total Unit Weight, γ_t (pcf)	Specific Gravity, G_s	Initial Void Ratio, e_0	Liquid Limit (percent)	Plasticity Index (percent)	Gravel (percent)	Sand (percent)	Fines Content/ Silt and Clay (percent)	pH	Chloride Content (mg/kg)	Sulphate Content (mg/kg)
Clay 9													
No. of Tests	CL, MH, CH	18	12	2	7	18	18	9	9	9	—	—	—
Minimum		15.3	115.2	2.71	0.45	35	19	0.0	1.5	80.9	—	—	—
Maximum		29.1	135.2	2.72	0.82	73	51	0.0	19.1	98.5	—	—	—
Average		23.6	125.7	2.72	0.64	59	37	0.0	11.6	88.4	—	—	—
Sand 10													
No. of Tests	SM, SC	—	—	2	6	—	—	2	2	2	—	—	—
Minimum		—	—	2.69	0.46	—	—	0.0	70.1	22.5	—	—	—
Maximum		—	—	2.71	0.63	—	—	0.0	75.5	29.9	—	—	—
Average		—	—	2.70	0.57	—	—	0.0	72.8	26.2	—	—	—
Clay 11													
No. of Tests	SC, CL, MH, CH	21	11	1	6	21	21	14	14	14	—	—	—
Minimum		18.2	113.6	2.72	0.67	31	16	0.0	3.2	55.4	—	—	—
Maximum		36.7	127.5	2.72	1.00	95	66	0.0	73.6	96.8	—	—	—
Average		28.1	118.9	2.72	0.78	63	38	0.0	19.1	85.1	—	—	—
Sand 12													
No. of Tests	CL	3	—	—	—	3	3	—	—	2	—	—	—
Minimum		13.9	—	—	—	36	17	—	—	80.9	—	—	—
Maximum		14.7	—	—	—	48	30	—	—	56.8	—	—	—
Average		14.3	—	—	—	42	23	—	—	83.9	—	—	—
Clay 13													
No. of Tests	ML, CH	10	3	—	1	10	10	—	—	7	—	—	—
Minimum		20.2	122.8	—	0.76	39	13	—	—	88.0	—	—	—
Maximum		35.3	131.7	—	0.76	90	54	—	—	98.3	—	—	—
Average		27.5	126.4	—	0.76	67	40	—	—	94.3	—	—	—
Sand 14													
No. of Tests	SM, CH	2	—	—	—	2	2	—	—	3	—	—	—
Minimum		18.0	—	—	—	18	2	—	—	28.4	—	—	—
Maximum		26.1	—	—	—	52	26	—	—	36.2	—	—	—
Average		22.1	—	—	—	35	14	—	—	32.3	—	—	—

Table 2.5.4-16 (Sheet 4 of 4)
General Physical and Chemical Properties Test Results (Power Block Area)

Stratum/ Statistics	USCS Group Symbol	Natural Moisture Content (percent)	Total Unit Weight, γ_t (pcf)	Specific Gravity, G_s	Initial Void Ratio, e_0	Liquid Limit (percent)	Plasticity Index (percent)	Gravel (percent)	Sand (percent)	Fines Content/ Silt and Clay (percent)	pH	Chloride Content (mg/kg)	Sulphate Content (mg/kg)
Clay 15													
No. of Tests	CH	1	—	—	—	1	1	—	—	1	—	—	—
Minimum		22.7	—	—	—	69	44	—	—	96.5	—	—	—
Maximum		22.7	—	—	—	69	44	—	—	96.5	—	—	—
Average		22.7	—	—	—	69	44	—	—	96.5	—	—	—
Sand 16													
No. of Tests	SM, SC	—	—	—	—	—	—	—	—	2	—	—	—
Minimum		—	—	—	—	—	—	—	—	19.4	—	—	—
Maximum		—	—	—	—	—	—	—	—	28.9	—	—	—
Average		—	—	—	—	—	—	—	—	24.2	—	—	—
Clay 17													
No. of Tests	CL, CH	3	1	1	—	3	3	1	1	3	—	—	—
Minimum		17.5	130.8	2.71	—	37	22	0.0	33.7	66.3	—	—	—
Maximum		19.6	130.8	2.71	—	59	40	0.0	33.7	79.4	—	—	—
Average		18.3	130.8	2.71	—	46	31	0.0	33.7	73.4	—	—	—
Sand 18													
No. of Tests	SM, CL	3	—	—	—	3	3	—	—	—	—	—	—
Minimum		12.3	—	—	—	17	2	—	—	—	—	—	—
Maximum		14.2	—	—	—	39	2	—	—	—	—	—	—
Average		13.2	—	—	—	32	2	—	—	—	—	—	—

Table 2.5.4-17 (Sheet 1 of 3)
General Physical Properties Test Results (Cooling Basin)

Stratum/ Statistics	USCS Group Symbol	Natural Moisture Content (percent)	Total Unit Weight, γ_t (pcf)	Specific Gravity, G_s	Initial Void Ratio, e_0	Liquid Limit (percent)	Plasticity Index (percent)	Gravel (percent)	Sand (percent)	Fines Content/ Silt and Clay (percent)
Clay 1 (Top)										
No. of Tests	CH, CL, ML	76	11	23	4	42	42	45	45	45
Minimum		9.3	110.3	2.66	0.52	26	11	0.0	1.6	50.4
Maximum		31.2	131.1	2.74	0.74	81	59	0.7	49.5	98.4
Average		17.6	126.1	2.69	0.62	44	27	0.0	26.5	73.4
Sand 1										
No. of Tests	SC, SC-SM,	33	4	13	1	9	9	19	19	19
Minimum	SM, SP-SM	6.1	111.7	2.65	0.46	16	5	0.0	50.6	4.9
Maximum		24.6	133.1	2.73	0.46	37	22	0.5	95.1	49.4
Average		13.1	121.8	2.67	0.46	29	14	0.1	73.3	26.6
Clay 1 (Bottom)										
No. of Tests	CH, CL	35	5	12	1	34	34	34	34	34
Minimum		9.8	118.4	2.66	0.63	24	8	0.0	1.1	55.0
Maximum		30.2	128.5	2.78	0.63	90	58	0.0	45.0	98.9
Average		22.0	122.6	2.71	0.63	58	38	0.0	12.3	87.7
Sand 2										
No. of Tests	CL, SC,	11	4	9	2	6	6	24	24	24
Minimum	SC-SM, SM	10.4	123.9	2.65	0.53	21	6	0.0	16.2	6.0
Maximum	ML, SP	11.8	127.8	2.72	0.63	48	35	3.8	94.0	83.8
Average		17.3	125.6	2.67	0.58	30	17	0.3	70.0	29.7
Clay 3										
No. of Tests	CH, MH, CL,	34	12	14	4	36	36	34	34	34
Minimum	SC, SP-SC,	13.7	117.8	2.66	0.56	30	13	0.0	2.5	50.3
Maximum	SM	36.6	133.0	2.78	0.88	95	66	2.7	49.7	97.4
Average		22.6	122.9	2.70	0.71	57	36	0.2	22.1	77.7

Table 2.5.4-17 (Sheet 2 of 3)
General Physical Properties Test Results (Cooling Basin)

Stratum/ Statistics	USCS Group Symbol	Natural Moisture Content (percent)	Total Unit Weight, γ_t (pcf)	Specific Gravity, G_s	Initial Void Ratio, e_0	Liquid Limit (percent)	Plasticity Index (percent)	Gravel (percent)	Sand (percent)	Fines Content/ Silt and Clay (percent)
Sand 4										
No. of Tests	CH, CL, SC SP-SC, ML, SM, SP	16	7	12	4	6	6	32	32	31
Minimum		17.3	114.8	2.65	0.54	23	4	0.0	42.4	4.5
Maximum		30.7	129.8	2.73	0.78	68	48	8.6	94.4	57.6
Average		21.4	122.2	2.68	0.66	37	20	0.7	80.9	18.4
Clay 5 (Top)										
No. of Tests	CH, CL, SC, SM, SP-SP	19	8	10	2	17	17	15	15	15
Minimum		16.0	116.0	2.69	0.58	21	3	0.0	0.9	64.8
Maximum		26.6	133.1	2.75	0.60	77	60	4.2	35.2	99.1
Average		21.5	124.6	2.71	0.59	55	37	0.4	14.9	84.7
Sand 5										
No. of Tests	CL, SC, SC-SM, SM	7	1	3	1	6	6	12	12	12
Minimum		15.7	116.9	2.65	0.69	17	2	0.0	50.8	12.6
Maximum		24.8	116.9	2.65	0.69	36	22	0.1	87.4	49.2
Average		20.8	116.9	2.65	0.69	26	11	0.0	73.1	26.9
Clay 5 (Bottom)										
No. of Tests	CH, CL	4	—	3	—	4	4	4	4	4
Minimum		19.4	—	2.69	—	49	34	0.0	1.8	64.8
Maximum		34.0	—	2.72	—	54	38	0.0	35.2	98.2
Average		24.0	—	2.71	—	52	36	0.0	11.5	88.6
Sand 6										
No. of Tests	CH, CL, SC, SM, SP-SM	7	—	2	—	4	4	8	8	8
Minimum		14.3	—	2.65	—	27	8	2.0	65.5	8.3
Maximum		30.7	—	2.66	—	76	47	0.9	91.6	34.5
Average		21.0	—	2.66	—	47	28	0.2	78.2	21.7

Table 2.5.4-17 (Sheet 3 of 3)
General Physical Properties Test Results (Cooling Basin)

Stratum/ Statistics	USCS Group Symbol	Natural Moisture Content (percent)	Total Unit Weight, γ_t (pcf)	Specific Gravity, G_s	Initial Void Ratio, e_0	Liquid Limit (percent)	Plasticity Index (percent)	Gravel (percent)	Sand (percent)	Fines Content/ Silt and Clay (percent)
Clay 7										
No. of Tests	CH, CL	—	—	—	—	—	—	—	—	—
Minimum		—	—	—	—	—	—	—	—	—
Maximum		—	—	—	—	—	—	—	—	—
Average		—	—	—	—	—	—	—	—	—
Sand 8										
No. of Tests	SC, SM	2	—	2	—	2	2	3	3	3
Minimum		16.8	—	2.65	—	23	10	0.0	56.7	27.4
Maximum		22.6	—	2.66	—	24	11	0.0	72.6	43.3
Average		19.7	—	2.66	—	24	11	0.0	64.0	36.0
Clay 9										
No. of Tests	CH, CL	2	—	1	—	2	2	2	2	2
Minimum		24.9	—	2.69	—	49	24	0.0	4.1	80.4
Maximum		32.1	—	2.69	—	67	40	0.0	19.6	95.9
Average		28.5	—	2.69	—	58	37	0.0	11.9	88.2

Table 2.5.4-18 (Sheet 1 of 6)
Laboratory Strength Test Results (Power Block Area)

										UU Tests[a]		CIU-Bar-Tests[a]				DS Tests[a]	
Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)
Stratum Clay 1 (Top)																	
B-2174UD	UD1	10.0	69.6	130.4	16.7	37	24	CL	CU	—	—	400	22.5	40	33.5	—	—
B-2182UD	UD1	10.0	69.5	128.8	14.0	37	23	CL	UU	3920	—	—	—	—	—	—	—
B-2269UD	UD1	10.0	70.1	134.5	17.6	40	24	CL	UU	3880	—	—	—	—	—	—	—
B-2269UD	UD2	13.0	67.1	129.0	23.0	53	32	CH	UU	2460	—	—	—	—	—	—	—
B-2274UD	UD1	10.2	70.2	130.3	19.3	—	—	CL	UU	2740	0.47	—	—	—	—	—	—
Minimum, Stratum Clay 1 (Top)				128.8	14.0	37	23	—	—	2460	0.47	400	22.5	40	33.5	—	—
Maximum, Stratum Clay 1 (Top)				134.5	23.0	53	32	—	—	3920	0.47	400	22.5	40	33.5	—	—
Average, Stratum Clay 1 (Top)				130.6	18.1	42	26	—	—	3250	0.47	400	22.5	40	33.5	—	—
Stratum Clay 1 (Bottom)																	
B-2182UD	UD5	33.0	45.7	126.0	29.6	68	42	CH	UU	2860	—	—	—	—	—	—	—
B-2269UD	UD3	30.0	50.1	135.0	15.8	34	19	CL	UU	4800	0.53	—	—	—	—	—	—
B-2269UD	UD4	33.0	47.1	134.2	15.0	34	17	CL	UU	3920	—	—	—	—	—	—	—
B-2269UD	UD5	50.0	30.1	127.5	21.5	59	36	CH	UU	3060	0.22	—	—	—	—	—	—
Minimum, Stratum Clay 1 (Bottom)				126.0	15.0	34	17	—	—	2860	0.22	—	—	—	—	—	—
Maximum, Stratum Clay 1 (Bottom)				135.0	29.6	68	42	—	—	4800	0.53	—	—	—	—	—	—
Average, Stratum Clay 1 (Bottom)				130.7	20.5	49	29	—	—	3660	0.38	—	—	—	—	—	—

Table 2.5.4-18 (Sheet 2 of 6)
Laboratory Strength Test Results (Power Block Area)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a] Undrained Shear Strength (pounds per square foot)	UU Tests[a] Ratio, Undrained Shear Strength/ Preconsolidation	CIU-Bar-Tests[a] Undrained Cohesion (pounds per square foot)	CIU-Bar-Tests[a] Undrained Friction Angle (degrees)	CIU-Bar-Tests[a] Drained Cohesion (pounds per square foot)	CIU-Bar-Tests[a] Drained Friction Angle (degrees)	DS Tests[a] Drained Cohesion (pounds per square foot)	DS Tests[a] Drained Friction Angle (degrees)
Stratum Clay 3																	
B-2182UD	UD7	65.0	14.5	116.6	25.0	27	10	SC	UU	3100	0.27	—	—	—	—	—	—
B-2269UD	UD7	70.0	10.1	115.2	28.3	74	44	CH	UU	2360	0.11	—	—	—	—	—	—
B-2269UD	UD8	73.0	7.1	123.1	22.4	65	40	CH	UU	4340	—	—	—	—	—	—	—
B-2274UD	UD4	67.0	13.4	119.9	28.1	79	46	CH	UU	2840	0.17	—	—	—	—	—	—
Minimum, Stratum Clay 3				115.2	22.4	27	10	—	—	2360	0.11	—	—	—	—	—	—
Maximum, Stratum Clay 3				123.1	28.3	79	46	—	—	4340	0.27	—	—	—	—	—	—
Average, Stratum Clay 3				118.7	26.0	61	35	—	—	3160	0.18	—	—	—	—	—	—
Stratum Sand 4																	
B-2182UD	UD11	90.5	–11.0	141.0	12.3	25	12	CL	UU	7880	0.52	—	—	—	—	—	—
B-2182UD	UD12B	95.0	–15.5	113.3	17.7	—	—	SP-SM	DS	—	—	—	—	—	—	100	39.2
Minimum, Stratum Sand 4				113.3	12.3	25	12	—	—	7880	0.52	—	—	—	—	100	39.2
Maximum, Stratum Sand4 4				141.0	17.7	25	12	—	—	7880	0.52	—	—	—	—	100	39.2
Average, Stratum Sand 4				127.2	15.0	25	12	—	—	7880	0.52	—	—	—	—	100	39.2
Stratum Clay 5 (Top)																	
B-2182UD	UD13	120.0	–40.5	131.8	18.7	38	21	SC	UU	6020	0.29	—	—	—	—	—	—
B-2269UD	UD10	123.0	–42.9	135.1	17.4	69	43	CH	UU	4120	—	—	—	—	—	—	—
Minimum, Stratum Sand 5				131.8	17.4	38	21	—	—	4120	0.29	—	—	—	—	—	—
Maximum, Stratum Sand 5				135.1	18.7	69	43	—	—	6020	0.29	—	—	—	—	—	—
Average, Stratum Sand 5				133.5	18.1	54	32	—	—	5070	0.29	—	—	—	—	—	—

Table 2.5.4-18 (Sheet 3 of 6)
Laboratory Strength Test Results (Power Block Area)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a]		CIU-Bar-Tests[a]				DS Tests[a]	
										Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)
Stratum Clay 5 (Bottom)																	
B-2182UD	UD15	145.0	–65.5	128.4	25.3	NV	NP	ML	UU	2900	0.16	—	—	—	—	—	—
B-2269UD	UD11	150.0	–69.9	127.9	21.8	50	28	CH	UU	5900	0.25	—	—	—	—	—	—
Minimum, Stratum Clay 5 (Bottom)				127.9	21.8	50	28	—	—	2900	0.16	—	—	—	—	—	—
Maximum, Stratum Clay 5 (Bottom)				128.4	25.3	50	28	—	—	5900	0.25	—	—	—	—	—	—
Average, Stratum Clay 5 (Bottom)				128.2	23.6	50	28	—	—	4400	0.21	—	—	—	—	—	—
Stratum Sand 6																	
B-2174UD	UD8	145.0	–65.4	118.7	17.5	—	—	SM	DS	—	—	—	—	—	—	480	34.1
B-2174UD	UD10	183.0	–103.4	127.0	15.7	—	—	SM	DS	—	—	—	—	—	—	580	35.7
B-2182UD	UD16	180.0	–100.5	123.2	15.1	—	—	SM	DS	—	—	—	—	—	—	880	36.0
Minimum, Stratum Sand 6				118.7	15.1	—	—	—	—	—	—	—	—	—	—	480	34.1
Maximum, Stratum Sand 6				127.0	17.5	—	—	—	—	—	—	—	—	—	—	880	36.0
Average, Stratum Sand 6				123.0	16.1	—	—	—	—	—	—	—	—	—	—	647	35.3
Stratum Sand 8																	
B-2174UD	UD15	265.0	–185.4	129.5	19.3	26	12	SC	DS	—	—	—	—	—	—	0	33.7
B-2269UD	UD16	280.0	–199.5	127.5	18.6	26	9	SC	DS	—	—	—	—	—	—	400	34.0
B-2274UD	UD12	221.1	–140.7	126.6	10.3	—	—	SC	DS	—	—	—	—	—	—	600	31.9
B-2274UD	UD13	240.0	–159.6	131.8	15.6	32	17	CL	CU	—	—	6000	0.0	6000	0.0	—	—

Table 2.5.4-18 (Sheet 4 of 6)
Laboratory Strength Test Results (Power Block Area)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a] Undrained Shear Strength (pounds per square foot)	UU Tests[a] Ratio, Undrained Shear Strength/ Preconsolidation	CIU-Bar-Tests[a] Undrained Cohesion (pounds per square foot)	CIU-Bar-Tests[a] Undrained Friction Angle (degrees)	CIU-Bar-Tests[a] Drained Cohesion (pounds per square foot)	CIU-Bar-Tests[a] Drained Friction Angle (degrees)	DS Tests[a] Drained Cohesion (pounds per square foot)	DS Tests[a] Drained Friction Angle (degrees)
Minimum, Stratum Sand 8				126.6	10.3	26	9	—	—	—	—	6000	0.0	6000	0.0	0	31.9
Maximum, Stratum Sand 8				131.8	19.3	32	17	—	—	—	—	6000	0.0	6000	0.0	600	34.0
Average, Stratum Sand 8				128.9	16.0	28	13	—	—	—	—	6000	0.0	6000	0.0	333	33.2
Stratum Clay 9																	
B-2182UD	UD25	303.0	–223.5	119.7	25.1	52	26	CH	UU	4720	0.11	—	—	—	—	—	—
B-2182UD	UD26	320.0	–240.5	133.2	15.5	35	19	CL	UU	9460	0.26	—	—	—	—	—	—
B-2182UD	UD28	330.0	–250.5	124.5	28.0	69	40	CH	UU	5840	—	—	—	—	—	—	—
B-2182UD	UD30	340.0	–260.5	135.2	15.0	43	26	CL	UU	10560	0.28	—	—	—	—	—	—
B-2182UD	UD31	343.0	–263.5	134.2	15.8	47	29	CL	UU	13460	—	—	—	—	—	—	—
B-2274UD	UD16	320.0	–239.6	119.3	25.0	58	31	CH	UU	7800	0.18	—	—	—	—	—	—
B-2274UD	UD17	380.0	–299.6	123.3	24.3	72	37	MH	UU	5740	—	—	—	—	—	—	—
Minimum, Stratum Clay 9				119.3	15.0	35	19	—	—	4720	0.11	—	—	—	—	—	—
Maximum, Stratum Clay 9				135.2	28.0	72	40	—	—	13460	0.28	—	—	—	—	—	—
Average, Stratum Clay 9				127.1	21.2	54	30	—	—	8226	0.21	—	—	—	—	—	—
Stratum Sand 10																	
B-2274UD	UD18	330.1	–249.7	126.1	14.0	—	—	—	DS	—	—	—	—	—	—	2600	30.8
B-2274UD	UD19	350.1	–269.7	126.2	20.5	—	—	—	DS	—	—	—	—	—	—	0	36.0
Minimum, Stratum Sand 10				126.1	14.0	—	—	—	—	—	—	—	—	—	—	0	30.8
Maximum, Stratum Sand 10				126.2	20.5	—	—	—	—	—	—	—	—	—	—	2600	36.0

Table 2.5.4-18 (Sheet 5 of 6)
Laboratory Strength Test Results (Power Block Area)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a]		CIU-Bar-Tests[a]				DS Tests[a]	
										Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)
Average, Stratum Sand 10				126.2	17.3	—	—	—	—	—	—	—	—	—	—	1300	33.4
Stratum Clay 11																	
B-2182UD	UD33	380.0	–300.5	114.5	32.2	68	36	CH	UU	7800	0.18	—	—	—	—	—	—
B-2182UD	UD37	400.0	–320.5	127.4	23.6	49	24	CL	UU	5060	0.17	—	—	—	—	—	—
B-2269UD	UD18	375.0	–294.5	127.3	22.3	46	32	CL	UU	3800	—	—	—	—	—	—	—
B-2269UD	UD20	400.0	–319.5	127.5	24.1	88	32	CH	UU	4260	0.15	—	—	—	—	—	—
B-2274UD	UD20	380.0	–299.6	117.4	31.0	70	35	MH	UU	6540	0.14	—	—	—	—	—	—
B-2274UD	UD22	400.0	–319.6	121.5	25.6	56	31	CH	UU	6400	0.13	—	—	—	—	—	—
Minimum, Stratum Clay 11				114.5	22.3	46.0	24.0	—	—	3800	0.13	—	—	—	—	—	—
Maximum, Stratum Clay 11				127.5	32.2	88.0	36.0	—	—	7800	0.18	—	—	—	—	—	—
Average, Stratum Clay 11				122.6	26.5	62.8	31.7	—	—	5643	0.15	—	—	—	—	—	—
Stratum Clay 13																	
B-2174UDR	UD26	445.0	–366.1	124.6	26.2	65	40	CH	UU	6080	0.12	—	—	—	—	—	—
Minimum, Stratum Clay 11				124.6	26.2	65.0	40.0	—	—	6080	0.12	—	—	—	—	—	—
Maximum, Stratum Clay 11				124.6	26.2	65.0	40.0	—	—	6080	0.12	—	—	—	—	—	—
Average, Stratum Clay 11				124.6	26.2	65.0	40.0	—	—	6080	0.12	—	—	—	—	—	—
Structural Fill Materials																	
Fordyce Raw Material																	
3/8" sieved material			—	128.5[c]	12.4[c]	—	—	SP	DS	—	—	—	—	—	—	0	40.0

Table 2.5.4-18 (Sheet 6 of 6)
Laboratory Strength Test Results (Power Block Area)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a]		CIU-Bar-Tests[a]				DS Tests[a]	
										Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)
CW&A Texas DOT Grade 4 Material																	
3/8" sieved material			—	138.1[c]	5.7[c]	—	—	GW-GC	DS	—	—	—	—	—	—	0	42.0
CW&A Texas DOT Grade 6 Material																	
3/8” sieved material			—	134.6[c]	6.2[c]	—	—	GW-GC	DS	—	—	—	—	—	—	0	39.0

(a) UU = unconsolidated undrained triaxial compression test. CIU-Bar = consolidated undrained triaxial compression test with pore pressures measured. DS = direct shear test.
(b) Elevations are referenced to NAVD 88.
(c) Compacted density and moisture content.

Table 2.5.4-19 (Sheet 1 of 8)
Laboratory Strength Test Results (Cooling Basin)

										UU Tests[a]		CIU-Bar Tests[a]				DS Tests[a]		DSS Tests[a]			
Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/Preconsolidation Pressure	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Vertical Consolidation Stress (pounds/ square foot)	Horizontal Shear Stress (pounds/square foot)	Shear Strain, (%)	Effective Vertical Stress, σ_v' (pounds/square foot)
Stratum Clay 1 (Top)																					
B-2304UD	UD2	11.0	57.5	110.3	11.9	—	—	ML	DS	—	—	—	—	—	—	0	41.3	—	—	—	—
B-2321UD	UD1	3.5	68.3	119.1	18.3	42	29	CL	DSS	—	—	—	—	—	—	—	—	760	330	29.6	440
B-2321UD	UD3	10.0	61.8	126.1	16.8	51	35	CH	DSS	—	—	—	—	—	—	—	—	1460	1410	29.4	2150
B-2321UD	UD4	13.5	58.3	118.0	21.7	81	59	CH	DSS	—	—	—	—	—	—	—	—	1460	990	23.7	1690
B-2321UD	UD5	17.0	54.8	118.3	19.5	40	25	CL	DSS	—	—	—	—	—	—	—	—	2220	820	11.7	1220
B-2352UD	UD1	3.5	59.3	131.1	18.3	46	27	CL	UU	2660	0.20	—	—	—	—	—	—	—	—	—	—
B-2352UD	UD3	11.5	51.3	128.9	18.6	39	21	CL	UU	2420	0.18	—	—	—	—	—	—	—	—	—	—
B-2352UD	UD5	24.0	38.8	123.6	22.7	—	—	CH	UU	2420	—	—	—	—	—	—	—	—	—	—	—
Minimum, Stratum Clay 1 (Top)				110.3	11.9	39	21	—	—	2420	0.18	—	—	—	—	0	41.3	760	330	11.7	440
Maximum, Stratum Clay 1 (Top)				131.1	22.7	81	59	—	—	2660	0.20	—	—	—	—	0	41.3	2220	1410	29.6	2150
Average, Stratum Clay 1 (Top)				121.9	18.5	50	33	—	—	2500	0.19	—	—	—	—	0	41.3	1475	888	23.6	1375

Table 2.5.4-19 (Sheet 2 of 8)
Laboratory Strength Test Results (Cooling Basin)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a] Undrained Shear Strength (pounds per square foot)	UU Tests[a] Ratio, Undrained Shear Strength/ Preconsolidation Pressure	CIU-Bar Tests[a] Undrained Cohesion (pounds per square foot)	CIU-Bar Tests[a] Undrained Friction Angle (degrees)	CIU-Bar Tests[a] Drained Cohesion (pounds per square foot)	CIU-Bar Tests[a] Drained Friction Angle (degrees)	DS Tests[a] Drained Cohesion (pounds per square foot)	DS Tests[a] Drained Friction Angle (degrees)	DSS Tests[a] Vertical Consolidation Stress (pounds/ square foot)	DSS Tests[a] Horizontal Shear Stress (pounds/square foot)	DSS Tests[a] Shear Strain, (%)	DSS Tests[a] Effective Vertical Stress, σ_v' (pounds/square foot)
Stratum Sand 1																					
B-2302UD	UD3	13.5	66.5	121.3	17.4	NV	NP	SM	CU	—	—	3700	29.0	0	35.0	—	—	—	—	—	—
B-2319UD	UD2	5.5	68.7	133.1	13.7	37	21	SC	UU	4320	—	—	—	—	—	—	—	—	—	—	—
Minimum, Stratum Sand 1				121.3	13.7	37	21	—	—	4320	—	3700	29.0	0	35.0	—	—	—	—	—	—
Maximum, Stratum Sand 1				133.1	17.4	37	21	—	—	4320	—	3700	29.0	0	35.0	—	—	—	—	—	—
Average, Stratum Sand 1				127.2	15.6	37	21	—	—	4320	—	3700	29.0	0	35.0	—	—	—	—	—	—
Stratum Clay 1 (Bottom)																					
B-2319UD	UD4	25.0	49.2	130.0	18.7	61	45	CH	DSS	—	—	—	—	—	—	—	—	2930	2420	20.3	4720
B-2321UD	UD6	28.5	43.3	116.6	25.0	75	55	CH	DSS	—	—	—	—	—	—	—	—	3630	1340	23.8	2490
B-2321UD	UD8	48.5	23.3	117.0	29.9	64	48	CH	DSS	—	—	—	—	—	—	—	—	5780	2900	3.9	4440
B-2359UD	UD4	35.0	42.4	128.6	22.3	68	51	CH	DSS	—	—	—	—	—	—	—	—	4350	2580	11.8	5360
B-2359UD	UD5	40.0	38.9	126.2	23.0	65	47	CH	DSS	—	—	—	—	—	—	—	—	5050	2380	8.8	5190
B-2321	UD7	38.5	33.3	122.4	14.8	60	37	CH	UU	3920	0.38	—	—	—	—	—	—	—	—	—	—
Minimum, Stratum Clay 1 (Bottom)				116.6	14.8	60.0	37.0	—	—	3920	0.38	—	—	—	—	—	—	2930	1340	3.9	2490
Maximum, Stratum Clay 1 (Bottom)				130.0	29.9	75.0	55.0	—	—	3920	0.38	—	—	—	—	—	—	5780	2900	23.8	5360
Average, Stratum Clay 1 (Bottom)				123.5	22.3	65.5	47.2	—	—	3920	0.38	—	—	—	—	—	—	4348	2324	13.7	4440

Table 2.5.4-19 (Sheet 3 of 8)
Laboratory Strength Test Results (Cooling Basin)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a]		CIU-Bar Tests[a]				DS Tests[a]		DSS Tests[a]			
										Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation Pressure	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Vertical Consolidation Stress (pounds/ square foot)	Horizontal Shear Stress (pounds/square foot)	Shear Strain, (%)	Effective Vertical Stress, σ_v' (pounds/square foot)
Stratum Sand 2																					
B-2302UD	UD7	63.5	16.5	124.7	21.1	22	6	SP-SM	DS	—	—	—	—	—	—	340	37.6	—	—	—	—
B-2302UD	UD9	55.0	25.0	123.9	14.3	—	—	ML	DS	—	—	—	—	—	—	480	37.9	—	—	—	—
Minimum, Stratum Sand 2				123.9	14.3	22	6	—	—	—	—	—	—	—	—	340	37.6	—	—	—	—
Maximum, Stratum Sand 2				124.7	21.1	22	6	—	—	—	—	—	—	—	—	480	37.9	—	—	—	—
Average, Stratum Sand 2				124.3	17.7	22	6	—	—	—	—	—	—	—	—	410	37.8	—	—	—	—
Stratum Clay 3																					
B-2302UD	UD10	66.0	14.0	127.0	22.5	50	28	CH	—	—	—	—	—	0	10	—	—	—	—	—	—
B-2302UD	UD11	69.5	10.5	119.7	18.5	59	34	CH	UU	3080	0.24	—	—	—	—	—	—	—	—	—	—
B-2302UD	UD12	78.5	1.5	124.2	20.8	64	43	CH	—	—	—	—	—	—	—	—	—	7910	3950	15.1	7370
B-2304UD	UD7	73.5	–8.0	117.8	27.6	69	35	MH	UU	3280	0.18	—	—	—	—	—	—	—	—	—	—
B-2304UD	UD8	83.5	–15.0	118.9	30.9	61	35	CH	—	—	—	—	—	0	14	—	—	8660	2780	6.2	6930
B-2319UD	UD7	65.0	9.2	124.2	20.1	39	22	CL	—	—	—	—	—	0	30	—	—	7200	4460	15.7	4410
B-2321UD	UD9	58.5	13.3	127.9	20.0	49	35	CL	—	—	—	—	—	0	23	—	—	6480	2170	10.1	4800
B-2321UD	UD10	63.0	8.8	133.4	15.2	36	22	CL	—	—	—	—	—	—	—	—	—	7180	3360	14.9	6510
B-2352UD	UD8	68.0	–5.2	122.8	14.4	—	—	SM	—	—	—	—	—	—	—	1440	39.4	—	—	—	—
B-2359UD	UD10	70.0	7.4	133.0	16.6	95	61	CH	—	—	—	—	—	0	30	—	—	7220	3780	12.7	7220
Minimum, Stratum Clay 3				117.8	14.4	36	22	—	—	3080	0	—	—	0	10.0	1440	39.4	6480	2170	6.2	4410
Maximum, Stratum Clay 3				133.4	30.9	95	61	—	—	3280	0	—	—	0	30.0	1440	39.4	8660	4460	15.7	7370
Average, Stratum Clay 3				124.9	20.7	58	35	—	—	3180	0	—	—	0	21.4	1440	39.4	7442	3417	12.5	6207

Table 2.5.4-19 (Sheet 4 of 8)
Laboratory Strength Test Results (Cooling Basin)

										UU Tests[a]		CIU-Bar Tests[a]				DS Tests[a]		DSS Tests[a]			
Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation Pressure	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Vertical Consolidation Stress (pounds/ square foot)	Horizontal Shear Stress (pounds/square foot)	Shear Strain, (%)	Effective Vertical Stress, σ_v' (pounds/square foot)
Stratum Sand 4																					
B-2302UD	UD14	108.5	–28.5	129.8	17.8	—	—	SM	DS	—	—	—	—	—	—	1020	35.5	—	—	—	—
B-2319UD	UD8	75.0	–0.8	123.0	24.6	—	—	SP-SM	UU	12,380	—	—	—	—	—	—	—	—	—	—	—
B-2321UD	UD12	93.0	–21.2	124.2	22.7	—	—	SP-SM	—	—	—	—	—	—	—	1620	36.1	—	—	—	—
B-2359UD	UD11	77.0	0.4	122.2	19.9	23	4	SC-SM	UU	7620	0.34	—	—	—	—	—	—	—	—	—	—
B-2359UD	UD12	80.0	–2.7	124.4	19.4	26	12	SC	DSS	—	—	—	—	—	—	—	—	8010	4410	25.0	7700
B-2359UD	UD14	88.5	–11.2	121.0	25.3	—	—	ML	DS	—	—	—	—	—	—	0	34.5	—	—	—	—
Minimum, Stratum Sand 4				121.0	17.8	23.0	4.0	—	—	7620	0.34	—	—	—	—	0	34.5	8010	4410	25.0	7700
Maximum, Stratum Sand 4				129.8	25.3	26.0	12.0	—	—	12,380	0.34	—	—	—	—	1620	36.1	8010	4410	25.0	7700
Average, Stratum Sand 4				124.1	21.6	24.5	8.0	—	—	10,000	0.34	—	—	—	—	880	35.4	8010	4410	25.0	7700
Stratum Clay 5 (Top)																					
B-2302UD	UD16	120.5	–40.5	123.4	25.1	76	60	CH	DSS	—	—	—	—	—	—	—	—	10,850	5520	8.5	9620
B-2302UD	UD19	145.5	–65.5	130.3	19.4	49	34	CH	DSS	—	—	—	—	—	—	—	—	12,250	7670	10.5	9470
B-2304UD	UD11	111.0	–42.5	127.1	22.7	77	58	CH	DSS	—	—	—	—	0	17.0	—	—	10,090	5690	5.2	8330
B-2304UD	UD13	121.0	–52.5	133.1	21	62	44	CH	DSS	—	—	—	—	0	22.0	—	—	10,810	6140	7.5	8450
B-2321UD	UD15	130.5	–58.7	128.5	20.3	61	44	CH	DSS	—	—	—	—	0	45.0	—	—	11,550	5070	15.7	9410
B-2359UD	UD17	110.0	–32.7	125.5	17.4	21	3	SM	UU	5800	—	—	—	—	—	—	—	—	—	—	—
B-2359UD	UD19	114.0	–36.7	124.0	17.3	—	—	SM	—	—	—	—	—	—	—	1880	36.9	—	—	—	—

Table 2.5.4-19 (Sheet 5 of 8)
Laboratory Strength Test Results (Cooling Basin)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a] Undrained Shear Strength (pounds per square foot)	UU Tests[a] Ratio, Undrained Shear Strength/ Preconsolidation Pressure	CIU-Bar Tests[a] Undrained Cohesion (pounds per square foot)	CIU-Bar Tests[a] Undrained Friction Angle (degrees)	CIU-Bar Tests[a] Drained Cohesion (pounds per square foot)	CIU-Bar Tests[a] Drained Friction Angle (degrees)	DS Tests[a] Drained Cohesion (pounds per square foot)	DS Tests[a] Drained Friction Angle (degrees)	DSS Tests[a] Vertical Consolidation Stress (pounds/ square foot)	DSS Tests[a] Horizontal Shear Stress (pounds/square foot)	DSS Tests[a] Shear Strain, (%)	DSS Tests[a] Effective Vertical Stress, σ_v' (pounds/square foot)
Stratum Clay 5 (Top) (continued)																					
Minimum, Stratum Clay 5 (Top)				123.4	17.3	21.0	3.0	—	—	5800	—	—	—	0	17.0	1880	36.9	10,090	5070	5.2	8330
Maximum, Stratum Clay 5 (Top)				133.1	25.1	77.0	60.0	—	—	5800	—	—	—	0	45.0	1880	36.9	12,250	7670	15.7	9620
Average, Stratum Clay 5 (Top)				127.4	20.5	57.7	40.5	—	—	5800	—	—	—	0	28.0	1880	36.9	11,110	6018	9.5	9056
Stratum Sand 5																					
B-2304UD	UD15	141.0	–72.5	117	17.9	—	—	SP-SM	DS	—	—	—	—	—	—	2520	35.3	—	—	—	—
Minimum, Stratum Sand 5				117.0	17.9	—	—	—	—	—	—	—	—	—	—	2520	35.3	—	—	—	—
Maximum, Stratum Sand 5				117.0	17.9	—	—	—	—	—	—	—	—	—	—	2520	35.3	—	—	—	—
Average, Stratum Sand 5				117.0	17.9	—	—	—	—	—	—	—	—	—	—	2520	35.3	—	—	—	—
Stratum Clay 5 (Bottom)																					
B-2359UD	UD20	120.0	–42.7	113.1	36.3	51	36	CH	DSS	—	—	—	—	—	—	—	—	10,790	2950	2.4	8680
Minimum, Stratum Clay 5 (Bottom)				113.1	36.3	51	36	—	—	—	—	—	—	—	—	—	—	10,790	2950	2.4	8680
Maximum, Stratum Clay 5 (Bottom)				113.1	36.3	51	36	—	—	—	—	—	—	—	—	—	—	10,790	2950	2.4	8680
Average, Stratum Clay 5 (Bottom)				113.1	36.3	51	36	—	—	—	—	—	—	—	—	—	—	10,790	2950	2.4	8680

Table 2.5.4-19 (Sheet 6 of 8)
Laboratory Strength Test Results (Cooling Basin)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a]		CIU-Bar Tests[a]				DS Tests[a]		DSS Tests[a]			
										Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation Pressure	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Vertical Consolidation Stress (pounds/ square foot)	Horizontal Shear Stress (pounds/square foot)	Shear Strain, (%)	Effective Vertical Stress, σ_v' (pounds/square foot)
Composite "A"/Sand																					
—	A	—	—	136.3[c]	14.5[c]	34	22	SC	—	—	—	—	—	—	—	—	—	—	—	—	—
—	B	—	—	137.0[c]	14.0[c]	—	—	—	CU	—	—	1220	14.6	500	25.1	—	—	—	—	—	—
—	C	—	—	135.9[c]	14.0[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	—	—	—	—
—	A	—	—	136.0[c]	14.0[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	2710	1290	28.6	1980
—	B	—	—	136.4[c]	13.9[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	4320	2780	25.2	5170
—	C	—	—	136.6[c]	13.9[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	8750	3900	23.3	7900
—	D	—	—	137.2[c]	14.4[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	12,890	4390	29.3	8420
—	E	—	—	136.9[c]	14.3[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	17,480	5140	18.8	11,480
—	F	—	—	136.8[c]	14.2[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	28,900	7650	15.6	18,110
—	G	—	—	136.8[c]	14.1[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	2200	1860	29.8	3440
—	H	—	—	136.6[c]	13.7[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	4400	2010	29.3	3410
—	I	—	—	136.6[c]	14.0[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	8610	3090	21.2	6080
—	J	—	—	136.9[c]	14.1[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	13120	4680	16.7	10,110
—	K	—	—	137.1[c]	15.7[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	17,430	4340	11.6	10,180
—	L	—	—	136.8[c]	14.1[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	28,950	7600	13.4	18,890
Minimum, Composite "A"/Sand				136.0[c]	13.7[c]	34	22	—	—	—	—	1220	14.6	500	25.1	—	—	2200	1290	11.6	1980
Maximum, Composite "A"/Sand				137.2[c]	15.7[c]	34	22	—	—	—	—	1220	14.6	500	25.1	—	—	28,950	7650	29.8	18,890
Average, Composite "A"/Sand				136.7[c]	14.2[c]	34	22	—	—	—	—	1220	14.6	500	25.1	—	—	12,480	4061	21.9	8764

Table 2.5.4-19 (Sheet 7 of 8)
Laboratory Strength Test Results (Cooling Basin)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)[b]	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests[a]		CIU-Bar Tests[a]				DS Tests[a]		DSS Tests[a]			
										Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation Pressure	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Vertical Consolidation Stress (pounds/ square foot)	Horizontal Shear Stress (pounds/square foot)	Shear Strain, (%)	Effective Vertical Stress, σ_v' (pounds/square foot)
Composite "B"/Clay																					
—	A	—	—	132.8[c]	16.3[c]	44	29	CL	—	—	—	—	—	—	—	—	—	—	—	—	—
—	B	—	—	134.2[c]	16.8[c]	—	—	—	CU	—	—	740	14.4	380	26.1	—	—	—	—	—	—
—	C	—	—	134.1[c]	16.2[c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	A	—	—	133.4[c]	14.0[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	2220	2080	14.6	3510
—	B	—	—	133.7[c]	13.9[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	4350	1860	9.2	3310
—	C	—	—	133.8[c]	13.9[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	8670	3450	17.3	6790
—	D	—	—	134.1[c]	14.4[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	12,720	4320	12.9	9580
—	E	—	—	134.3[c]	14.3[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	17,490	5590	11.5	13,260
—	F	—	—	133.9[c]	14.2[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	28,710	7510	9.5	20,340
—	G	—	—	134.3[c]	14.1[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	2190	1000	28.8	1420
—	H	—	—	134.1[c]	13.7[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	4370	2100	18.4	3710
—	I	—	—	134.3[c]	14.0[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	8730	3820	14.3	7640
—	J	—	—	134.1[c]	14.1[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	12,950	3850	9.2	8250
—	K	—	—	134.3[c]	15.7[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	17,300	5970	13.4	13,930
—	L	—	—	136.3[c]	14.1[c]	—	—	—	DSS	—	—	—	—	—	—	—	—	28,820	8270	11.7	21,500
Minimum, Composite "B"/Clay				132.8[c]	13.7[c]	—	—	—	—	—	—	740	14.4	380	26.1	—	—	2190	1000	9.2	1420
Maximum, Composite "B"/Clay				136.3[c]	16.8[c]	—	—	—	—	—	—	740	14.4	380	26.1	—	—	28,820	8270	28.8	21,500
Average, Composite "B"/Clay				134.1[c]	14.6[c]	—	—	—	—	—	—	740	14.4	380	26.1	—	—	12,377	4152	14.2	9437

Table 2.5.4-19 (Sheet 8 of 8)
Laboratory Strength Test Results (Cooling Basin)

Boring Number	Sample Number	Sample Top Depth (feet)	Sample Top Elevation (feet)(b)	Total Unit Weight (pounds/ cubic foot)	Natural Moisture Content (percent)	Liquid Limit (percent)	Plasticity Index (percent)	USCS Group	Test Type	UU Tests(a)		CIU-Bar Tests(a)				DS Tests(a)		DSS Tests(a)			
										Undrained Shear Strength (pounds per square foot)	Ratio, Undrained Shear Strength/ Preconsolidation Pressure	Undrained Cohesion (pounds per square foot)	Undrained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Drained Cohesion (pounds per square foot)	Drained Friction Angle (degrees)	Vertical Consolidation Stress (pounds/ square foot)	Horizontal Shear Stress (pounds/square foot)	Shear Strain, (%)	Effective Vertical Stress, σ_v' (pounds/square foot)
Drainage Sand Materials																					
C-33	—	—	—	110.3(c)	3.0(c)	—	—	SP	DS	—	—	—	—	—	—	0	37.0	—	—	—	—
C-144	—	—	—	108.0(c)	8.1(c)	—	—	SP	DS	—	—	—	—	—	—	0	36.0	—	—	—	—

(a) UU = unconsolidated undrained triaxial compression test. CIU-Bar = consolidated undrained triaxial compression test with pore pressures measured. DS = direct shear test. DSS = direct simple shear test.
(b) Elevations are referenced to NAVD 88.
(c) Compacted density and moisture content.

Table 2.5.4-20
Undrained Shear Strengths of Cohesive Soil Strata (Power Block Area)

Values from Laboratory Tests			
Stratum	**Minimum s_u (ksf)**	**Maximum s_u (ksf)**	**Average s_u (ksf)**
Clay 1 (Top)	2.5	3.9	3.3
Clay 1 (Bottom)	2.9	4.8	3.7
Clay 3	2.4	4.3	3.2
Clay 5 (Top)	4.1	6.0	5.1
Clay 5 (Bottom)	2.6	5.9	4.4
Clay 7	Not Tested	Not Tested	Not Tested
Clay 9	4.7	13.5	8.2
Clay 11	3.8	7.8	6.0
Clay 13	6.1	6.1	6.1
Clay 15	Not Tested	Not Tested	Not Tested
Clay 17	Not Tested	Not Tested	Not Tested

Values from CPT Correlation			
Stratum	**Minimum s_u (ksf)**	**Maximum s_u (ksf)**	**Average s_u (ksf)**
Clay 1 (Top)	0.3	6.3	2.8
Clay 1 (Bottom)	2.3	9.4	3.7
Clay 3	1.8	13.1	4.2
Clay 5 (Top)	Not Reached	Not Reached	Not Reached
Clay 5 (Bottom)	Not Reached	Not Reached	Not Reached
Clay 7	Not Reached	Not Reached	Not Reached
Clay 9	Not Reached	Not Reached	Not Reached
Clay 11	Not Reached	Not Reached	Not Reached
Clay 13	Not Reached	Not Reached	Not Reached
Clay 15	Not Reached	Not Reached	Not Reached
Clay 17	Not Reached	Not Reached	Not Reached

Values from SPT Correlation		
Stratum	**Selected Corrected $(N_1)_{60}$-Value (blows/foot)**	**Calculated s_u (ksf)**
Clay 1 (Top)	19	2.5
Clay 1 (Bottom)	19	2.5
Clay 3	19	2.4
Clay 5 (Top)	16	2.0
Clay 5 (Bottom)	16	2.0
Clay 7	40	5.0
Clay 9	31	3.9
Clay 11	30	3.8
Clay 13	28	3.5
Clay 15	33	4.1
Clay 17	45	5.6

Values Selected for Use	
Stratum	**Selected s_u (ksf)**
Clay 1 (Top)	3.2
Clay 1 (Bottom)	3.2
Clay 3	3.0
Clay 5 (Top)	3.0
Clay 5 (Bottom)	3.0
Clay 7	6.0
Clay 9	4.0
Clay 11	5.0
Clay 13	6.0
Clay 15	6.1
Clay 17	5.6

Table 2.5.4-21
Undrained Shear Strengths of Cohesive Soil Strata (Cooling Basin)

Values from Laboratory Tests			
Stratum	**Minimum s_u (ksf)**	**Maximum s_u (ksf)**	**Average s_u (ksf)**
Clay 1 (Top)	2.4	2.7	2.5
Clay 1 (Bottom)	3.9	3.9	3.9
Clay 3	3.1	3.3	3.2
Clay 5 (Top)	5.8	5.8	5.8
Clay 5 (Bottom)	Not Tested	Not Tested	Not Tested
Clay 7	Not Tested	Not Tested	Not Tested
Clay 9	Not Tested	Not Tested	Not Tested

Values from CPT Correlation			
Stratum	**Minimum s_u (ksf)**	**Maximum s_u (ksf)**	**Average s_u (ksf)**
Clay 1 (Top)	0.4	4.9	1.7
Clay 1 (Bottom)	0.8	9.0	3.5
Clay 3	1.2	11.8	4.0
Clay 5 (Top)	1.6	6.5	3.2
Clay 5 (Bottom)	Not Reached	Not Reached	Not Reached
Clay 7	Not Reached	Not Reached	Not Reached
Clay 9	Not Reached	Not Reached	Not Reached

Values from SPT Correlation		
Stratum	**Selected Corrected $(N_1)_{60}$-Value (blows/ foot)**	**Calculated s_u (ksf)**
Clay 1 (Top)	21	2.6
Clay 1 (Bottom)	21	2.6
Clay 3	16	2.0
Clay 5 (Top)	20	2.5
Clay 5 (Bottom)	20	2.5
Clay 7	17	2.1
Clay 9	13	1.6

Values Selected for Use	
Stratum	**Selected s_u (ksf)**
Clay 1 (Top)	2.3
Clay 1 (Bottom)	3.4
Clay 3	4.0
Clay 5 (Top)	3.6
Clay 5 (Bottom)	2.5
Clay 7	2.1
Clay 9	1.6

Table 2.5.4-22 (Sheet 1 of 2)
Laboratory Consolidation Test Results (Power Block Area)

Stratum/ Boring No.	Sample No.	Sample Depth (feet)	Sample Top El. (feet)[(a)]	LL (%)	PI (%)	USCS Group Symbol	Specific Gravity, G_s	Initial Effective Stress σ_v' (ksf)	Dry Unit Weight, γ_t (pcf)	Moisture Content (%)	P_c'[(b)] (ksf)	C_c[(c)]	C_r[(d)]	e_0[(e)]	OCR[(f)]
Clay 1 (Top)															
B-2269UD	UD-1	10.0-12.0	70.1	40	24	CL	2.67	1.47	109.7	17.8	17.2	0.126	0.012	0.52	11.7
B-2274UD	UD-1	10.2-11.9	70.2	33	18	CL	2.75	1.48	113.8	16.4	5.8	0.110	0.013	0.51	3.9
Clay 1 (Bottom)															
B-2182UD	UD-6	37.0-38.5	42.7	33	17	CL	2.75	4.49	111.0	16.1	8.6	0.143	0.022	0.55	1.9
B-2269UD	UD-3	30.0-32.0	50.1	34	19	CL	2.66	4.09	110.7	15.4	9.0	0.136	0.003	0.50	2.2
B-2269UD	UD-5	50.0-51.7	30.1	59	36	CH	2.70	5.48	104.9	21.5	13.7	0.159	0.060	0.61	2.5
Clay 3															
B-2182UD	UD-7	65.0-66.7	14.7	27	10	SC	2.74	6.37	95.4	20.9	11.5	0.156	0.047	0.79	1.8
B-2269UD	UD-7	70.0-71.7	10.1	74	44	CH	2.72	6.70	84.4	36.6	22.2	0.362	0.050	1.01	3.3
B-2274UD	UD-4	67.0-68.7	13.4	79	46	CH	2.76	6.74	89.2	32.6	17.1	0.252	0.039	0.93	2.5
Clay 5 (Top)															
B-2182UD	UD-13	120-121.7	–40.3	38	21	SC	2.71	9.90	104.6	20.4	21.0	0.196	0.027	0.61	2.1
Clay 5 (Bottom)															
B-2182UD	UD-15	145-147.5	–65.3	NV	NP	ML	2.70	11.52	95.4	26.8	18.4	0.156	0.032	0.77	1.6
B-2269UD	UD-11	150-151.7	–69.9	50	28	CH	2.70	11.80	103.7	21.8	23.2	0.193	0.063	0.62	2.0
Clay 7															
B-2182UD	UD-17	215-217.5	–135.3	43	26	CL	2.72	16.28	101.7	22.8	26.9	0.199	0.030	0.67	1.7
Clay 9															
B-2182UD	UD-25	303-304.2	–223.3	52	26	CH	2.79	22.30	91.3	26.5	22.1	0.209	0.032	0.91	1.0
B-2182UD	UD-26	320-321.5	–240.3	35	19	CL	2.73	23.39	115.5	14.9	35.7	0.149	0.015	0.47	1.5
B-2182UD	UD-29	333-334.7	–253.3	56	30	CH	2.72	24.21	96.9	24.7	38.3	0.276	0.037	0.76	1.6
B-2182UD	UD-30	340-341.1	–260.3	43	26	CL	2.73	24.66	116.9	15.5	38.1	0.140	0.028	0.46	1.5
B-2274UD	UD-16	300-301.8	–219.6	58	31	CH	2.76	22.29	90.9	26.8	43.0	0.309	0.037	0.90	1.9

Table 2.5.4-22 (Sheet 2 of 2)
Laboratory Consolidation Test Results (Power Block Area)

Stratum/ Boring No.	Sample No.	Sample Depth (feet)	Sample Top El. (feet)(a)	LL (%)	PI (%)	USCS Group Symbol	Specific Gravity, G_s	Initial Effective Stress σ_v' (ksf)	Dry Unit Weight, γ_t (pcf)	Moisture Content (%)	P_c'(b) (ksf)	C_c(c)	C_r(d)	e_0(e)	OCR(f)
Clay 11															
B-2182UD	UD-33	380-381.7	–300.3	68	36	CH	2.78	27.34	84.9	33.8	43.3	0.455	0.028	1.04	1.6
B-2182UD	UD-37	400-402.5	–320.3	49	24	CL	2.76	28.50	91.4	29.3	29.1	0.252	0.030	0.88	1.0
B-2269UD	UD-20	400-402.1	–319.9	63	43	CH	2.77	28.14	85.7	32.9	28.2	0.289	0.056	1.02	1.0
B-2274UD	UD-20	380-381.8	–299.6	70	35	MH	2.76	27.69	86.0	34.9	48.1	0.409	0.050	1.00	1.7
B-2274UD	UD-21	390-391.8	–309.6	73	39	CH	2.75	28.20	83.6	36.7	47.9	0.402	0.047	1.05	1.7
B-2274UD	UD-22	400-401.3	–319.6	56	31	CH	2.72	28.81	98.2	26.3	49.6	0.252	0.020	0.73	1.7
Clay 13															
B-2174UDR	UD-26	445-446.0	–366.0	65	40	CH	2.78	30.91	96.2	27.6	50.0	0.233	0.038	0.80	1.6
B-2174UDR	UD-27	490-492.5	–411.0	60	43	CH	2.73	33.82	109.6	20.2	41.1	0.149	0.037	0.56	1.2
Clay 17															
B-2274UD	UD-26	580-582.5	–499.6	37	22	CL	2.70	40.63	111.0	17.8	50.7	0.126	0.020	0.52	1.2

(a) Elevations are referenced to NAVD 88.
(b) Preconsolidation pressure, P_c'.
(c) Compression index, C_c.
(d) Recompression index, C_r.
(e) Initial void ratio, e_0.
(f) Overconsolidation Ratio, OCR.

Table 2.5.4-23 (Sheet 1 of 2)
Laboratory Consolidation Test Results (Cooling Basin)

Stratum/ Boring No.	Sample No.	Sample Depth (feet)	Sample Top El. (feet)[(a)]	LL (%)	PI (%)	USCS Group Symbol	Specific Gravity, G_s	Initial Effective Stress σ_v' (ksf)	Dry Unit Weight, γ_t (pcf)	Moisture Content (%)	P_c'[(b)] (ksf)	C_c[(c)]	C_r[(d)]	e_0[(e)]	OCR[(f)]
Constant Rate-of-Strain (CRS) Tests															
Clay 1 (Top)															
B-2321UD	UD-1	5.2	68.31	42	29	CL	2.71	0.52	101.2	17.4	3.8	0.100	0.018	0.67	7.3
B-2321UD	UD-3	11.4	61.81	51	35	CH	2.71	1.33	105.4	15.4	6.0	0.102	0.025	0.60	4.5
B-2321UD	UD-4	15.2	58.31	81	59	CH	2.72	1.77	103.0	21.8	9.3	0.104	0.027	0.65	5.3
Clay 1 (Bottom)															
B-2319UD	UD-4	26.7	49.16	61	45	CH	2.72	3.27	109.7	19.2	30.0	0.126	0.053	0.55	9.2
B-2321UD	UD-5	18.7	54.81	40	25	CL	2.72	2.21	97.2	19.5	10.0	0.113	0.012	0.74	4.5
B-2321UD	UD-6	30.2	43.31	75	55	CH	2.72	3.65	94.8	23.9	16.0	0.125	0.040	0.79	4.4
B-2321UD	UD-8	49.8	23.31	64	48	CH	2.72	5.85	91.5	28.5	23.3	0.165	0.055	0.85	4.0
B-2359UD	UD-4	36.5	42.35	68	51	CH	2.73	4.46	103.2	21.6	43.9	0.141	0.065	0.65	9.9
B-2359UD	UD-5	41.2	37.35	65	47	CH	2.71	5.08	106.7	18.4	39.9	0.155	0.070	0.58	7.9
Clay 3															
B-2302UD	UD-12	80.2	1.50	64	43	CH	2.68	6.90	100.2	20.9	28.2	0.163	0.036	0.67	4.1
B-2304UD	UD-8	85.3	–15.04	61	35	CH	2.71	7.09	89.6	31.3	26.6	0.180	0.083	0.89	3.8
B-2319UD	UD-7	66.6	9.16	39	22	CL	2.66	6.33	103.5	18.8	19.6	0.095	0.009	0.60	3.1
B-2321UD	UD-9	59.5	13.31	49	35	CL	2.68	7.54	103.6	19.3	15.7	0.115	0.054	0.61	2.1
B-2321UD	UD-10	65.1	8.81	36	22	CL	2.67	8.15	115.4	13.7	31.0	0.110	0.029	0.44	3.8
B-2359UD	UD-10	71.6	7.35	95	61	CH	2.72	7.51	109.5	16.8	26.1	0.125	0.035	0.55	3.5
Clay 5 (Top)															
B-2302UD	UD-16	122.2	–40.50	76	60	CH	2.72	9.46	97.5	25.5	30.0	0.181	0.103	0.74	3.2
B-2302UD	UD-19	147.0	65.50	49	34	CL	2.69	11.00	103.8	21.5	30.0	0.155	0.040	0.62	2.7
B-2304UD	UD-11	112.9	–42.54	77	58	CH	2.71	8.80	103.2	21.7	33.3	0.150	0.068	0.64	3.8
B-2304UD	UD-13	123.0	–52.54	62	44	CH	2.71	9.43	107.2	18.6	28.2	0.145	0.045	0.58	3.0
B-2321UD	UD-15	132.5	–58.69	61	44	CH	2.71	10.78	100.8	21.0	13.1	0.120	0.020	0.68	1.2
Clay 5 (Bottom)															
B-2359UD	UD-20	121.3	–42.65	51	36	CH	2.72	10.56	85.0	34.0	40.0	0.273	0.064	1.00	3.8

Table 2.5.4-23 (Sheet 2 of 2)
Laboratory Consolidation Test Results (Cooling Basin)

Stratum/ Boring No.	Sample No.	Sample Depth (feet)	Sample Top El. (feet)[(a)]	LL (%)	PI (%)	USCS Group Symbol	Specific Gravity, G_s	Initial Effective Stress σ_v' (ksf)	Dry Unit Weight, γ_t (pcf)	Moisture Content (%)	P_c'[(b)] (ksf)	C_c[(c)]	C_r[(d)]	e_0[(e)]	OCR[(f)]
Load-Controlled (LC) Tests															
Clay 1 (Top)															
B-2352UD	UD-1	3.5	59.3	46	27	CL	2.70	0.49	111.5	17.3	12.2	0.149	0.003	0.51	24.9
B-2352UD	UD-3	11.5	51.3	39	21	CL	2.71	1.49	108.8	18.4	13.4	0.156	0.020	0.56	9.0
Clay 1 (Bottom)															
B-2321UD	UD-7	38.5	33.3	60	37	CH	2.78	4.90	101.9	21.3	10.4	0.153	0.032	0.7	2.1
B-2352UD	UD-5	24.0	38.8	67	38	CH	2.67	3.05	94.4	28.0	14.8	0.189	0.010	0.77	4.8
B-2359UD	UD-3	30.8	46.6	66	36	CH	2.78	3.94	91.0	30.2	15.5	0.252	0.035	0.91	3.9
Clay 3															
B-2302UD	UD-11	69.5	10.5	59	34	CH	2.74	6.35	96.8	24.2	12.7	0.189	0.025	0.77	2.0
B-2304UD	UD-7	73.5	–5.0	69	35	MH	2.78	6.49	92.6	29.8	18.0	0.226	0.028	0.87	2.8
Clay 5 (Top)															
B-2304UD	UD-9	98.5	–30.0	62	37	CH	2.74	8.04	99.8	25.8	17.7	0.196	0.027	0.71	2.2
B-2321UD	UD-14	128.5	–56.7	58	31	CH	2.75	10.68	96.8	25.5	11.2	0.203	0.033	0.77	1.0
B-2359UD	UD-18	112.0	–34.7	27	12	SC	2.77	10.06	92.4	25.5	24.2	0.186	0.025	0.87	2.4

(a) Elevations are referenced to NAVD 88.
(b) Preconsolidation pressure, P_c'.
(c) Compression index, C_c.
(d) Recompression index, C_r.
(e) Initial void ratio, e_0.
(f) Overconsolidation Ratio, OCR.

Table 2.5.4-24
Summary of Laboratory Consolidation Test Properties for Cohesive Soil Strata (Power Block Area)

Stratum	No. of Tests	Statistics	C_r[(a)]	C_c[(b)]	P_c' (ksf)[(c)]	OCR[(d)]	e_o[(e)]
Clay 1 (Top)	2	Maximum	0.013	0.126	17.2	11.7	0.52
		Minimum	0.012	0.110	5.8	3.9	0.51
		Average	0.013	0.118	11.5	7.8	0.52
Clay 1 (Bottom)	3	Maximum	0.060	0.159	13.7	2.5	0.55
		Minimum	0.003	0.136	8.6	1.9	0.50
		Average	0.028	0.146	10.4	2.2	0.53
Clay 3	3	Maximum	0.050	0.362	22.2	3.3	1.01
		Minimum	0.039	0.156	11.5	1.8	0.79
		Average	0.045	0.257	16.9	2.6	0.90
Clay 5 (Top)	1	Maximum	0.027	0.196	21.0	2.1	0.61
		Minimum	0.027	0.196	21.0	2.1	0.61
		Average	0.027	0.196	21.0	2.1	0.61
Clay 5 (Bottom)	2	Maximum	0.063	0.193	23.2	1.6	0.77
		Minimum	0.032	0.156	18.4	2.0	0.62
		Average	0.048	0.175	20.8	1.8	0.70
Clay 7	1	Maximum	0.030	0.199	26.9	1.7	0.67
		Minimum	0.030	0.199	26.9	1.7	0.67
		Average	0.030	0.199	26.9	1.7	0.67
Clay 9	5	Maximum	0.037	0.309	43.0	1.9	0.91
		Minimum	0.015	0.140	22.1	1.0	0.47
		Average	0.030	0.217	35.4	1.5	0.69
Clay 11	6	Maximum	0.056	0.455	49.6	1.7	1.02
		Minimum	0.020	0.252	28.2	1.0	0.88
		Average	0.039	0.343	41.0	1.5	0.95
Clay 13	2	Maximum	0.038	0.233	50.0	1.6	0.80
		Minimum	0.037	0.149	41.1	1.2	0.50
		Average	0.038	0.191	45.6	1.4	0.68
Clay 17	1	Maximum	0.020	0.126	50.7	1.2	0.52
		Minimum	0.020	0.126	50.7	1.2	0.52
		Average	0.020	0.126	50.7	1.2	0.52

(a) Recompression index, C_r.
(b) Compression index, C_c.
(c) Preconsolidation pressure, P_c’.
(d) Overconsolidation Ratio, OCR.
(e) Initial void ratio, e_0.

Table 2.5.4-25
Summary of Laboratory Consolidation Test Properties for Cohesive Soil Strata (Cooling Basin)

Stratum	Constant Rate-of-Strain (CRS) Tests							Load-Controlled (LC) Tests						
	No. of Tests	Statistics	C_r (a)	C_c (b)	P_c' (ksf) (c)	OCR (d)	e_o (e)	No. of Tests	Statistics	C_r (a)	C_c (b)	P_c' (ksf) (c)	OCR (d)	e_o (e)
Clay 1 (Top)	3	Maximum	0.027	0.104	9.3		0.67		Maximum	0.020	0.156	13.4		0.56
		Minimum	0.018	0.100	3.8	5.6	0.60	2	Minimum	0.003	0.149	12.2	16.9	0.51
		Average	0.023	0.102	6.4		0.64		Average	0.012	0.153	12.8		0.54
Clay 1 (Bottom)	6	Maximum	0.070	0.165	43.9		0.85		Maximum	0.035	0.252	15.5		0.91
		Minimum	0.012	0.113	10.0	6.6	0.55	3	Minimum	0.010	0.153	10.4	3.6	0.70
		Average	0.049	0.138	27.2		0.69		Average	0.026	0.198	13.6		0.79
Clay 3	6	Maximum	0.083	0.180	31.0		0.89		Maximum	0.028	0.226	18.0		0.87
		Minimum	0.009	0.095	15.7	3.4	0.44	2	Minimum	0.025	0.189	12.7	2.4	0.77
		Average	0.041	0.131	24.5		0.63		Average	0.027	0.208	15.4		0.82
Clay 5 (Top)	5	Maximum	0.103	0.181	33.3		0.74		Maximum	0.033	0.203	24.2		0.87
		Minimum	0.020	0.120	13.1	2.8	0.58	3	Minimum	0.025	0.186	11.2	1.9	0.71
		Average	0.055	0.150	26.9		0.65		Average	0.028	0.195	17.7		0.78
Clay 5 (Bottom)	1	Maximum	0.064	0.273	40.0		1.00		Maximum	—	—	—		—
		Minimum	0.064	0.273	40.0	3.8	1.00	—	Minimum	—	—	—	—	—
		Average	0.064	0.273	40.0		1.00		Average	—	—	—		—

(a) Recompression index, C_r.
(b) Compression index, C_c.
(c) Preconsolidation pressure, P_c'.
(d) Overconsolidation Ratio, OCR.
(e) Initial void ratio, e_0.

Table 2.5.4-26
Overconsolidation Ratios and Preconsolidation Pressures of Cohesive Soil Strata (Power Block Area)

Stratum	Average OCR			Average P'c (ksf)	
	From Consolidation Tests	From CPTs	Values for Use	From Consolidation Tests	Values for Use
Clay 1	4.5	6.0	5.3	10.9	10
Clay 3	2.6	1.9	2.1	16.9	16
Clay 5	1.9	—	1.9	20.9	20
Clay 7	1.7	—	1.7	26.9	25
Clay 9	1.5	—	1.5	35.4	35
Clay 11	1.5	—	1.5	41.0	40
Clay 13	1.4	—	1.4	45.6	45
Clay 15	—	—	1.3	—	47
Clay 17	1.2	—	1.2	50.7	50

Table 2.5.4-27
Overconsolidation Ratios and Preconsolidation Pressures of Cohesive Soil Strata (Cooling Basin)

	Average OCR			Average P'c (ksf)	
Stratum	**From Consolidation Tests**	**From CPTs**	**Values for Use**	**From Consolidation Tests**	**Values for Use**
Clay 1	9.0[(a)]	5.2	7	13.3[(a)]	15
	6.1[(b)]			16.0[(b)]	
Clay 3	2.4[(a)]	2.2	3	15.4[(a)]	20
	3.4[(b)]			24.5[(b)]	
Clay 5	1.9[(a)]	1.2	2	17.7[(a)]	23
	3.3[(b)]			29.1[(b)]	

(a) From load-controlled (LC) consolidation tests (Reference 2.5.4-47).
(b) From constant rate-of-strain consolidation tests (Reference 2.5.4-48).

Table 2.5.4-28
High Strain Elastic Moduli Values (Power Block Area)

E-Values (ksf)				
Stratum	**From $(N_1)_{60}$**	**From s_u**	**From V_s**	**Values for Use**
Clay 1(Top)	—	1920	1437	2020
Sand 1	1044	—	1271	1160
Clay 1 (Bottom)	—	1920	2792	2020
Sand 2	936	—	1225	1080
Clay 3	—	1800	2885	2340
Sand 4	1980	—	2739	2360
Clay 5 (Top)	—	1800	4665	3090
Sand 5	1404	—	2018	1710
Clay 5 (Bottom)	—	1800	4088	3090
Sand 6	2196	—	2331	2260
Clay 7	—	3600	6262	4930
Sand 8	2736	—	2919	2830
Clay 9	—	2400	5124	3760
Sand 10	3852	—	2909	3380
Clay 11	—	3000	4143	3570
Sand 12	2196	—	3632	2910
Clay 13	—	3600	6307	4950
Sand 14	2376	—	3616	3000
Clay 15	—	3660	7841	5750
Sand 16	2484	—	3407	2950
Clay 17	—	3360	10,007	6680
Sand 18	3600	—	4328	3960

Table 2.5.4-29
High Strain Elastic Moduli Values (Cooling Basin)

E-Values (ksf)				
Stratum	**From $(N_1)_{60}$**	**From s_u**	**From V_s**	**Values for Use**
Clay 1(Top)	—	1800	1531	1950
Sand 1	1080	—	616	850
Clay 1 (Bottom)	—	1800	2679	1950
Sand 2	1368	—	1048	1210
Clay 3	—	1930	3297	2850
Sand 4	1224	—	1488	1360
Clay 5 (Top)	—	2380	4177	3340
Sand 5	1512	—	1944	1730
Clay 5 (Bottom)	—	2380	4426	3340
Sand 6	1260	—	1807	1530
Clay 7	—	2370	4066	2660
Sand 8	1296	—	2747	2020
Clay 9	—	960	5767	3360
Sand 10	—	—	3201	3200
Clay 11	—	—	5433	5430

Table 2.5.4-30
High Strain Shear Moduli Values (Power Block Area)

Stratum	G (ksf)
Clay 1	700
Sand 1	450
Sand 2	420
Clay 3	810
Sand 4	910
Clay 5	1070
Sand 5	660
Sand 6	870
Clay 7	1700
Sand 8	1090
Clay 9	1300
Sand 10	1300
Clay 11	1230
Sand 12	1120
Clay 13	1710
Sand 14	1150
Clay 15	1980
Sand 16	1130
Clay 17	2300
Sand 18	1520

Table 2.5.4-32 (Sheet 1 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[(a)]	Clay 1	Sand 1	Sand 2	Clay 3	Sand 4
Average thickness, feet	41.9[(b)]	8.8	12.3	24.0	26.6
USCS symbol	CL, CH	SC	SC, SM, ML	CL, CH	SC, SC-SM
Natural moisture content (MC), %	20	16	18.5	24.8	17.5
Total unit weight (γ_{total}), pcf	129	135	135	119	132
Fines content, %	80	40	40	75	25
Liquid limit (LL), %	55	N/A[(c)]	N/A[(c)]	53	N/A[(c)]
Plasticity index (PI), %	35	N/A[(c)]	N/A[(c)]	35	N/A[(c)]
Uncorrected SPT N-value, bpf	15	26	30	25	82
Corrected SPT $(N_1)_{60}$-value, bpf	19	29	26	19	55
Shear wave velocity, ft/sec	785	1,080	1,060	992	1,603
Undrained shear strength (s_u), ksf	3.2	N/A[(c)]	N/A[(c)]	3	N/A[(c)]
Friction angle (Φ'), degree	N/A[(c)]	33	33	N/A[(c)]	37
Elastic modulus (high strain) (E), ksf	2020	1160	1080	2340	2360
Shear modulus (high strain) (G), ksf	700	450	420	810	910
Shear modulus (low strain) (G_{max}), ksf	2521	4890	4711	3637	10,534
Earth Pressure Coefficients					
Active (K_a)	0.50	0.30	0.30	0.50	0.24
Passive (K_p)	2.00	3.40	3.40	2.00	4.00
At Rest (K_0)	0.70	0.45	0.45	0.70	0.40
Coefficient of sliding	0.30	0.40	0.40	0.30	0.45
Consolidation Properties					
C_c (C_r)	0.132 (0.021)	N/A[(c)]	N/A[(c)]	0.257 (0.045)	N/A[(c)]
Void ratio, e_o	0.54	N/A[(c)]	N/A[(c)]	0.90	0.48
P_c', ksf (OCR)	10.0 (5.0)	N/A[(c)]	N/A[(c)]	16.0 (2.1)	N/A[(c)]

Table 2.5.4-32 (Sheet 1 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[(a)]	Clay 1	Sand 1	Sand 2	Clay 3	Sand 4
Average thickness, feet	41.9[(b)]	8.8	12.3	24.0	26.6
USCS symbol	CL, CH	SC	SC, SM, ML	CL, CH	SC, SC-SM
Natural moisture content (MC), %	20	16	18.5	24.8	17.5
Total unit weight (γ_{total}), pcf	129	135	135	119	132
Fines content, %	80	40	40	75	25
Liquid limit (LL), %	55	N/A[(c)]	N/A[(c)]	53	N/A[(c)]
Plasticity index (PI), %	35	N/A[(c)]	N/A[(c)]	35	N/A[(c)]
Uncorrected SPT N-value, bpf	15	26	30	25	82
Corrected SPT $(N_1)_{60}$-value, bpf	19	29	26	19	55
Shear wave velocity, ft/sec	785	1,080	1,060	992	1,603
Undrained shear strength (s_u), ksf	3.2	N/A[(c)]	N/A[(c)]	3	N/A[(c)]
Friction angle (Φ'), degree	N/A[(c)]	33	33	N/A[(c)]	37
Elastic modulus (high strain) (E), ksf	2020	1160	1080	2340	2360
Shear modulus (high strain) (G), ksf	700	450	420	810	910
Shear modulus (low strain) (G_{max}), ksf	2521	4890	4711	3637	10,534
Earth Pressure Coefficients					
Active (K_a)	0.50	0.30	0.30	0.50	0.24
Passive (K_p)	2.00	3.40	3.40	2.00	4.00
At Rest (K_0)	0.70	0.45	0.45	0.70	0.40
Coefficient of sliding	0.30	0.40	0.40	0.30	0.45
Consolidation Properties					
C_c (C_r)	0.132 (0.021)	N/A[(c)]	N/A[(c)]	0.257 (0.045)	N/A[(c)]
Void ratio, e_o	0.54	N/A[(c)]	N/A[(c)]	0.90	0.48
P_c', ksf (OCR)	10.0 (5.0)	N/A[(c)]	N/A[(c)]	16.0 (2.1)	N/A[(c)]

Table 2.5.4-32 (Sheet 2 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[(a)]	Clay 5	Sand 5	Sand 6	Clay 7	Sand 8
Average thickness, feet	28.4[(b)]	12.9	50.0	45.2	32.7
USCS symbol	CH, CL	SC, SC-SM	SC, SP-SM	CH, CL	SC, SC-SM
Natural moisture content (MC), %	25	20	19	21	21
Total unit weight (γ_{total}), pcf	127	132	132	125	132
Fines content, %	85	25	15	75	30
Liquid limit (LL), %	60	N/A[(c)]	N/A[(c)]	51	N/A[(c)]
Plasticity index (PI), %	40	N/A[(c)]	N/A[(c)]	30	N/A[(c)]
Uncorrected SPT N-value, bpf	26	62	98	66	118
Corrected SPT $(N_1)_{60}$-value, bpf	16	39	61	40	76
Shear wave velocity, ft/sec	1136	1376	1479	1445	1655
Undrained shear strength (s_u), ksf	3	N/A[(c)]	N/A[(c)]	6	N/A[(c)]
Friction angle (Φ'), degree	N/A[(c)]	36	39	N/A[(c)]	36
Elastic modulus (high strain) (E), ksf	3090	1710	2260	4930	2830
Shear modulus (high strain) (G), ksf	1070	660	870	1700	1090
Shear modulus (low strain) (G_{max}), ksf	5090	7762	8967	8106	11,228
Earth Pressure Coefficients					
Active (K_a)	0.50	0.26	N/A[(c)]	N/A[(c)]	N/A[(c)]
Passive (K_p)	2.00	3.80	N/A[(c)]	N/A[(c)]	N/A[(c)]
At Rest (K_0)	0.70	0.40	N/A[(c)]	N/A[(c)]	N/A[(c)]
Coefficient of sliding	0.30	0.45	N/A[(c)]	N/A[(c)]	N/A[(c)]
Consolidation Properties					
C_c (C_r)	0.185 (0.038)	N/A[(c)]	N/A[(c)]	0.199 (0.030)	N/A[(c)]
Void ratio, e_o	0.7	N/A[(c)]	N/A[(c)]	0.67	N/A[(c)]
P_c', ksf (OCR)	20.0 (1.9)	N/A[(c)]	N/A[(c)]	25.0 (1.6)	N/A[(c)]

Table 2.5.4-32 (Sheet 3 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[a]	Clay 9	Sand 10	Clay 11	Sand12	Clay 13	Sand 14
Average thickness, feet	44.7	28.5	46.9	20.6	75.8	39.7
USCS symbol	CH, CL	SM, SC	CH, CL	SM	CH, ML	SC, SM
Natural moisture content (MC), %	23.5	N/A[c]	28	14.5	27.5	22
Total unit weight (γ_{total}), pcf	126	132	119	132	126	132
Fines content, %	90	25	85	25	95	30
Liquid limit (LL), %	59	N/A[c]	63	N/A[c]	67	N/A[c]
Plasticity index (PI), %	35	N/A[c]	40	N/A[c]	40	N/A[c]
Uncorrected SPT N-value, bpf	50	164	45	100	44	102
Corrected SPT $(N_1)_{60}$-value, bpf	31	100	30	61	28	66
Shear wave velocity, ft/sec	1252	1652	1146	1846	1361	1842
Undrained shear strength (s_u), ksf	4	N/A[c]	5	N/A[c]	6	N/A[c]
Friction angle (Φ’), degree	N/A[c]	38	N/A[c]	36	N/A[c]	36
Elastic modulus (high strain) (E), ksf	3760	3380	3570	2910	4950	3000
Shear modulus (high strain) (G), ksf	1300	1300	1230	1120	1710	1150
Shear modulus (low strain) (G_{max}), ksf	6134	11,188	4854	13,970	7248	13,909
Earth Pressure Coefficients						
Active (K_a)	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]
Passive (K_p)	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]
At Rest (K_0)	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]
Coefficient of sliding	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]
Consolidation Properties						
C_c (C_r)	0.122 (0.030]	N/A[c]	0.343 (0.039)	N/A[c]	0.190 (0.038)	N/A[c]
Void ratio, e_o	0.7	N/A[c]	0.95	N/A[c]	0.68	N/A[c]
P_c’, ksf (OCR)	35.0 (1.5)	N/A[c]	40.0 (1.5)	N/A[c]	45.0 (1.4)	N/A[c]

Table 2.5.4-32 (Sheet 4 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[(a)]	Clay 15	Sand 16	Clay 17	Sand 18	Structural Fill (CW&A#4)
Average thickness, feet	11.8	16.5	21.2	>9.1	N/A[(c)]
USCS symbol	CH	SM, SC	CL, CH	SM	GW-GC
Natural moisture content (MC), %	22.5	N/A[(c)]	18.5	13	6
Total unit weight (γ_{total}), pcf	126	132	131	132	138
Fines content, %	95	25	75	25	7
Liquid limit (LL), %	69	N/A[(c)]	46	N/A[(c)]	N/A[(c)]
Plasticity index (PI), %	45	N/A[(c)]	30	N/A[(c)]	N/A[(c)]
Uncorrected SPT N-value, bpf	55	111	69	N/A[(c)]	N/A
Corrected SPT $(N_1)_{60}$-value, bpf	33	69	45	100	30[(d)]
Shear wave velocity, ft/sec	1479	1788	1793	2015	700/1000[(e)]
Undrained shear strength (s_u), ksf	6.1	N/A[(c)]	5.6	N/A[(c)]	N/A[(c)]
Friction angle (Φ'), degree	N/A[(c)]	38	N/A[(c)]	40	39
Elastic modulus (high strain) (E), ksf	5750	2950	6680	3960	1100
Shear modulus (high strain) (G), ksf	1980	1130	2300	1520	400
Shear modulus (low strain) (G_{max}), ksf	8560	13,105	13,079	16,644	2100/4280[(f)]
Earth Pressure Coefficients					
Active (K_a)	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	0.23
Passive (K_p)	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	4.40
At Rest (K_0)	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	0.50
Coefficient of sliding	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	0.55
Consolidation Properties					
C_c (C_r)	0.190 (0.038)	N/A[(c)]	0.126 (0.020)	N/A[(c)]	N/A[(c)]
Void ratio, e_o	0.68	N/A[(c)]	0.80	N/A[(c)]	N/A[(c)]
P_c', ksf (OCR)	47.0 (1.3)	N/A[(c)]	50.0 (1.2)	N/A[(c)]	N/A[(c)]

(a) The values tabulated above are for use as guideline only. Reference should be made to specific boring and CPT logs and laboratory test results for appropriate modifications at specific locations and for specific calculations.
(b) Thicknesses of Clay 1 (Top) and Clay 1 (Bottom) are combined. Thicknesses of Clay 5 (Top) and Clay 5 (Bottom) are combined.
(c) N/A indicates that the property is either not measured or not applicable.
(d) Estimated values.
(e) Value varies with depth: 700 ft/sec for the upper 15 feet; 1000 ft/sec for the depths from 15 feet to 110 feet (the deepest excavation).
(f) Value varies with depth: 2100 ksf for the upper 15 feet; 4280 ksf for the depths from 15 feet to 110 feet.

Table 2.5.4-33 (Sheet 1 of 4)
Geotechnical Engineering Parameters Selected for Design (Cooling Basin)

Parameter[a]	**Clay 1**	**Sand 1**	**Sand 2**	**Clay 3**	**Sand 4**
Average thickness, feet	27.7[b]	14.6	17.7	19.1	24.8
USCS symbol	CL, CH	SC	SC, SM, ML	CL, CH	SC, SC-SM
Natural moisture content (MC), %	20	16	17	23	21
Total unit weight (γ_{total}), pcf	125	126	125	123	123
Fines content, %	80	27	28	78	17
Liquid limit (LL), %	51	N/A[c]	N/A[c]	57	N/A[c]
Plasticity index (PI), %	30	N/A[c]	N/A[c]	35	N/A[c]
Uncorrected SPT N-value, bpf	16	23	43	20	50
Corrected SPT $(N_1)_{60}$-value, bpf	21	30	38	16	34
Shear wave velocity, ft/sec	821	778	1015	1019	1224
Undrained shear strength (s_u), ksf	NA[d],[e]	N/A[c]	N/A[c]	NA[d],[e]	N/A[c]
Friction angle (Φ'), degree	28[e]	40[e]	40[e]	28[e]	40[e]
Elastic modulus (high strain) (E), ksf	1950	850	1210	2850	1360
Shear modulus (high strain) (G), ksf	670	330	470	980	520
Shear modulus (low strain) (G_{max}), ksf	2640	2370	4030	3970	5720
Earth Pressure Coefficients					
Active (K_a)	0.50	0.25	0.25	0.50	0.25
Passive (K_p)	2.00	4.00	4.00	2.00	4.00
At Rest (K_0)	0.70	0.40	0.40	0.70	0.40
Coefficient of sliding	0.30	0.45	0.45	0.30	0.45
Consolidation Properties					
C_c (C_r)	0.148 (0.0270)	N/A[c]	N/A[c]	0.169 (0.034)	N/A[c]
Void ratio, e_o	0.638	N/A[c]	N/A[c]	0.723	N/A[c]
P_c', ksf (OCR)	15 (8.2)	N/A[c]	N/A[c]	20 (3.0)	N/A[c]

Table 2.5.4-33 (Sheet 2 of 4)
Geotechnical Engineering Parameters Selected for Design (Cooling Basin)

Parameter[a]	Clay 5	Sand 5	Sand 6	Clay 7	Sand 8
Average thickness, feet	27.0[b]	12.6	23.9	27.3	26.6
USCS symbol	CH, CL	SC, SC-SM	SC, SP-SM	CH, CL	SC, SC-SM
Natural moisture content (MC), %	23	21	21	21[f]	21[f]
Total unit weight (γ_{total}), pcf	125	123	123	125	123
Fines content, %	86	27	28	77	36
Liquid limit (LL), %	53	N/A[c]	N/A[c]	51[f]	N/A[c]
Plasticity index (PI), %	35	N/A[c]	N/A[c]	30[f]	N/A[c]
Uncorrected SPT N-value, bpf	32	72	69	37	98
Corrected SPT $(N_1)_{60}$-value, bpf	20	42	35	17	36
Shear wave velocity, ft/sec	1153	1399	1349	1314	1663
Undrained shear strength (s_u), ksf	NA[d],[e]	N/A[c]	N/A[c]	NA[d],[e]	N/A[c]
Friction angle (Φ’), degree	28[e]	40[e]	40[e]	28[e]	40[e]
Elastic modulus (high strain) (E), ksf	3340	1730	1530	2660	2020
Shear modulus (high strain) (G), ksf	1150	670	590	920	780
Shear modulus (low strain) (G_{max}), ksf	5170	7476	6950	6700	10,560
Earth Pressure Coefficients					
Active (K_a)	0.50	0.25	N/A[c]	N/A[c]	N/A[c]
Passive (K_p)	2.00	4.00	N/A[c]	N/A[c]	N/A[c]
At Rest (K_0)	0.55	0.40	N/A[c]	N/A[c]	N/A[c]
Coefficient of sliding	0.70	0.45	N/A[c]	N/A[c]	N/A[c]
Consolidation Properties					
C_c (C_r)	0.148 (0.053)	N/A[c]	N/A[c]	0.199 (0.030)[f]	N/A[c]
Void ratio, e_o	0.85	N/A[c]	N/A[c]	0.67[f]	N/A[c]
P_c’, ksf (OCR)	25.0 (2.0)	N/A[c]	N/A[c]	25 (1.6)[f]	N/A[c]

Table 2.5.4-33 (Sheet 3 of 4)
Geotechnical Engineering Parameters Selected for Design (Cooling Basin)

Parameter[(a)]	Clay 9	Sand 10	Clay 11
Average thickness, feet	40.9	32.5	>15
USCS symbol	CH, CL	SM, SC	CH, CL
Natural moisture content (MC), %	28.5	N/A[(c)]	28[(f)]
Total unit weight (γ_{total}), pcf	125	123	125
Fines content, %	88	26	85
Liquid limit (LL), %	58	N/A[(c)]	63[(f)]
Plasticity index (PI), %	35	N/A[(c)]	40[(f)]
Uncorrected SPT N-value, bpf	41	164[(f)]	45[(f)]
Corrected SPT $(N_1)_{60}$-value, bpf	13	98[(f)]	29[(f)]
Shear wave velocity, ft/sec	1506	1733	1465
Undrained shear strength (s_u), ksf	NA[(d),(e)]	N/A[(c)]	NA[(d),(e)]
Friction angle (Φ'), degree	28[(e)]	40[(e)]	28[(e)]
Elastic modulus (high strain) (E), ksf	3360	3200	5430
Shear modulus (high strain) (G), ksf	1160	1230	1870
Shear modulus (low strain) (G_{max}), ksf	8800	12,310	7930
Earth Pressure Coefficients			
Active (K_a)	N/A[(c)]	N/A[(c)]	N/A[(c)]
Passive (K_p)	N/A[(c)]	N/A[(c)]	N/A[(c)]
At Rest (K_0)	N/A[(c)]	N/A[(c)]	N/A[(c)]
Coefficient of sliding	N/A[(c)]	N/A[(c)]	N/A[(c)]
Consolidation Properties			
C_c (C_r)	0.122 (0.030)[(f)]	N/A[(c)]	0.343 (0.039)[(f)]
Void ratio, e_o	0.70[(f)]	N/A[(c)]	0.95[(f)]
P_c', ksf (OCR)	35 (1.5)[(f)]	N/A[(c)]	40.0 (1.5)[(f)]

Table 2.5.4-33 (Sheet 4 of 4)
Geotechnical Engineering Parameters Selected for Design (Cooling Basin)

Parameter[(a)]	Drainage Sand (ASTM C33 & C144)	Embankment Fill (Composite "A"/Sand)	Embankment Fill (Composite "B"/Clay)
Average thickness, feet	N/A[(c)]	N/A[(c)]	N/A[(c)]
USCS symbol	SP/SP	SC	CL
Natural moisture content (MC), %	5 & 4	13	18
Total unit weight (γ_{total}), pcf	111 & 108	137	134
Fines content, %	1 & 2	46	74
Liquid limit (LL), %	N/A[(c)]	34	44
Plasticity index (PI), %	N/A[(c)]	22	29
Uncorrected SPT N-value, bpf	N/A[(c)]	N/A[(c)]	N/A[(c)]
Corrected SPT $(N_1)_{60}$-value, bpf	N/A[(c)]	N/A[(c)]	N/A[(c)]
Shear wave velocity, ft/sec	N/A[(c)]	1,160	950
Undrained shear strength (s_u), ksf	N/A[(c)]	NA[(g),(e)]	NA[(g),(e)]
Friction angle (Φ'), degree	37 & 36	30[(e)]	30[(e)]
Elastic modulus (high strain) (E), ksf	N/A[(c)]	600 x s_u[(g),(e)]	600 x s_u[(g),(e)]
Shear modulus (high strain) (G), ksf	N/A[(c)]	N/A[(c)]	N/A[(c)]
Shear modulus (low strain) (G_{max}), ksf	N/A[(c)]	5,690	3,710
Earth Pressure Coefficients			
Active (K_a)	N/A[(c)]	N/A[(c)]	N/A[(c)]
Passive (K_p)	N/A[(c)]	N/A[(c)]	N/A[(c)]
At Rest (K_0)	N/A[(c)]	N/A[(c)]	N/A[(c)]
Coefficient of sliding	N/A[(c)]	N/A[(c)]	N/A[(c)]
Consolidation Properties			
C_c [C_r]	N/A[(c)]	N/A[(c)]	N/A[(c)]
Void ratio, e_o	N/A[(c)]	N/A[(c)]	N/A[(c)]
P_c', ksf [OCR]	N/A[(c)]	N/A[(c)]	N/A[(c)]

(a) The values tabulated above are for use as guideline only. Reference should be made to specific boring and CPT logs and laboratory test results for appropriate modifications at specific locations and for specific calculations.
(b) Thicknesses of Clay 1 (Top) and Clay 1 (bottom) are combined. Thicknesses of Clay 5 (Top) and Clay 5 (Bottom) are combined.
(c) N/A indicates that the property is either not measured or not applicable.
(d) Values are a function of effective stress (refer to Subsection 2.5.5 text and Figure 2.5.5-12).
(e) Under plane strain conditions.
(f) Values are carried over from the Power Block area (Table 2.5.4-32).
(g) Values are a function of effective stress (refer to Subsection 2.5.5 text and Figure 2.5.5-10).

Table 2.5.4-34
Field Electrical Resistivity Test Results (Power Block Area)

Resistivity (ohm-m)											
		Spacing (feet)									
		3	5	7.5	10	15	30	50	100	200	300
		Inferred Strata									
ER Test Location	Surface El. (feet)	Clay 1	Clay 1	Clay 1	Clay 1	Clay 1	Clay 1	Clay 1	Clay 1	Sand 2/ Clay 3/ Sand 4	Clay5/ Sand 5
R-2101	80.5	296	219	197	193	184	158	146	175	234	263
R-2102	80.5	326	245	210	198	184	175	146	175	292	327
R-2201	80.7	235	207	180	163	140	140	175	234	350	350
R-2202	80.7	270	213	175	158	140	123	146	175	292	245
Minimum		235	207	175	158	140	123	146	175	234	245
Maximum		326	245	210	198	184	175	175	234	350	350
Average		282	221	190	178	162	149	153	190	292	296

Table 2.5.4-35
Soil Chemistry Evaluation Guidelines
(Power Block Area; Cooling Basin)

Potential for Attack on Buried Steel (Corrosiveness/Chlorides)					
	Range for Corrosiveness				
Property	**Little Corrosive**	**Mildly Corrosive**	**Moderately Corrosive**	**Corrosive**	**Very Corrosive**
Resistivity (ohm-m)	>100[a],[b]	20-100[a] 50-100[b] >30[b,(c)]	10-20[a] 20-50[b]	5-10[a] 7-20[b]	<5[a] <2[b]
pH	–	>5 and <10[b]	–	5-6.5[a]	<5[a]
Chlorides (ppm)	–	<200[b]	–	300-1000[a]	>1000[a]

(a) Reference A.
(b) Reference B.
(c) Reference B, provided 5<pH<10, chlorides <200 ppm, and sulphates <1000 ppm.

Potential for Attack on Normal Weight Concrete in Contact with the Ground (Aggressiveness/Sulphates)[a]			
Concrete Exposure	**Water Soluble Sulphate (SO_4) in Soil (%)**	**Cement Type[b]**	**Water Cement Ratio (Maximum)**
Mild	0.00-0.10	—	—
Moderate	0.10-0.20	II, IP(MS), IS(MS)	0.50
Severe	0.20-2.00	V[c]	0.45
Very Severe	Over 2.00	V (with Pozzolan)	0.45

(a) Reference C.
(b) Per ASTM C 150 or ASTM C 595
(c) Or a blend of Type II cement and a ground granulated blast furnace slag or a pozzolan that gives equivalent sulphate resistance.

References:

A American Petroleum Institute. Cathodic Protection of Above Ground Petroleum Storage Tanks, API Recommended Practice No. 651, Washington D.C., 1991.

B STS Consultants, Inc. Reinforced Soil Structures, Volume 1, Design and Construction Guidelines, FHWA Report No. FHWA-RD-89-043, McLean, VA, 1990.

C American Concrete Institute. Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1994.

Table 2.5.4-36 (Sheet 1 of 3)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[a]	Easting (feet)[a]	Ground Surface Elevation (feet)[b]	Depth (feet)	Base Elevation (feet)[b]
Power Block Area (Unit 1)					
B-2150	13,412,560.45	2,599,590.93	80.44	150.00	–69.56
B-2151	13,412,636.54	2,599,654.12	80.41	200.00	–119.59
B-2152	13,412,705.76	2,599,720.24	80.26	150.00	–69.74
B-2153	13,412,821.99	2,599,842.54	80.23	150.10	–69.87
B-2154	13,412,450.91	2,599,619.84	80.54	150.00	–69.46
B-2155	13,412,471.13	2,599,698.69	80.36	150.00	–69.64
B-2156	13,412,548.01	2,599,760.77	80.25	201.50	–121.25
B-2157	13,412,623.72	2,599,823.05	80.07	150.00	–69.93
B-2158	13,412,749.59	2,599,928.77	80.45	100.00	–19.55
B-2159	13,412,476.54	2,599,788.95	80.40	211.50	–131.10
B-2160	13,412,180.67	2,599,627.24	80.43	200.00	–119.57
B-2161	13,412,263.41	2,599,698.18	80.49	150.00	-69.51
B-2162A	13,412,385.92	2,599,799.34	80.16	202.80	–122.64
B-2162A Offset	13,412,378.65	2,599,792.16	80.05	210.00	–129.95
B-2163	13,412,463.50	2,599,862.07	79.85	150.00	–70.15
B-2164	13,412,537.94	2,599,925.58	80.38	151.40	–71.02
B-2165	13,412,661.24	2,600,035.28	80.13	150.00	–69.87
B-2166	13,412,109.03	2,599,713.14	80.50	150.00	–69.50
B-2167	13,412,192.20	2,599,781.27	80.19	150.00	–69.81
B-2168	13,412,294.30	2,599,891.10	80.12	201.50	–121.38
B-2169	13,412,350.21	2,599,938.43	79.47	400.00	–320.53
B-2170	13,412,413.86	2,599,989.72	79.68	300.00	–220.32
B-2170R	13,412,396.19	2,599,989.32	79.18	300.00	–220.82
B-2171	13,412,488.43	2,600,092.96	80.03	81.50	–1.47
B-2171R	13,412,479.95	2,600,074.23	79.97	300.00	–220.03
B-2172	13,412,096.23	2,599,829.90	80.10	100.00	–19.90
B-2173	13,412,224.54	2,599,944.52	79.59	300.00	–220.41
B-2174A	13,412,299.46	2,600,000.64	80.11	601.00	–520.89
B-2174A Offset	13,412,316.51	2,599,991.79	79.28	617.00	–537.72
B-2174UD	13,412,276.56	2,600,005.51	78.58	301.40	–222.82
B-2174UDR	13,412,303.29	2,600,012.41	78.98	593.00	–514.02
B-2175	13,412,370.49	2,600,062.81	80.12	200.00	–119.88
B-2176A	13,412,511.69	2,600,175.17	79.81	200.00	–120.19
B-2176A Offset	13,412,522.55	2,600,178.10	79.99	210.00	–130.01
B-2177	13,412,196.92	2,600,000.49	79.61	150.00	–70.39
B-2178	13,412,315.44	2,600,107.24	79.53	151.10	–71.57
B-2179	13,412,424.96	2,600,168.71	79.78	200.00	–120.22
B-2180	13,412,247.39	2,600,062.56	78.85	200.00	–121.15
B-2181	13,412,143.28	2,600,062.56	79.24	151.30	–72.06
B-2182A	13,412,219.77	2,600,133.20	79.69	399.80	–320.11
B-2182A Offset	13,412,209.92	2,600,137.01	79.70	410.00	–330.30
B-2182UD	13,412,207.39	2,600,143.80	79.47	401.90	–322.43
B-2183	13,412,265.91	2,600,166.16	79.63	151.30	–71.67
B-2184	13,412,295.45	2,600,305.41	79.71	151.20	–71.49
B-2285	13,412,682.80	2,600,322.38	80.35	151.20	–70.85

Table 2.5.4-36 (Sheet 2 of 3)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)(a)	Easting (feet)(a)	Ground Surface Elevation (feet)(b)	Depth (feet)	Base Elevation (feet)(b)
Power Block Area (Unit 2)					
B-2250	13,413,327.46	2,600,233.62	81.05	151.30	–70.25
B-2251	13,413,404.52	2,600,297.97	80.79	210.00	–129.21
B-2252	13,413,478.24	2,600,360.51	80.74	153.40	–72.66
B-2253	13,413,587.94	2,600,484.98	80.86	150.00	–69.14
B-2254	13,413,216.45	2,600,262.92	80.54	151.40	–70.86
B-2255	13,413,238.32	2,600,340.81	80.67	151.30	–70.63
B-2256	13,413,314.37	2,600,403.14	80.26	200.00	–119.74
B-2257	13,413,389.48	2,600,466.52	80.78	151.40	–70.62
B-2258	13,413,515.61	2,600,571.48	80.75	100.00	–19.25
B-2259	13,413,243.36	2,600,432.64	80.35	210.00	–129.65
B-2260	13,412,945.84	2,600,269.60	80.71	198.90	–118.19
B-2261	13,413,029.99	2,600,340.99	80.50	151.50	–71.00
B-2262A	13,413,146.75	2,600,442.41	80.42	200.00	–119.58
B-2262A Offset	13,413,146.80	2,600,433.53	80.57	210.00	–129.43
B-2263	13,413,227.48	2,600,506.73	80.43	151.10	–70.67
B-2264	13,413,303.45	2,600,569.40	80.51	151.00	–70.49
B-2265	13,413,424.28	2,600,677.27	80.60	154.00	–73.40
B-2266	13,412,873.85	2,600,353.67	80.67	149.50	–68.83
B-2267	13,412,957.87	2,600,424.20	80.74	149.50	–68.76
B-2268	13,413,056.37	2,600,528.54	80.58	200.00	–119.42
B-2269	13,413,117.17	2,600,582.50	80.45	403.30	–322.85
B-2269UD	13,413,092.19	2,600,593.55	80.06	402.10	–322.04
B-2270	13,413,179.24	2,600,633.41	80.62	300.00	–219.38
B-2271	13,413,253.44	2,600,735.25	80.46	301.20	–220.74
B-2272	13,412,863.17	2,600,472.73	80.22	100.00	–19.78
B-2273	13,412,991.36	2,600,585.49	80.69	399.40	–318.71
B-2274A	13,413,066.34	2,600,642.97	80.86	594.70	–513.84
B-2274A Offset	13,413,070.52	2,600,633.47	80.34	620.00	–539.66
B-2274UD	13,413,047.70	2,600,652.45	80.41	607.70	–527.29
B-2275	13,413,133.62	2,600,702.31	80.49	199.50	–119.01
B-2276A	13,413,276.30	2,600,822.55	80.53	199.50	–118.97
B-2276A Offset	13,413,289.36	2,600,817.99	80.63	210.00	–129.37
B-2277	13,412,961.61	2,600,644.66	80.60	150.30	–69.70
B-2278	13,413,084.23	2,600,745.84	80.69	151.40	–70.71
B-2279	13,413,192.06	2,600,811.88	80.28	198.80	–118.52
B-2280	13,413,014.25	2,600,704.09	80.57	198.10	–117.53
B-2281	13,412,908.71	2,600,705.43	80.42	150.00	–69.58
B-2282A	13,412,970.74	2,600,757.69	80.31	400.00	–319.69
B-2282A Offset	13,412,962.40	2,600,766.39	80.46	410.00	–329.54
B-2283	13,413,031.52	2,600,808.58	80.40	151.20	–70.80
B-2284	13,413,060.61	2,600,948.44	80.42	150.00	–69.58

Table 2.5.4-36 (Sheet 3 of 3)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[a]	Easting (feet)[a]	Ground Surface Elevation (feet)[b]	Depth (feet)	Base Elevation (feet)[b]
Outside Power Block Area					
B-08	13,415,809.85	2,598,937.51	81.71	150.00	–68.29
B-10	13,418,474.15	2,604,736.80	77.69	150.20	–72.51
B-2185	13,412,320.56	2,600,808.84	79.48	151.10	–71.62
B-2301A	13,414,429.68	2,596,278.37	81.23	300.00	–218.77
B-2301	13,414,414.60	2,596,251.62	80.79	310.00	–229.21
B-2307A	13,420,888.12	2,603,157.79	76.75	299.40	–222.65
B-2307	13,420,917.89	2,603,184.91	76.38	310.00	–233.62

(a) Northings and Eastings are referenced to the Texas South Central State Plane (Zone 4204) projected coordinate system, using a horizontal datum of NAD 83 and are in U.S. Survey Feet.

(b) Elevations are referenced to NAVD 88.

Table 2.5.4-37 (Sheet 1 of 2)
As-Built Boring Information (Cooling Basin)

Boring Number	Northing (feet)[(a)]	Easting (feet)[(a)]	Ground Surface Elevation (feet)[(b)]	Depth (feet)	Base Elevation (feet)[(b)]
B-01	13,404,257.08	2,606,680.96	71.46	150.00	–78.54
B-02	13,411,511.00	2,607,865.77	74.68	150.00	–75.32
B-03	13,414,926.74	2,609,291.47	74.89	150.00	–75.11
B-04	13,414,277.17	2,607,437.06	78.97	150.20	–71.23
B-05	13,414,770.02	2,605,821.89	77.56	150.20	–72.64
B-06	13,415,884.18	2,604,971.12	78.98	150.20	–71.22
B-07	13,418,366.17	2,606,567.82	77.39	150.20	–72.81
B-09	13,414,943.90	2,604,897.77	77.36	150.20	–72.84
B-11	13,411,479.49	2,607,866.27	74.77	310.00	–235.23
B-12	13,418,446.37	2,606,546.46	76.70	310.00	–233.30
B-2302A	13,407,371.01	2,598,389.30	80.32	150.00	–69.68
B-2302	13,407,401.61	2,598,386.93	80.00	315.00	–235.00
B-2302UD	13,407,373.35	2,598,406.10	80.00	147.30	–67.30
B-2303A	13,402,308.03	2,600,478.63	75.36	300.00	–224.64
B-2303	13,402,314.55	2,600,497.11	75.56	310.00	–234.44
B-2304A	13,396,556.48	2,608,686.75	68.33	296.50	–228.17
B-2304	13,396,541.80	2,608,710.01	68.12	310.00	–241.88
B-2304UD	13,396,571.12	2,608,693.06	68.46	143.50	–75.04
B-2305A	13,406,652.71	2,621,646.04	65.45	300.00	–234.55
B-2305	13,406,649.21	2,621,680.51	65.58	305.00	–239.42
B-2306A	13,411,450.19	2,615,249.64	64.28	100.00	–35.72
B-2306	13,411,472.15	2,615,253.02	64.68	310.00	–245.32
B-2308	13,404,197.77	2,599,333.56	76.39	100.00	–23.61
B-2310	13,406,601.70	2,601,353.57	75.95	100.00	–24.05
B-2315	13,416,228.72	2,609,409.27	47.06	101.10	–54.04
B-2316	13,413,189.22	2,608,491.76	75.17	100.80	–25.63
B-2317	13,410,598.40	2,600,511.90	76.73	101.00	–24.27
B-2318	13,401,612.98	2,601,154.61	75.31	101.50	–26.19
B-2319	13,403,601.01	2,603,048.72	74.16	151.50	–77.34
B-2319UD	13,403,595.98	2,603,062.86	74.16	115.00	–40.84
B-2320	13,407,573.79	2,606,839.75	71.46	151.50	–80.04
B-2321	13,410,953.82	2,610,037.97	71.62	150.00	–78.38
B-2321UD	13,410,937.49	2,610,017.10	71.81	132.50	–60.69
B-2322	13,413,528.90	2,612,528.69	68.53	100.00	–31.47
B-2324	13,416,308.77	2,612,208.94	24.47	151.20	–126.73
B-2331	13,409,862.54	2,612,278.74	69.37	101.10	–31.73
B-2332	13,414,435.21	2,603,735.80	78.68	100.20	–21.52
B-2333	13,398,864.77	2,603,981.87	76.07	101.50	–25.43
B-2334	13,400,634.86	2,606,130.71	71.85	61.50	10.35
B-2335	13,404,183.94	2,610,412.10	66.75	61.50	5.25
B-2336	13,409,474.40	2,616,874.85	68.00	100.00	–32.00
B-2337	13,407,263.05	2,614,846.26	67.23	100.00	–32.77
B-2338	13,398,220.80	2,606,385.80	68.15	101.70	–33.55

Table 2.5.4-37 (Sheet 2 of 2)
As-Built Boring Information (Cooling Basin)

Boring Number	Northing (feet)(a)	Easting (feet)(a)	Ground Surface Elevation (feet)(b)	Depth (feet)	Base Elevation (feet)(b)
B-2340	13,400,762.63	2,609,812.65	68.09	61.50	6.59
B-2344	13,404,997.85	2,615,527.11	65.78	61.50	4.28
B-2346	13,407,540.56	2,618,951.51	67.09	100.00	–32.91
B-2348	13,409,626.85	2,621,653.06	50.63	150.00	–99.37
B-2349	13,417,352.46	2,607,239.49	76.66	101.20	–24.54
B-2350	13,395,764.08	2,610,122.62	65.25	100.10	–34.85
B-2351	13,398,915.88	2,613,285.96	63.73	100.00	–36.27
B-2352	13,402,480.47	2,617,531.27	62.91	150.00	–87.09
B-2352UD	13,402,493.35	2,617,543.73	62.84	94.50	–31.66
B-2353	13,406,185.70	2,620,582.19	65.60	99.90	–34.30
B-2354	13,418,119.59	2,607,884.13	76.83	100.20	–23.37
B-2355	13,412,008.12	2,611,224.44	71.04	101.70	–30.66
B-2356	13,409,147.49	2,614,293.88	67.71	101.90	–34.19
B-2357	13,404,654.33	2,620,736.11	65.67	100.00	–34.33
B-2358	13,402,101.51	2,611,620.85	66.47	151.50	–85.03
B-2359	13,417,294.57	2,605,500.03	77.57	151.30	–73.73
B-2359UD	13,417,325.03	2,605,493.44	77.35	121.70	–44.35

(a) Northings and Eastings are referenced to the Texas South Central State Plane (Zone 4204) projected coordinate system, using a horizontal datum of NAD 83 and are in U.S. Survey Feet.

(b) Elevations are referenced to NAVD 88.

Table 2.5.4-38 (Sheet 1 of 3)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[(a)]
Power Block Area (Unit 1)					
B-2174UD	UD1	CL	Clay 1 (Top)	10.0	68.6
B-2174UD	UD2	CH	Clay 1 (Bottom)	30.0	48.6
B-2174UD	UD3	CL	Clay 3	75.0	3.6
B-2174UD	UD4	CL	Sand 4	90.0	–11.4
B-2174UD	UD5	CL	Sand 4	92.0	–13.4
B-2174UD	UD6	SP-SC	Sand 4	95.0	–16.4
B-2174UD	UD7	CH	Clay 5 (Top)	115.0	–36.4
B-2174UD	UD8	SM	Sand 6	145.0	–66.4
B-2174UD	UD9	SM	Sand 6	180.0	–101.4
B-2174UD	UD10	SM	Sand 6	183.0	–104.4
B-2174UD	UD11	SM	Sand 6	206.0	–127.4
B-2174UD	UD12	SM	[Sand 6]/ Clay 7	210.0	–131.4
B-2174UD	UD13	CH	Sand 8	245.0	–166.4
B-2174UD	UD14	CH	Sand 8	245.8	–167.2
B-2174UD	UD15	SC	Sand 8	265.0	–186.4
B-2174UD	UD16	CH	Clay 9	300.0	–221.4
B-2174UDR	UD17	CH (Top); SP (Bottom)	Clay 9/ [Sand 10]	319.3	–240.3
B-2174UDR	UD18	SP	Sand 10	324.8	–245.8
B-2174UDR	UD19	CH	Clay 11	334.9	–255.9
B-2174UDR	UD20	CH	Clay 11	359.1	–280.1
B-2174UDR	UD21	CH	Clay 11	397.7	–318.7
B-2174UDR	UD22	CH	Sand 12	409.6	–330.6
B-2174UDR	UD23	CL	Sand 12	419.5	–340.5
B-2174UDR	UD24	No Recovery	Clay 13	425.0	–346.0
B-2174UDR	UD25	No Recovery	Clay 13	442.0	–363.0
B-2174UDR	UD26	CH	Clay 13	445.0	–366.0
B-2174UDR	UD27	CH	Clay 13	490.0	–411.0
B-2174UDR	UD28	SC (Top); SM (Bottom)	Sand 14	525.0	–446.0
B-2174UDR	UD29	CH	Clay 15	550.0	–471.0
B-2174UDR	UD30	CH	Clay 17	570.0	–491.0
B-2174UDR	UD31	CH (Top); SM (Bottom)	Sand 18	590.5	–511.5
B-2182UD	UD1	CL	Clay 1 (Top)	10.0	69.5
B-2182UD	UD2	No Recovery	Clay 1 (Top)	13.0	66.5
B-2182UD	UD3	CH	Clay 1 (Top)	16.0	63.5
B-2182UD	UD4	No Recovery	Clay 1 (Top)	30.0	49.5
B-2182UD	UD5	CH	Clay 1 (Top)	33.0	46.5
B-2182UD	UD6	CL	Clay 1 (Top)	37.0	42.5
B-2182UD	UD7	SC (Top); SP (Bottom)	Clay 3	65.0	14.5
B-2182UD	UD8	SC (Top); CH (Bottom)	Clay 3	68.0	11.5
B-2182UD	UD9	CH	Sand 4	85.0	–5.5
B-2182UD	UD10	CH	Sand 4	90.0	–10.5
B-2182UD	UD11	CL	Sand 4	90.5	–11.0

Table 2.5.4-38 (Sheet 2 of 3)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[(a)]
Power Block Area (Unit 1) (cont.)					
B-2182UD	UD12	CL (Top); SP-SM (Bottom)	Sand 4	95.0	–15.5
B-2182UD	UD13	SC	Clay 5 (Top)	120.0	–40.5
B-2182UD	UD14	ML	[Clay 5 (Top)]/ Sand 5	123.0	–43.5
B-2182UD	UD15	ML	Clay 5 (Bottom)	145.0	–65.5
B-2182UD	UD16	SM	Sand 6	180.0	–100.5
B-2182UD	UD17	CL	Clay 7	215.0	–135.5
B-2182UD	UD18	CH	Clay 7	218.0	–138.5
B-2182UD	UD19	SM	Sand 8	240.0	–160.5
B-2182UD	UD20	SC-SM	Sand 8	242.0	–162.5
B-2182UD	UD21	No Recovery	Sand 8	265.0	–185.5
B-2182UD	UD22	CH	Sand 8	270.0	–190.5
B-2182UD	UD23	No Recovery	Sand 8	275.0	–195.5
B-2182UD	UD24	CH	Clay 9	300.0	–220.5
B-2182UD	UD25	CH	Clay 9	303.0	–223.5
B-2182UD	UD26	CL	Clay 9	320.0	–240.5
B-2182UD	UD27	CH (Top); SC (Bottom)	Clay 9	323.0	–243.5
B-2182UD	UD28	CH	Clay 9	330.0	–250.5
B-2182UD	UD29	CH	Clay 9	333.0	–253.5
B-2182UD	UD30	CL	Clay 9	340.0	–260.5
B-2182UD	UD31	CL	Clay 9	343.0	–263.5
B-2182UD	UD32	SP-SC (Top); SP (Bottom)	Sand 10	350.0	–270.5
B-2182UD	UD33	CH	Clay 11	380.0	–300.5
B-2182UD	UD34	CH	Clay 11	383.0	–303.5
B-2182UD	UD35	CH	Clay 11	390.0	–310.5
B-2182UD	UD36	CH	Clay 11	393.0	–313.5
B-2182UD	UD37	CL	Clay 11	400.0	–320.5
Power Block Area (Unit 2)					
B-2269UD	UD1	CL	Clay 1 (Top)	10.0	70.1
B-2269UD	UD2	CH	Clay 1 (Top)	13.0	67.1
B-2269UD	UD3	CL	Sand 1	30.0	50.1
B-2269UD	UD4	CL	Sand 1	33.0	47.1
B-2269UD	UD5	CH	Clay 1 (Bottom)	50.0	30.1
B-2269UD	UD6	CH	Clay 1 (Bottom)	53.0	27.1
B-2269UD	UD7	CH	Clay 3	70.0	10.1
B-2269UD	UD8	CH	Clay 3	73.0	7.1
B-2269UD	UD9	CH	[Sand 4]/ Clay 5 (Top)	120.0	–39.9
B-2269UD	UD10	CH	Clay 5 (Top)	123.0	–42.9
B-2269UD	UD11	CH	Sand 5	150.0	–69.9
B-2269UD	UD12	CH	Clay 5 (Bottom)	153.0	–72.9
B-2269UD	UD13	No Recovery	Clay 5 (Bottom)	165.0	–84.9
B-2269UD	UD14	SC	Sand 8	216.0	–135.9
B-2269UD	UD15	SC	Sand 8	216.2	–136.1
B-2269UD	UD16	SC	Sand 8	280.0	–199.9
B-2269UD	UD17	SC	Sand 8	283.2	–203.1

Table 2.5.4-38 (Sheet 3 of 3)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)(a)
Power Block Area (Unit 2) (cont.)					
B-2269UD	UD18	CL	Clay 11	375.0	–294.9
B-2269UD	UD19	CH	Clay 11	380.0	–299.9
B-2269UD	UD20	CH	Clay 11	400.0	–319.9
B-2274UD	UD1	CL	Clay 1 (Top)	10.2	70.2
B-2274UD	UD2	CH	Sand 1	29.8	50.6
B-2274UD	UD3	CH	Clay 3	64.9	15.5
B-2274UD	UD4	CH	Clay 3	67.0	13.4
B-2274UD	UD5	CL	Clay 3	89.8	-9.4
B-2274UD	UD6	No Recovery	Clay 3	94.9	–14.5
B-2274UD	UD7	SP	[Clay 3]/ Sand 4	97.4	–17.0
B-2274UD	UD8	CH	Clay 5 (Top)	120.0	–39.6
B-2274UD	UD9	SC	Clay 5 (Bottom)	146.1	–65.7
B-2274UD	UD10	CH	Sand 6	180.0	–99.6
B-2274UD	UD11	No Recovery	Sand 6	214.4	–134.0
B-2274UD	UD12	SC	Sand 8	221.1	–140.7
B-2274UD	UD13	CL	Sand 8	240.0	–159.6
B-2274UD	UD14	SC	Sand 8	265.0	–184.6
B-2274UD	UD15	SC	Sand 8	276.0	–195.6
B-2274UD	UD16	CH	Clay 9	300.0	–219.6
B-2274UD	UD17	MH	Clay 9	320.0	–239.6
B-2274UD	UD18	SM	Sand 10	330.1	–249.7
B-2274UD	UD19	SM	Sand 10	350.1	–269.7
B-2274UD	UD20	MH	Clay 11	380.0	–299.6
B-2274UD	UD21	CH	Clay 11	390.0	–309.6
B-2274UD	UD22	CH	Clay 11	400.0	–319.6
B-2274UD	UD23	CL	Sand 12	420.0	–339.6
B-2274UD	UD24	CH	Clay 13	480.0	–399.6
B-2274UD	UD25	CH	Sand 14	520.0	–439.6
B-2274UD	UD26	CL	Clay 17	580.0	–499.6
B-2274UD	UD27	SP-SC	Sand 18	600.0	–519.6
B-2274UD	UD28	SP	Sand 18	605.0	–524.6

(a) Elevations are referenced to NAVD 88.

“[ ]” = Minor component of a sample crossing two strata.

Table 2.5.4-39 (Sheet 1 of 2)
Undisturbed Sample Details (Cooling Basin)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[(a)]
B-2302UD	UD1	CH	Clay 1 (Top)	8.5	71.5
B-2302UD	UD2	CH	Clay 1 (Top)/ [Sand 1]	11.0	69.0
B-2302UD	UD3	SP-SM (t); SM (b)	Sand 1	13.5	66.5
B-2302UD	UD4	CH	Clay 1 (Bottom)	28.5	51.5
B-2302UD	UD5	CH	Clay 1 (Bottom)	38.5	41.5
B-2302UD	UD6	CL	Clay 1 (Bottom)	48.5	31.5
B-2302UD	UD7	SC-SM	Sand 2	59.0	21.0
B-2302UD	UD8	SM	Sand 2	61.0	19.0
B-2302UD	UD9	SP-SM	Sand 2/[Clay 3]	63.5	16.5
B-2302UD	UD10	CH	Clay 3	66.0	14.0
B-2302UD	UD11	CH	Clay 3	69.5	10.5
B-2302UD	UD12	CH	Clay 3	78.5	1.5
B-2302UD	UD13	SP (t); SP-SC (b)	Sand 4	88.5	–8.5
B-2302UD	UD14	SM	Sand 4	108.5	–28.5
B-2302UD	UD15	No Recovery	Clay 5 (Top)	N/A	N/A
B-2302UD	UD16	CH	Clay 5 (Top)	120.5	–40.5
B-2302UD	UD17	CL (t); SP (b)	Clay 5 (Top)	128.5	–48.5
B-2302UD	UD18	CH	Clay 5 (Bottom)	143.5	–63.5
B-2302UD	UD19	CH	Clay 5 (Btm)/ [Sand 6]	145.5	–65.5
B-2304UD	UD1	CL	Clay 1 (Top)	6.0	62.5
B-2304UD	UD2	ML (t); SC-SM (b)	Clay 1 (Top)	11.0	57.5
B-2304UD	UD3	SM	Sand 2	28.5	40.0
B-2304UD	UD4	SM	Sand 2	32.5	36.0
B-2304UD	UD5	CH	Clay 3	53.0	15.5
B-2304UD	UD6	CL	Clay 3	63.0	5.5
B-2304UD	UD7	MH	Clay 3	73.5	–5.0
B-2304UD	UD8	CH	Clay 3/[Sand 4]	83.5	–15.0
B-2304UD	UD9	CH	Clay 5 (Top)	98.5	–30.0
B-2304UD	UD10	No Recovery	Clay 5 (Top)	N/A	N/A
B-2304UD	UD11	CH	Clay 5 (Top)	111.0	-42.5
B-2304UD	UD12	CH	Clay 5 (Top)	118.5	–50.0
B-2304UD	UD13	CH	Clay 5 (Top)	121.0	–52.5
B-2304UD	UD14	CL (t); SP (b)	Sand 5	138.5	–70.0
B-2304UD	UD15	SP-SM	Sand 5	141.0	–72.5
B-2319UD	UD1	No Recovery	Sand 1	N/A	N/A
B-2319UD	UD2	SC	Sand 1	5.5	68.7
B-2319UD	UD3	SM	Sand 1	11.0	63.2
B-2319UD	UD4	CH	Clay 1 (Bottom)	25.0	49.2
B-2319UD	UD5	ML (t); SC (b)	Sand 2	35.0	39.2
B-2319UD	UD6	ML	Clay 3	55.0	19.2
B-2319UD	UD7	CL (t); SC (b)	Clay 3	65.0	9.2
B-2319UD	UD8	SP-SM	Clay 3/ [Sand 4]	75.0	–0.8
B-2319UD	UD9	CH (t); SP-SM (b)	Sand 4	85.0	–10.8
B-2319UD	UD10	SP	Sand 4	95.0	–20.8
B-2319UD	UD11	CH	Sand 5	110.0	–35.8
B-2319UD	UD12	No Recovery	Sand 5	N/A	N/A
B-2321UD	UD1	CL	Clay 1 (Top)	3.5	68.3

Table 2.5.4-39 (Sheet 2 of 2)
Undisturbed Sample Details (Cooling Basin)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[a]
B-2321UD	UD2	No Recovery	Clay 1 (Top)	N/A	N/A
B-2321UD	UD3	CH	Clay 1 (Top)	10.0	61.8
B-2321UD	UD4	CH	Clay 1 (Top)	13.5	58.3
B-2321UD	UD5	CL	Clay 1 (Top)	17.0	54.8
B-2321UD	UD6	CH	Clay 1 (Bottom)	28.5	43.3
B-2321UD	UD7	CH	Clay 1 (Bottom)	38.5	33.3
B-2321UD	UD8	CH	Clay 1 (Bottom)	48.5	23.3
B-2321UD	UD9	CL	Clay 3	58.5	13.3
B-2321UD	UD10	CL	Clay 3	63.0	8.8
B-2321UD	UD11	SC	Sand 4	88.5	–16.7
B-2321UD	UD12	SP-SM	Sand 4	93.0	–21.2
B-2321UD	UD13	SC	Sand 4	118.0	–46.2
B-2321UD	UD14	CH	Clay 5 (Top)	128.5	–56.7
B-2321UD	UD15	CH	Clay 5 (Top)	130.5	–58.7
B-2352UD	UD1	CL	Clay 1 (Top)	3.5	59.3
B-2352UD	UD2	CL	Clay 1 (Top)	9.0	53.8
B-2352UD	UD3	CL	Clay 1 (Top)	11.5	51.3
B-2352UD	UD4	CL	Clay 1 (Bottom)	14.0	48.8
B-2352UD	UD5	CH	Clay 1 (Bottom)	24.0	38.8
B-2352UD	UD6	CH	Clay 1 (Bottom)	34.0	28.8
B-2352UD	UD7	CL	[Sand 2]/Clay 3	59.0	3.8
B-2352UD	UD8	SM	Clay 3	68.0	–5.2
B-2352UD	UD9	SM	Sand 4	88.0	–25.2
B-2352UD	UD10	SM	Sand 4/[Sand 5]	92.0	–29.2
B-2359UD	UD1	CL (t); SP-SM (b)	Clay 1 (Top)/[Sand 1]	13.5	63.9
B-2359UD	UD2	SP (t); CH (b)	Sand 1/Clay 1 (Btm)]	25.0	52.4
B-2359UD	UD3	CH	Clay 1 (Bottom)	30.5	46.9
B-2359UD	UD4	CH	Clay 1 (Bottom)	35.0	42.4
B-2359UD	UD5	CH	Clay 1 (Bottom)	40.0	37.4
B-2359UD	UD6	SC	Sand 2	50.0	27.4
B-2359UD	UD7	ML	Sand 2	55.0	22.4
B-2359UD	UD8	SP-SC	Sand 2	62.0	15.4
B-2359UD	UD9	SC	Sand 2	65.0	12.4
B-2359UD	UD10	CH	Clay 3	70.0	7.4
B-2359UD	UD11	SC-SM	Sand 4	77.0	0.4
B-2359UD	UD12	SC	Sand 4	80.0	–2.7
B-2359UD	UD13	SP-SC	Sand 4	85.0	–7.7
B-2359UD	UD14	ML	Sand 4	88.5	–11.2
B-2359UD	UD15	SP-SC	Sand 4	95.0	–17.7
B-2359UD	UD16	SP-SC	Sand 4	98.0	–20.7
B-2359UD	UD17	SM	Clay 5 (Top)	110.0	–32.7
B-2359UD	UD18	SC	Clay 5 (Top)	112.5	–35.2
B-2359UD	UD19	SM	Clay 5 (Top)	114.0	–36.7
B-2359UD	UD20	CH	Clay 5 (Bottom)	120.0	–42.7

(a) Elevations are referenced to NAVD 88.

Table 2.5.4-40
As-Built Cone Penetration Test Information (Power Block Area)

CPT Number	Northing (feet)(a)	Easting (feet)(a)	Ground Surface Elevation (feet)(b)	Depth (feet)	Base Elevation (feet)(b)
Power Block Area (Unit 1)					
C-2101	13,412,774.10	2,599,705.86	80.12	94.60	–14.48
C-2102S	13,412,550.23	2,599,702.26	80.17	91.90	–11.73
C-2103	13,412,715.32	2,599,852.09	77.68	93.40	–15.72
C-2104S	13,412,187.52	2,599,704.22	80.10	71.50	8.60
C-2105	13,412,269.09	2,599,774.92	80.19	88.00	–7.81
C-2106	13,412,291.55	2,599,955.62	79.59	296.40	–216.81
C-2106S	13,412,296.36	2,599,958.27	79.51	79.30	0.21
C-2107	13,412,304.73	2,600,042.26	79.96	95.30	–15.34
C-2108	13,412,425.89	2,600,105.91	79.78	93.30	–13.52
C-2109S	13,412,545.94	2,600,138.83	79.93	90.00	–10.07
C-2110	13,412,478.15	2,600,217.10	80.00	92.90	–12.90
C-2111	13,412,225.65	2,600,089.78	78.04	16.70	61.34
C-2111A	13,412,224.80	2,600,089.84	78.14	33.90	44.24
C-2111B	13,412,225.10	2,600,087.29	78.28	38.40	39.88
C-2111C	13,412,238.89	2,600,087.16	78.04	85.80	–7.76
C-2111D	13,412,212.18	2,600,086.06	79.22	95.50	–16.28
C-2112	13,412,358.60	2,600,185.71	79.55	99.70	–20.15
C-2113	13,412,251.45	2,600,231.11	79.31	96.80	–17.49
C-2214	13,412,587.86	2,600,280.45	79.86	93.60	–13.74
C-2215	13,412,539.13	2,600,425.19	79.83	92.60	–12.77
Power Block Area (Unit 2)					
C-2201	13,413,541.97	2,600,349.92	80.62	98.70	–18.08
C-2202S	13,413,315.91	2,600,345.61	80.42	93.00	–12.58
C-2203	13,413,489.00	2,600,490.16	80.56	100.00	–19.44
C-2204S	13,412,953.12	2,600,347.76	80.35	55.00	25.35
C-2204SA	13,412,954.25	2,600,354.46	80.30	91.00	–10.70
C-2204SB	13,412,963.86	2,600,351.20	80.18	90.00	–9.82
C-2205	13,413,036.37	2,600,417.96	80.39	95.00	–14.61
C-2206	13,413,081.83	2,600,615.27	80.22	247.20	–166.98
C-2206S	13,413,071.11	2,600,604.08	80.63	93.80	–13.17
C-2207	13,413,071.18	2,600,687.06	80.39	90.60	–10.21
C-2208	13,413,191.48	2,600,748.18	80.54	96.00	–15.46
C-2209S	13,413,311.92	2,600,780.51	80.27	90.00	–9.73
C-2210	13,413,244.43	2,600,858.74	80.30	33.00	47.30
C-2210A	13,413,246.80	2,600,860.38	79.87	99.60	–19.73
C-2211	13,412,992.38	2,600,730.80	80.20	93.00	–12.80
C-2212	13,413,123.28	2,600,827.18	80.44	83.00	–2.56
C-2213	13,413,017.49	2,600,874.63	80.46	97.30	–16.84
Outside Power Block Area					
C-2216	13,414,151.27	2,600,733.87	80.54	96.70	–16.16

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-41
As-Built Cone Penetration Test Information (Cooling Basin)

CPT Number	Northing (feet)(a)	Easting (feet)(a)	Ground Surface Elevation (feet)(b)	Depth (feet)	Base Elevation (feet)(b)
C-2301S	13,408,989.39	2,599,158.23	79.08	34.83	44.25
C-2301SA	13,408,982.41	2,599,162.20	78.70	30.04	48.66
C-2302	13,412,519.49	2,602,124.85	77.49	94.79	–17.30
C-2303S	13,416,428.66	2,605,405.65	76.79	97.22	–20.43
C-2304	13,418,878.70	2,607,463.62	74.85	59.96	14.89
C-2305	13,408,849.43	2,603,251.14	75.47	60.16	15.31
C-2306	13,411,148.27	2,605,179.25	77.54	59.96	17.58
C-2307	13,414,685.38	2,608,147.28	74.88	59.96	14.92
C-2308	13,415,348.90	2,610,567.73	58.02	86.26	–28.24
C-2309	13,405,587.95	2,604,945.49	72.92	53.86	19.06
C-2310	13,409,556.77	2,608,738.56	70.88	59.96	10.92
C-2311	13,413,231.26	2,613,049.76	41.70	78.13	–36.43
C-2311A	13,413,277.55	2,612,969.43	50.49	100.24	–49.75
C-2312	13,397,971.98	2,606,226.92	64.99	90.13	–25.14
C-2313	13,399,066.96	2,607,529.09	71.17	59.96	11.21
C-2314	13,402,413.42	2,608,270.67	69.45	60.16	9.29
C-2315	13,405,943.12	2,612,535.56	66.35	60.29	6.06
C-2316	13,407,731.74	2,614,700.43	68.23	60.29	7.94
C-2317	13,408,493.37	2,617,901.20	45.17	83.57	–38.40
C-2318	13,403,305.07	2,613,240.79	66.39	59.96	6.43
C-2319	13,406,689.77	2,617,807.82	65.56	59.96	5.60
C-2321S	13,397,141.61	2,611,187.71	65.80	49.86	15.94
C-2321SA	13,397,149.37	2,611,182.17	65.90	51.10	14.80
C-2322	13,400,701.15	2,615,409.91	62.19	83.90	–21.71
C-2323S	13,404,257.20	2,619,650.56	65.67	100.17	–34.50
C-2324	13,406,320.31	2,622,094.07	63.58	59.96	3.62
C-2328	13,395,274.28	2,609,720.08	65.62	60.27	5.35

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-42
As-Built Test Pit Information (Power Block Area)

Test Pit Number	Northing (feet)[a]	Easting (feet)[a]	Ground Surface Elevation (feet)[b]	Depth (feet)	Base Elevation (feet)[b]
Power Block Area (Unit 1)					
TP-2101	13,412,437.27	2,599,756.15	80.43	10.0	70.4
TP-2102	13,412,124.00	2,599,818.54	80.35	10.0	70.4
TP-2103	13,411,950.60	2,600,103.92	79.70	10.0	69.7
TP-2104	13,412,451.21	2,600,288.03	80.20	10.0	70.2
Power Block Area (Unit 2)					
TP-2201	13,413,198.85	2,600,399.35	79.85	10.0	69.9
TP-2202	13,412,889.65	2,600,464.19	80.60	10.0	70.6
TP-2203	13,412,717.50	2,600,741.27	80.26	10.0	70.3
TP-2204	13,413,215.93	2,600,931.80	80.84	10.0	70.8

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-43
As-Built Test Pit Information (Cooling Basin)

Test Pit Number	Northing (feet)[(a)]	Easting (feet)[(a)]	Ground Surface Elevation (feet)[(b)]	Depth (feet)	Base Elevation (feet)[(b)]
TP-2310	13,406,614.56	2,601,358.66	75.57	10.0	65.6
TP-2314	13,413,935.46	2,607,799.59	74.70	10.0	64.7
TP-2317	13,410,595.30	2,600,492.45	76.76	10.0	66.8
TP-2319	13,403,607.12	2,603,037.74	74.25	10.0	64.3
TP-2320	13,407,598.78	2,606,824.54	71.41	10.0	61.4
TP-2321	13,410,972.16	2,610,031.41	70.82	10.0	60.8
TP-2332	13,414,422.39	2,603,751.85	78.22	10.0	68.2
TP-2334	13,400,632.04	2,606,110.32	72.41	10.0	62.4
TP-2335	13,404,163.77	2,610,401.63	66.82	10.0	56.8
TP-2337	13,407,266.15	2,614,864.54	66.92	10.0	56.9
TP-2351	13,398,902.07	2,613,286.15	63.91	10.0	53.9
TP-2352	13,402,479.96	2,617,531.97	62.97	10.0	53.0

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-44
Laboratory Compaction Test Results (Power Block Area)

Test Pit	Sample	Depth (feet)	Top El. (feet)[a]	USCS Group Symbol	Gravel (%)	Sand (%)	Silt/ Clay (%)	Specific Gravity	Natural Moisture Content (%)[b]	Maximum Dry Density (pcf)[c]	Optimum Moisture Content (%)[c]
TP-2101	Bulk 1	8	72.4	CH	0.0	16.3	83.7	2.73	17.5	117.5	13.5
TP-2102	Bulk 1	8	72.4	CH	0.0	15.3	84.7	2.70	15.7	119.5	14.5
TP-2103	Bulk 1	8	71.7	CL	0.2	21.2	78.6	2.69	26.9	121.5	12.0
TP-2104	Bulk 1	8	72.2	CL	0.0	24.3	75.7	2.68	11.1	125.0	11.0
TP-2201	Bulk 1	5-10	74.9	CL	0.0	29.4	70.6	2.68	18.1	121.0	12.5
TP-2202	Bulk 1	8	72.6	CH	0.0	22.0	78.0	2.69	19.6	122.0	12.5
TP-2203	Bulk 1	8	72.3	CL	0.0	16.6	83.4	2.73	17.7	120.5	12.5
TP-2204	Bulk 1	5-10	75.8	CL	0.0	15.6	84.4	2.71	17.2	125.0	11.5
Fordyce[d]	Raw Material	—	—	SW	42	55	3	2.70	—	127.0[e]	8.5[e]
—	—	—	—	—	—	—	—	—	—	120.5[f]	12.5[f]
C.W.&A.[d]	TxDOT Grade 4	—	—	GW-GC	50	43	7	2.67	—	138.0[e]	5.5[e]
—	—	—	—	—	—	—	—	—	—	136.5[f]	6.0[f]
C.W.&A.[d]	TxDOT Grade 6	—	—	GP-GC	47	43	10	2.66	—	137.0[e]	6.0[e]
—	—	—	—	—	—	—	—	—	—	133.0[f]	6.5[f]

(a) Elevations are referenced to NAVD 88.
(b) Natural Moisture for bulk samples obtained from jar sample at same depth or within depth range of bulk sample.
(c) Moisture/density testing performed in accordance with ASTM D 1557 (Modified Proctor) (Reference 2.5.4-19).
(d) Possible structural fill material sampled from offsite source.
(e) Test made on sample screened on 3/4” sieve.
(f) Test made on sample screened on 3/8” sieve.

Table 2.5.4-45
Laboratory Compaction Test Results (Cooling Basin)

Test Pit	Sample	Depth (feet)	Top El. (feet)(a)	USCS Group Symbol	Gravel (%)	Sand (%)	Silt/ Clay (%)	Specific Gravity	Natural Moisture Content (%)(b)	Maximum Dry Density (pcf)(c)	Optimum Moisture Content(c)
TP-2310	Bulk 1	5	70.6	CL	0	42.4	57.6	2.69	13.7	123.5	12.0
TP-2310	Bulk 2	10	65.6	SC-SM	0	71.1	28.9	2.66	8.3	128.5	9.5
TP-2314	Bulk 2	5-10	64.7	CH	0	4.3	95.7	2.72	22.7	113.5	16.5
TP-2317	Bulk 1	2-5	74.8	CL	0	31.0	69.0	2.67	19.1	122.0	13.0
TP-2317	Bulk 2	5-10	71.8	CL	0	20.5	79.5	2.70	16.4	123.5	12.5
TP-2319	Bulk 2	3-10	71.3	SC	0	52.7	47.3	2.67	13.0	125.0	11.0
TP-2320	Bulk 1	4-5	67.4	CL	0	38.2	61.8	2.69	15.2	122.5	12.5
TP-2320	Bulk 2	5-10	66.4	CL	0	29.6	70.4	2.67	12.0	126.5	11.5
TP-2321	Bulk 1	4-5	66.8	CH	0	28.0	72.0	2.70	15.3	116.0	14.5
TP-2321	Bulk 2	6.5-10	64.3	CL	0	19.0	81.0	2.70	16.0	120.0	13.5
TP-2332	Bulk 2	3-10	75.2	SM	0	80.0	20.0	2.66	7.7	122.0	11.0
TP-2334	Bulk 1	2-5	70.4	CL	0	32.0	68.0	2.72	14.8	123.0	11.5
TP-2334	Bulk 2	5-10	67.4	SC	0	52.6	47.4	2.67	15.2	127.5	10.0
TP-2335	Bulk 2	4-8	62.8	CL	0	46.4	53.6	2.67	11.2	124.5	11.5
TP-2335	Bulk 3	8-10	58.8	SM	0	75.2	24.8	2.66	7.3	122.0	11.0
TP-2337	Bulk 1	4-5	62.9	CL	0	38.3	61.7	2.66	18.7	122.0	11.5
TP-2337	Bulk 2	10	56.9	CL	0	25.0	75.0	2.69	17.2	121.0	12.0
TP-2351	Bulk 2	3.5-10	60.4	SC	0	61.8	38.2	2.66	13.0	125.0	11.5
TP-2352	Bulk 1	4-5	59.0	CL	0	33.1	66.9	2.66	17.0	122.5	11.0
Composite	A/Sand(d)	—	—	SC	0	53.6	46.4	2.66	12.7	126.0	10.5
Composite	B/Clay(e)	—	—	CL	0	26.4	73.6	2.69	18.1	121.0	12.5
Fordyce(f)	C33	—	—	SP	0	99	1	2.61	4.2	112.5	3.0
Fordyce(f)	C144	—	—	SP	0	98	2	2.61	5.1	105.5	8.0

(a) Elevations are referenced to NAVD 88.
(b) Natural Moisture for bulk samples obtained from jar sample at same depth or within depth range of bulk sample.
(c) Moisture/density testing performed in accordance with ASTM D 1557 (Modified Proctor) (Reference 2.5.4-19).
(d) Composite “A”/Sand embankment fill (combined TP-2319, Bulk 2 and TP-2334, Bulk 2).
(e) Composite “B”/Clay embankment fill (combined TP-2317, Bulk 1 and TP-2334, Bulk 1).
(f) Possible drainage sand material (for internal embankment drainage) sampled from offsite source.

Table 2.5.4-46
As-Built Observation Well Information (Power Block Area)

Investigation Station	Northing (feet)[a]	Easting (feet)[a]	Top of Concrete El. (feet)[b]	Reference El. (feet)[b]	Sand Top Depth (feet)	Sand Base/ Depth (feet)	Sand Top El. (feet)[b]	Sand Base/ El. (feet)[b]
Power Block Area (Unit 1)								
OW-2150U	13,412,568.08	2,599,582.77	80.91	82.78	51.0	66.2	29.9	14.8
OW-2150L	13,412,552.91	2,599,585.12	80.87	82.45	136.0	151.2	–55.1	–70.3
OW-2169U	13,412,343.77	2,599,945.85	80.11	81.77	51.0	66.0	29.1	14.1
OW-2169L	13,412,356.74	2,599,930.20	80.04	81.72	86.0	101.0	–6.0	–21.0
OW-2181U	13,412,147.38	2,600,052.86	80.01	81.31	36.0	51.0	44.0	29.0
OW-2181L	13,412,138.42	2,600,071.96	79.88	81.32	86.0	101.0	–6.1	–21.1
Power Block Area (Unit 2)								
OW-2253U	13,413,591.55	2,600,474.37	81.2	82.7	51.0	66	30.17	15.17
OW-2253L	13,413,584.76	2,600,494.74	81.2	82.8	131.0	146	–49.82	–64.82
OW-2269U	13,413,110.10	2,600,589.08	80.8	82.4	76.0	91.15	4.75	–10.4
OW-2269L	13,413,123.29	2,600,574.23	80.9	82.6	126.0	141.15	–45.11	–60.26
OW-2284U	13,413,055.14	2,600,956.60	81.0	82.6	61.0	76.07	19.98	4.91
OW-2284L	13,413,063.71	2,600,939.04	81.0	82.7	96.0	111.06	–15.03	–30.09
Outside Power Block Area								
OW-2185U	13,412,328.07	2,600,801.11	79.9	81.5	61.0	76	18.89	3.89
OW-2185L	13,412,314.47	2,600,815.69	79.8	81.4	86.0	101	–6.24	–21.24
OW-2301U	13,414,430.08	2,596,288.46	81.8	83.3	46.0	61	35.77	20.77
OW-2301L	13,414,429.77	2,596,268.29	81.9	83.2	126.0	141	–44.11	–59.11
OW-2307U	13,420,896.73	2,603,164.23	77.1	78.6	50.0	66	27.07	11.07
OW-2307L	13,420,879.09	2,603,152.12	76.9	78.6	95.0	111	–18.09	–34.09
OW-08U	13,415,801.21	2,598,934.58	82.4	83.9	86.0	101	–3.62	–18.62
OW-08L	13,415,818.85	2,598,942.49	82.6	84.1	124.0	138	–41.44	–55.44
OW-10U	13,418,474.37	2,604,768.43	78.1	79.5	45.0	59	33.09	19.09
OW-10L	13,418,486.44	2,604,760.99	78.1	79.9	123.0	138	–44.93	–59.93

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-47
As-Built Observation Well Information (Cooling Basin)

Investigation Station	Northing (feet)[(a)]	Easting (feet)[(a)]	Top of Concrete El. (feet)[(b)]	Reference El. (feet)[(b)]	Sand Top Depth (feet)	Sand Base/ Well Depth (feet)	Sand Top El. (feet)[(b)]	Sand Base/ Well El. (feet)[(b)]
OW-2302U	13,407,361.50	2,598,388.47	80.5	82.0	81.0	96	–0.48	–15.48
OW-2302L	13,407,382.11	2,598,388.94	80.5	82.0	136.0	151.15	–55.54	–70.69
OW-2304U	13,396,542.39	2,608,679.35	66.8	70.1	36.0	51	30.8	15.8
OW-2304L	13,396,528.12	2,608,678.06	68.9	69.7	81.0	96	–12.12	–27.12
OW-2319U	13,403,590.40	2,603,046.21	74.3	76.0	81.0	96	–6.67	–21.67
OW-2319L	13,403,611.30	2,603,051.83	74.7	76.1	141.0	156	–66.32	–81.32
OW-2320U	13,407,569.51	2,606,849.70	71.8	73.5	96.0	111	–24.2	–39.2
OW-2320L	13,407,580.88	2,606,834.36	71.8	73.2	136.0	151	–64.24	–79.24
OW-2321U	13,410,943.58	2,610,040.96	71.8	73.3	96.0	111	–24.21	–39.21
OW-2321L	13,410,955.46	2,610,027.59	72.0	73.5	136.0	151	–64.01	–79.01
OW-2324U	13,416,316.54	2,612,203.23	24.7	26.2	31.0	46	–6.33	–21.33
OW-2324L	13,416,300.52	2,612,217.00	24.9	26.3	110.0	126	–85.15	–101.15
OW-2348U	13,409,636.31	2,621,660.58	50.6	52.1	66.0	81	–15.44	–30.44
OW-2348L	13,409,617.75	2,621,644.36	51.2	52.7	130.0	145	–78.79	–93.79
OW-2352U	13,402,470.61	2,617,538.69	63.2	64.5	41.0	56	22.17	7.17
OW-2352L	13,402,468.45	2,617,518.54	63.3	64.6	76.0	91	–12.67	–27.67
OW-01U	13,404,253.64	2,606,666.85	72.2	73.7	42.0	61	30.16	11.16
OW-01L	13,404,252.09	2,606,686.52	72.2	73.7	96.0	111	–23.78	–38.78
OW-02U	13,411,502.39	2,607,862.19	75.3	76.7	50.0	64	25.25	11.25
OW-02L	13,411,520.51	2,607,869.30	75.1	76.5	94.0	109	–18.93	–33.93
OW-03U	13,414,934.48	2,609,294.86	75.6	77.1	40.0	54	35.6	21.6
OW-03L	13,414,918.69	2,609,286.61	75.2	76.7	84.0	98	–8.79	–22.79
OW-04U	13,414,280.51	2,607,428.57	79.6	81.1	71.0	86	8.61	–6.39
OW-04L	13,414,268.74	2,607,440.23	79.1	80.7	96.0	111	–16.87	–31.87
OW-05U	13,414,770.21	2,605,832.08	78.1	79.6	43.0	57	35.07	21.07
OW-05L	13,414,774.22	2,605,813.28	78.3	79.9	116.3	131	–38.04	–52.74
OW-06U	13,415,875.58	2,604,966.94	79.5	80.8	50.0	64	29.46	15.46
OW-06L	13,415,889.64	2,604,964.90	79.5	81.6	80.5	96	–1.01	–16.51
OW-07U	13,418,421.40	2,606,542.01	77.3	79.0	50.2	64	27.12	13.32
OW-07L	13,418,420.52	2,606,531.28	77.5	79.0	110.0	124	–32.53	–46.53
OW-09U	13,414,956.05	2,604,894.51	77.9	79.2	47.0	61	30.91	16.91
OW-09L	13,414,937.42	2,604,893.58	77.9	80.0	106.0	121	–28.14	–43.14

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-48
As-Built Borehole Permeameter Test Information (Cooling Basin)

Test Number	Northing (feet)[a]	Easting (feet)[a]	Ground El. (feet)[b]	Test El. (feet)[b]	Test Hole I.D. (inches)
B-2309P-U	13,405,492.30	2,600,435.20	76.25	71.25	1.2
B-2309P-L	13,405,491.59	2,600,445.06	76.13	66.13	1.2
B-2311P-U	13,407,705.71	2,602,287.63	75.71	70.71	1.2
B-2311P-L	13,407,702.98	2,602,296.89	75.33	65.33	1.2
B-2312P-U	13,410,699.82	2,604,161.16	75.46	70.46	1.2
B-2312P-L	13,410,694.32	2,604,153.23	75.50	65.50	1.2
B-2314P-U	13,413,937.97	2,607,776.49	75.48	70.48	1.2
B-2314P-L	13,413,940.68	2,607,782.57	75.42	65.42	1.2
B-2325P-U	13,401,288.29	2,603,699.18	73.79	68.79	1.2
B-2325P-L	13,401,292.30	2,603,696.51	73.85	63.85	1.2
B-2326P-U	13,403,069.23	2,605,616.46	70.97	65.97	1.2
B-2326P-L	13,403,074.73	2,605,620.44	70.76	60.76	1.2
B-2327P-U	13,404,711.41	2,607,393.78	71.24	66.24	1.2
B-2327P-L	13,404,712.18	2,607,384.02	70.81	60.81	1.2
B-2328P-U	13,406,233.26	2,609,021.31	68.13	63.13	1.2
B-2328P-L	13,406,222.90	2,609,021.23	68.42	58.42	1.2
B-2339P-U[c]	13,399,916.45	2,608,670.14	68.75	63.75	1.2
B-2339P-L[c]	13,399,911.22	2,608,674.69	68.63	58.63	1.2
B-2341P-U	13,401,608.46	2,610,954.27	65.22	60.22	1.2
B-2341P-L	13,401,608.46	2,610,954.27	65.22	55.22	1.2
B-2342P-U	13,402,788.89	2,612,523.26	67.61	62.61	1.2
B-2342P-L	13,402,761.03	2,612,526.25	67.34	57.34	1.2
B-2343P-U	13,404,159.36	2,614,386.73	64.62	59.62	1.2
B-2343P-L	13,404,159.35	2,614,395.88	64.95	54.95	1.2
B-2345P-U	13,405,835.31	2,616,662.51	67.91	62.91	1.2
B-2345P-L	13,405,831.44	2,616,657.32	67.79	57.79	1.2

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.
(c) Coordinates and elevations not recorded for B-2339P-U and L. Values taken from B-2339P.

Table 2.5.4-49
As-Built Pumping Test Information (Cooling Basin)

Well Number	Drilling Method	Well Depth (feet)	Screened Interval (feet)	Northing (feet)[(a)]	Easting (feet)[(a)]	Top of Concrete El. (feet)[(b)]	Reference El. (feet)[(b)]	Well I.D. (inches)
TW-2320U	Rotary	82	55-80	13,407,428.59	2,607,105.51	72.72	71.50	6
OW-01L	Rotary	111	100-110	13,404,252.09	2,606,686.52	73.74	72.22	2
OW-01U	Rotary	61	50-60	13,404,253.64	2,606,666.85	73.65	72.16	2
OW-02L	Rotary	109	98-108	13,411,520.51	2,607,869.30	76.53	75.07	2
OW-02U	Rotary	64	53-63	13,411,502.39	2,607,862.19	76.74	75.25	2
OW-2319L	Rotary	156	145-155	13,403,611.30	2,603,051.83	76.05	74.68	2
OW-2319U	Rotary	96	85-95	13,403,590.40	2,603,046.21	75.97	74.33	2
OW-2320L	Rotary	151	140-150	13,407,580.88	2,606,834.36	73.19	71.76	2
OW-2320U	Rotary	111	100-110	13,407,569.51	2,606,849.70	73.50	71.80	2
OW-2320U1	Rotary	81	60-80	13,407,445.66	2,607,080.05	72.90	71.36	2
OW-2320U2	Rotary	81	60-80	13,407,436.76	2,607,093.25	72.92	71.36	2
OW-2320U3	Rotary	81	60-80	13,407,448.17	2,607,121.37	72.84	71.36	2
OW-2320U4	Rotary	81	60-80	13,407,466.49	2,607,138.42	72.91	71.42	2
OW-2321L	Rotary	151	140-150	13,410,955.46	2,610,027.59	73.54	71.99	2
OW-2321U	Rotary	111	100-110	13,410,943.58	2,610,040.96	73.27	71.79	2
TW-2359L	Rotary	182	150-180	13,417,241.41	2,605,450.48	79.88	77.69	6
OW-06L	Rotary	96	85-95	13,415,889.64	2,604,964.90	81.55	79.49	2
OW-06U	Rotary	64	53-63	13,415,875.58	2,604,966.94	80.77	79.46	2
OW-07L	Rotary	124	113-123	13,418,420.52	2,606,531.28	79.04	77.47	4
OW-07U	Rotary	64	53-63	13,418,421.40	2,606,542.01	79.02	77.32	2
OW-09L	Rotary	121	110-120	13,414,937.42	2,604,893.58	80.00	77.86	2
OW-09U	Rotary	61	50-60	13,414,956.05	2,604,894.51	79.24	77.91	2
OW-10U	Rotary	59	48-58	13,418,474.37	2,604,768.43	79.53	78.09	2
OW-10L	Rotary	138	127-137	13,418,486.44	2,604,760.99	79.88	78.07	2
OW-2359L1	Rotary	176	155-175	13,417,263.65	2,605,470.56	79.36	78.08	2
OW-2359L2	Rotary	176	155-175	13,417,259.76	2,605,433.37	78.93	77.56	2
OW-2359L3	Rotary	176	155-175	13,417,278.58	2,605,416.18	78.83	77.26	2
OW-2359U1	Rotary	96	85-95	13,417,252.64	2,605,460.64	79.29	77.66	2

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-50
As-Built Field Electrical Resistivity Test Information (Power Block Area)

Test Number	Northing (feet)[a]	Easting (feet)[a]	Center Point El. (feet)[b]	Compass Bearing (degrees)
R-2101	13,412,470.72	2,599,460.82	80.53	300
R-2102	13,412,470.72	2,599,460.82	80.53	30
R-2201	13,413,399.51	2,600,266.58	80.66	300
R-2202	13,413,399.51	2,600,266.58	80.66	210

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-51 (Sheet 1 of 3)
S-Wave Velocity Profile Numerical Values; Upper Approximately 600 Feet of Site Soils (Power Block Area)

Stratum	Top El. (feet)[(a)]	Base El. (feet)[(a)]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Median V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	No. of Tests
Power Block Area (Unit 1)								
Fill (Upper)	95.0	90.0	—	—	—	597	—	—
Fill (Middle)	90.0	85.0	—	—	—	708	—	—
Fill (Lower)	85.0	80.0	—	—	—	783	—	—
Clay 1 (Top)	80.0	51.5	1100	276	755	736	178	70
Sand 1	—	—	—	—	—	—	—	—
Clay 1 (Btm)	51.5	33.0	1560	470	770	858	272	60
Sand 2	33.0	19.5	1283	570	940	979	165	30
Clay 3	19.5	–4.5	1600	710	1020	1031	189	79
Sand 4	–4.5	–28.0	5380	687	1590	1826	935	68
Clay 5 (Top)	–28.0	–49.5	1650	700	1040	1063	202	51
Sand 5	–49.5	–61.0	1290	870	1060	1038	143	9
Clay 5 (Btm)	–61.0	–70.0	1640	850	1105	1153	242	36
Sand 6	–70.0	–126.5	3120	920	1420	1533	404	137
Clay 7	–126.5	–172.5	2010	800	1480	1445	339	33
Sand 8	–172.5	–206.5	2300	980	1430	1539	329	58
Clay 9	–206.5	–252.5	1510	990	1260	1253	117	62
Sand 10	–252.5	–268.0	2220	1160	1650	1667	278	23
Clay 11	–268.0	–327.5	1750	820	1160	1173	192	59
Sand 12	–327.5	–345.5	2030	1580	1820	1821	127	11
Clay 13	–345.5	–421.0	2310	1020	1325	1410	263	46
Sand 14	–421.0	–454.0	2040	1540	1795	1780	136	20
Clay 15	–454.0	–465.0	1800	1100	1600	1523	245	7
Sand 16	–465.0	–480.0	1980	1720	1740	1814	109	9
Clay 17	–480.0	–506.5	2030	1180	1605	1632	318	16
Sand 18	–506.5	–520.0	2380	1830	1970	2022	190	9
Power Block Area (Unit 2)								
Fill (Upper)	95.0	90.0	—	—	—	597	—	—
Fill (Middle)	90.0	85.0	—	—	—	708	—	—
Fill (Lower)	85.0	80.0	—	—	—	783	—	—
Clay 1 (Top)	80.0	51.5	1160	167	580	608	171	72
Sand 1	51.5	43.0	1350	738	1079	1080	154	32
Clay 1 (Btm)	43.0	27.5	1300	550	965	950	200	48
Sand 2	27.5	18.0	1470	750	1190	1158	194	25
Clay 3	18.0	–6.5	1670	490	899	960	276	96
Sand 4	–6.5	–36.0	1850	900	1360	1351	235	60
Clay 5 (Top)	–36.0	–53.0	2870	790	1065	1219	401	44
Sand 5	–53.0	–66.0	2490	1140	1490	1498	270	25

Table 2.5.4-51 (Sheet 2 of 3)
S-Wave Velocity Profile Numerical Values; Upper Approximately 600 Feet of Site Soils (Power Block Area)

Stratum	Top El. (feet)[(a)]	Base El. (feet)[(a)]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Median V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	No. of Tests
Power Block Area (Unit 2) (continued)								
Clay 5 (Btm)	–66.0	–79.0	1740	790	1110	1119	175	31
Sand 6	–79.0	–128.5	3400	490	1365	1421	401	128
Clay 7	—	—	—	—	—	—	—	—
Sand 8	–128.5	–204.0	3000	1140	1750	1737	347	82
Clay 9	–204.0	–248.0	1750	990	1250	1250	149	50
Sand 10	–248.0	–289.0	2020	1270	1660	1645	192	51
Clay 11	–289.0	–323.0	1410	910	1100	1102	113	36
Sand 12	–323.0	–326.0	2190	1610	1860	1866	147	14
Clay 13	–326.0	–422.0	2270	1050	1280	1312	184	46
Sand 14	–422.0	–468.5	2400	1370	1870	1885	196	29
Clay 15	–468.5	–481.0	1560	1360	1410	1436	88	7
Sand 16	–481.0	–499.0	1980	1540	1750	1765	125	11
Clay 17	–499.0	–515.0	2120	1950	2060	2050	63	10
Sand 18	–515.0	–520.0	2040	1940	2000	1993	50	3
Power Block Area (Units 1 & 2)								
Fill (Upper)	95.0	90.0	—	—	—	597	—	—
Fill (Middle)	90.0	85.0	—	—	—	708	—	—
Fill (Lower)	85.0	80.0	—	—	—	783	—	—
Clay 1 (Top)	80.0	51.5	1160	167	670	671	185	142
Sand 1	51.5	43.0	1350	738	1079	1080	154	32
Clay 1 (Btm)	43.0	30.5	1560	470	835	899	246	108
Sand 2	30.5	18.5	1470	570	1040	1060	198	55
Clay 3	18.5	–5.5	1670	490	990	992	243	175
Sand 4	–5.5	–32.0	5380	687	1460	1603	737	128
Clay 5 (Top)	–32.0	–51.0	2870	700	1060	1135	318	95
Sand 5	–51.0	–64.0	2490	870	1375	1376	316	34
Clay 5 (Btm)	–64.0	–73.5	1740	790	1110	1137	213	67
Sand 6	–73.5	–127.5	3400	490	1390	1479	405	265
Clay 7	–127.5	–172.5	2010	800	1480	1445	339	33
Sand 8	–172.5	–205.5	3000	980	1630	1655	353	140
Clay 9	–205.5	–250.0	1750	990	1260	1252	132	112
Sand 10	–250.0	–278.5	2220	1160	1660	1652	221	74
Clay 11	–278.5	–325.5	1750	820	1130	1146	169	95
Sand 12	–325.5	–346.0	2190	1580	1840	1846	138	25
Clay 13	–346.0	–421.5	2310	1020	1310	1361	231	92
Sand 14	–421.5	–461.5	2400	1370	1840	1842	180	49
Clay 15	–461.5	–473.0	1800	1100	1445	1479	183	14
Sand 16	–473.0	–489.5	1980	1540	1745	1788	118	20

Table 2.5.4-51 (Sheet 3 of 3)
S-Wave Velocity Profile Numerical Values; Upper Approximately 600 Feet of Site Soils (Power Block Area)

Stratum	Top El. (feet)[(a)]	Base El. (feet)[(a)]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Median V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	No. of Tests
Power Block Area (Units 1 & 2) (continued)								
Clay 17	–489.5	–511.0	2120	1180	1950	1793	324	26
Sand 18	–511.0	–520.0	2380	1830	1965	2015	164	12
Outside Power Block Area								
Clay 1 (Top)	80.0	63.5	1122	583	847	841	187	12
Sand 1		—	—	—	—	—	—	—
Clay 1 (Btm)	63.5	49.5	1402	586	1172	1102	264	17
Sand 2	49.5	16.5	1783	875	1262	1292	232	40
Clay 3	16.5	–6.0	1478	741	1019	1081	207	27
Sand 4	–6.0	–25.0	3125	1135	1426	1588	509	23
Clay 5 (Top)	–25.0	–33.5	1307	877	1111	1094	128	10
Sand 5	–33.5	–47.5	2343	1048	1320	1438	388	18
Clay 5 (Btm)	–47.5	–60.5	1624	854	1256	1243	221	16
Sand 6	–60.5	–113.0	2232	1038	1396	1481	292	64
Clay 7	–113.0	–159.0	1754	1120	1367	1386	159	29
Sand 8	–159.0	–173.0	5965	940	1745	2093	1173	45
Clay 9	–173.0	–208.5	2044	1079	1618	1616	262	42
Sand 10	–208.5	–231.5	2076	1267	1302	1504	324	13

(a) Elevations are referenced to NAVD 88

Table 2.5.4-52 (Sheet 1 of 2) S-Wave Velocity Profile Numerical Values; Deeper Than Approximately 600 Feet Below Existing Ground Surface (Power Block Area)

Top El. (feet)[(a)]	Base El. (feet)[(a)]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	V_s Values for Use (ft/sec)	No. of Tests	Assumed Poisson's Ratio, μ
–620	–820	3126	1547	2089	219	2080	1200	0.46
–820	–1020	2985	1713	2224	340	2220	1200	0.45
–1020	–1220	3351	1863	2428	277	2420	1200	0.45
–1220	–1420	3741	2033	2491	318	2490	1200	0.44
–1420	–1620	3505	2024	2526	342	2520	1806	0.43
–1620	–1820	3477	2053	2623	274	2620	2000	0.43
–1820	–2020	3779	2071	2753	285	2750	2000	0.42
–2020	–2220	4013	2383	2836	225	2830	2000	0.41
–2220	–2420	4547	2266	2879	254	2870	2219	0.41
–2420	–2620	6242	2303	3002	277	3000	2400	0.40
–2620	–2820	4494	2268	3179	403	3170	2400	0.39
–2820	–3020	6108	2552	3418	356	3410	2400	0.39
–3020	–3220	6686	2360	3579	398	3570	2400	0.38
–3220	–3420	6300	2327	3683	523	3680	2400	0.37
–3420	–3620	7473	2751	3933	473	3930	2400	0.37
–3620	–3820	6172	2811	4004	496	4000	2400	0.36
–3820	–4020	6035	2867	4055	448	4050	2400	0.35
–4020	–4220	6007	3087	3980	377	3980	2034	0.35
–4220	-4420	5281	3193	3929	395	3920	2000	0.34
–4420	–4620	7916	3074	3930	325	3930	2000	0.33
–4620	–4820	5289	2931	3860	452	3860	2000	0.33
–4820	–5020	5629	3132	3863	291	3860	2000	0.32
–5020	–5220	5443	3035	3889	300	3880	2000	0.31
–5220	–5420	5819	2999	4002	290	4000	2000	0.31
–5420	–5620	6677	3014	3984	445	3980	2000	0.30
–5620	–5820	6225	3342	4134	421	4130	2000	0.30
–5820	–6020	6066	3289	4127	466	4120	2000	0.30
–6020	–6220	5742	3450	4102	446	4100	2000	0.30
–6220	–6420	6203	3098	4134	419	4130	2000	0.30
-6420	–6620	6217	3470	4206	372	4200	2000	0.30
–6620	–6820	5954	3659	4223	414	4220	2000	0.30
–6820	–7020	6185	3416	4234	439	4230	2000	0.30
–7020	–7220	7737	3454	4321	500	4320	2000	0.30
–7220	–7420	6298	3621	4361	469	4360	2000	0.30
–7420	–7620	6946	3586	4385	558	4380	2000	0.30
–7620	–7820	6308	3673	4421	563	4420	2000	0.30
–7820	–8020	6618	3514	4511	629	4510	2000	0.30
–8020	–8220	7056	3167	4571	734	4570	2000	0.30
–8220	–8420	6791	3026	4550	691	4550	2000	0.30

Table 2.5.4-52 (Sheet 2 of 2)
S-Wave Velocity Profile Numerical Values; Deeper Than Approximately 600 Feet Below Existing Ground Surface (Power Block Area)

Top El. (feet)[a]	Base El. (feet)[a]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	V_s Values for Use (ft/sec)	No. of Tests	Assumed Poisson's Ratio, μ
–8420	–8620	8653	3171	5090	961	5090	1702	0.30
–8620	–8820	8898	3826	5305	1027	5300	1600	0.30
–8820	–9020	8494	4239	5430	997	5430	1600	0.30
–9020	–9220	8004	4310	5512	986	5510	1600	0.30
–9220	–9420	8064	4010	5480	913	5480	1600	0.30
–9420	–9620	7352	3649	5532	857	5530	1600	0.30
–9620	–9820	8928	4485	5726	702	5720	1542	0.30
–9820	–10,020	7695	4744	5744	705	5740	1200	0.30
–10,020	–10,220	7317	4461	5507	588	5500	1200	0.30
–10,220	–10,420	6834	4481	5777	461	5770	1307	0.30
–10,420	–10,620	7451	4836	5941	466	5940	1600	0.30
–10,620	–10,820	7384	4297	5691	530	5690	1600	0.30
–10,820	–11,020	6598	4434	5379	474	5370	1600	0.30
–11,020	–11,220	7035	4404	5299	279	5290	1600	0.30
–11,220	–11,420	7467	4291	5159	337	5150	1600	0.30
–11,420	–11,620	6961	4565	5430	287	5430	1600	0.30
–11,620	—11,820	6456	4757	5425	284	5420	1638	0.30
–11,820	–12,020	7226	4644	5530	456	5530	1971	0.30
–12,020	–12,220	7166	4844	5724	409	5720	1600	0.30
–12,220	–12,420	6684	4726	5594	497	5590	1400	0.30
–12,420	–12,620	6362	4693	5318	284	5310	848	0.30
–12,620	–12,820	7165	4511	5176	496	5170	718	0.30
–12,820	–13,020	6704	4483	5140	542	5140	800	0.30
–13,020	–13,220	7282	4491	5146	519	5140	800	0.30
–13,220	–13,420	6568	4501	5122	439	5120	674	0.30
–13,420	–13,620	7075	5065	5599	336	5590	400	0.30
–13,620	–13,820	7745	5008	5729	405	5720	400	0.30
–13,820	–14,020	6845	4943	5331	261	5330	400	0.30
–14,020	–14,220	6403	4853	5420	281	5420	400	0.30
–14,220	–14,420	6784	4721	5407	396	5400	400	0.30
–14,420	–14,620	7080	4688	5331	360	5330	400	0.30
–14,620	–14,820	7538	4947	5625	450	5620	400	0.30
–14,820	–15,020	6724	5062	5598	320	5590	400	0.30
–15,020	–15,220	7941	4893	5574	404	5570	400	0.30
–15,220	–15,420	6560	4672	5150	302	5150	400	0.30
–15,420	–15,620	5396	4549	4827	155	4820	400	0.30
–15,620	–15,780	5407	4290	4987	156	4980	322	0.30

(a) Elevations are referenced to NAVD 88.

Table 2.5.4-53
S-Wave Velocity Profile Numerical Values; (Cooling Basin)

Stratum	Top El. (feet)[a]	Base El. (feet)	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Median V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	V_s Values for Use (ft/sec)	No. of Tests
Clay 1 (Top)	70.0	60.0	1045	194	726	740	229	740	35
Sand 1	60.0	47.5	1204	294	800	778	230	778	25
Clay 1 (Btm)	47.5	31.5	1465	475	868	903	248	903	107
Sand 2	31.5	14.5	1691	559	991	1015	182	1015	73
Clay 3	14.5	1.5	2063	585	1013	1019	238	1019	101
Sand 4	1.5	–26.0	3281	866	1105	1224	383	1224	101
Clay 5 (Top)	–26.0	–40.5	2711	741	1035	1134	344	1134	91
Sand 5	–40.5	–56.5	3528	894	1356	1399	434	1399	78
Clay 5 (Btm)	–56.5	–73.0	2038	656	1180	1173	287	1173	53
Sand 6	–73.0	–96.5	2711	831	1339	1349	242	1349	204
Clay 7	–96.5	–148.5	2294	877	1262	1314	345	1314	113
Sand 8	–148.5	–184.0	3038	1038	1628	1663	350	1663	112
Clay 9	–184.0	–229.0[b]	2412	974	1528	1506	251	1506	104
Sand 10	–229.0	–219.5[b]	3010	1193	1628	1733	444	1733	38
Clay 11	–219.5	–234.5[b]	1465	1465	1465	1465	—	1465	1

(a) Elevations are referenced to NAVD 88.

(b) Because of the broad area covered by the cooling basin, the average top and base elevations of certain strata may not be representative of the subsurface conditions present at a particular location. Refer to the detailed information contained in Reference 2.5.4-2 to evaluate specific subsurface conditions.

Table 2.5.4-54
Shear Modulus Degradation Curves Numerical Values (Power Block Area)

Shear Strain (%)	G/G_{max}	
	EPRI PI = 70%[(a)]	Vucetic & Dobry PI = 200%[(b)]
Cohesive Soil Strata		
1.00E+00	0.30	0.47
3.16E-01	0.53	0.75
1.00E-01	0.78	0.90
3.16E-02	0.94	0.97
1.00E-02	0.99	0.99
3.16E-03	1.00	1.00
1.00E-03	1.00	1.00
3.16E-04	1.00	1.00
1.00E-04	1.00	1.00

(a) Applicable to Strata Clay 1 (Top), Clay 1 (Bottom), and Clay 17.
(b) Applicable to Strata Clay 3, Clay 5 (Top), Clay 5 (Bottom), Clay 7, Clay 9, Clay 11, Clay 13, and Clay 15.

Shear Strain (%)	G/G_{max}		
	Reference 2.5.4-58[(a)]	Peninsular D <50 Feet[(b)]	Peninsular D >50 Feet[(c)]
Cohesionless Soil Strata			
1.00E+00	0.05	0.09	0.20
3.16E-01	0.10	0.22	0.40
1.00E-01	0.20	0.43	0.64
3.16E-02	0.37	0.67	0.84
1.00E-02	0.55	0.85	0.95
3.16E-03	0.73	0.96	0.97
1.00E-03	0.87	1.00	1.00
3.16E-04	0.97	1.00	1.00
1.00E-04	1.00	1.00	1.00

(a) Applicable to Fill (Upper), Fill (Middle), and Fill (Lower); refer to Table 2.5.4-51.
(b) Applicable to Stratum Sand 1.
(c) Applicable to Strata Sand 2, Sand 4, Sand 6, Sand 8, Sand 10, Sand 12, Sand 14, Sand 16, and Sand 18.

Table 2.5.4-55
Shear Modulus Degradation Curves Numerical Values (Cooling Basin)

Shear Strain (%)	G/G_{max}	
	EPRI PI = 40%[a]	EPRI PI = 70%[b]
Composite Samples[c]		
1.00E+00	0.11	0.30
3.16E-01	0.26	0.53
1.00E-01	0.49	0.78
3.16E-02	0.75	0.94
1.00E-02	0.92	0.99
3.16E-03	0.99	1.00
1.00E-03	1.00	1.00
3.16E-04	1.00	1.00
1.00E-04	1.00	1.00

(a) Applicable to Composite “A”/Sand.
(b) Applicable to Composite “B”/Clay.
(c) Refer to Table 2.5.4-54 for shear modulus degradation curve numerical values for in situ soil strata.

Table 2.5.4-56
Damping Curves Numerical Values (Power Block Area)

Shear Strain (%)	Damping (%)		
	EPRI PI = 70%[a]	Vucetic & Dobry PI = 100%[b]	Vucetic & Dobry PI = 200%[c]
Cohesive Soil Strata			
1.00E+00	13.8	9.7	8.0
3.16E-01	9.3	6.0	4.7
1.00E-01	5.4	4.0	3.1
3.16E-02	3.3	2.9	2.2
1.00E-02	2.7	2.1	1.6
3.16E-03	2.6	1.5	1.3
1.00E-03	2.6	1.3	1.1
3.16E-04	2.6	1.2	0.9
1.00E-04	2.6	1.1	0.9

(a) Applicable to Strata Clay 1 (Top) and Clay 1 (Bottom).
(b) Applicable to Stratum Clay 3.
(c) Applicable to Strata Clay 5 (Top), Clay 5 (Bottom), Clay 7, Clay 9, Clay 11, Clay 13, Clay 15, and Clay 17.

Shear Strain (%)	Damping (%)		
	Reference 2.5.4-58[a]	Peninsular D <50 Feet[b]	Peninsular D >50 Feet[c]
Cohesionless Soil Strata			
1.00E+00	24.6	22.8	16.5
3.16E-01	20.8	16.5	10.3
1.00E-01	15.4	10.3	5.5
3.16E-02	9.6	5.5	2.6
1.00E-02	5.4	3.0	1.4
3.16E-03	3.0	1.6	0.9
1.00E-03	1.9	1.3	0.5
3.16E-04	1.0	1.1	0.5
1.00E-04	0.8	1.1	0.5

(a) Applicable to Fill (Upper), Fill (Middle), and Fill (Lower); refer to Table 2.5.4-51.
(b) Applicable to Stratum Sand 1.
(c) Applicable to Strata Sand 2, Sand 4, Sand 6, Sand 8, Sand 10, Sand 12, Sand 14, Sand 16, and Sand 18.

Table 2.5.4-57
Damping Curves Numerical Values (Cooling Basin)

Shear Strain (%)	Damping (%)	
	EPRI PI = 60%[a]	EPRI PI = 70%[b]
Composite Samples[c]		
1.00E+00	15.8	13.8
3.16E-01	11.1	9.3
1.00E-01	6.5	5.4
3.16E-02	3.9	3.3
1.00E-02	2.8	2.7
3.16E-03	2.6	2.6
1.00E-03	2.4	2.6
3.16E-04	2.4	2.6
1.00E-04	2.4	2.6

(a) Applicable to Composite “A”/Sand.
(b) Applicable to Composite “B”/Clay.
(c) Refer to Table 2.5.4-56 for damping curve numerical values for in situ soil strata.

Table 2.5.4-58
RCTS Test Results; Stratum Clay 1 (Top) (Power Block Area)

Boring B-2182UD Sample UD3 Stratum Clay 1 (Top)	Resonant Column Stage σ_o = 9 psi				Torsional Shear Stage First Cycle; σ_o = 9 psi			Torsional Shear Stage Tenth Cycle; σ_o = 9 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = 17.7 feet	3.74E-04		3.74E-04	4.84	9.42E-04	1.00	2.10	9.56E-04	1.00	1.90
Total Unit Weight = 125.3 pcf	7.29E-04	1.00	7.29E-04	4.83	1.89E-03	1.00	1.98	1.90E-03	1.00	2.09
Moisture Content = 21.6%	1.43E-03	1.00	1.07E-03	4.83	3.89E-03	0.98	1.96	3.92E-03	0.98	2.06
USCS Group Symbol = CH	2.84E-03	0.99	2.10E-03	4.88	9.60E-03	0.98	2.21	9.61E-03	0.94	2.21
Fines Content = 82.4%	5.76E-03	0.97	4.26E-03	5.00	2.00E-02	0.93	2.74	2.01E-02	0.94	2.76
Liquid Limit = 58%	1.15E-02	0.96	8.40E-03	5.07	—	—	—	—	—	—
Plasticity Index = 40%	2.22E-02	0.92	1.62E-02	5.23	—	—	—	—	—	—
Specific Gravity = 2.70	4.24E-02	0.88	3.01E-02	5.39	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	1.04E-01	0.78	7.14E-02	6.14	—	—	—	—	—	—
Estimated σ'_{mean} = 9 psi	2.32E-01	0.61	1.46E-01	8.18	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 37 psi				Torsional Shear Stage First Cycle; σ_o = 37 psi			Torsional Shear Stage Tenth Cycle; σ_o = 37 psi		
Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
3.26E-04	1.00	3.26E-04	4.34	1.00E-03	1.00	1.53	9.68E-04	1.00	1.63
6.60E-04	1.00	6.60E-04	4.37	1.95E-03	1.00	1.67	1.92E-03	1.00	1.79
1.27E-03	1.00	9.53E-04	4.36	3.83E-03	1.00	1.91	3.83E-03	1.00	1.82
2.55E-03	1.00	1.96E-03	4.38	9.89E-03	0.99	2.11	9.87E-03	0.98	2.06
5.10E-03	1.00	3.87E-03	4.46	2.05E-02	0.95	2.29	2.06E-02	0.94	2.49
1.00E-02	0.98	7.61E-03	4.48	—	—	—	—	—	—
1.91E-02	0.96	1.41E-02	4.53	—	—	—	—	—	—
3.91E-02	0.90	2.93E-02	4.73	—	—	—	—	—	—
8.77E-02	0.79	6.39E-02	5.36	—	—	—	—	—	—
1.99E-01	0.66	1.33E-01	6.99	—	—	—	—	—	—
4.90E-01	0.50	2.99E-01	9.4	—	—	—	—	—	—
1.01E+00	0.35	5.68E-01	11.37	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-59
RCTS Test Results; Stratum Clay 3 (Power Block Area)

Boring B-2182UD Sample UD9 Stratum Clay 3	Resonant Column Stage σ_o = 39 psi				Torsional Shear Stage First Cycle; σ_o = 39 psi			Torsional Shear Stage Tenth Cycle; σ_o = 39 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = 85.8 feet	1.97E-04	1.00	1.97E-04	3.61	1.01E-03	1.00	1.71	9.82E-04	1.00	1.85
Total Unit Weight = 115.0 pcf	3.86E-04	1.00	3.86E-04	3.62	1.99E-03	1.00	1.85	2.05E-03	1.00	1.77
Moisture Content = 35.1%	7.87E-04	1.00	7.87E-04	3.63	3.99E-03	1.00	1.65	3.99E-03	1.00	1.75
USCS Group Symbol = CH	1.61E-03	1.00	1.24E-03	3.68	1.02E-02	0.99	1.69	1.02E-02	0.99	1.78
Fines Content = 86.6%	3.22E-03	1.00	2.44E-03	3.76	2.07E-02	0.97	1.85	2.07E-02	0.97	1.80
Liquid Limit = 80%	6.44E-03	1.00	4.89E-03	3.75	—	—	—	—	—	—
Plasticity Index = 56%	1.28E-02	1.00	9.63E-02	3.92	—	—	—	—	—	—
Specific Gravity = 2.70	2.59E-02	0.98	1.97E-02	4.17	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	5.25E-02	0.96	3.88E-02	4.52	—	—	—	—	—	—
Estimated σ'_{mean} = 39 psi	1.05E-01	0.90	7.44E-02	5.11	—	—	—	—	—	—
	2.14E-01	0.75	1.41E-01	6.58	—	—	—	—	—	—
	4.21E-01	0.58	2.49E-01	9.28	—	—	—	—	—	—

Resonant Column Stage σ_o = 156 psi				Torsional Shear Stage First Cycle; σ_o = 156 psi			Torsional Shear Stage Tenth Cycle; σ_o = 156 psi		
Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
2.39E-04	1.00	2.39E-04	3.14	1.07E-03	1.00	1.21	1.08E-03	1.00	1.26
4.74E-04	1.00	4.74E-04	3.14	2.04E-03	1.00	1.40	2.03E-03	1.00	1.50
9.98E-04	1.00	9.98E-04	3.14	4.04E-03	1.00	1.46	4.06E-03	1.00	1.53
1.99E-03	1.00	1.55E-03	3.18	1.02E-02	1.00	1.50	1.01E-02	1.00	1.38
3.97E-03	1.00	3.13E-03	3.22	—	—	—	—	—	—
7.92E-03	1.00	6.26E-03	3.28	—	—	—	—	—	—
1.59E-02	0.99	1.24E-02	3.38	—	—	—	—	—	—
3.17E-02	0.98	2.44E-02	3.53	—	—	—	—	—	—
6.34E-02	0.96	4.82E-02	3.86	—	—	—	—	—	—
1.28E-01	0.88	9.58E-02	4.22	—	—	—	—	—	—
2.47E-01	0.75	1.78E-01	4.92	—	—	—	—	—	—
4.81E-01	0.60	3.42E-01	6.01	—	—	—	—	—	—
9.08E-01	0.49	5.72E-01	8.63	—	—	—	—	—	—

Table 2.5.4-60
RCTS Test Results; Stratum Sand 4 (Power Block Area)

Boring B-2174UD Sample UD6 Stratum Sand 4	Resonant Column Stage σ_o = 42 psi				Torsional Shear Stage First Cycle; σ_o = 42 psi			Torsional Shear Stage Tenth Cycle; σ_o = 42 psi		
	Peak Shear Strain (%)	G/G_{max}	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/G_{max}	Damping Ratio (%)	Peak Shear Strain (%)	G/G_{max}	Damping Ratio (%)
Depth = 96.4 feet	1.82E-04	1.00	1.82E-04	0.39	7.94E-04	1.00	0.37	7.52E-04	1.00	0.54
Total Unit Weight = 117.7 pcf	3.57E-04	1.00	3.57E-04	0.42	1.03E-03	1.00	0.53	1.03E-03	1.00	0.41
Moisture Content = 12.9%	7.21E-04	1.00	7.21E-04	0.45	2.07E-03	1.00	0.44	2.07E-03	1.00	0.39
USCS Group Symbol = SP-SC	1.38E-03	0.99	1.33E-03	0.46	4.22E-03	0.98	0.72	4.22E-03	0.98	0.61
Fines Content = 6.8%	2.60E-03	0.98	2.44E-03	0.51	1.05E-02	0.96	0.90	1.06E-02	0.96	0.86
Liquid Limit = No Value	4.76E-03	0.97	4.47E-03	0.59	—	—	—	—	—	—
Plasticity Index = Non-Plastic	8.36E-03	0.95	7.77E-03	0.75	—	—	—	—	—	—
Specific Gravity = 2.68	1.38E-02	0.92	1.25E-02	1.03	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	2.37E-02	0.86	2.11E-02	1.51	—	—	—	—	—	—
Estimated σ'_{mean} = 42.0 psi	3.59E-02	0.81	3.05E-02	2.20	—	—	—	—	—	—
	5.51E-02	0.75	4.41E-02	3.28	—	—	—	—	—	—
	8.96E-02	0.66	6.63E-02	4.64	—	—	—	—	—	—

Resonant Column Stage σ_o = 168 psi				Torsional Shear Stage First Cycle; σ_o = 168 psi			Torsional Shear Stage Tenth Cycle; σ_o = 168 psi		
Peak Shear Strain (%)	G/G_{max}	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/G_{max}	Damping Ratio (%)	Peak Shear Strain (%)	G/G_{max}	DampingRatio (%)
1.51E-04	1.00	1.51E-04	0.31	1.05E-03	1.00	0.32	1.06E-03	1.00	0.39
2.97E-04	1.00	2.97E-04	0.36	2.10E-03	1.00	0.31	2.12E-03	1.00	0.31
6.09E-04	1.00	6.09E-04	0.41	4.23E-03	0.99	0.29	4.25E-03	1.00	0.30
1.18E-03	1.00	1.13E-03	0.40	8.59E-03	0.98	0.35	8.55E-03	0.99	0.48
2.25E-03	0.99	2.16E-03	0.42	—	—	—	—	—	—
4.18E-03	0.98	3.97E-03	0.44	—	—	—	—	—	—
7.33E-03	0.97	6.96E-03	0.54	—	—	—	—	—	—
1.26E-02	0.94	1.18E-02	0.70	—	—	—	—	—	—
2.12E-02	0.91	1.98E-02	0.93	—	—	—	—	—	—
3.42E-02	0.87	3.08E-02	1.44	—	—	—	—	—	—
5.33E-02	0.82	4.63E-02	2.07	—	—	—	—	—	—
8.33E-02	0.75	6.83E-02	3.17	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-61
RCTS Test Results; Stratum Clay 5 (Top) (Power Block Area)

Boring B-2274UD Sample UD8 Stratum Clay 5 (Top)	Resonant Column Stage σ_o = 49 psi				Torsional Shear Stage First Cycle; σ_o = 49 psi			Torsional Shear Stage Tenth Cycle; σ_o = 49 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = 122.0 feet	7.07E-04	1.00	7.07E-04	3.42	9.92E-04	1.00	0.90	9.87E-04	1.00	0.90
Total Unit Weight = 112.6 pcf	1.53E-03	1.00	1.53E-03	3.48	1.96E-03	1.00	1.24	1.95E-03	1.00	1.02
Moisture Content = 33.5%	3.07E-03	1.00	2.40E-03	3.51	3.83E-03	1.00	1.28	3.87E-03	1.00	1.06
USCS Group Symbol = CH	6.10E-03	1.00	4.76E-03	3.58	9.66E-03	1.00	1.27	9.66E-03	1.00	1.16
Fines Content = 94.1%	1.23E-02	1.00	1.05E-02	3.66	1.96E-02	0.99	1.19	1.97E-02	0.99	1.25
Liquid Limit = 93%	2.47E-02	0.99	1.92E-02	3.72	—	—	—	—	—	—
Plasticity Index = 64%	4.90E-02	0.98	3.82E-02	3.89	—	—	—	—	—	—
Specific Gravity = 2.72	9.31E-02	0.95	7.17E-02	4.09	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	1.86E-01	0.87	1.39E-01	4.47	—	—	—	—	—	—
Estimated σ'_{mean} = 49 psi	3.87E-01	0.76	2.79E-01	5.27	—	—	—	—	—	—
	8.04E-01	0.61	4.99E-01	8.33	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 197 psi				Torsional Shear Stage First Cycle; σ_o = 197 psi			Torsional Shear Stage Tenth Cycle; σ_o = 197 psi		
Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
3.19E-04	1.00	3.19E-04	3.00	1.02E-03	1.00	1.09	1.07E-03	1.00	0.88
6.88E-04	1.00	6.88E-04	3.05	2.00E-03	1.00	0.91	2.03E-03	1.00	1.31
1.33E-03	1.00	1.07E-03	3.08	4.00E-03	1.00	0.93	4.06E-03	1.00	1.08
2.63E-03	1.00	2.13E-03	3.13	9.75E-03	1.00	1.48	9.78E-03	1.00	1.48
5.21E-03	1.00	4.16E-03	3.22	1.99E-02	0.97	1.45	2.01E-02	0.98	1.56
1.03E-02	1.00	8.27E-03	3.28	—	—	—	—	—	—
2.05E-02	0.98	1.64E-02	3.38	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-62
RCTS Test Results; Stratum Sand 5 (Power Block Area)

Boring B-2182UD Sample UD14 Stratum Sand 5	Resonant Column Stage σ_o = 50 psi				Torsional Shear Stage First Cycle; σ_o = 50 psi			Torsional Shear Stage Tenth Cycle; σ_o = 50 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = 124.7 feet	2.07E-04	1.00	2.70E-04	0.91	1.05E-03	1.00	0.35	1.06E-03	1.00	0.40
Total Unit Weight = 124.9 pcf	5.57E-04	1.00	5.57E-04	0.97	2.10E-03	1.00	0.59	2.11E-03	1.00	0.48
Moisture Content = 22.2%	1.09E-03	1.00	1.09E-03	1.03	4.26E-03	0.98	0.72	4.27E-03	0.99	0.68
USCS Group Symbol = SC	2.14E-03	0.99	1.95E-03	1.11	1.04E-02	0.96	1.00	1.04E-02	0.97	1.00
Fines Content = 13.4%	4.12E-03	0.97	3.71E-03	1.25	—	—	—	—	—	—
Liquid Limit = No Value	7.78E-03	0.96	6.93E-03	1.34	—	—	—	—	—	—
Plasticity Index = Non-Plastic	1.40E-02	0.93	1.23E-02	1.58	—	—	—	—	—	—
Specific Gravity = 2.66	2.43E-02	0.88	2.09E-02	1.99	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	4.01E-02	0.83	3.33E-02	2.71	—	—	—	—	—	—
Estimated σ'_{mean} = 50 psi	6.54E-02	0.76	5.10E-02	3.71	—	—	—	—	—	—
	1.07E-01	0.69	7.08E-02	5.15	—	—	—	—	—	—
	1.67E-01	0.65	1.13E-01	6.32	—	—	—	—	—	—

Resonant Column Stage σ_o = 200 psi				Torsional Shear Stage First Cycle; σ_o = 200 psi			Torsional Shear Stage Tenth Cycle; σ_o = 200 psi		
Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
1.38E-04	1.00	1.38E-04	0.82	1.04E-03	1.00	0.27	1.05E-03	1.00	0.43
2.72E-04	1.00	2.72E-04	0.84	2.10E-03	0.99	0.33	2.11E-03	1.00	0.39
5.61E-04	1.00	5.61E-04	0.86	4.22E-03	0.99	0.45	4.21E-03	1.00	0.56
1.11E-03	1.00	1.11E-03	0.89	8.51E-03	0.98	0.56	8.48E-03	0.99	0.56
2.18E-03	0.99	2.03E-03	0.96	—	—	—	—	—	—
4.24E-03	0.98	3.94E-03	0.99	—	—	—	—	—	—
8.09E-03	0.97	7.44E-03	1.08	—	—	—	—	—	—
1.48E-02	0.94	1.35E-02	1.27	—	—	—	—	—	—
2.59E-02	0.91	2.31E-02	1.68	—	—	—	—	—	—
4.37E-02	0.87	3.80E-02	2.09	—	—	—	—	—	—
7.18E-02	0.80	5.96E-02	2.68	—	—	—	—	—	—
8.69E-02	0.75	7.13E-02	3.07	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-63
RCTS Test Results; Stratum Sand 6 (Power Block Area)

Boring B-2269UD Sample UD15 Stratum Sand 6	Resonant Column Stage σ_o = 77 psi				Torsional Shear Stage First Cycle; σ_o = 77 psi			Torsional Shear Stage Tenth Cycle; σ_o = 77 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = 216.2 feet	1.50E-04	1.00	1.50E-04	2.74	9.94E-03	0.89	2.15	9.96E-03	0.89	2.12
Total Unit Weight = 122.7 pcf	3.00E-04	1.00	3.00E-04	2.77	1.89E-02	0.85	2.81	1.89E-02	0.84	2.89
Moisture Content = 13.9%	6.19E-04	1.00	6.19E-04	2.88	—	—	—	—	—	—
USCS Group Symbol = SC	1.24E-03	0.98	1.03E-03	3.02	—	—	—	—	—	—
Fines Content = 40.1%	2.43E-03	0.97	1.99E-03	3.20	—	—	—	—	—	—
Liquid Limit = 26%	4.85E-03	0.93	3.93E-03	3.46	—	—	—	—	—	—
Plasticity Index = 12%	9.59E-03	0.89	7.57E-03	3.92	—	—	—	—	—	—
Specific Gravity = 2.66	1.82E-02	0.84	1.38E-02	4.46	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	3.83E-02	0.72	2.80E-02	5.32	—	—	—	—	—	—
Estimated σ'_{mean} = 77 psi	7.52E-02	0.61	5.19E-02	6.55	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 308 psi				Torsional Shear Stage First Cycle; σ_o = 308 psi			Torsional Shear Stage Tenth Cycle; σ_o = 308 psi		
Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
5.10E-05	1.00	5.10E-05	2.27	9.95E-03	0.88	1.70	9.94E-03	0.88	1.65
1.01E-04	1.00	1.01E-04	2.30	—	—	—	—	—	—
2.01E-04	1.00	2.01E-04	2.32	—	—	—	—	—	—
3.98E-04	1.00	3.98E-04	2.39	—	—	—	—	—	—
8.20E-04	0.99	8.20E-04	2.44	—	—	—	—	—	—
1.61E-03	0.98	1.37E-03	2.48	—	—	—	—	—	—
3.16E-03	0.96	2.69E-03	2.61	—	—	—	—	—	—
6.20E-03	0.94	5.15E-03	2.94	—	—	—	—	—	—
1.24E-02	0.88	1.02E-02	3.33	—	—	—	—	—	—
2.42E-02	0.81	1.91E-02	3.74	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-64
RCTS Test Results; Stratum Clay 7 (Power Block Area)

Boring B-2182UD Sample UD18 Stratum Clay 7	**Resonant Column Stage σ_o = 78 psi**				**Torsional Shear Stage First Cycle; σ_o = 78 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 78 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 220.5 feet	2.66E-04	1.00	2.66E-04	2.43	1.01E-03	1.00	0.56	1.00E-03	1.00	0.46
Total Unit Weight = 115.1 pcf	5.48E-04	1.00	5.48E-04	2.46	2.02E-03	1.00	0.61	2.04E-03	1.00	0.50
Moisture Content = 35.2%	1.08E-03	0.99	1.08E-03	2.48	3.97E-03	1.00	0.59	4.00E-03	1.00	0.60
USCS Group Symbol = CH	2.18E-03	0.99	2.18E-03	2.56	1.02E-02	1.00	0.70	1.02E-02	1.00	0.79
Fines Content = 96.3%	4.39E-03	0.99	3.51E-03	2.62	—	—	—	—	—	—
Liquid Limit = 97%	8.79E-03	0.99	7.03E-03	2.74	—	—	—	—	—	—
Plasticity Index = 67%	1.76E-02	0.99	1.46E-02	2.89	—	—	—	—	—	—
Specific Gravity = 2.70	3.49E-02	0.98	2.79E-02	3.13	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	6.95E-02	0.95	5.35E-02	3.61	—	—	—	—	—	—
Estimated σ'_{mean} = 78 psi	1.34E-01	0.86	1.00E-01	4.21	—	—	—	—	—	—
	2.31E-01	0.76	1.64E-01	5.21	—	—	—	—	—	—
	3.73E-01	0.67	2.54E-01	6.38	—	—	—	—	—	—

	Resonant Column Stage σ_o = 310 psi				**Torsional Shear Stage First Cycle; σ_o = 310 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 310 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
	3.89E-04	1.00	3.89E-04	2.32	1.04E-03	1.00	0.63	1.01E-03	1.00	0.72
	7.88E-04	1.00	7.88E-04	2.38	2.02E-03	1.00	0.68	2.06E-03	1.00	0.72
	1.57E-03	1.00	1.30E-03	2.40	4.04E-03	1.00	0.72	4.04E-03	1.00	0.60
	3.10E-03	1.00	2.51E-03	2.43	9.98E-03	1.00	0.62	1.00E-02	1.00	0.63
	6.27E-03	1.00	5.14E-03	2.48	2.03E-02	0.99	0.75	2.02E-02	0.99	0.64
	1.25E-02	1.00	1.03E-02	2.49	—	—	—	—	—	—
	2.52E-02	0.99	2.04E-02	2.63	—	—	—	—	—	—
	5.02E-02	0.97	4.06E-02	2.77	—	—	—	—	—	—
	9.79E-02	0.94	7.73E-02	3.20	—	—	—	—	—	—
	1.93E-01	0.85	1.47E-01	3.72	—	—	—	—	—	—
	3.55E-01	0.74	2.56E-01	4.78	—	—	—	—	—	—
	6.03E-01	0.63	4.22E-01	6.06	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Table 2.5.4-65
RCTS Test Results; Stratum Sand 8 (Power Block Area)

Boring B-2274UD Sample UD14 Stratum Sand 8	**Resonant Column Stage σ_o = 91 psi**				**Torsional Shear Stage First Cycle; σ_o = 91 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 91 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 267.5 feet	2.30E-04	1.00	2.30E-04	0.72	1.02E-03	1.00	0.28	1.02E-03	1.00	0.25
Total Unit Weight = 130.0 pcf	4.59E-04	1.00	4.59E-04	0.72	2.03E-03	1.00	0.33	2.05E-03	1.00	0.39
Moisture Content = 18.5%	9.58E-04	0.99	9.58E-04	0.75	4.15E-03	0.98	0.44	4.14E-03	0.99	0.46
USCS Group Symbol = SC	1.87E-03	0.99	1.70E-03	0.80	1.07E-03	0.95	0.71	1.07E-03	0.95	0.75
Fines Content = 12.0%	3.61E-03	0.98	3.35E-03	0.81	—	—	—	—	—	—
Liquid Limit = No Value	6.92E-03	0.96	6.29E-03	0.92	—	—	—	—	—	—
Plasticity Index = Non-Plastic	1.28E-02	0.94	1.16E-02	1.18	—	—	—	—	—	—
Specific Gravity = 2.65	2.22E-02	0.90	1.95E-02	1.57	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	3.75E-02	0.84	3.19E-02	2.06	—	—	—	—	—	—
Estimated σ'_{mean} = 91 psi	6.15E-02	0.76	5.04E-02	2.66	—	—	—	—	—	—
	9.52E-02	0.71	7.33E-02	3.91	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 365 psi				**Torsional Shear Stage First Cycle; σ_o = 365 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 365 psi**		
Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
1.37E-04	1.00	1.37E-04	0.58	1.03E-03	1.00	0.33	1.04E-03	1.00	0.41
2.71E-04	1.00	2.71E-04	0.61	2.06E-03	1.00	0.39	2.06E-03	1.00	0.33
5.55E-04	1.00	5.55E-04	0.64	4.10E-03	1.00	0.37	4.12E-03	1.00	0.50
1.10E-03	1.00	1.10E-03	0.70	—	—	—	—	—	—
2.17E-03	0.99	2.04E-03	0.73	—	—	—	—	—	—
4.22E-03	0.98	3.92E-03	0.79	—	—	—	—	—	—
8.23E-03	0.97	7.57E-03	0.87	—	—	—	—	—	—
1.48E-02	0.95	1.35E-02	1.01	—	—	—	—	—	—
2.61E-02	0.91	2.38E-02	1.23	—	—	—	—	—	—
4.26E-02	0.85	3.79E-02	1.62	—	—	—	—	—	—
6.69E-02	0.78	5.68E-02	2.21	—	—	—	—	—	—
1.02E-01	0.72	8.28E-02	3.02	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-66
RCTS Test Results; Stratum Clay 9 (Power Block Area)

Boring B-2182UD Sample UD24 Stratum Clay 9	**Resonant Column Stage σ_o = 102 psi**				**Torsional Shear Stage First Cycle; σ_o = 102 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 102 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 300.6 feet	2.67E-05	1.00	2.67E-05	N/A	1.99E-04	0.99	2.69	2.13E-04	0.99	2.74
Total Unit Weight = 123.1 pcf	5.12E-05	1.00	5.12E-05	N/A	3.88E-04	0.99	2.80	3.89E-03	1.00	2.63
Moisture Content = 22.7%	1.01E-04	1.01	1.01E-05	3.41	7.67E-04	1.00	2.77	7.72E-04	1.00	2.74
USCS Group Symbol = CH	2.00E-04	1.00	2.00E-04	3.40	1.63E-03	1.01	2.76	1.64E-03	1.01	2.75
Fines Content = 93.0%	3.71E-04	1.00	3.71E-04	3.39	3.27E-03	1.01	2.74	3.27E-03	1.01	2.79
Liquid Limit = 69%	7.24E-04	1.00	7.42E-04	3.39	—	—	—	—	—	—
Plasticity Index = 49%	1.53E-03	1.00	1.53E-03	3.40	—	—	—	—	—	—
Specific Gravity = 2.72	3.04E-03	1.00	3.04E-03	3.43	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	6.02E-03	1.00	6.02E-03	3.46	—	—	—	—	—	—
Estimated σ'_{mean} = 102 psi	1.15E-02	0.99	1.15E-03	3.62	—	—	—	—	—	—
	2.26E-02	0.97	2.26E-02	3.86	—	—	—	—	—	—
	3.64E-02	0.94	3.64E-02	4.25	—	—	—	—	—	—

Resonant Column Stage σ_o = 406 psi				**Torsional Shear Stage First Cycle; σ_o = 406 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 406 psi**		
Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
2.34E-05	1.00	2.34E-05	N/A	3.32E-04	1.00	2.68	3.26E-04	1.01	2.62
4.49E-05	1.00	4.49E-05	N/A	6.66E-04	0.99	2.66	6.58E-04	1.00	2.63
8.84E-05	1.00	8.84E-05	3.38	1.33E-03	0.99	2.60	1.32E-03	1.00	2.51
1.76E-04	1.00	1.76E-04	3.36	2.87E-03	1.00	2.64	2.86E-03	1.00	2.62
3.27E-04	1.00	3.27E-04	3.36	—	—	—	—	—	—
6.52E-04	1.00	6.52E-04	3.35	—	—	—	—	—	—
1.35E-03	1.00	1.35E-03	3.37	—	—	—	—	—	—
2.69E-03	1.00	2.69E-03	3.37	—	—	—	—	—	—
5.33E-03	1.00	5.33E-03	3.37	—	—	—	—	—	—
9.08E-03	0.99	9.08E-03	3.50	—	—	—	—	—	—
2.03E-02	0.98	2.03E-02	3.57	—	—	—	—	—	—
3.32E-02	0.96	3.32E-02	3.8	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-67
RCTS Test Results; Stratum Sand 10 (Power Block Area)

Boring B-2182UD Sample UD32 Stratum Sand 10	Resonant Column Stage σ_o = 116 psi				Torsional Shear Stage First Cycle; σ_o = 116 psi			Torsional Shear Stage Tenth Cycle; σ_o = 116 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = 352.7 feet	1.08E-04	1.00	1.08E-04	0.40	1.06E-03	1.00	0.40	1.04E-03	1.00	0.41
Total Unit Weight = 126.8 pcf	2.19E-04	1.00	2.19E-04	0.42	2.15E-03	0.99	0.53	2.13E-03	0.98	0.43
Moisture Content = 21.1%	4.31E-04	1.00	4.31E-04	0.48	9.50E-03	0.94	0.95	9.47E-03	0.92	0.80
USCS Group Symbol = SP-SC	8.63E-04	0.99	8.63E-04	0.56	—	—	—	—	—	—
Fines Content = 8.9%	1.64E-03	0.98	1.54E-03	0.62	—	—	—	—	—	—
Liquid Limit = No Value	3.02E-03	0.97	2.84E-03	0.74	—	—	—	—	—	—
Plasticity Index = Non-Plastic	5.52E-03	0.95	5.08E-03	0.84	—	—	—	—	—	—
Specific Gravity = 2.66	9.23E-03	0.93	8.58E-03	1.02	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	1.54E-02	0.90	1.40E-02	1.23	—	—	—	—	—	—
Estimated σ'_{mean} = 116 psi	2.54E-02	0.85	2.24E-02	1.77	—	—	—	—	—	—
	4.20E-02	0.78	3.53E-02	2.52	—	—	—	—	—	—
	6.55E-02	0.73	5.18E-02	3.69	—	—	—	—	—	—

Resonant Column Stage σ_o = 455 psi				Torsional Shear Stage First Cycle; σ_o = 455 psi			Torsional Shear Stage Tenth Cycle; σ_o = 455 psi		
Peak Shear Strain (%)	G/G_{ma}	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
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Table 2.5.4-68
RCTS Test Results; Stratum Clay 11 (Power Block Area)

Boring B-2269UD Sample UD19 Stratum Clay 11	**Resonant Column Stage σ_o = 125 psi**				**Torsional Shear Stage First Cycle; σ_o = 125 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 125 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 381.6 feet	3.80E-04	1.00	3.80E-04	2.56	1.03E-03	1.00	0.68	1.02E-03	1.00	0.70
Total Unit Weight = 114.6 pcf	7.23E-04	1.00	7.23E-04	2.57	2.04E-03	1.00	0.74	2.04E-03	1.00	0.74
Moisture Content = 33.0%	1.40E-03	1.00	1.16E-03	2.63	4.06E-03	1.00	0.59	4.05E-03	1.00	0.60
USCS Group Symbol = CH	2.77E-03	1.00	2.32E-03	2.61	9.95E-03	1.00	0.86	9.96E-03	1.00	0.69
Fines Content = 81.9%	5.46E-03	1.00	4.53E-03	2.61	—	—	—	—	—	—
Liquid Limit = 88%	1.08E-02	0.99	8.97E-03	2.62	—	—	—	—	—	—
Plasticity Index = 57%	2.14E-02	0.99	1.80E-02	2.65	—	—	—	—	—	—
Specific Gravity = 2.69	4.17E-02	0.98	3.46E-02	2.62	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	8.19E-02	0.95	6.80E-02	2.76	—	—	—	—	—	—
Estimated σ'_{mean} = 125 psi	1.54E-01	0.90	1.23E-01	3.23	—	—	—	—	—	—
	2.72E-01	0.83	2.04E-01	4.52	—	—	—	—	—	—
	4.83E-01	0.73	3.23E-01	6.92	—	—	—	—	—	—

Resonant Column Stage σ_o = 455 psi				**Torsional Shear Stage First Cycle; σ_o = 455 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 455 psi**		
Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
3.01E-04	1.00	3.01E-04	2.35	9.98E-04	1.00	0.90	9.95E-04	1.00	0.55
6.20E-04	1.00	6.20E-04	2.36	2.00E-03	1.00	0.79	1.99E-03	1.00	0.64
1.21E-03	1.00	1.21E-03	2.36	3.99E-03	1.00	0.89	3.97E-03	1.00	0.86
2.36E-03	1.00	2.03E-03	2.38	1.02E-02	0.98	1.06	1.02E-02	0.97	1.17
4.61E-03	1.00	4.01E-03	2.33	—	—	—	—	—	—
8.76E-03	1.00	7.62E-03	2.32	—	—	—	—	—	—
1.66E-02	1.00	1.43E-02	2.33	—	—	—	—	—	—
3.16E-02	1.00	2.72E-02	2.44	—	—	—	—	—	—
5.72E-02	0.99	4.92E-02	2.52	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-69
RCTS Test Results; Stratum Sand 12 (Power Block Area)

Boring B-2274UD Sample UD23 Stratum Sand 12	Resonant Column Stage σ_o = 136 psi				Torsional Shear Stage First Cycle; σ_o = 136 psi			Torsional Shear Stage Tenth Cycle; σ_o = 136 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = 422.5 feet	8.20E-05	1.00	8.20E-05	4.64	6.81E-04	1.00	0.82	6.89E-04	1.00	1.02
Total Unit Weight = 134.4 pcf	1.64E-04	1.00	1.64E-04	4.74	1.10E-03	1.00	0.90	1.09E-03	1.00	1.02
Moisture Content = 15.5%	3.28E-04	1.00	3.28E-04	4.81	2.20E-03	1.00	1.15	2.19E-03	1.00	1.00
USCS Group Symbol = CL	6.82E-04	1.00	6.82E-04	4.92	4.46E-03	0.99	1.13	4.46E-03	0.99	0.99
Fines Content = 58.3%	1.36E-03	1.00	9.94E-04	4.99	—	—	—	—	—	—
Liquid Limit = 36%	2.76E-03	0.99	2.02E-03	5.18	—	—	—	—	—	—
Plasticity Index = 21%	5.60E-03	0.96	4.09E-03	5.28	—	—	—	—	—	—
Specific Gravity = 2.68	1.14E-02	0.91	8.22E-03	5.51	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	2.36E-02	0.83	1.65E-02	6.16	—	—	—	—	—	—
Estimated σ'_{mean} = 136 psi	5.14E-02	0.70	3.34E-02	7.86	—	—	—	—	—	—
	1.23E-01	0.52	7.00E-02	10.89	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 455 psi				Torsional Shear Stage First Cycle; σ_o = 455 psi			Torsional Shear Stage Tenth Cycle; σ_o = 455 psi		
Peak Shear Strain (%)	G/G_{max}	Avg. Shea Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/G_{max}	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
3.60E-05	1.00	3.60E-05	3.59	1.02E-03	1.00	0.51	1.03E-03	1.00	0.52
7.10E-05	1.00	7.10E-05	3.62	2.04E-03	1.00	0.61	2.06E-03	1.00	0.51
1.43E-04	1.00	1.43E-04	3.64	4.10E-03	1.00	0.74	4.09E-03	1.00	0.62
2.86E-04	1.00	2.86E-04	3.68	8.29E-03	0.99	0.93	8.26E-03	0.99	0.90
5.94E-04	1.00	5.94E-04	3.80	—	—	—	—	—	—
1.19E-03	1.00	9.39E-04	3.79	—	—	—	—	—	—
2.34E-03	0.99	1.85E-03	3.92	—	—	—	—	—	—
4.77E-03	0.97	3.72E-03	4.02	—	—	—	—	—	—
1.15E-02	0.92	8.86E-03	4.34	—	—	—	—	—	—
1.90E-02	0.87	1.43E-02	4.93	—	—	—	—	—	—
3.92E-02	0.74	2.70E-02	6.56	—	—	—	—	—	—
6.12E-02	0.65	3.98E-02	7.86	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-70
RCTS Test Results; Stratum Clay 13 (Power Block Area)

Boring B-2274UD Sample UD24 Stratum Clay 13	**Resonant Column Stage σ_o = 154 psi**				**Torsional Shear Stage First Cycle; σ_o = 154 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 154 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 481.1 feet	3.88E-04	1.00	3.88E-04	2.05	1.01E-03	1.00	1.01	1.02E-03	1.00	0.75
Total Unit Weight = 123.5 pcf	8.13E-04	1.00	8.13E-04	2.08	1.99E-03	1.00	1.01	2.00E-03	1.00	0.85
Moisture Content = 26.2%	1.65E-03	1.00	1.40E-03	2.15	3.99E-03	1.00	0.94	4.00E-03	1.00	0.89
USCS Group Symbol = CH	3.29E-03	1.00	2.79E-03	2.20	1.01E-02	0.99	0.93	1.00E-02	1.00	0.88
Fines Content = 96.1%	6.54E-03	1.00	5.62E-03	2.28	—	—	—	—	—	—
Liquid Limit = 69%	1.27E-02	0.99	1.08E-02	2.36	—	—	—	—	—	—
Plasticity Index = 42%	2.48E-02	0.99	2.08E-02	2.54	—	—	—	—	—	—
Specific Gravity = 2.71	4.72E-02	0.96	3.96E-02	2.70	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	8.93E-02	0.90	7.32E-02	2.96	—	—	—	—	—	—
Estimated σ'_{mean} = 154 psi	1.67E-01	0.80	1.30E-01	3.92	—	—	—	—	—	—
	3.22E-01	0.67	2.25E-01	5.85	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 455 psi				**Torsional Shear Stage First Cycle; σ_o = 455 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 455 psi**		
Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
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Table 2.5.4-71
RCTS Test Results; Stratum Sand 14 (Power Block Area)

Boring B-2174UDR **Sample UD28** **Stratum Sand 14**	**Resonant Column Stage** **σ_o = 167 psi**				**Torsional Shear Stage** **First Cycle; σ_o = 167 psi**			**Torsional Shear Stage** **Tenth Cycle; σ_o = 167 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 527.5 feet	1.06E-04	1.00	1.06E-04	1.36	1.02E-03	1.00	0.57	1.03E-03	1.00	0.43
Total Unit Weight = 126.1 pcf	2.07E-04	1.00	2.07E-04	1.34	2.11E-03	0.97	0.44	2.12E-03	0.97	0.50
Moisture Content = 20.9%	4.21E-04	1.00	4.21E-04	1.35	4.38E-03	0.93	0.62	4.41E-03	0.94	0.56
USCS Group Symbol = SM	8.60E-04	0.99	8.60E-04	1.38	9.14E-03	0.89	0.86	9.11E-03	0.91	0.87
Fines Content = 21.5%	1.70E-03	0.98	1.53E-03	1.37	—	—	—	—	—	—
Liquid Limit = 18%	3.31E-03	0.97	2.98E-03	1.45	—	—	—	—	—	—
Plasticity Index = 2%	6.32E-03	0.96	5.63E-03	1.56	—	—	—	—	—	—
Specific Gravity = 2.68	1.17E-02	0.93	1.03E-02	1.85	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	2.15E-02	0.87	1.82E-02	2.34	—	—	—	—	—	—
Estimated σ'_{mean} = 167 psi	3.74E-02	0.81	3.06E-02	3.13	—	—	—	—	—	—
	6.57E-02	0.73	5.06E-02	4.19	—	—	—	—	—	—
	8.32E-02	0.69	6.32E-02	4.58	—	—	—	—	—	—

Resonant Column Stage **σ_o = 455 psi**				**Torsional Shear Stage** **First Cycle; σ_o = 455 psi**			**Torsional Shear Stage** **Tenth Cycle; σ_o = 455 psi**		
Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
8.00E-05	1.00	8.00E-05	1.24	1.02E-03	1.00	0.63	1.00E-03	1.00	0.51
1.59E-04	1.00	1.59E-04	1.29	1.90E-03	1.00	0.65	1.90E-03	0.99	0.63
3.17E-04	1.00	3.17E-04	1.28	—	—	—	—	—	—
6.53E-04	1.00	6.53E-04	1.30	—	—	—	—	—	—
1.29E-03	0.99	1.29E-03	1.33	—	—	—	—	—	—
2.54E-03	0.98	2.31E-03	1.35	—	—	—	—	—	—
4.89E-03	0.97	4.40E-03	1.42	—	—	—	—	—	—
9.03E-03	0.94	8.04E-03	1.67	—	—	—	—	—	—
1.68E-02	0.90	1.48E-02	1.99	—	—	—	—	—	—
2.99E-02	0.85	2.54E-02	2.66	—	—	—	—	—	—
4.42E-02	0.80	3.62E-02	3.17	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-72
RCTS Test Results; Stratum Clay 17 (Power Block Area)

Boring B-2174UDR Sample UD30 Stratum Clay 17	**Resonant Column Stage σ_o = 180 psi**				**Torsional Shear Stage First Cycle; σ_o = 180 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 180 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 571.6 feet	2.09E-04	1.00	2.09E-04	4.02	9.62E-04	1.00	0.93	9.38E-04	1.00	0.78
Total Unit Weight = 126.4 pcf	4.23E-04	1.00	4.23E-04	4.05	1.95E-03	1.00	1.05	1.94E-03	1.00	1.16
Moisture Content = 23.1%	8.54E-04	1.00	8.54E-04	4.09	3.87E-03	1.00	0.97	3.85E-03	1.00	0.92
USCS Group Symbol = CH	1.72E-03	1.00	1.34E-03	4.10	9.72E-03	1.00	1.12	9.69E-03	1.00	1.16
Fines Content = 68.3%	3.46E-03	0.99	2.70E-03	4.12	—	—	—	—	—	—
Liquid Limit = 59%	6.94E-03	0.99	5.41E-03	4.13	—	—	—	—	—	—
Plasticity Index = 40%	1.40E-02	0.97	1.08E-02	4.31	—	—	—	—	—	—
Specific Gravity = 2.74	2.84E-02	0.94	2.16E-02	4.53	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	5.73E-02	0.87	4.18E-02	5.22	—	—	—	—	—	—
Estimated σ'_{mean} = 180 psi	1.18E-01	0.76	8.27E-02	6.03	—	—	—	—	—	—
	2.48E-01	0.63	1.61E-01	7.80	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 455 psi				**Torsional Shear Stage First Cycle; σ_o = 455 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 455 psi**		
Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
1.44E-04	1.00	1.44E-04	3.69	9.48E-04	1.00	1.11	1.01E-03	1.00	1.19
2.88E-04	1.00	2.88E-04	3.74	1.88E-03	1.00	1.24	1.89E-03	1.00	1.43
6.00E-04	1.00	6.00E-04	3.77	3.69E-03	1.00	1.18	3.74E-03	1.00	1.00
1.20E-03	1.00	1.20E-03	3.80	7.43E-03	1.00	1.08	7.46E-03	1.00	1.09
2.40E-03	1.00	1.89E-03	3.81	—	—	—	—	—	—
4.81E-03	0.99	3.80E-03	3.82	—	—	—	—	—	—
9.69E-03	0.98	7.66E-03	3.91	—	—	—	—	—	—
1.95E-02	0.97	1.52E-02	3.91	—	—	—	—	—	—
3.93E-02	0.92	3.03E-02	4.23	—	—	—	—	—	—
7.68E-02	0.85	5.76E-02	5.01	—	—	—	—	—	—
1.18E-01	0.76	8.41E-02	5.97	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
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Table 2.5.4-73
RCTS Test Results; Stratum Sand 18 (Power Block Area)

Boring B-2174UDR Sample UD31 Stratum Sand 18	**Resonant Column Stage σ_o = 186 psi**				**Torsional Shear Stage First Cycle; σ_o = 186 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 186 psi**		
	Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
Depth = 593.0 feet	1.74E-04	1.00	1.74E-04	0.69	1.06E-03	1.00	0.30	1.05E-03	1.00	0.31
Total Unit Weight = 125.0 pcf	3.43E-04	1.00	3.43E-04	0.68	2.18E-03	1.00	0.36	2.16E-03	1.00	0.47
Moisture Content = 14.1%	7.08E-04	1.00	7.08E-04	0.69	4.39E-03	0.98	0.54	4.39E-03	0.97	0.49
USCS Group Symbol = SM	1.39E-03	0.99	1.30E-03	0.69	8.92E-03	0.96	0.64	8.89E-03	0.96	0.55
Fines Content = 17.8%	2.69E-03	0.98	2.53E-03	0.71	—	—	—	—	—	—
Liquid Limit = 17%	5.11E-03	0.98	4.80E-03	0.77	—	—	—	—	—	—
Plasticity Index = 2%	9.41E-03	0.96	8.75E-03	0.86	—	—	—	—	—	—
Specific Gravity = 2.65	1.65E-02	0.92	1.51E-02	1.15	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	2.83E-02	0.88	2.52E-02	1.59	—	—	—	—	—	—
Estimated σ'_{mean} = 186 psi	4.73E-02	0.81	4.06E-02	2.11	—	—	—	—	—	—
	7.80E-02	0.74	6.39E-02	3.04	—	—	—	—	—	—
	9.51E-02	0.72	7.52E-02	3.67	—	—	—	—	—	—

Resonant Column Stage σ_o = 455 psi				**Torsional Shear Stage First Cycle; σ_o = 455 psi**			**Torsional Shear Stage Tenth Cycle; σ_o = 455 psi**		
Peak Shear Strain (%)	**G/Gmax**	**Avg. Shear Strain (%)**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**	**Peak Shear Strain (%)**	**G/Gmax**	**Damping Ratio (%)**
1.10E-04	1.00	1.10E-04	0.63	1.05E-03	1.00	0.22	1.05E-03	1.00	0.28
2.20E-04	1.00	2.20E-04	0.65	2.09E-03	1.00	0.27	2.09E-03	1.00	0.33
4.37E-04	1.00	4.37E-04	0.68	4.18E-03	1.00	0.36	4.20E-03	1.00	0.38
8.96E-04	1.00	8.96E-04	0.68	—	—	—	—	—	—
1.76E-03	0.99	1.66E-03	0.69	—	—	—	—	—	—
3.39E-03	0.99	3.18E-03	0.72	—	—	—	—	—	—
6.30E-03	0.97	5.92E-03	0.76	—	—	—	—	—	—
1.16E-02	0.94	1.08E-02	0.90	—	—	—	—	—	—
2.09E-02	0.91	1.90E-02	1.28	—	—	—	—	—	—
3.61E-02	0.86	3.22E-02	1.69	—	—	—	—	—	—
5.87E-02	0.81	4.93E-02	2.52	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
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Table 2.5.4-74
RCTS Test Results; Embankment Fill/Sand; Composite A Sample (Cooling Basin)

Test Pits TP-2319/TP-2334 Embankment Fill/Sand Composite A Sample	Resonant Column Stage σ_o = 19 psi				Torsional Shear Stage First Cycle; σ_o = 19 psi			Torsional Shear Stage Tenth Cycle; σ_o = 19 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = N/A feet	2.32E-04	1.00	2.32E-04	6.44	9.91E-04	1.00	2.69	1.02E-03	0.99	2.98
Total Unit Weight = 135.9 pcf	4.64E-04	1.00	4.64E-04	6.44	1.98E-03	1.00	2.58	1.99E-03	0.99	2.59
Moisture Content = 14.8%	9.63E-04	1.00	9.63E-04	6.52	4.02E-03	0.98	2.56	4.01E-03	1.00	2.76
USCS Group Symbol = SC	1.94E-03	0.99	1.32E-03	6.52	1.00E-02	0.94	3.17	1.00E-02	0.96	3.10
Fines Content = 46.4%	3.91E-03	0.98	2.62E-03	6.64	—	—	—	—	—	—
Liquid Limit = 34%	8.01E-03	0.95	5.29E-03	6.88	—	—	—	—	—	—
Plasticity Index = 22%	1.71E-02	0.87	1.11E-02	7.48	—	—	—	—	—	—
Specific Gravity = 2.66	3.92E-02	0.73	2.40E-02	9.16	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	—	—	—	—	—	—	—	—	—	—
Estimated σ'_{mean} = 19 psi	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 75 psi				Torsional Shear Stage First Cycle; σ_o = 75 psi			Torsional Shear Stage Tenth Cycle; σ_o = 75 psi		
Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
1.38E-04	1.00	1.38E-04	5.91	1.01E-03	1.00	2.90	1.01E-03	1.00	2.51
2.75E-04	1.00	2.75E-04	5.96	2.05E-03	0.99	2.64	2.01E-03	1.00	2.79
5.73E-04	1.00	5.73E-04	5.97	4.09E-03	0.99	2.48	4.09E-03	0.99	2.37
1.15E-03	1.00	8.02E-04	6.01	1.01E-02	0.96	2.90	1.01E-02	0.96	2.83
2.31E-03	0.99	1.62E-03	6.03	—	—	—	—	—	—
4.66E-03	0.98	3.26E-03	6.11	—	—	—	—	—	—
9.62E-03	0.93	6.54E-03	6.56	—	—	—	—	—	—
2.08E-02	0.83	1.37E-02	7.35	—	—	—	—	—	—
4.90E-02	0.67	3.04E-02	9.13	—	—	—	—	—	—
1.40E-01	0.45	7.58E-02	12.50	—	—	—	—	—	—
1.69E-01	0.42	8.97E-02	13.10	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

Table 2.5.4-75
RCTS Test Results; Embankment Fill/Clay; Composite B Sample (Cooling Basin)

Test Pits TP-2317/TP-2334 Embankment Fill/Clay Composite B Sample	Resonant Column Stage σ_o = 19 psi				Torsional Shear Stage First Cycle; σ_o = 19 psi			Torsional Shear Stage Tenth Cycle; σ_o = 19 psi		
	Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
Depth = N/A feet	3.02E-04	1.00	3.02E-04	5.40	1.04E-03	1.00	2.18	1.04E-03	1.00	2.06
Total Unit Weight = 133.0 pcf	6.23E-04	1.00	6.23E-04	5.42	2.05E-03	1.00	2.15	2.04E-03	1.00	2.14
Moisture Content = 14.8%	1.23E-03	1.00	8.96E-04	5.43	4.58E-03	1.00	2.27	4.55E-03	1.00	2.49
USCS Group Symbol = CL	2.48E-03	1.00	1.73E-03	5.49	9.52E-03	1.00	2.54	9.54E-03	1.00	2.51
Fines Content = 73.6%	4.94E-03	1.00	3.51E-03	5.54	—	—	—	—	—	—
Liquid Limit = 44%	9.95E-03	0.99	6.96E-03	5.56	—	—	—	—	—	—
Plasticity Index = 29%	2.02E-02	0.97	1.39E-02	5.69	—	—	—	—	—	—
Specific Gravity = 2.69	4.20E-02	0.90	2.90E-02	6.10	—	—	—	—	—	—
Estimated In-Situ K_0 = 0.5	9.34E-02	0.76	6.07E-02	7.40	—	—	—	—	—	—
Estimated σ'_{mean} = 19 psi	2.44E-01	0.55	1.42E-01	10.25	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—

Resonant Column Stage σ_o = 75 psi				Torsional Shear Stage First Cycle; σ_o = 75 psi			Torsional Shear Stage Tenth Cycle; σ_o = 75 psi		
Peak Shear Strain (%)	G/Gmax	Avg. Shear Strain (%)	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)	Peak Shear Strain (%)	G/Gmax	Damping Ratio (%)
—	—	—	—	—	—	—	—	—	—
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Table 2.5.4-76
Liquefaction Evaluation, SPT Method (Power Block Area)

Boring (Number of Test Points)	Test El.[a],[b] (feet)	FOS[b]	Stratum (Disposition)	[c]
B-2153 (1)	80.2	0.95	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2160 (1)	76.9	0.96	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2161 (1)	80.5	1.02	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2172 (1)	79.1	0.94	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2257 (1)	80.8	0.87	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2272 (1)	76.7	0.98	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2277 (1)	76.8	0.68	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2277 (1)	–55.4	0.98	Stratum Sand 5 (isolated; refer to Subsection 2.5.4.8.2.1)	
B-2301A (1)	–27.3	1.09	Stratum Sand 4 (no structure) (outside power block area)	√

(a) Elevations are referenced to NAVD 88.
(b) Range of Test Els. and FOS values are given where multiple test points occur.
(c) √ denotes tests having FOS<1.10, but made in strata that are in areas without structures, or in fine-grained soils which are nonliquefiable.

Table 2.5.4-77
Liquefaction Evaluation, SPT Method (Cooling Basin)

Boring (Number of Test Points)	Test El.[(a),(b)] (feet)	FOS[(b)]	Structure	Foundation El. (feet)	Stratum (Disposition)	(c)
B-01 (1)	71.5	1.08	No Structure (CB Interior)	N/A	Stratum Sand 1 (excavated [at cut area])	√
B-02 (1)	74.7	0.83	No Structure (CB Interior)	N/A	Stratum Clay 1 (No structure)	√
B-03 (1)	74.9	1.08	No Structure (East of CB)	N/A	Stratum Sand 1 (No structure)	√
B-04 (1)	79.0	0.83	East Dam of CB	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
B-04 (1)	65.3	0.76	East Dam of CB	N/A	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-06 (1)	79.0	0.98	No structure (Northeast of CB)	N/A	Stratum Clay 1 (Top) (No structure)	√
B-09 (1)	77.4	0.98	North Dam of CB	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
B-2304A (1)	–210.2	1.06	West Dam of CB	N/A	Stratum Sand 8 (fine-grained interbed; nonliquefiable)	√
B-2324 (1)	24.5	0.81	No Structure (East of CB)	N/A	Stratum Sand 2 (No structure)	√
B-2336 (1)	57.0	0.97	No Structure (East of CB)	N/A	Stratum Sand 1 (No structure)	√
B-2337 (1)	8.7	0.93	East Dam of CB	N/A	Stratum Sand 4 (isolated; refer to Subsection 2.5.4.8.2.2)	
B-2348 (2)	46.4 to 44.3	0.90 to 0.93	No Structure (East of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√
B-2350 (1)	57.0	1.00	South Dam of CB	N/A	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2351 (1)	60.1	1.01	South Dam of CB	N/A	Stratum Sand 1 (isolated; refer to Subsection 2.5.4.8.2.2)	
B-2355 (1)	–19.2	0.96	No Structure (East of CB)	N/A	Stratum Sand 4 (No structure)	√
B-2357 (1)	65.7	0.83	No Structure (Southeast of CB)	N/A	Stratum Clay 1 (Top) (No structure)	√

(a) Elevations are referenced to NAVD 88.
(b) Range of Test Els. and FOS values are given where multiple test points occur.
(c) √ denotes tests having FOS<1.10, but made in strata that are excavated (at cut area), in areas without structures, or in fine-grained soils which are nonliquefiable.

Table 2.5.4-78 (Sheet 1 of 2)
Liquefaction Evaluation, Cone Penetration Test Method (Power Block Area)

CPT (Number of Test Points)	Test El.[(a),(b)] (feet)	FOS[(b)]	Stratum (Disposition)	(c)
C-2101 (2)	80.12 to 79.37	0.54 to 0.81	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2102S (3)	80.17 to 78.92	0.54 to 0.98	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2103 (6)	77.68 to 73.93	0.46 to 1.02	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2104S (3)	80.10 to 77.35	0.73 to 1.08	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2105 (2)	80.19 to 79.44	0.54 to 0.80	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2106S (6)	79.51 to 76.76	0.59 to 1.06	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2107 (3)	79.96 to 77.71	0.46 to 1.07	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2108 (2)	79.78 to 79.03	0.47 to 0.76	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2109S (3)	79.93 to 78.68	0.44 to 0.97	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2110 (5)	80.00 to 77.75	0.50 to 1.05	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2111D (3)	79.22 to 77.97	0.52 to 1.08	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2112 (4)	79.55 to 77.80	0.46 to 0.92	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2113 (4)	79.31 to 77.56	0.45 to 1.03	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2114 (3)	79.86 to 78.61	0.46 to 0.86	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2115 (4)	79.83 to 78.08	0.46 to 0.99	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2201 (3)	80.62 to 79.37	0.51 to 0.87	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2202 (2)	80.42 to 79.67	0.60 to 1.02	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2203 (3)	80.56 to 76.31	0.44 to 0.90	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2204SB (2)	80.18 to 79.43	0.58 to 0.67	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2205 (9)	80.39 to 76.14	0.47 to 1.09	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2206S (2)	80.63 to 79.88	0.57 to 1.00	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2207 (2)	80.39 to 79.64	0.49 to 0.78	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2208 (3)	80.54 to 79.29	0.55 to 0.98	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√

Table 2.5.4-78 (Sheet 2 of 2)
Liquefaction Evaluation, Cone Penetration Test Method (Power Block Area)

CPT (Number of Test Points)	Test El.[(a),(b)] (feet)	FOS[(b)]	Stratum (Disposition)	(c)
C-2209S (7)	80.27 to 76.02	0.54 to <1.10	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2210A (3)	79.87 to 78.62	0.51 to 0.97	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2211 (3)	80.20 to 78.95	0.51 to 0.87	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2212 (2)	80.44 to 79.69	0.54 to 0.83	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2213 (3)	80.46 to 79.21	0.48 to 1.08	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2216 (2)	80.54 to 79.79	0.51 to 0.75	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√

(a) Elevations are referenced to NAVD 88.
(b) Range of Test Els. and FOS values are given where multiple test points occur.
(c) √ denotes tests having FOS<1.10, but made in strata that are in areas without structures, or in fine-grained soils which are nonliquefiable.

Table 2.5.4-79 (Sheet 1 of 2)
Liquefaction Evaluation, Cone Penetration Test Method (Cooling Basin)

CPT (Number of Test Points)	Test El.[(a),(b)] (feet)	FOS[(b)]	Structure	Foundation El. (feet)	Stratum (Disposition)	(c)
C-2301S (4)	79.08 to 77.33	0.47 to 0.77	North Dam of CB	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2301S (1)	69.33	1.08	North Dam of CB	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2301S (1)	67.83	0.98	North Dam of CB	N/A	Stratum Sand 1 (isolated; refer to Subsection 2.5.4.8.3.2)	
C-2301SA (4)	78.70 to 76.95	0.59 to 1.00	North Dam of CB	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2301SA (3)	69.95 to 68.95	1.00 to 1.05	North Dam of CB	N/A	Stratum Sand 1 (excavated [at cut area])	√
C-2302 (3)	77.49 to 76.24	0.56 to 0.98	North Dam of CB	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2303S (4)	76.79 to 75.04	0.55 to 0.72	No Structure (NE of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√
C-2304 (1)	74.60	0.62	No Structure (East of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√
C-2305 (2)	75.47 to 74.72	0.58 to 0.81	No Structure (CB Interior)	N/A	Stratum Sand 1 (excavated [at cut area])	√
C-2306 (2)	77.54 to 76.79	0.65 to 0.84	No Structure (CB Interior)	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2307 (5)	74.88 to 72.63	0.48 to 0.91	No Structure (East of CB)	N/A	Stratum Sand 1 (no structure)	√
C-2307 (1)	63.63	1.01	No Structure (East of CB)	N/A	Stratum Sand 1 (no structure)	√
C-2308 (9)	58.02 to 52.77	0.53 to 1.09	No Structure (East of CB)	N/A	Stratum Sand 1 (no structure)	√
C-2308 (1)	-6.23	1.09	No Structure (East of CB)	N/A	Stratum Sand 4 (no structure)	√
C-2309 (2)	72.92 to 72.17	0.53 to 0.85	No Structure (CB Interior)	N/A	Stratum Sand 1 (excavated [at cut area])	√
C-2310 (3)	70.88 to 69.63	0.59 to 0.92	No Structure (CB Interior)	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2311 (7)	41.70 to 37.95	0.46 to 0.97	No Structure (East of CB)	N/A	Stratum Clay 1 (no structure)	√
C-2311A (7)	50.49 to 47.24	0.46 to 1.05	No Structure (East of CB)	N/A	Stratum Clay 1 (no structure)	√
C-2312 (2)	64.99 to 64.24	0.57 to 0.75	West Dam of CB	N/A	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2312 (5)	52.74 to 50.74	0.89 to 1.01	West Dam of CB	N/A	Stratum Sand 1 (isolated; refer to Subsection 2.5.4.8.3.2)	
C-2313 (6)	71.17 to 68.42	0.51 to 0.97	No Structure (CB Interior)	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2314 (2)	69.45 to 68.70	0.68 to 0.83	No Structure (CB Interior)	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2315 (5)	66.35 to 64.10	0.49 to 0.95	No Structure (CB Interior)	N/A	Stratum Clay 1 (Top) (no structure)	√

Table 2.5.4-79 (Sheet 2 of 2)
Liquefaction Evaluation, Cone Penetration Test Method (Cooling Basin)

CPT (Number of Test Points)	Test El.(a),(b) (feet)	FOS(b)	Structure	Foundation El. (feet)	Stratum (Disposition)	(c)
C-2316 (3)	68.23 to 66.98	0.47 to 0.68	East Dam of CB	N/A	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2317 (5)	45.17 to 42.92	0.51 to 1.08	No Structure (East of CB)	N/A	Stratum Clay 1 (Bottom) (no structure)	√
C-2318 (4)	66.39 to 64.64	0.57 to 0.82	No Structure (CB Interior)	N/A	Stratum Clay 1 (Top) (no structure)	√
C-2319 (4)	65.56 to 63.81	0.45 to 0.98	No Structure (East of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√
C-2319 (2)	56.31 to 55.81	0.85 to 0.97	No Structure (East of CB)	N/A	Stratum Sand 1 (no structure)	√
C-2321S (5)	65.80 to 63.05	0.59 to 1.07	South Dam of CB	N/A	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2321S (1)	54.05	0.99	South Dam of CB	N/A	Stratum Sand 1 (isolated; refer to Subsection 2.5.4.8.3.2)	
C-2321S (2)	47.55 to 46.05	1.03 to 1.08	South Dam of CB	N/A	Stratum Sand 1 (isolated; refer to Subsection 2.5.4.8.3.2)	
C-2321SA (3)	65.90 to 64.65	0.56 to 0.79	South Dam of CB	N/A	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2322 (5)	62.19 to 59.95	0.56 to 0.89	South Dam of CB	N/A	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2322 (1)	-18.56	0.95	South Dam of CB	N/A	Stratum Sand 5 (isolated; refer to text)	
C-2323S (5)	65.67 to 63.42	0.49 to 0.85	No Structure (Southeast of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√
C-2323S (1)	53.92	0.92	No Structure (Southeast of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√
C-2324 (4)	63.58 to 61.83	0.47 to 1.09	No Structure (East of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√
C-2328 (3)	65.62 to 64.37	0.56 to 0.82	No Structure (South of CB)	N/A	Stratum Clay 1 (Top) (no structure)	√

(a) Elevations are referenced to NAVD 88.

(b) Range of Test Els. and FOS values are given where multiple test points occur.

(c) √ denotes tests having FOS<1.10, but made in strata that are excavated (at cut area), in areas without structures, or in fine-grained soils which are nonliquefiable.

Table 2.5.4-80 (Sheet 1 of 2)
Liquefaction Evaluation, S-Wave Velocity Method (Power Block Area)

V_s Boring/CPT (Number of Test Points)	Test El.[(a),(b)] (feet)	FOS[(b)]	Stratum (Disposition)	(c)
B-2162A Offset (1)	52.2	0.93	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2162A Offset (5)	45.6 to 39.8	0.52 to 1.02	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
B-2174A Offset (2)	54.7 to 53.0	0.70 to 0.81	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2174A Offset (2)	44.8 to 43.2	0.44 to 0.88	Stratum Clay 1 (Bottom) fine-grained; nonliquefiable)	√
B-2174A Offset (2)	25.2 to 23.5	0.61 to 1.03	Stratum Sand 2 (isolated; refer to Subsection 2.5.4.8.4.1)	
B-2174A Offset (2)	–30.6 to –32.3	0.84 to 0.85	Stratum Clay 5 (Top) (fine-grained; nonliquefiable)	√
B-2174A Offset (1)	–257.0	0.77	Stratum Clay 11 (fine-grained; nonliquefiable)	√
B-2174A Offset (8)	–286.5 to –306.2	0.64 to 0.97	Stratum Clay 11 (fine-grained; nonliquefiable)	√
B-2174A Offset (1)	–363.6	1.08	Stratum Clay 13 (fine-grained; nonliquefiable)	√
B-2176A Offset (1)	42.3	0.81	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
B-2182A Offset (2)	–141.8 to –143.4	0.78 to 0.90	Stratum Clay 7 (fine-grained; nonliquefiable)	√
C-2102S (1)	78.2	0.61	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2102S (1)	48.7	0.87	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
C-2102S (1)	–9.6	0.86	Stratum Sand 4 (isolated; refer to Subsection 2.5.4.8.4.1)	
C-2104S (3)	75.6 to 53.6	0.57 to 0.96	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2104S (2)	48.6 to 43.6	0.78 to 1.00	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
C-2106S (2)	75.0 to 68.0	0.35 to 0.98	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2109S (3)	75.4 to 53.4	0.60 to 0.83	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2109S (1)	48.4	0.88	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
B-2262A Offset (5)	64.2 to 56.0	0.60 to 0.96	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2262A Offset (4)	34.6 to 29.7	0.56 to 1.09	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
B-2262A Offset (4)	16.6 to 6.8	0.43 to 0.78	Stratum Clay 3 (fine-grained; nonliquefiable)	√

Table 2.5.4-80 (Sheet 2 of 2)
Liquefaction Evaluation, S-Wave Velocity Method (Power Block Area)

V_s Boring/CPT (Number of Test Points)	Test El.[(a),(b)] (feet)	FOS[(b)]	Stratum (Disposition)	(c)
B-2262A Offset (5)	–81.8 to –88.4	0.29 to 0.94	Stratum Sand 6 (isolated; refer to Subsection 2.5.4.8.4.1)	
B-2274A Offset (5)	72.1 to 59.0	0.80 to 1.07	Stratum Clay 1 (Top) (excavated [at structure])	√
B-2274A Offset (1)	27.9	0.70	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
B-2274A Offset (4)	9.8 to –5.0	0.57 to 0.83	Stratum Clay 3 (fine-grained; nonliquefiable)	√
B-2274A Offset (2)	–82.1 to –83.7	0.68 to 0.81	Stratum Sand 6 (isolated; refer to Subsection 2.5.4.8.4.1)	
B-2274A Offset (8)	–300.2 to –311.7	0.80 to 1.07	Stratum Clay 11 (fine-grained; nonliquefiable)	√
B-2276A Offset (2)	15.0 to 13.4	0.80 to 1.07	Stratum Clay 3 (fine-grained; nonliquefiable)	√
B-2276A Offset (1)	–71.9	0.97	Stratum Clay 5 (Bottom) (fine-grained; nonliquefiable)	√
B-2282A Offset (6)	64.1 to 55.9	0.80 to 1.03	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
B-2282A Offset (2)	13.2 to 11.6	1.06 to 1.07	Stratum Clay 3 (fine-grained; nonliquefiable)	√
C-2202S (4)	76.0 to 59.0	0.67 to 0.97	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2204SB (5)	78.5 to 59.0	0.15 to 1.03	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2204SB (2)	24.0 to 19.0	0.75 to 1.02	Stratum Clay 3 (fine-grained; nonliquefiable)	√
C-2206S (4)	76.0 to 59.0	0.40 to 0.76	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√
C-2206S (2)	19.0 to 14.0	1.00 to 1.05	Stratum Clay 3 (fine-grained; nonliquefiable)	√
C-2209S (3)	76.0 to 64.0	0.45 to 0.97	Stratum Clay 1 (Top) (fine-grained; nonliquefiable)	√

(a) Elevations are referenced to NAVD 88.
(b) Range of Test Els. and FOS values are given where multiple test points occur.
(c) √ denotes tests having FOS<1.10, but made in strata that are excavated (at structure), in areas without structures, or in fine-grained soils which are nonliquefiable.

Table 2.5.4-81
Liquefaction Evaluation, S-Wave Velocity Method (Cooling Basin)

V_s Boring/CPT (Number of Test Points)	Test El.[(a),(b)] (feet)	FOS[(b)]	Structure	Foundation El. (feet)	Stratum (Disposition)	[(c)]
B-2302 (2)	52.1 to 48.8	0.97 to 1.05	West Dam of CB	N/A	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
B-2302 (2)	17.3 to 16.0	0.55 to 1.09	West Dam of CB	N/A	Stratum Sand 2 (isolated; refer to Subsection 2.5.4.8.4.2)	
B-2302 (1)	14.4	0.62	West Dam of CB	N/A	Stratum Clay 3 (fine-grained; nonliquefiable)	√
B-2303 (4)	57.5 to 51.06	0.62 to <1.10	West Dam of CB	N/A	Stratum Clay 1 (Bottom) (fine-grained; nonliquefiable)	√
B-2303 (4)	23.1 to 18.2	0.82 to 0.93	West Dam of CB	N/A	Stratum Clay 3 (fine-grained; nonliquefiable)	√
B-2303 (3)	–75.4 to –78.6	0.95 to 1.08	West Dam of CB	N/A	Stratum Clay 5 (Bottom) (fine-grained; nonliquefiable)	√
B-2303 (1)	–108.2	0.97	West Dam of CB	N/A	Stratum Sand 6 (isolated; refer to Subsection 2.5.4.8.4.2)	
B-2304 (3)	–86.1 to –89.4	0.60 to 1.07	West Dam of CB	N/A	Stratum Clay 5 (Bottom) (fine-grained; nonliquefiable)	√
B-2305 (1)	45.9	1.06	No Structure (East of CB)	N/A	Clay 1 (Bottom) (no structure)	√
B-2305 (2)	–70.6 to –72.2	0.83 to 1.01	No Structure (East of CB)	N/A	Stratum Clay 5 (Bottom) (no structure)	√
C-2301S (1)	74.8	0.27	North Dam of CB	N/A	Stratum Clay 1 (Top) (excavated [at cut area])	√
C-2301S (1)	67.8	0.42	North Dam of CB	N/A	Stratum Sand 1 (isolated; refer to Subsection 2.5.4.8.4.2)	
C-2303S (1)	65.3	0.26	No Structure (Northeast of CB)	N/A	Stratum Sand 1 (no structure)	√
C-2303S (1)	35.3	0.74	No Structure (Northeast of CB)	N/A	Stratum Clay 1 (no structure)	√
C-2303S (1)	-9.7	1.08	No Structure (Northeast of CB)	N/A	Stratum Clay 5 (no structure)	√
C-2323S (2)	63.7 to 59.2	0.34 to 0.35	No Structure (Southeast of CB)	N/A	Stratum Clay 1 (no structure)	√
C-2323S (1)	54.2	0.58	No Structure (Southeast of CB)	N/A	Stratum Sand 1 (no structure)	√

(a) Elevations are referenced to NAVD 88.
(b) Range of Test Els. and FOS values are given where multiple test points occur.
(c) √ denotes tests having FOS<1.10, but made in strata that are excavated (at cut area), in areas without structures, or in fine-grained soils which are nonliquefiable.

Table 2.5.4-82
Subsurface Conditions; Soil Properties (Typical LWR (with an Integral UHS) Reactor and Fuel Building); (Power Block Area)

Simplified Soil Profile						Soil Profile for Calculation	
Top Depth (feet)[a]	Bottom Depth (feet)[a]	Top El. (feet)[b]	Bottom El. (feet)[b]	Thickness (feet)	Stratum	Clay Preferred Profile	Sand Preferred Profile
Unit 1							
65.6	87.0	29.4	8.0	21.4	Structural Fill	Structural Fill	Structural Fill
87.0	103.0	8.0	–8.0	16.0	Clay 3	Clay 3	Clay 3
103.0	118.0	–8.0	–23.0	15.0	Sand 4	Sand 4	Sand 4
118.0	150.0	–23.0	–55.0	32.0	Clay 5	Clay 5	Clay 5
150.0	175.0	–55.0	–80.0	25.0	Clay 5/Sand 6	Clay 5	Sand 6
175.0	220.0	–80.0	–125.0	45.0	Sand 6	Sand 6	Sand 6
220.0	255.0	–125.0	–160.0	35.0	Clay 7	Clay 7	Clay 7
255.0	300.0	–160.0	–205.0	45.0	Sand 8	Sand 8	Sand 8
300.0	337.0	–205.0	–242.0	37.0	Clay 9	Clay 9	Clay 9
337.0	350.0	–242.0	–255.0	13.0	Sand 10	Sand 10	Sand 10
350.0	422.0	–255.0	–327.0	72.0	Clay 11	Clay 11	Clay 11
422.0	440.0	–327.0	–345.0	18.0	Sand 12	Sand 12	Sand 12
440.0	516.0	–345.0	–421.0	76.0	Clay 13	Clay 13	Clay 13
516.0	549.0	–421.0	–454.0	33.0	Sand 14	Sand 14	Sand 14
549.0	560.0	–454.0	–465.0	11.0	Clay 15	Clay 15	Clay 15
560.0	575.0	–465.0	–480.0	15.0	Sand 16	Sand 16	Sand 16
575.0	600.0	–480.0	–505.0	25.0	Clay 17	Clay 17	Clay 17
Unit 2							
65.6	87.0	29.4	8.0	21.4	Structural Fill	Structural Fill	Structural Fill
87.0	110.0	8.0	–15.0	23.0	Sand 2/Clay 3	Clay 3	Sand 2
110.0	130.0	–15.0	–35.0	20.0	Sand 4	Sand 4	Sand 4
130.0	170.0	–35.0	–75.0	40.0	Clay 5	Clay 5	Clay 5
170.0	235.0	–75.0	–140.0	65.0	Sand 6	Sand 6	Sand 6
235.0	305.0	–140.0	–210.0	70.0	Sand 8	Sand 8	Sand 8
305.0	345.0	–210.0	–250.0	40.0	Clay 9	Clay 9	Clay 9
345.0	385.0	–250.0	–290.0	40.0	Sand 10/Clay 11	Clay 11	Sand 10
385.0	418.0	–290.0	–323.0	33.0	Clay 11	Clay 11	Clay 11
418.0	440.0	–323.0	–345.0	22.0	Sand 12	Sand 12	Sand 12
440.0	518.0	–345.0	–423.0	78.0	Clay 13	Clay 13	Clay 13
518.0	562.0	–423.0	–467.0	44.0	Sand 14	Sand 14	Sand 14
562.0	577.0	–467.0	–482.0	15.0	Clay 15	Clay 15	Clay 15
577.0	595.0	–482.0	–500.0	18.0	Sand 16	Sand 16	Sand 16

(a) Depths measured from El. 95 feet.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-83
Subsurface Conditions; Average Properties within the Foundation Deformation Zone (Typical LWR (with an Integral UHS) Reactor/Fuel Building) (Power Block Area)

Structure	Soil Profile for Calculation						Shear Strength				Foundation Width, B (feet)	Effective Shear Depth H' (feet)
	Soil Profile	Stratum	Top El.[(a)] (feet)	Bottom El.[(a)] (feet)	Thickness (feet)	Total Thickness (feet)	Layer c (ksf)	Layer Φ (°)	Avg c (ksf)	Avg Φ (°)		
Reactor/ Fuel Building (Unit 1)	Clay Preferred	Fill	29.4	8.0	21.4	105.3	0.0	39.0	2.0	15.2	161.0	105.3
		Clay 3	8.0	–8.0	16.0		3.0	0.0				
		Sand 4	–8.0	–23.0	15.0		0.0	37.0				
		Clay 5	–23.0	–55.0	32.0		3.0	0.0				
		Clay 5	–55.0	–75.9	20.9		3.0	0.0				
Reactor/ Fuel Building (Unit 1)	Sand Preferred	Fill	29.4	8.0	21.4	131.0	0.0	39.0	1.1	26.9	161.0	131.0
		Clay 3	8.0	–8.0	16.0		3.0	0.0				
		Sand 4	–8.0	–23.0	15.0		0.0	37.0				
		Clay 5	–23.0	–55.0	32.0		3.0	0.0				
		Sand 6	–55.0	–80.0	25.0		0.0	39.0				
		Sand 6	–80.0	–101.6	21.6		0.0	39.0				
Reactor/ Fuel Building (Unit 2)	Clay Preferred	Fill	29.4	8.0	21.4	113.5	0.0	39.0	1.7	19.3	161.0	113.5
		Clay 3	8.0	–15.0	23.0		3.0	0.0				
		Sand 4	–15.0	–35.0	20.0		0.0	37.0				
		Clay 5	–35.0	–75.0	40.0		3.0	0.0				
		Sand 6	–75.0	–84.1	9.1		0.0	39.0				
Reactor/ Fuel Building (Unit 2)	Sand Preferred	Fill	29.4	8.0	21.4	134.0	0.0	39.0	0.9	28.0	161.0	134.0
		Sand 2	8.0	–15.0	23.0		0.0	33.0				
		Sand 4	–15.0	–35.0	20.0		0.0	37.0				
		Clay 5	–35.0	–75.0	40.0		3.0	0.0				
		Sand 6	–75.0	–104.6	29.6		0.0	39.0				

(a) Elevations are referenced to NAVD 88.

Table 2.5.4-84
Subsurface Conditions; Soil Properties
(Typical LWR (with an Integral UHS) Control Building) (Power Block Area)

Simplified Soil Profile						Soil Profile for Calculation	
Top Depth (feet)[(a)]	Bottom Depth (feet)[(a)]	Top El. (feet)[(b)]	Bottom El. (feet)[(b)]	Thickness (feet)	Stratum	Clay Preferred Profile	Sand Preferred Profile
Unit 1							
48.9	70.0	46.1	25.0	21.1	Structural Fill	Structural Fill	Structural Fill
70.0	73.0	25.0	22.0	3.0	Sand 2/Clay 3	Clay 3	Sand 2
73.0	100.0	22.0	–5.0	27.0	Clay 3	Clay 3	Clay 3
100.0	120.0	–5.0	–25.0	20.0	Sand 4	Sand 4	Sand 4
120.0	170.0	–25.0	–75.0	50.0	Clay 5	Clay 5	Clay 5
170.0	215.0	–75.0	–120.0	45.0	Sand 6	Sand 6	Sand 6
215.0	255.0	–120.0	–160.0	40.0	Clay 7	Clay 7	Clay 7
255.0	300.0	–160.0	–205.0	45.0	Sand 8	Sand 8	Sand 8
300.0	337.0	–205.0	–242.0	37.0	Clay 9	Clay 9	Clay 9
337.0	350.0	–242.0	–255.0	13.0	Sand 10	Sand 10	Sand 10
350.0	422.0	–255.0	–327.0	72.0	Clay 11	Clay 11	Clay 11
422.0	440.0	–327.0	–345.0	18.0	Sand 12	Sand 12	Sand 12
440.0	516.0	–345.0	–421.0	76.0	Clay 13	Clay 13	Clay 13
516.0	549.0	–421.0	–454.0	33.0	Sand 14	Sand 14	Sand 14
549.0	560.0	–454.0	–465.0	11.0	Clay 15	Clay 15	Clay 15
560.0	575.0	–465.0	–480.0	15.0	Sand 16	Sand 16	Sand 16
575.0	600.0	–480.0	–505.0	25.0	Clay 17	Clay 17	Clay 17
Unit 2							
48.9	70.0	46.1	25.0	21.1	Structural Fill	Structural Fill	Structural Fill
70.0	73.0	25.0	22.0	3.0	Clay 1	Clay 1	Clay 1
73.0	82.0	22.0	13.0	9.0	Sand 2	Sand 2	Sand 2
82.0	105.0	13.0	–10.0	23.0	Sand 2/Clay 3	Clay 3	Sand 2
105.0	130.0	–10.0	–35.0	25.0	Sand 4	Sand 4	Sand 4
130.0	157.0	–35.0	–62.0	27.0	Clay 5/Sand 5	Clay 5	Sand 5
157.0	172.0	–62.0	–77.0	15.0	Clay 5	Clay 5	Clay 5
172.0	235.0	–77.0	–140.0	63.0	Sand 6	Sand 6	Sand 6
235.0	305.0	–140.0	–210.0	70.0	Sand 8	Sand 8	Sand 8
305.0	345.0	–210.0	–250.0	40.0	Clay 9	Clay 9	Clay 9
345.0	385.0	–250.0	–290.0	40.0	Sand 10/Clay 11	Clay 11	Sand 10
385.0	418.0	–290.0	–323.0	33.0	Clay 11	Clay 11	Clay 11
418.0	440.0	–323.0	–345.0	22.0	Sand 12	Sand 12	Sand 12
440.0	518.0	–345.0	–423.0	78.0	Clay 13	Clay 13	Clay 13
518.0	562.0	–423.0	–467.0	44.0	Sand 14	Sand 14	Sand 14
562.0	577.0	–467.0	–482.0	15.0	Clay 15	Clay 15	Clay 15
577.0	595.0	–482.0	–500.0	18.0	Sand 16	Sand 16	Sand 16

(a) Depths measured from El. 95 feet.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-85
Subsurface Conditions; Average Properties within the Foundation Deformation Zone (Typical LWR (with an Integral UHS) Control Building) (Power Block Area)

Structure	Soil Profile for Calculation						Shear Strength				Foundation Width, B (feet)	Effective Shear Depth H' (feet)
	Soil Profile	Stratum	Top El.(a) (feet)	Bottom El.(a) (feet)	Thickness (feet)	Total Thickness (feet)	Layer c (ksf)	Layer Φ (°)	Avg c (ksf)	Avg Φ (°)		
Control Building (Unit 1)	Clay Preferred	Fill	46.1	25.0	21.1	56.1	0.0	39.0	1.6	20.4	78.0	56.1
		Clay 3	25.0	22.0	3.0		3.0	0.0				
		Clay 3	22.0	-5.0	27.0		3.0	0.0				
		Sand 4	–5.0	–10.0	5.0		0.0	37.0				
Control Building (Unit 1)	Sand Preferred	Fill	46.1	25.0	21.1	58.8	0.0	39.0	1.4	22.9	78.0	58.8
		Sand 2	25.0	22.0	3.0		0.0	33.0				
		Clay 3	22.0	–5.0	27.0		3.0	0.0				
		Sand 4	–5.0	–12.7	7.7		0.0	37.0				
Control Building (Unit 2)	Clay Preferred	Fill	46.1	25.0	21.1	59.0	0.0	39.0	1.3	23.1	78.0	59.0
		Clay 1	25.0	22.0	3.0		3.2	0.0				
		Sand 2	22.0	13.0	9.0		0.0	33.0				
		Clay 3	13.0	–10.0	23.0		3.0	0.0				
		Sand 4	–10.0	–12.9	2.9		0.0	37.0				
Control Building (Unit 2)	Sand Preferred	Fill	46.1	25.0	21.1	74.6	0.0	39.0	0.1	34.8	78.0	74.6
		Clay 1	25.0	22.0	3.0		3.2	0.0				
		Sand 2	22.0	13.0	9.0		0.0	33.0				
		Sand 2	13.0	–10.0	23.0		0.0	33.0				
		Sand 4	–10.0	–28.5	18.5		0.0	37.0				

(a) Elevations are referenced to NAVD 88.

Table 2.5.4-86
Typical Subsurface Conditions; Soil Properties
(Typical LWR (with an Integral UHS) Fire Water Service Complex) (Power Block Area)

Simplified Soil Profile						Soil Profile for Calculation	
Top Depth (feet)[a]	Bottom Depth (feet)[a]	Top El. (feet)[b]	Bottom El. (feet)[b]	Thickness (feet)	Stratum	Clay Preferred Profile	Sand Preferred Profile
Unit 1							
7.7	15.0	87.3	80.0	7.3	Structural Fill	Structural Fill	Structural Fill
15.0	56.0	80.0	39.0	41.0	Clay 1	Clay 1	Clay 1
56.0	106.0	39.0	-11.0	50.0	Clay 3	Clay 3	Clay 3
106.0	123.0	-11.0	-28.0	17.0	Sand 4	Sand 4	Sand 4
123.0	168.0	-28.0	-73.0	45.0	Clay 5	Clay 5	Clay 5
168.0	215.0	-73.0	-120.0	47.0	Sand 6	Sand 6	Sand 6
215.0	255.0	-120.0	-160.0	40.0	Clay 7	Clay 7	Clay 7
255.0	300.0	-160.0	-205.0	45.0	Sand 8	Sand 8	Sand 8
300.0	337.0	-205.0	-242.0	37.0	Clay 9	Clay 9	Clay 9
337.0	350.0	-242.0	-255.0	13.0	Sand 10	Sand 10	Sand 10
350.0	422.0	-255.0	-327.0	72.0	Clay 11	Clay 11	Clay 11
422.0	440.0	-327.0	-345.0	18.0	Sand 12	Sand 12	Sand 12
440.0	516.0	-345.0	-421.0	76.0	Clay 13	Clay 13	Clay 13
516.0	549.0	-421.0	-454.0	33.0	Sand 14	Sand 14	Sand 14
549.0	560.0	-454.0	-465.0	11.0	Clay 15	Clay 15	Clay 15
560.0	575.0	-465.0	-480.0	15.0	Sand 16	Sand 16	Sand 16
575.0	600.0	-480.0	-505.0	25.0	Clay 17	Clay 17	Clay 17
Unit 2							
7.7	15.0	87.3	80.0	7.3	Structural Fill	Structural Fill	Structural Fill
15.0	43.0	80.0	52.0	28.0	Clay 1	Clay 1	Clay 1
43.0	52.0	52.0	43.0	9.0	Sand 1	Sand 1	Sand 1
52.0	71.0	43.0	24.0	19.0	Clay 1	Clay 1	Clay 1
71.0	77.0	24.0	18.0	6.0	Sand 2	Sand 2	Sand 2
77.0	105.0	18.0	-10.0	28.0	Clay 3	Clay 3	Clay 3
105.0	128.0	-10.0	-33.0	23.0	Sand 4	Sand 4	Sand 4
128.0	136.0	-33.0	-41.0	8.0	Clay 5	Clay 5	Clay 5
136.0	157.0	-41.0	-62.0	21.0	Sand 5	Sand 5	Sand 5
157.0	169.0	-62.0	-74.0	12.0	Clay 5	Clay 5	Clay 5
169.0	235.0	-74.0	-140.0	66.0	Sand 6	Sand 6	Sand 6
235.0	305.0	-140.0	-210.0	70.0	Sand 8	Sand 8	Sand 8
305.0	345.0	-210.0	-250.0	40.0	Clay 9	Clay 9	Clay 9
345.0	385.0	-250.0	-290.0	40.0	Sand 10/Clay 11	Clay 11	Sand 10
385.0	418.0	-290.0	-323.0	33.0	Clay 11	Clay 11	Clay 11
418.0	440.0	-323.0	-345.0	22.0	Sand 12	Sand 12	Sand 12
440.0	518.0	-345.0	-423.0	78.0	Clay 13	Clay 13	Clay 13
518.0	562.0	-423.0	-467.0	44.0	Sand 14	Sand 14	Sand 14
562.0	577.0	-467.0	-482.0	15.0	Clay 15	Clay 15	Clay 15
577.0	595.0	-482.0	-500.0	18.0	Sand 16	Sand 16	Sand 16

(a) Depths measured from El. 95 feet.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-87
Subsurface Conditions; Average Properties within the Foundation Deformation Zone (Typical LWR (with an Integral UHS) Fire Water Service Complex) (Power Block Area)

Structure	Soil Profile for Calculation						Shear Strength				Foundation Width, B (feet)	Effective Shear Depth H' (feet)
	Soil Profile	Stratum	Top El.[a] (feet)	Bottom El.[a] (feet)	Thickness (feet)	Total Thickness (feet)	Layer c (ksf)	Layer Φ (°)	Avg c (ksf)	Avg Φ (°)		
FWSC (Unit 1)	N/A	Fill	87.3	80.0	7.3	38.5	0.0	39.0	2.6	8.7	66.0	38.5
		Clay 1	80.0	48.8	31.2		3.2	0.0				
FWSC (Unit 2)	Clay Preferred	Fill	87.3	80.0	7.3	42.1	0.0	39.0	2.1	13.8	66.0	42.1
		Clay 1	80.0	52.0	28.0		3.2	0.0				
		Sand 1	52.0	45.2	6.8		0.0	33.0				
FWSC (Unit 2)	Sand Preferred	Fill	87.3	80.0	7.3	42.1	0.0	39.0	2.1	13.8	66.0	42.1
		Clay 1	80.0	52.0	28.0		3.2	0.0				
		Sand 1	52.0	45.2	6.8		0.0	33.0				

(a) Elevations are referenced to NAVD 88.

Table 2.5.4-88
Calculated Foundation Bearing Capacities of Seismic Category I Structures (Typical LWR (with an Integral UHS)) (Power Block Area)

Structure	Embedment Depth, D (feet)	Groundwater Table Depth, h (feet)	Overburden Pressure, q (ksf)	Soil Profile	Ultimate Bearing Capacity, q_{ult} (ksf)	Factor of Safety,FOS	Allowable Bearing Capacity, q_a (ksf)
Reactor/Fuel Building (Unit 1)	65.6	10.0	4.4	Clay Preferred	56.5	3.0	18.8
				Sand Preferred	146.1	3.0	48.7
Reactor/Fuel Building (Unit 2)	65.6	10.0	4.4	Clay Preferred	77.4	3.0	25.8
				Sand Preferred	177.2	3.0	59.1
Control Building (Unit 1)	48.9	10.0	3.4	Clay Preferred	68.6	3.0	22.9
				Sand Preferred	78.6	3.0	26.2
Control Building (Unit 2)	48.9	10.0	3.4	Clay Preferred	85.6	3.0	28.5
				Sand Preferred	228.3	3.0	76.1
FWSC (Unit 1)	7.7	10.0	0.9	N/A	25.0	3.0	8.3
FWSC (Unit 2)	7.7	10.0	0.9	Clay Preferred	30.0	3.0	10.0
				Sand Preferred	30.0	3.0	10.0

Table 2.5.4-89
Calculated Foundation Settlements of Seismic Category I Structures
(Typical LWR (with an Integral UHS)) (Power Block Area)

Structure	Soil Profile	Calculated Settlement (inches)			Allowable Settlement (inches)			
		Edge	Corner	Center	Any Corner	Average Four Corners	Differential Along Long Dimension	Center
Reactor/Fuel Building (Unit 1)	Clay Preferred	2.7	1.5	5.0	4.0	2.6	3.0	N/A
	Sand Preferred	2.7	1.5	5.0				
Reactor/Fuel Building (Unit 2)	Clay Preferred	2.7	1.5	5.0	4.0	2.6	3.0	N/A
	Sand Preferred	2.7	1.5	5.1				
Control Building (Unit 1)	Clay Preferred	0.9	0.5	1.7	0.7	0.5	0.6	N/A
	Sand Preferred	0.9	0.5	1.7				
Control Building (Unit 2)	Clay Preferred	0.9	0.5	1.7	0.7	0.5	0.6	N/A
	Sand Preferred	0.9	0.5	1.7				
FWSC (Unit 1)	N/A	0.4	0.2	0.6	0.7	0.4	0.5	N/A
FWSC (Unit 2)	Clay Preferred	0.4	0.2	0.6	0.7	0.4	0.5	N/A
	Sand Preferred	0.4	0.2	0.6				

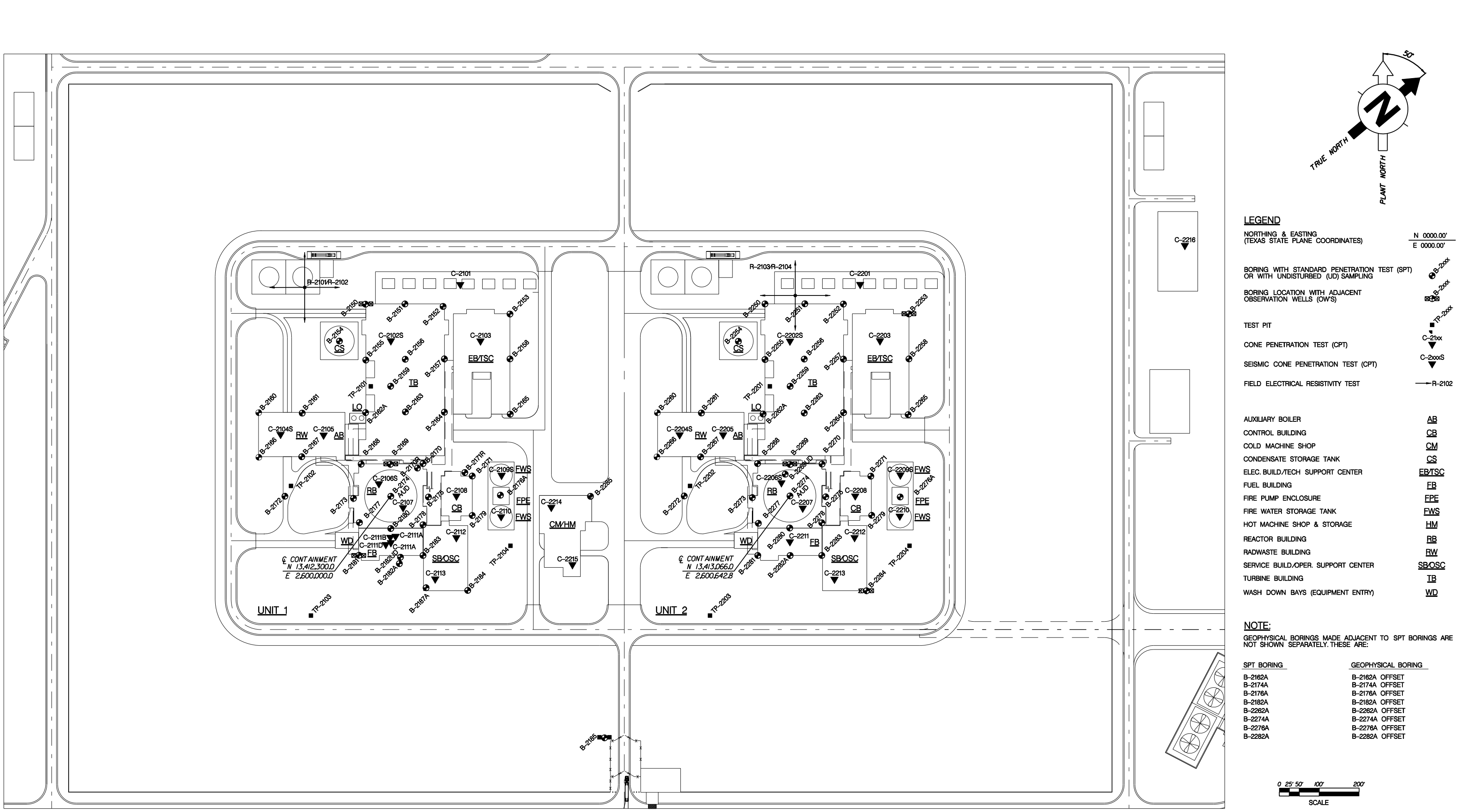


Figure 2.5.4-1 Subsurface Investigation Location Plan (Power Block Area) (Typical Dual Unit LWR (with an Integral UHS) Layout Shown)

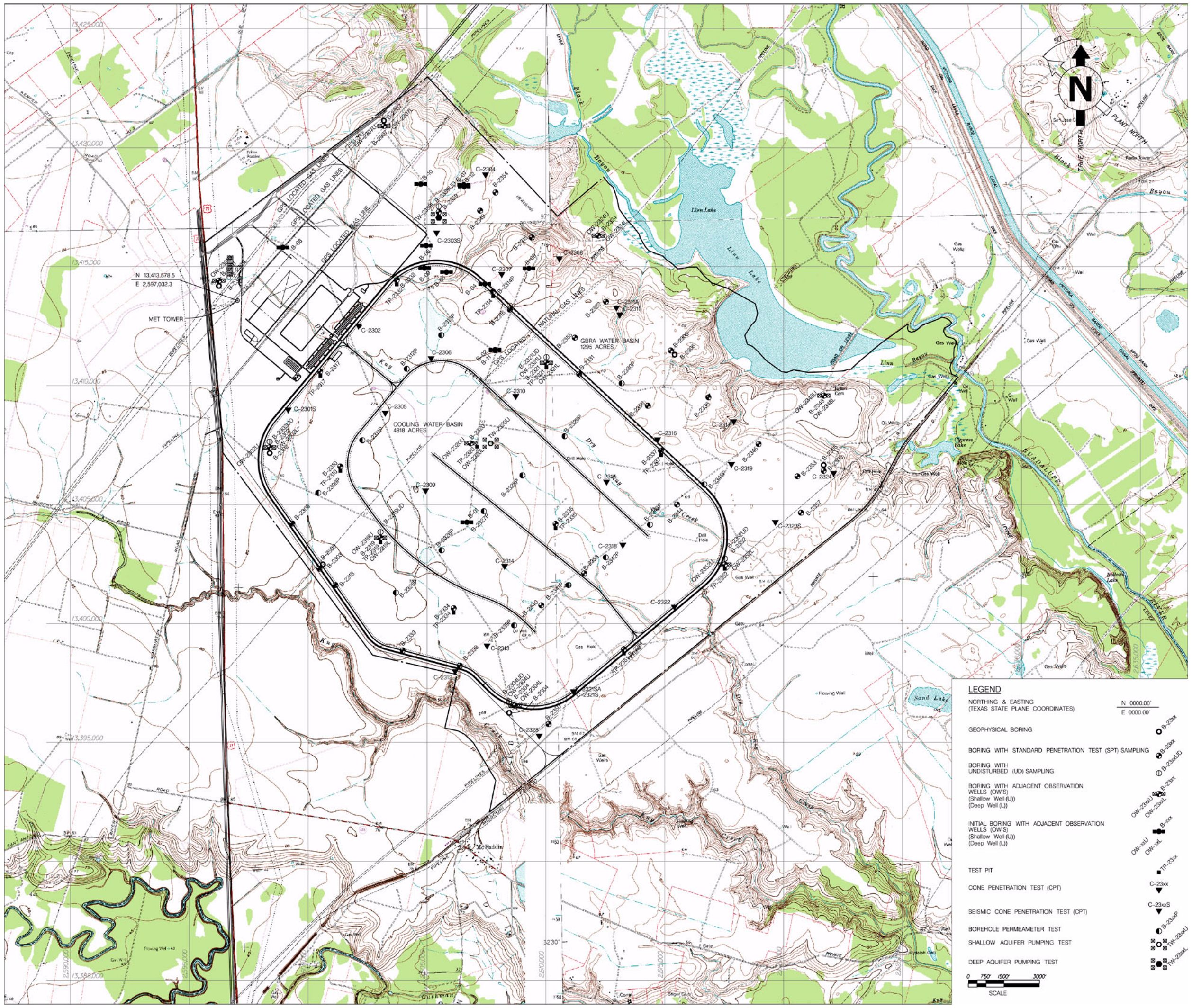
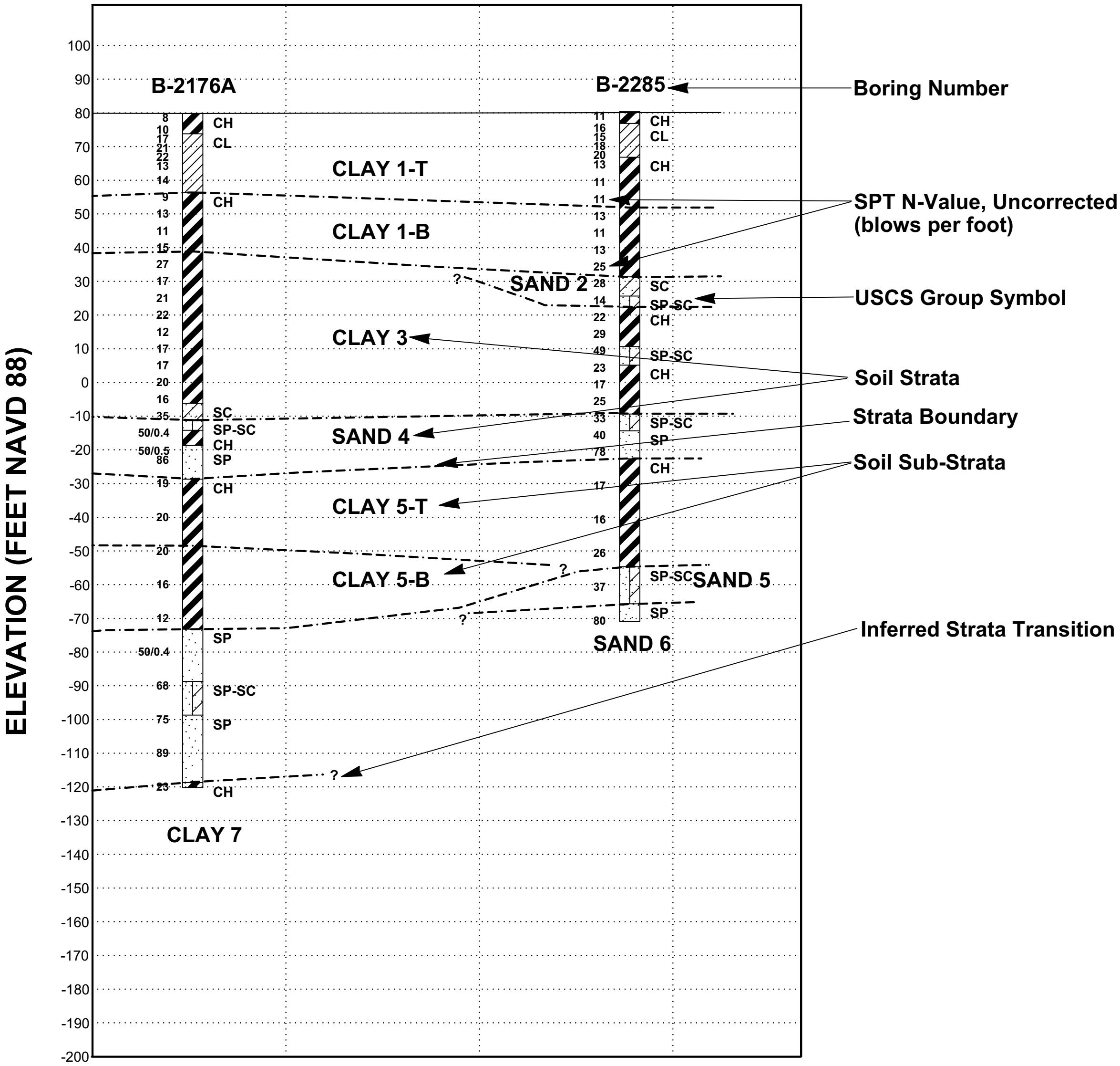


Figure 2.5.4-2 Subsurface Investigation Location Plan (Cooling Basin)



NOTES:

[1] See report text for stratum descriptions.
[2] Subsurface data have been obtained only at actual boring and CPT locations. Stratification shown between borings is based on extrapolation of the data obtained from the borings. Actual stratification between borings may differ from that shown.

Figure 2.5.4-3 Subsurface Profile Legend (Power Block Area; Cooling Basin)

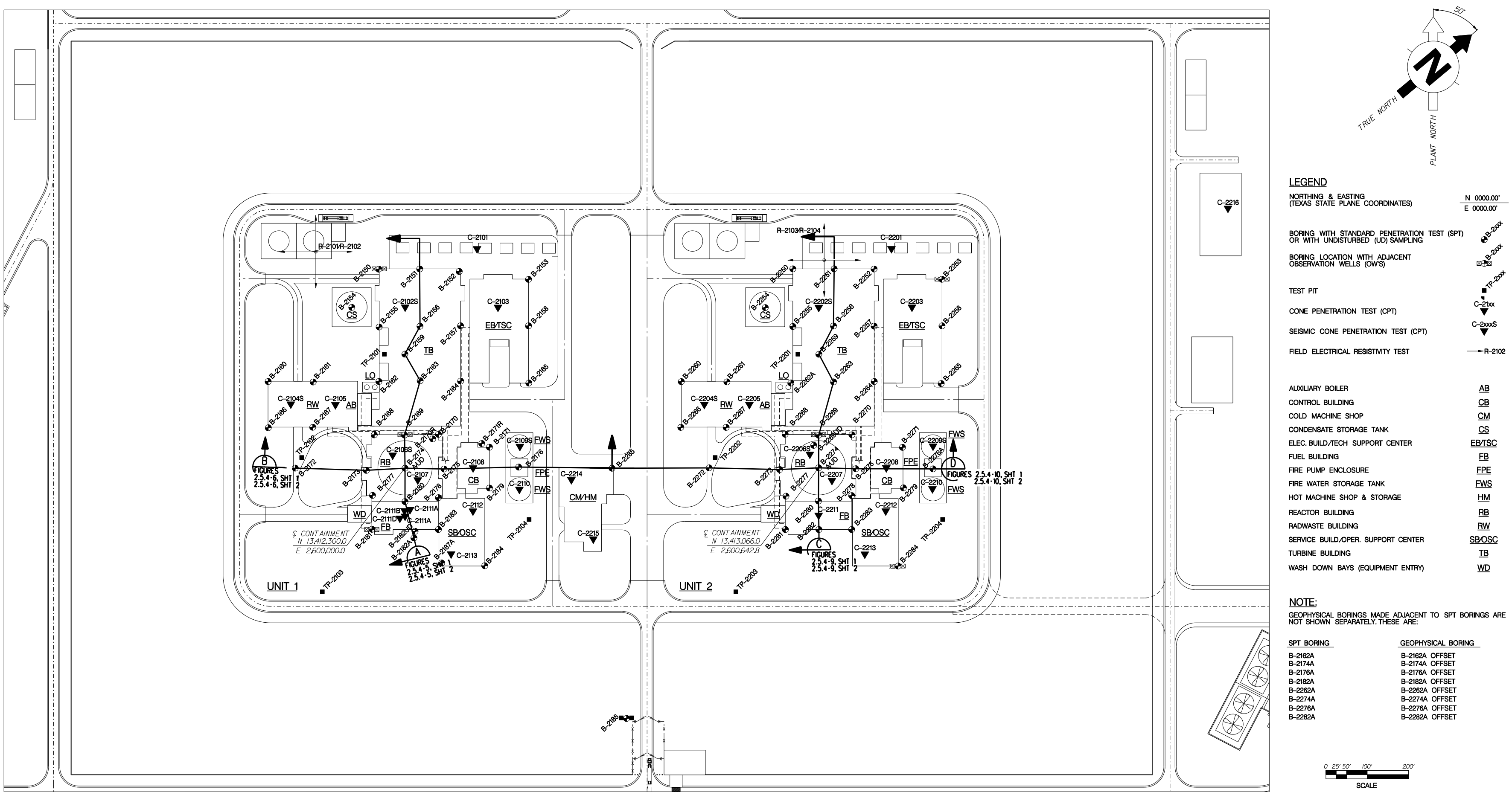


Figure 2.5.4-4 Subsurface Profile Plan (Power Block Area) (Typical Dual Unit LWR (with an Integral UHS) Layout Shown)

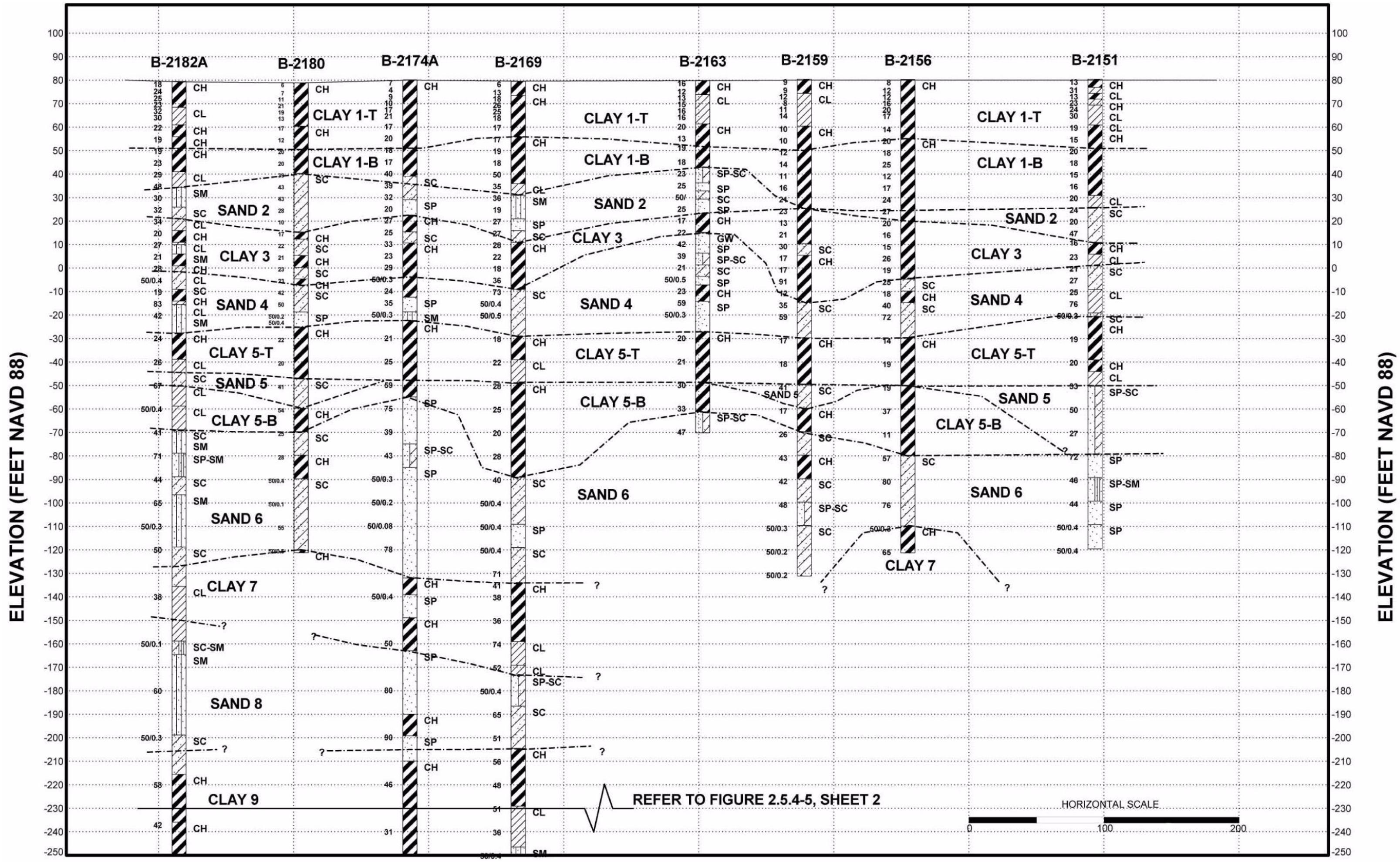


Figure 2.5.4-5 Subsurface Profile A; Unit 1 (North-South) (Power Block Area) (Sheet 1 of 2)

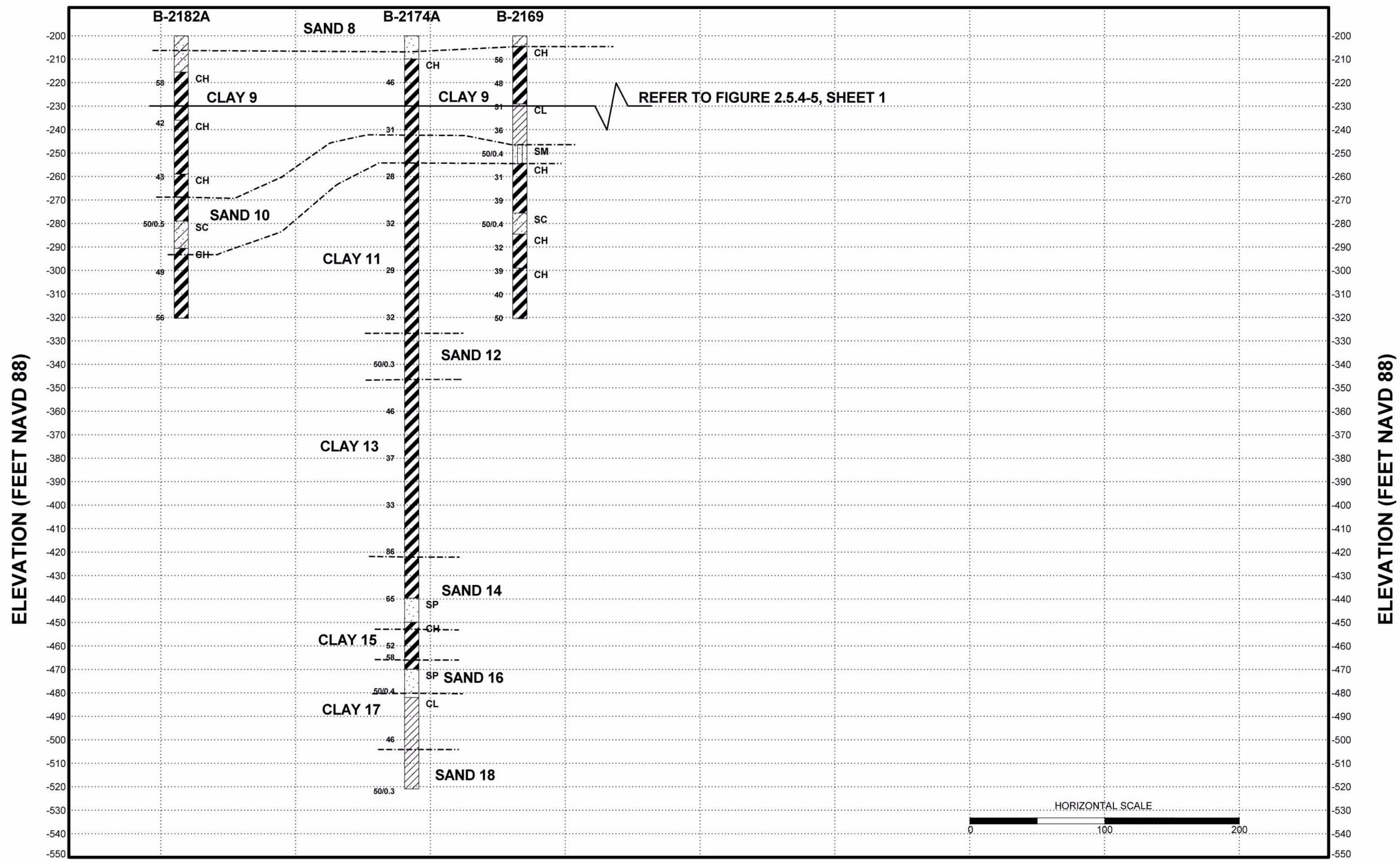


Figure 2.5.4-5 Subsurface Profile A; Unit 1 (North-South) (Power Block Area) (Sheet 2 of 2)

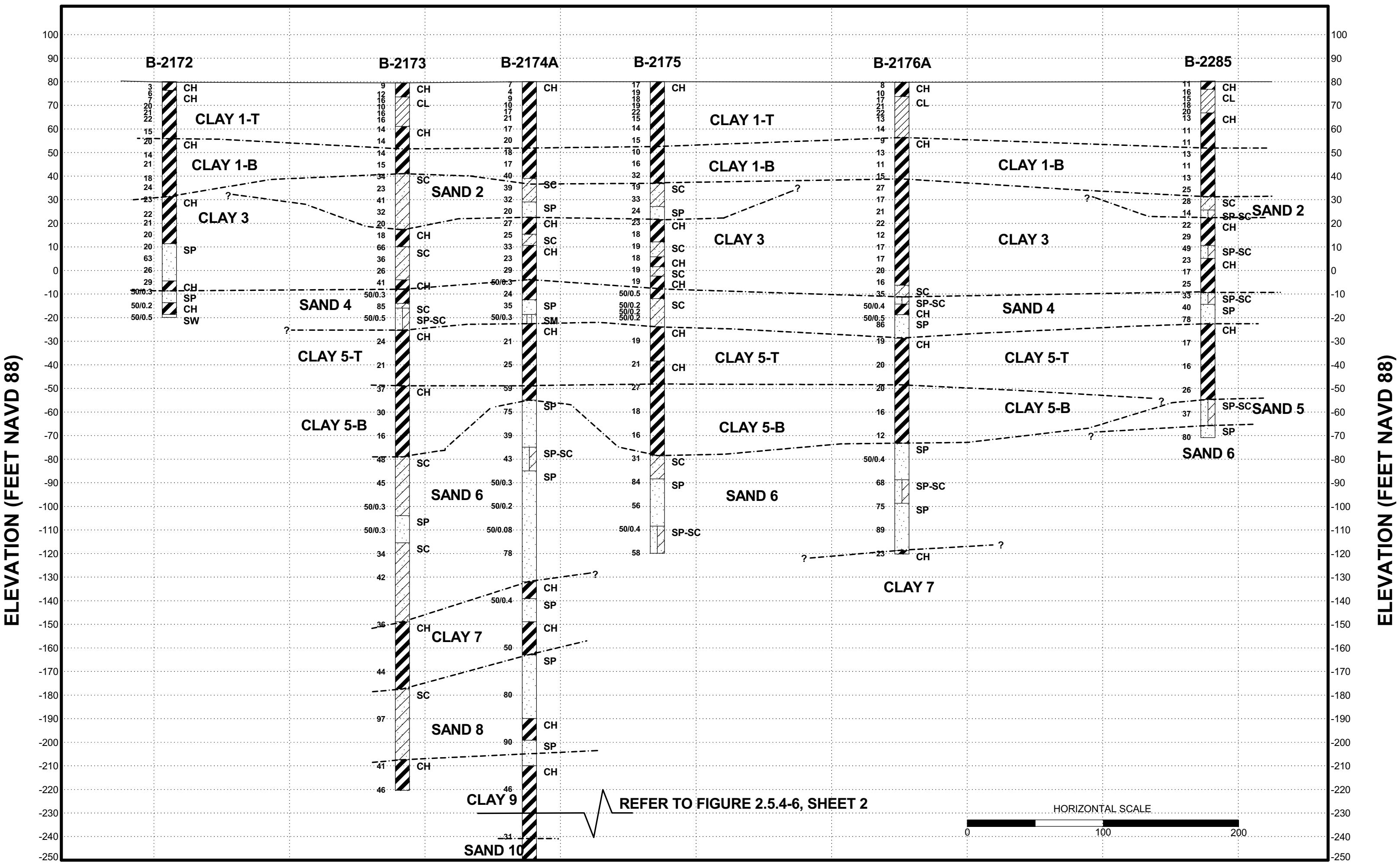


Figure 2.5.4-6 Subsurface Profile B; Unit 1 (East-West) (Power Block Area) (Sheet 1 of 2)

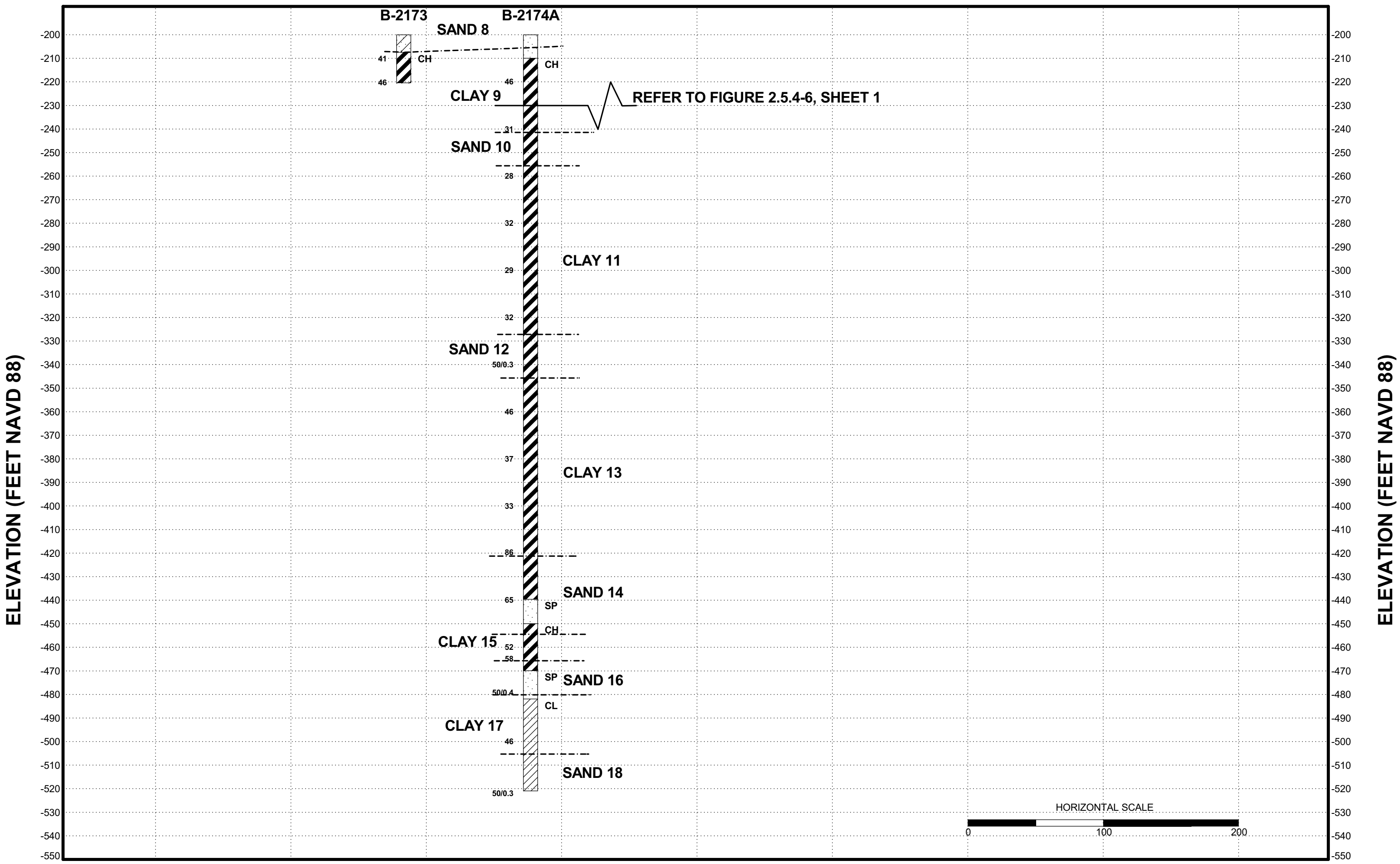


Figure 2.5.4-6 Subsurface Profile B; Unit 1 (East-West) (Power Block Area) (Sheet 2 of 2)

Figure 2.5.4-7 Not Used

Figure 2.5.4-8   Not Used

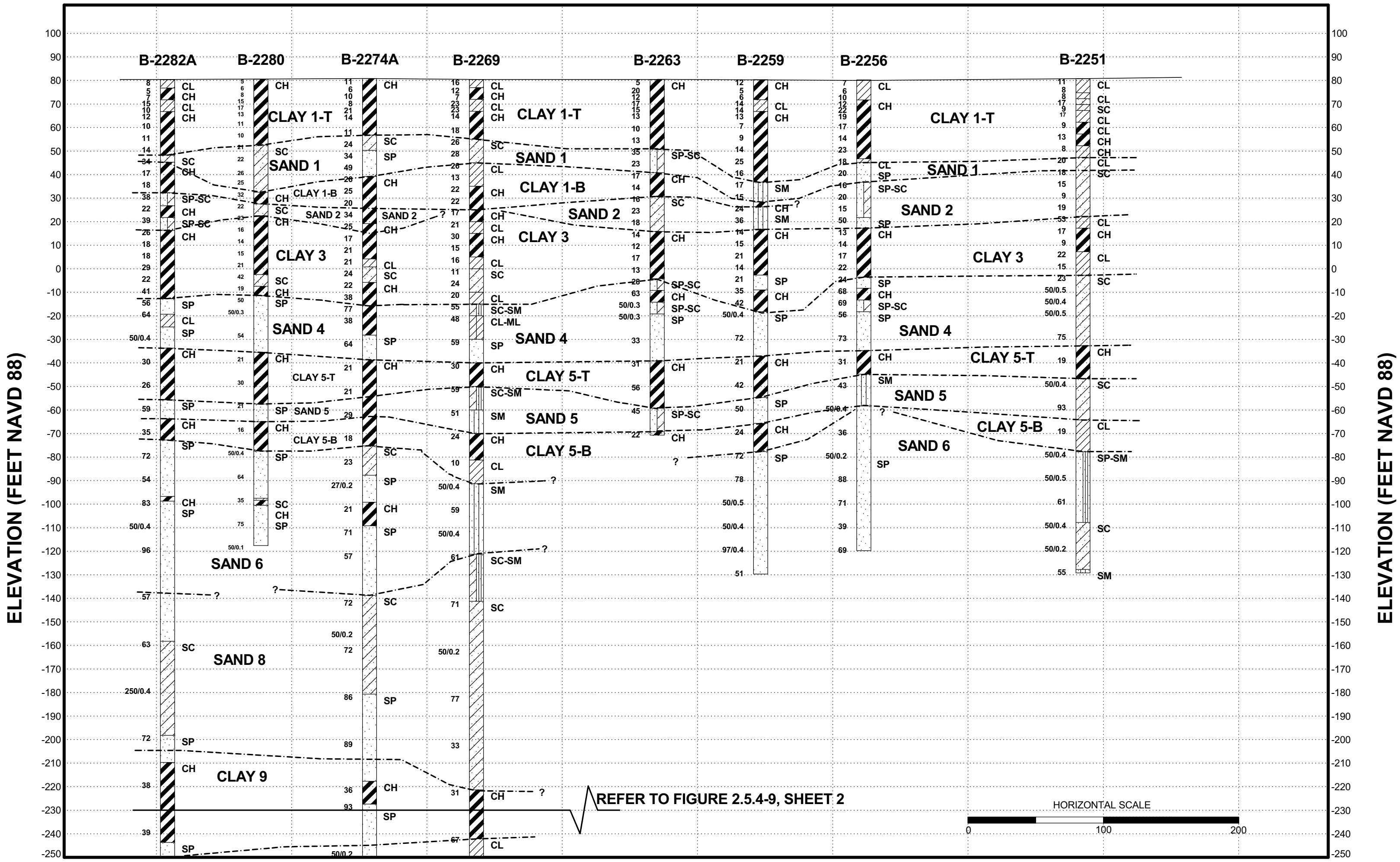


Figure 2.5.4-9 Subsurface Profile C; Unit 2 (North-South) (Power Block Area) (Sheet 1 of 2)

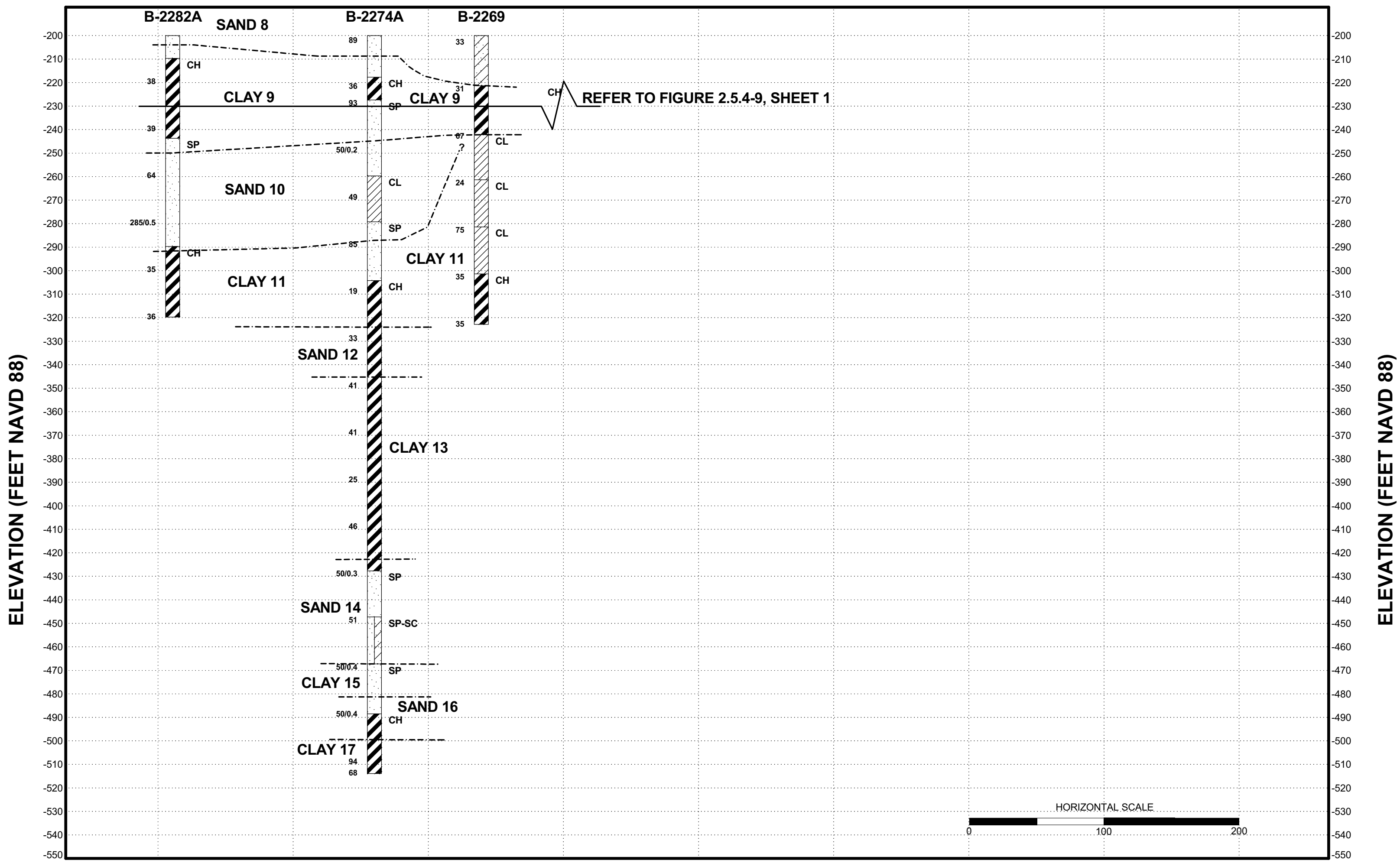


Figure 2.5.4-9 Subsurface Profile C; Unit 2 (North-South) (Power Block Area) (Sheet 2 of 2)

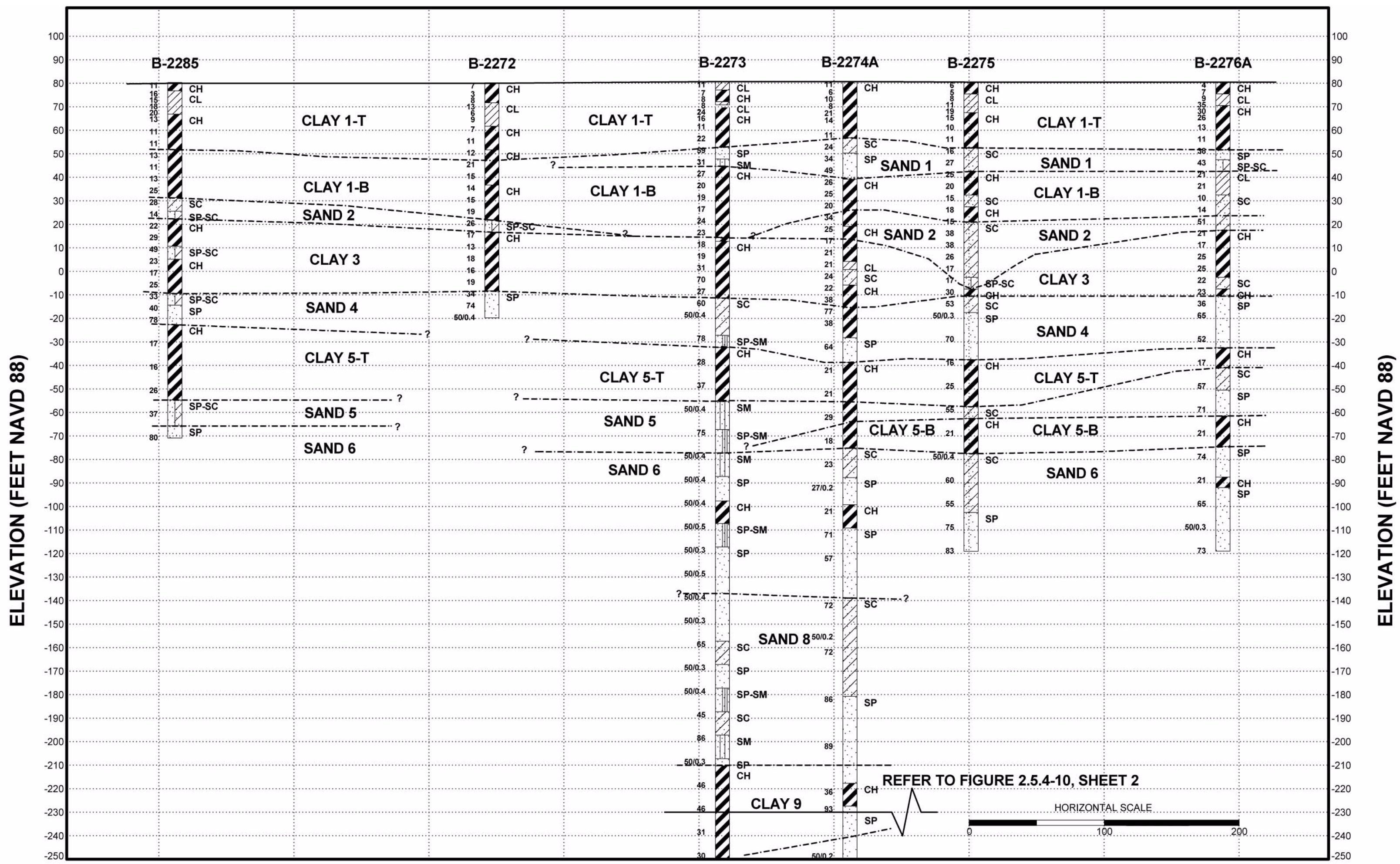


Figure 2.5.4-10 Subsurface Profile D; Unit 2 (East-West) (Power Block Area) (Sheet 1 of 2)

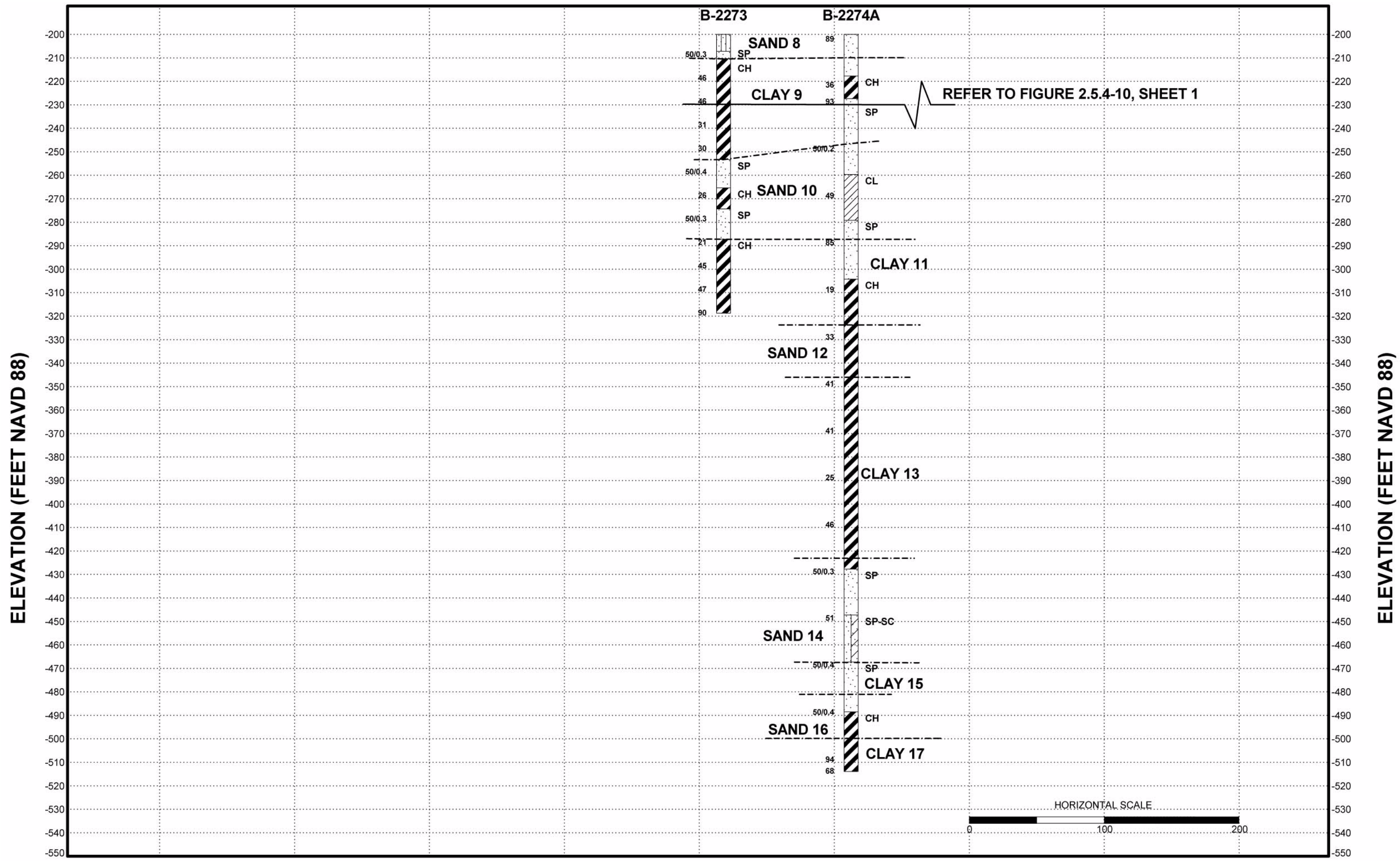


Figure 2.5.4-10 Subsurface Profile D; Unit 2 (East-West) (Power Block Area) (Sheet 2 of 2)

Figure 2.5.4-11 Not Used

Figure 2.5.4-12 Not Used

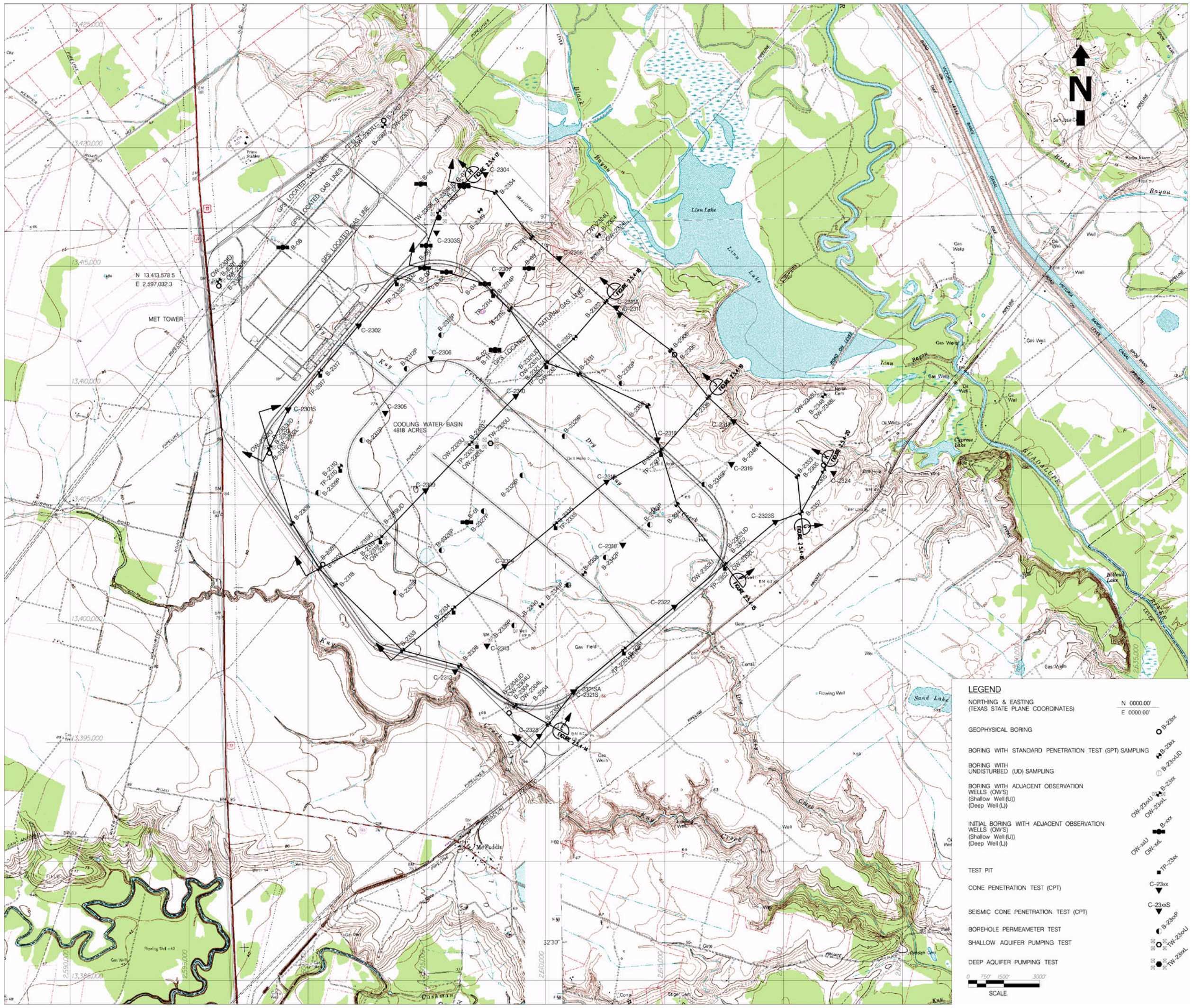


Figure 2.5.4-13 Subsurface Profile Plan (Cooling Basin)

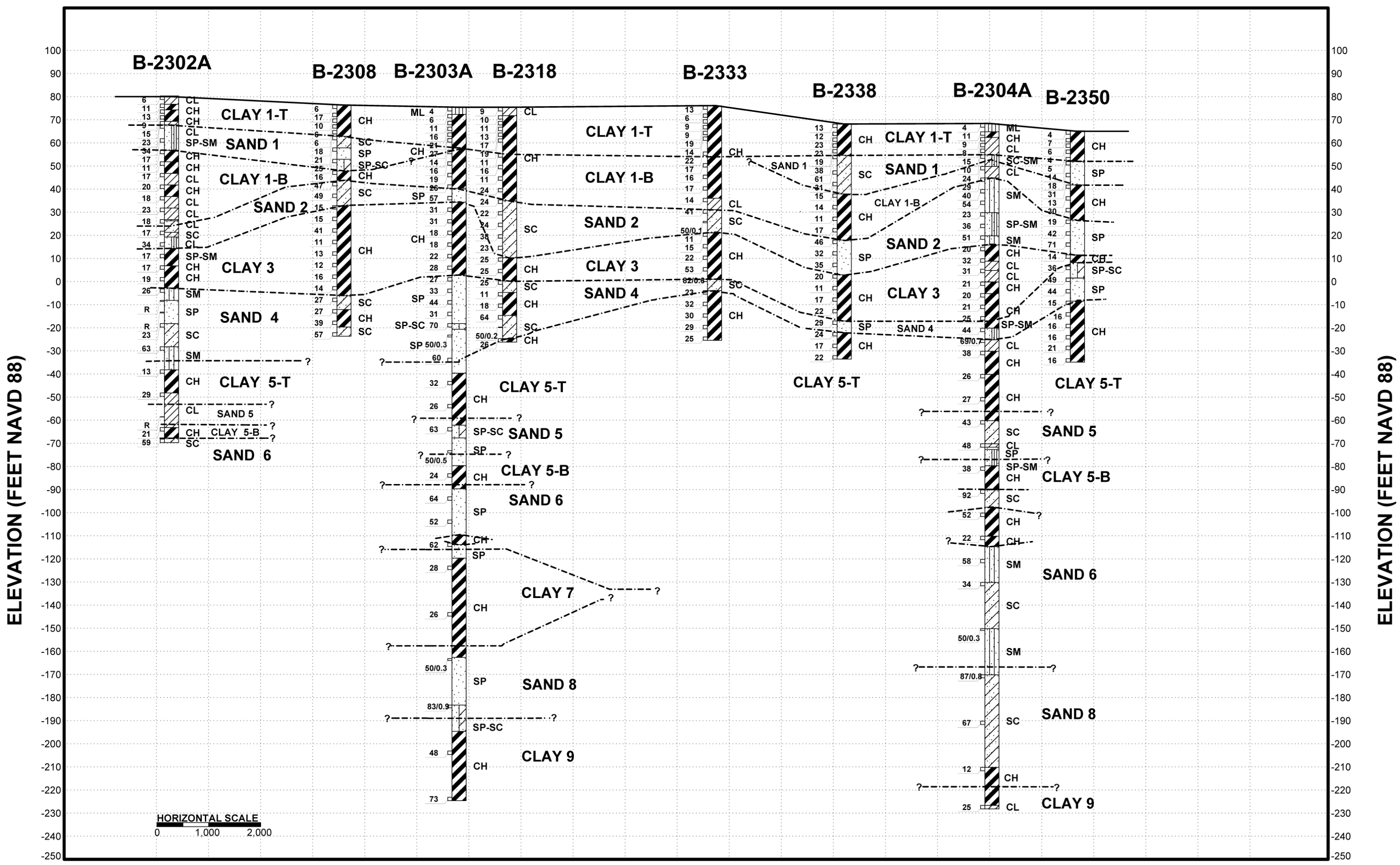


Figure 2.5.4-14 Subsurface Profile Plan E; West Embankment Dam of Cooling Basin (North-South) (Cooling Basin)

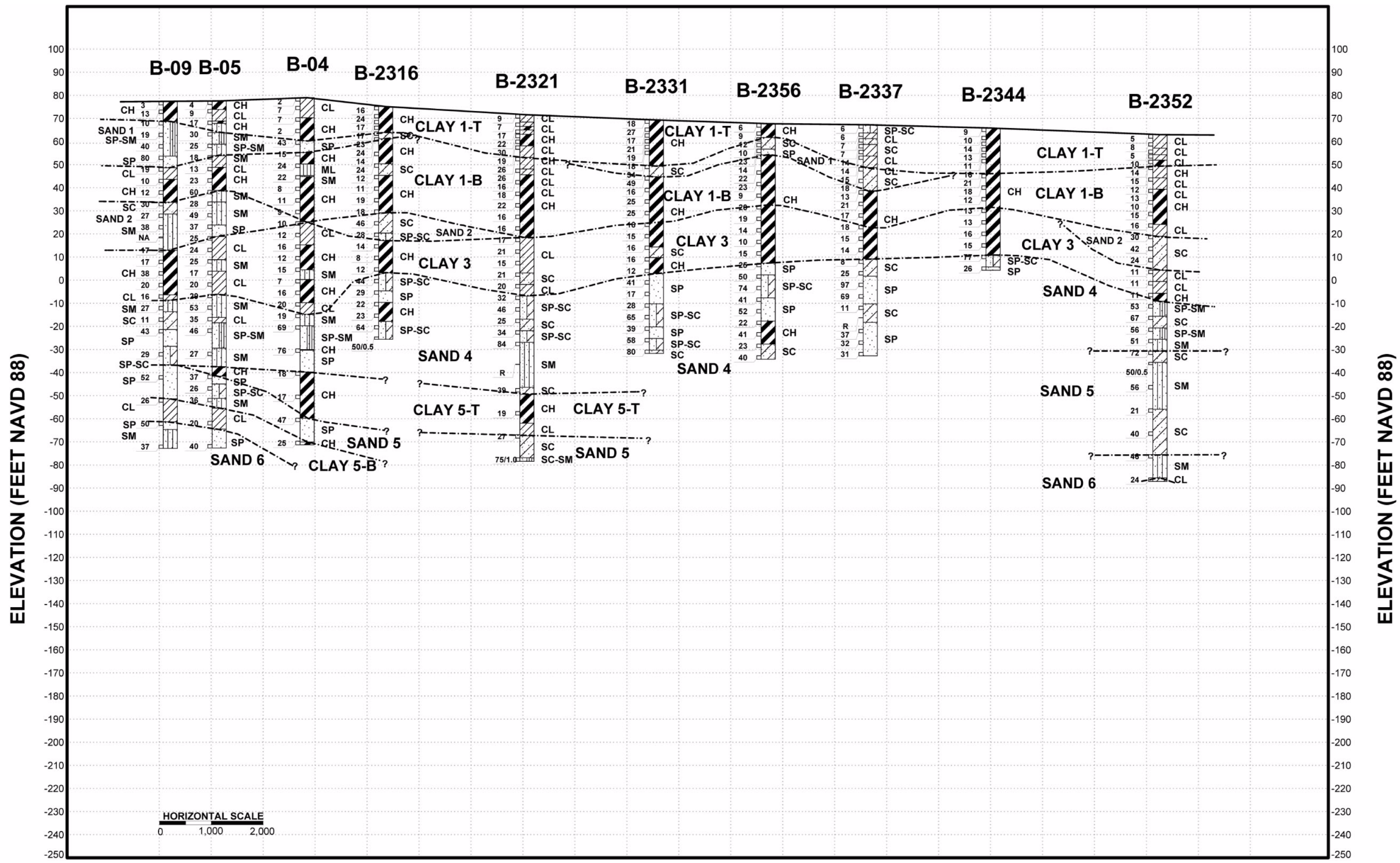


Figure 2.5.4-15 Subsurface Profile F; East Embankment Dam of Cooling Basin (North-South) (Cooling Basin)

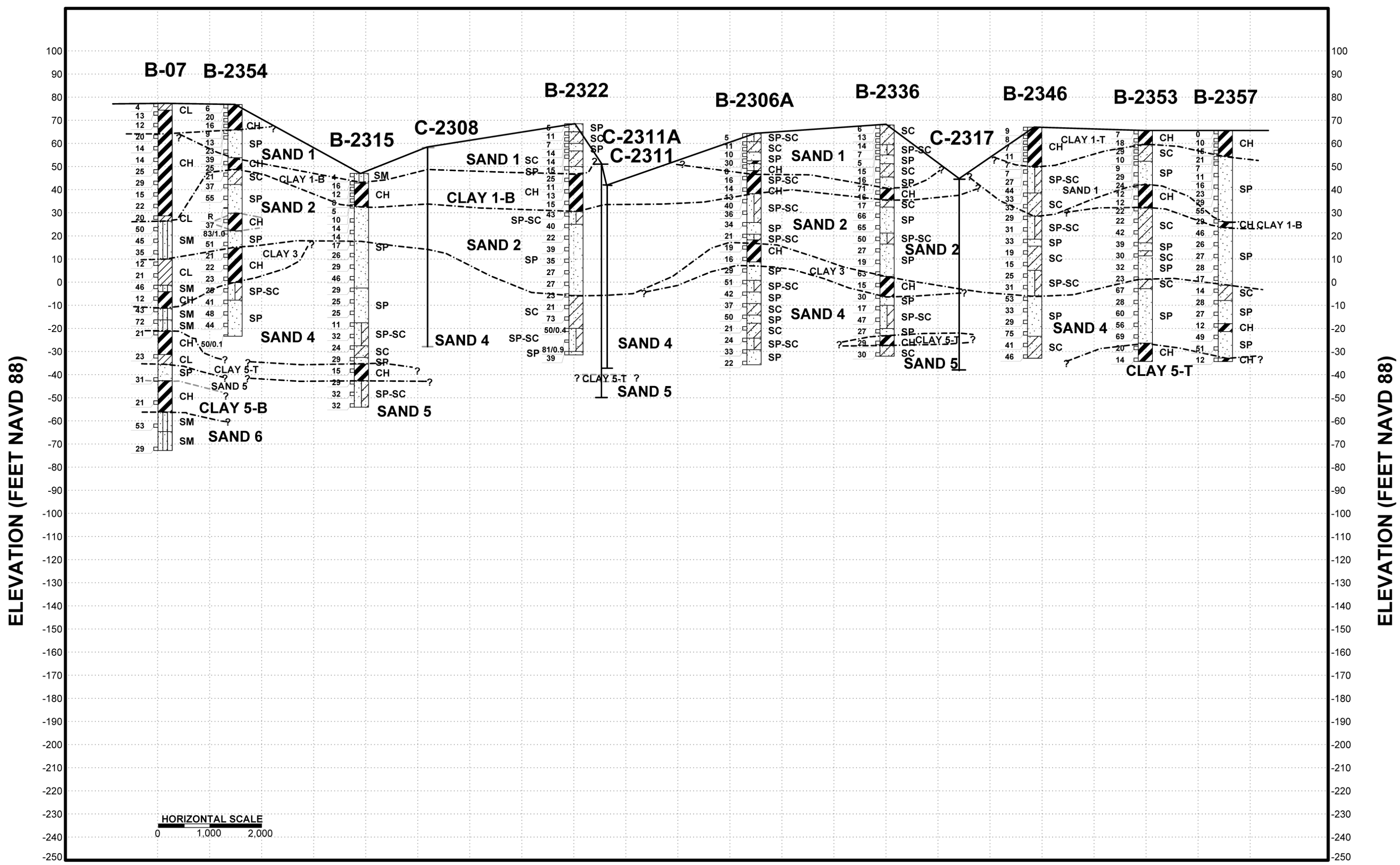


Figure 2.5.4-16 Subsurface Profile G; East of Cooling Basin (North-South) (Cooling Basin)

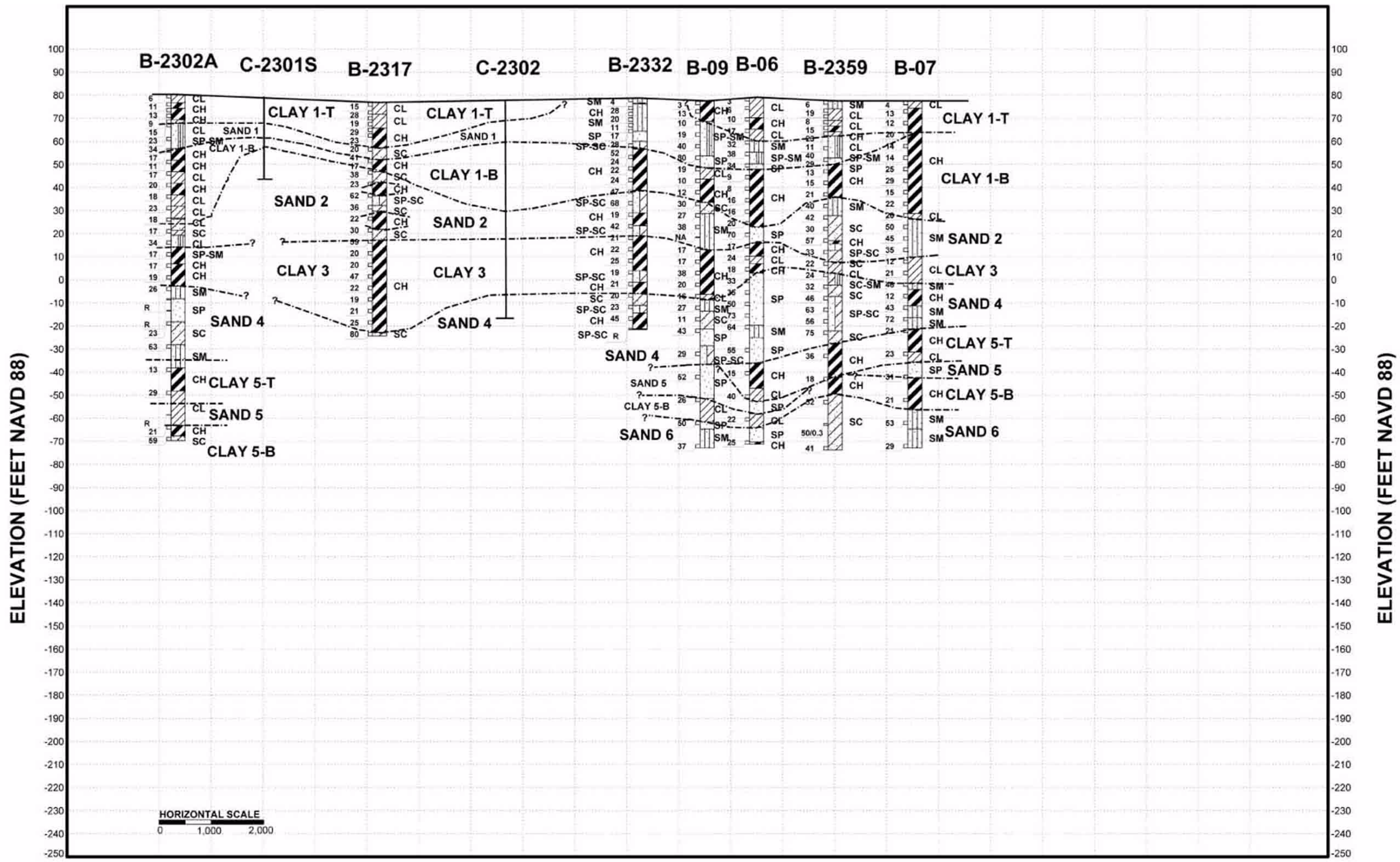


Figure 2.5.4-17 Subsurface Profile H; North Embankment Dam of Cooling Basin (East-West) (Cooling Basin)

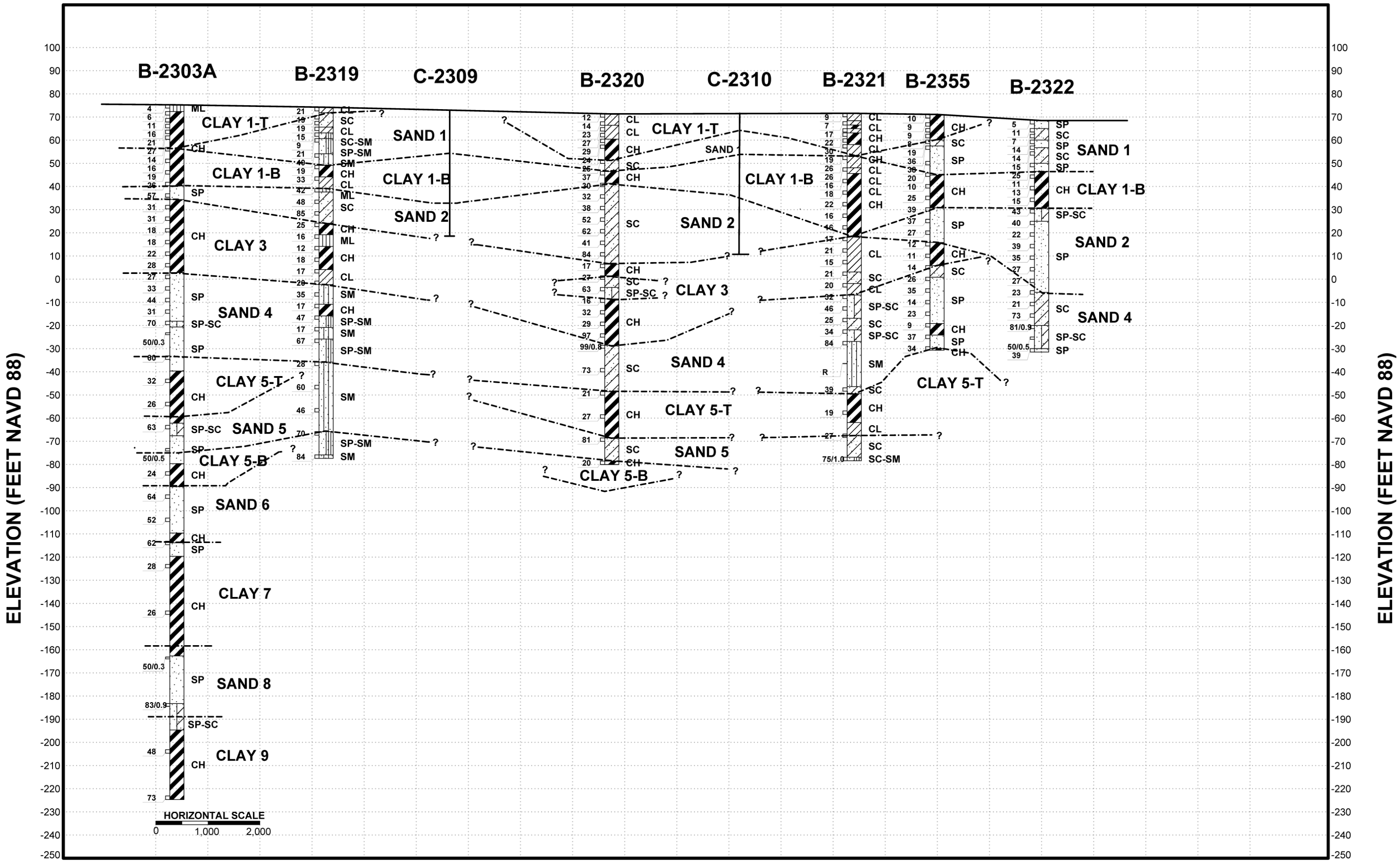


Figure 2.5.4-18 Subsurface Profile I; North-Central Area of Cooling Basin (East-West) (Cooling Basin)

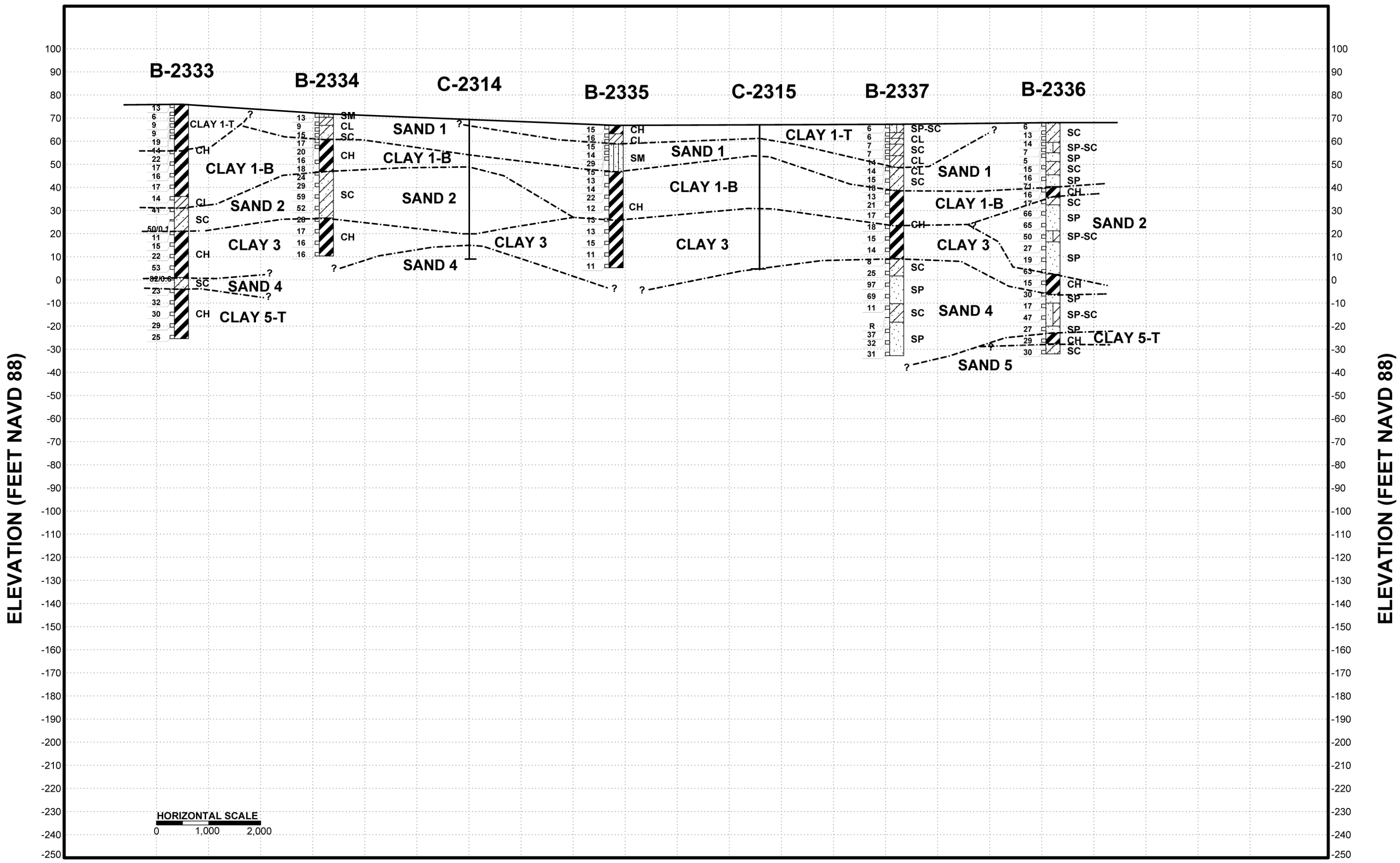


Figure 2.5.4-19 Subsurface Profile J; South-Central Area of Cooling Basin (East-West) (Cooling Basin)

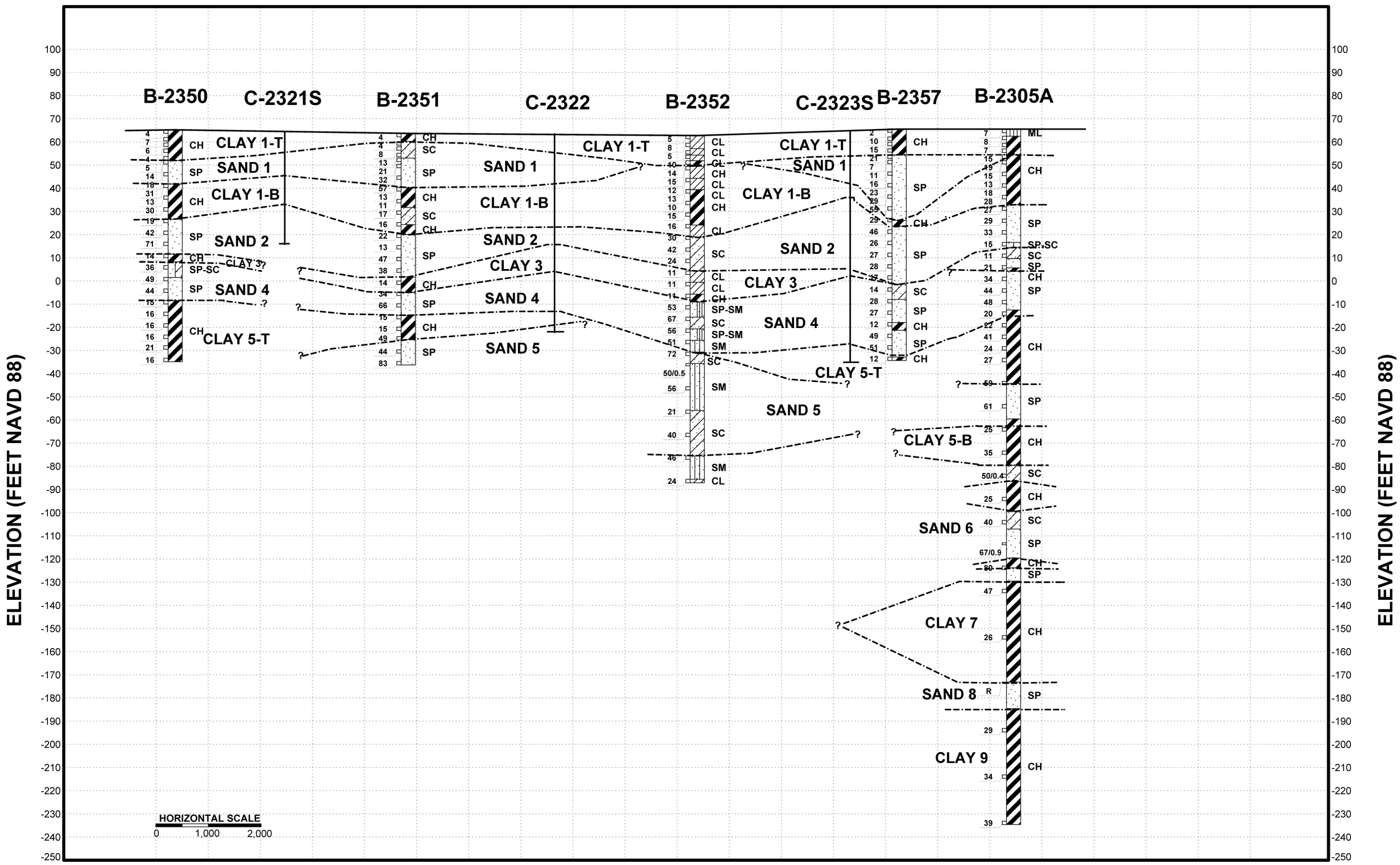


Figure 2.5.4-20 Subsurface Profile K; South Embankment Dam of Cooling Basin (East-West) (Cooling Basin)

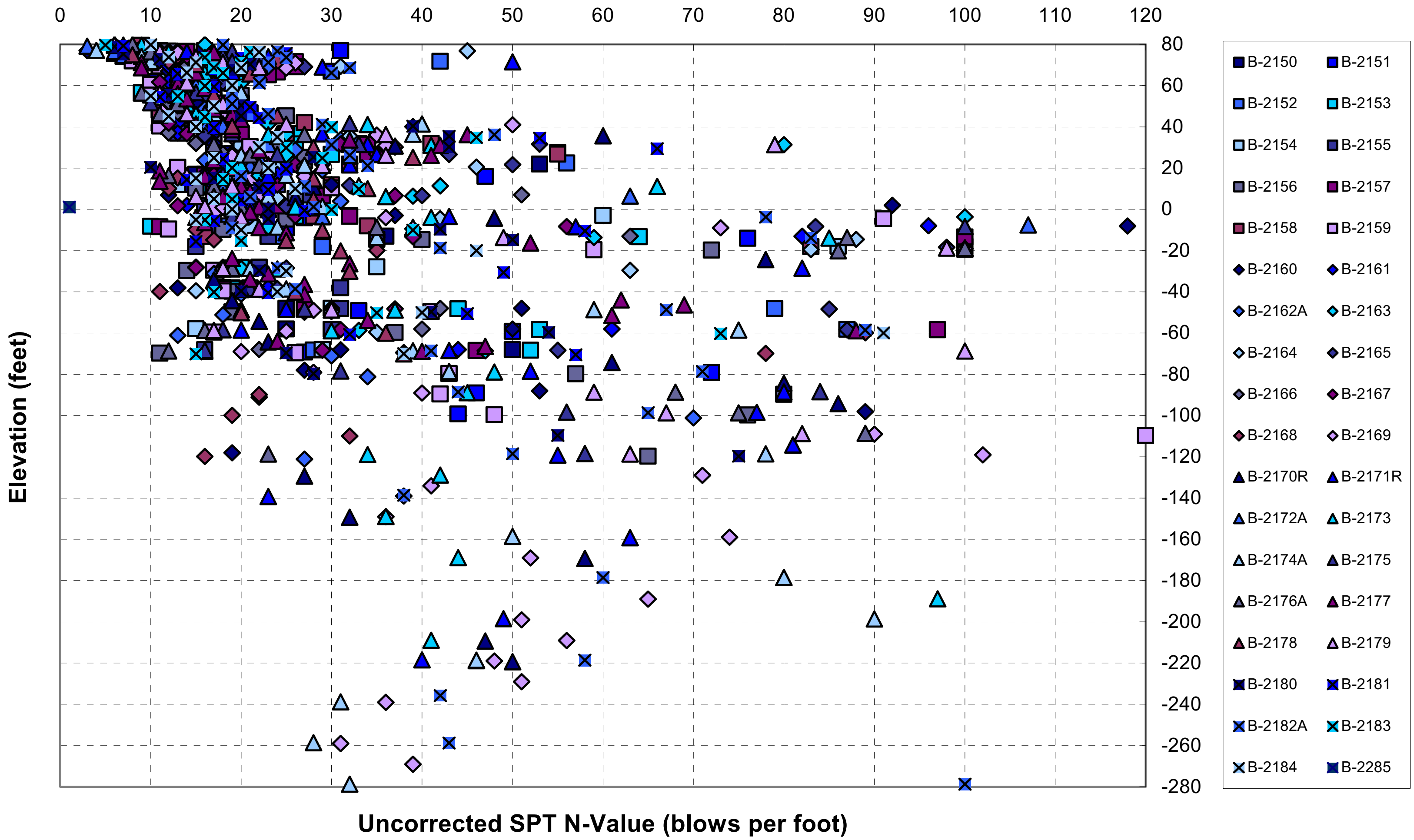


Figure 2.5.4-21 Uncorrected SPT N-Values; Unit 1 (Power Block Area)

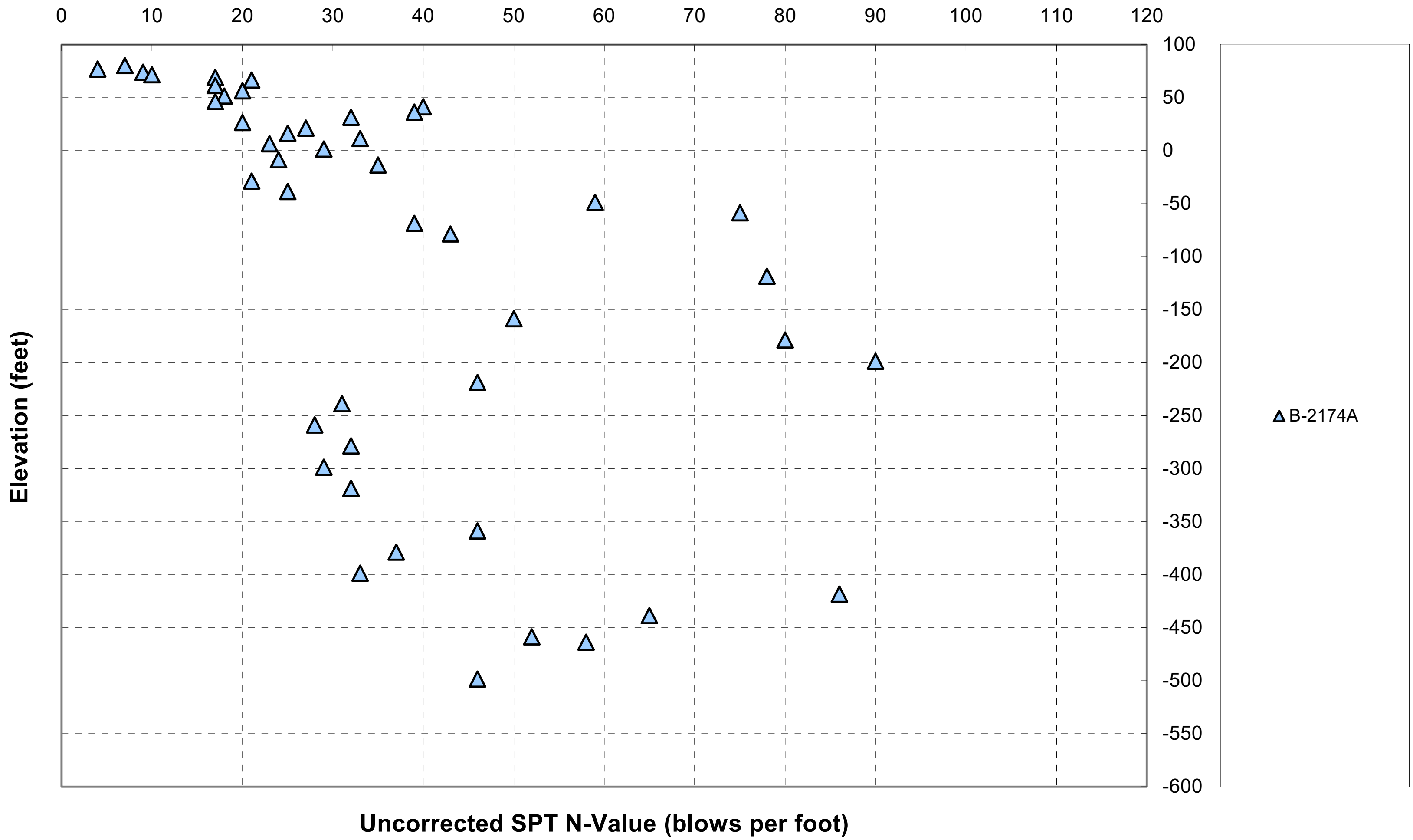


Figure 2.5.4-22 Uncorrected SPT N-Values; Unit 1; Boring B-2174A (Power Block Area)

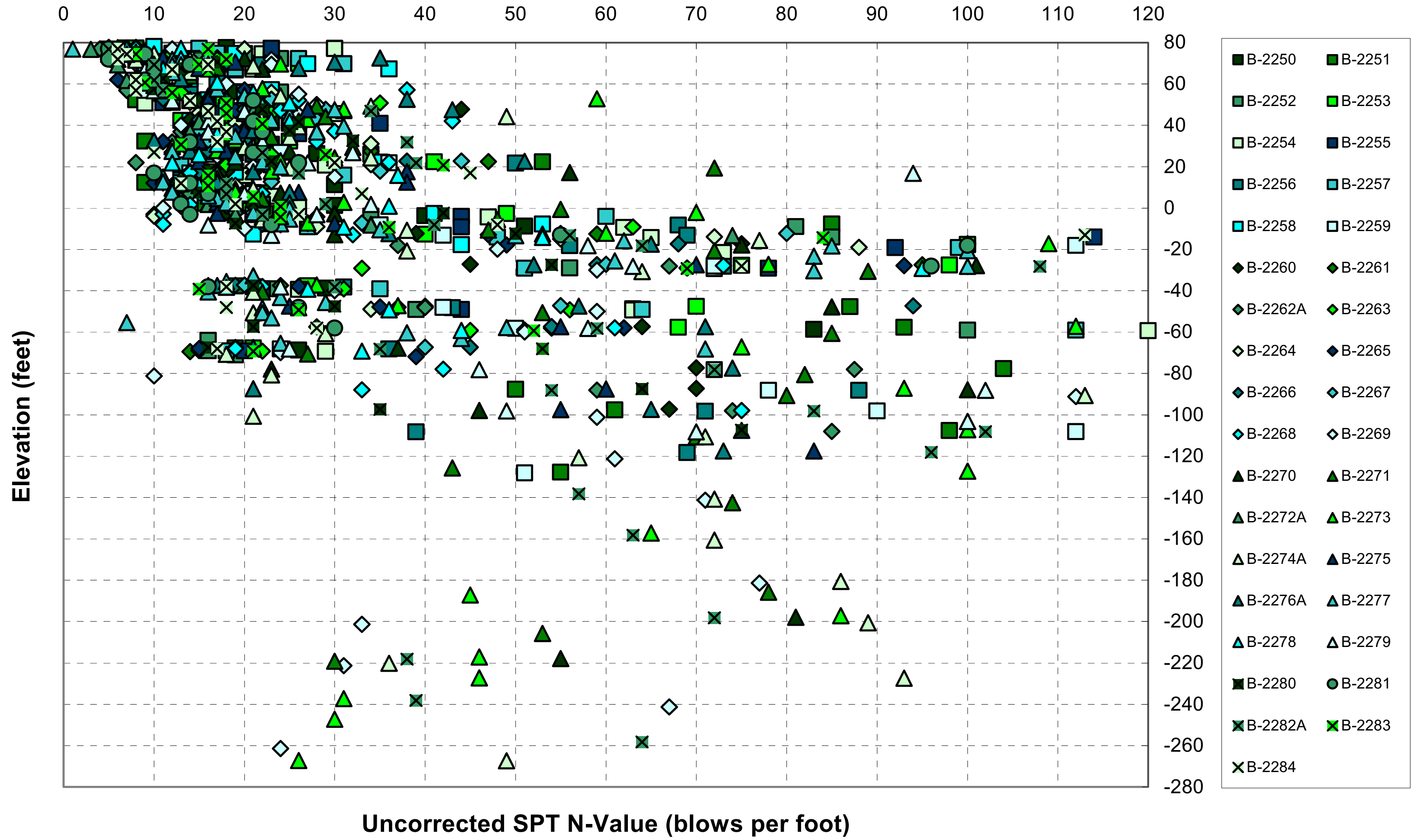


Figure 2.5.4-23 Uncorrected SPT N-Values; Unit 2 (Power Block Area)

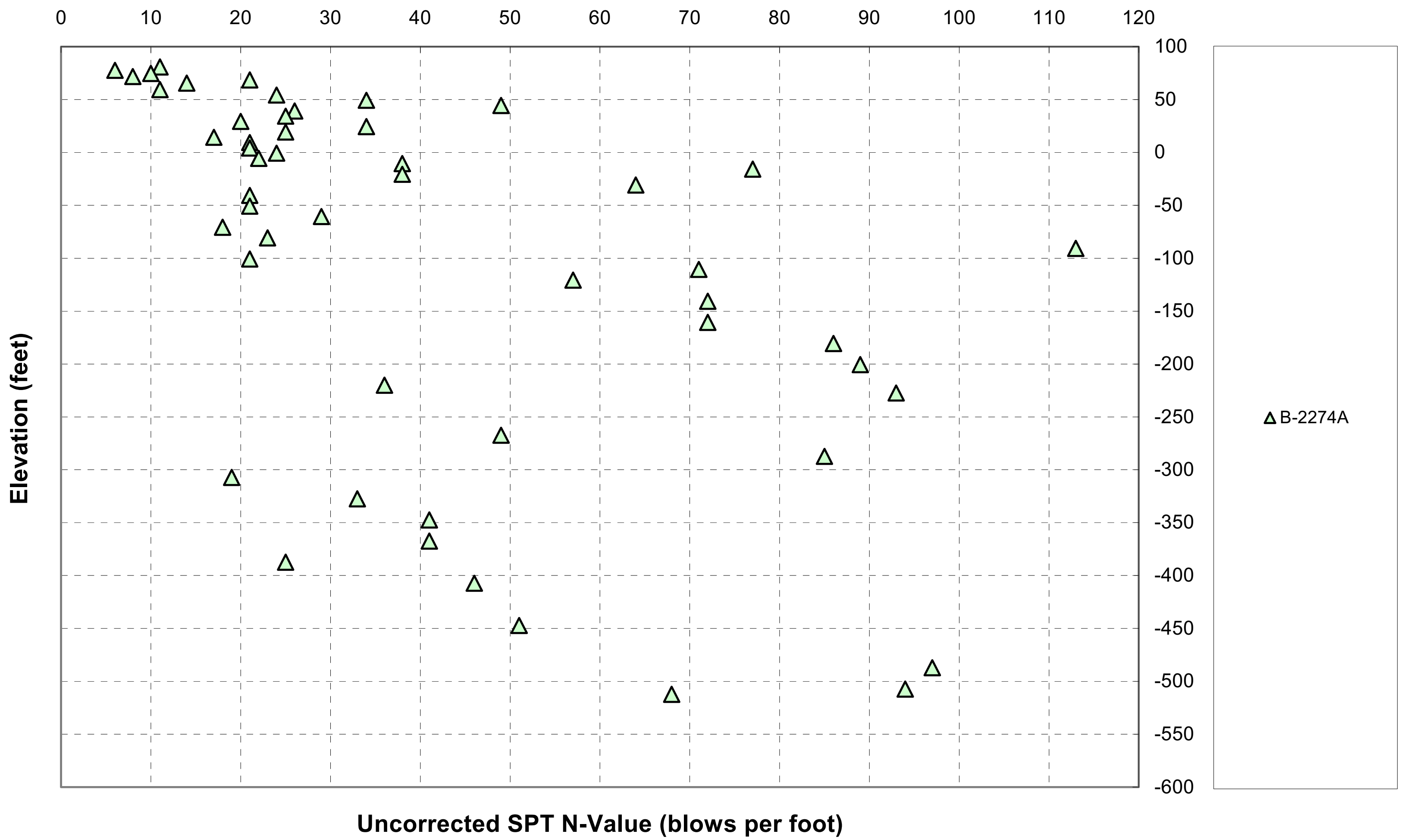


Figure 2.5.4-24 Uncorrected SPT N-Values; Unit 2; Boring B-2274A (Power Block Area)

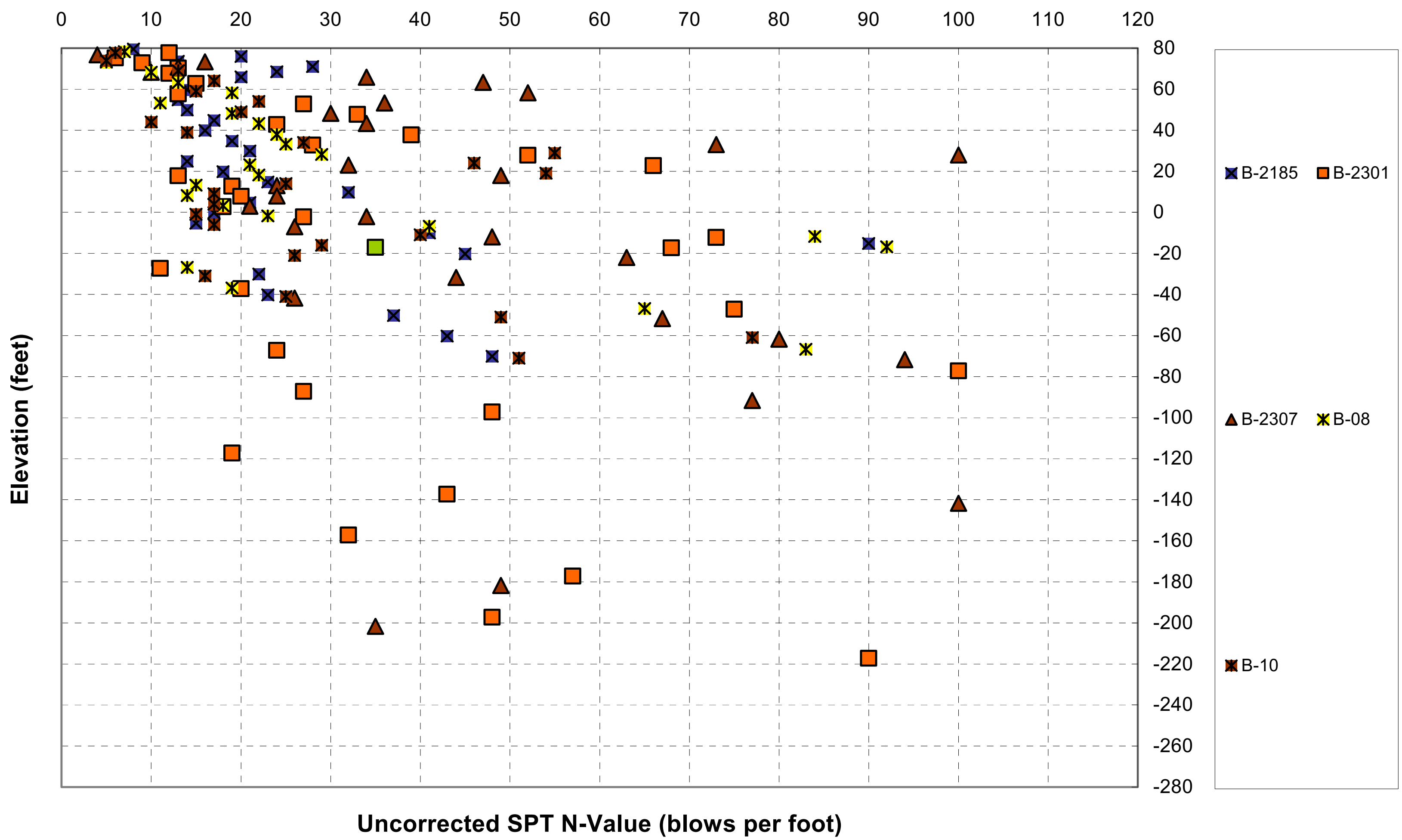


Figure 2.5.4-25 Uncorrected SPT N-Values; Investigations Outside Power Block Area

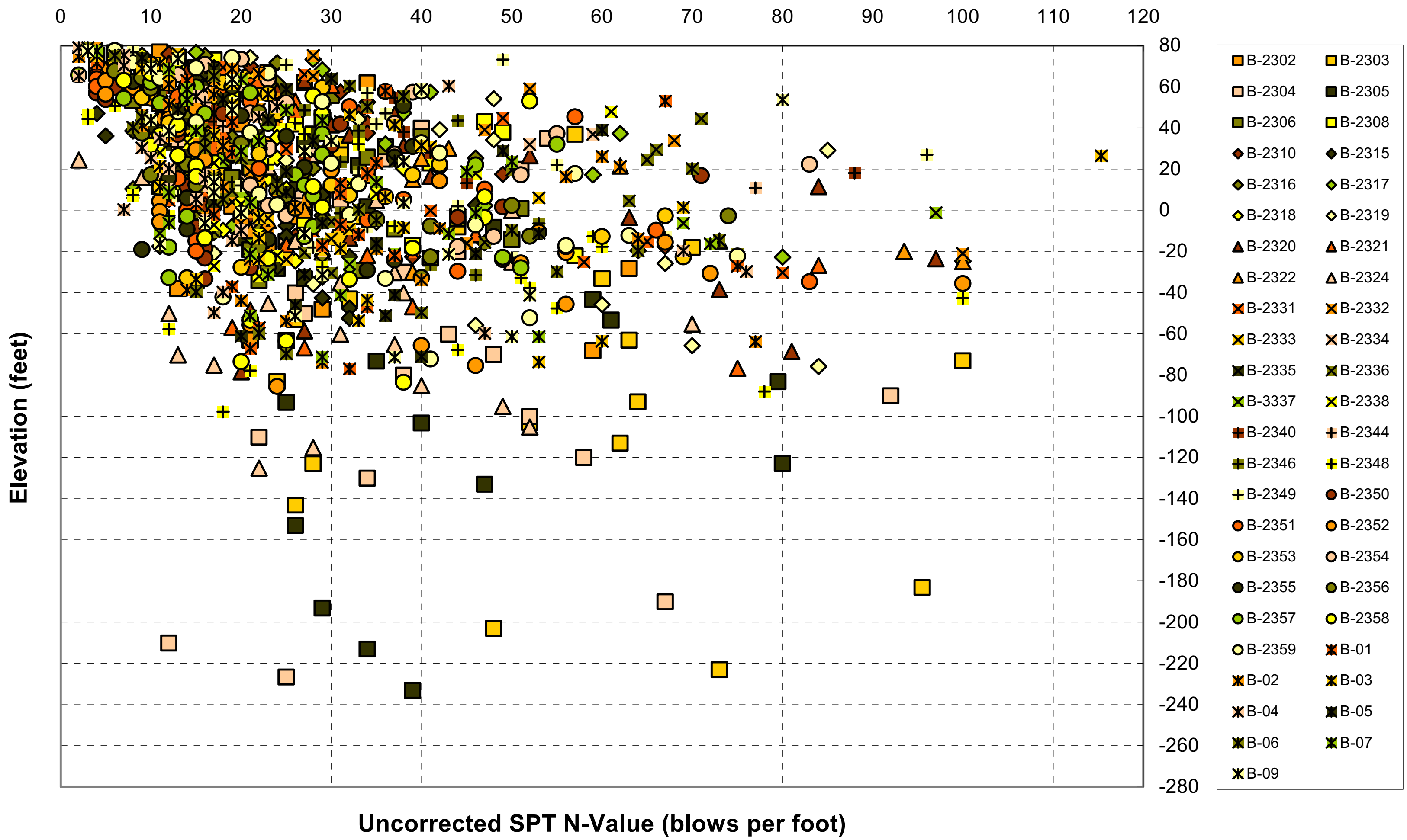


Figure 2.5.4-26 Uncorrected SPT N-Values (Cooling Basin)

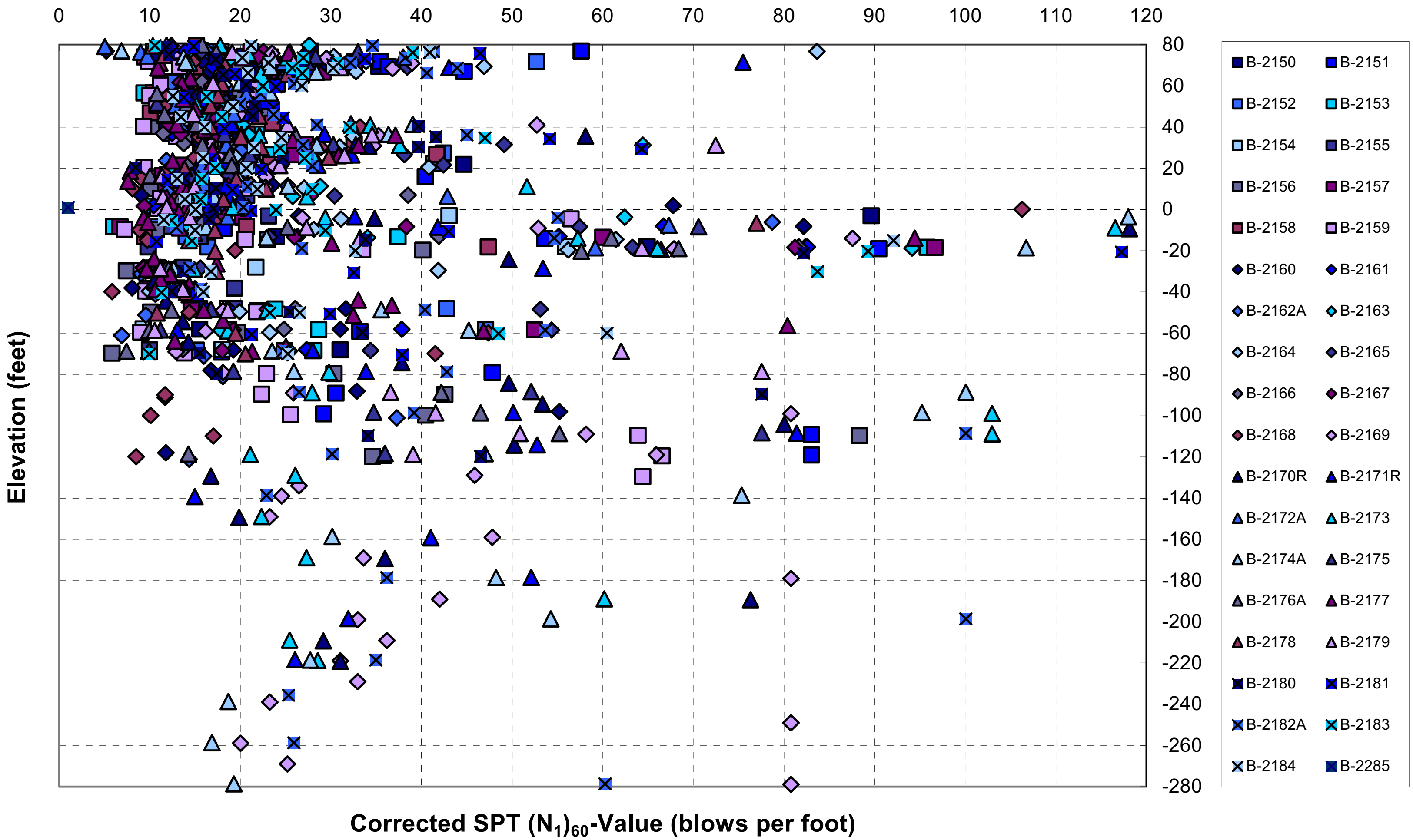


Figure 2.5.4-27 Corrected SPT $(N_1)_{60}$-Values; Unit 1 (Power Block Area)

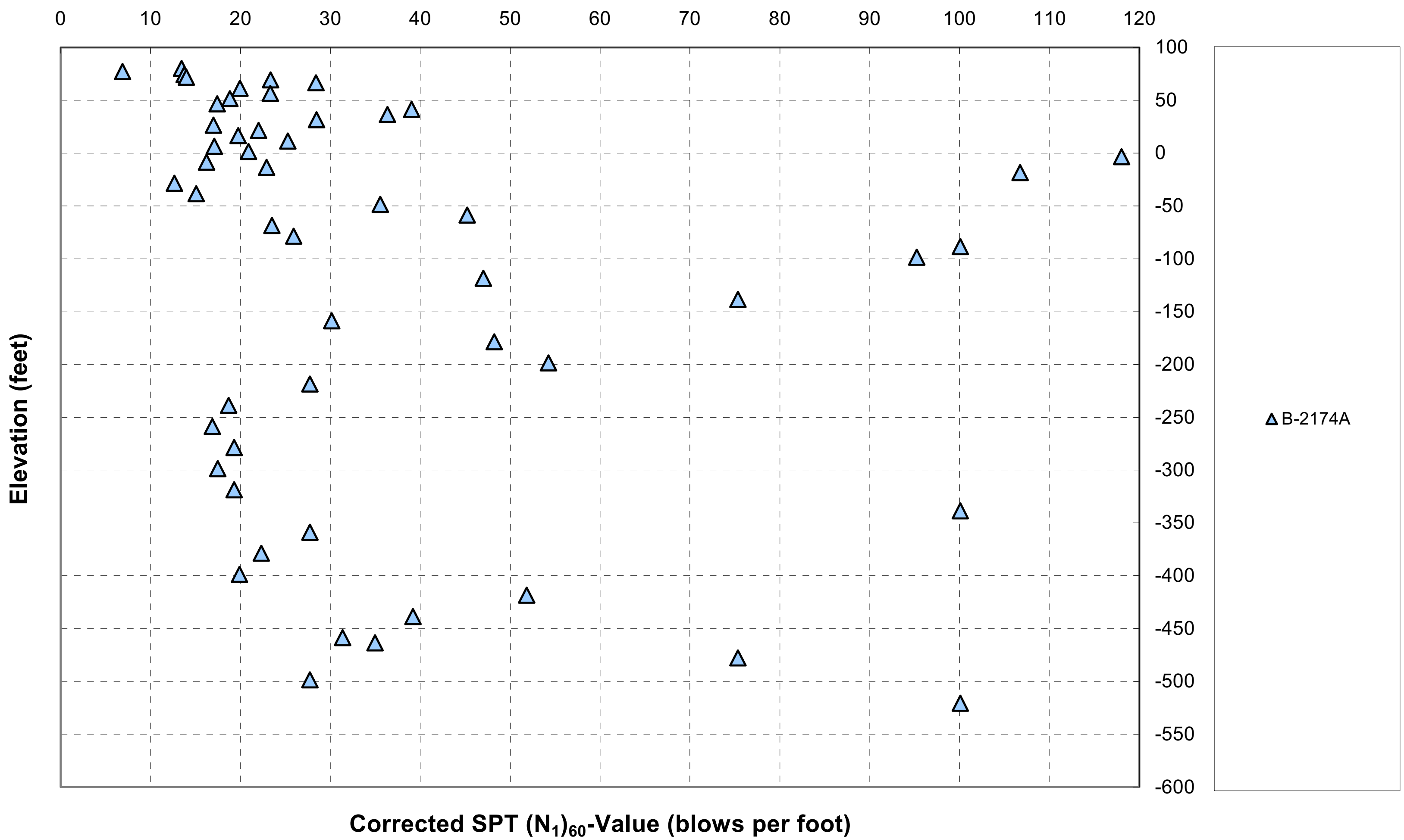


Figure 2.5.4-28 Corrected SPT $(N_1)_{60}$-Values; Unit 1; Boring B-2174A (Power Block Area)

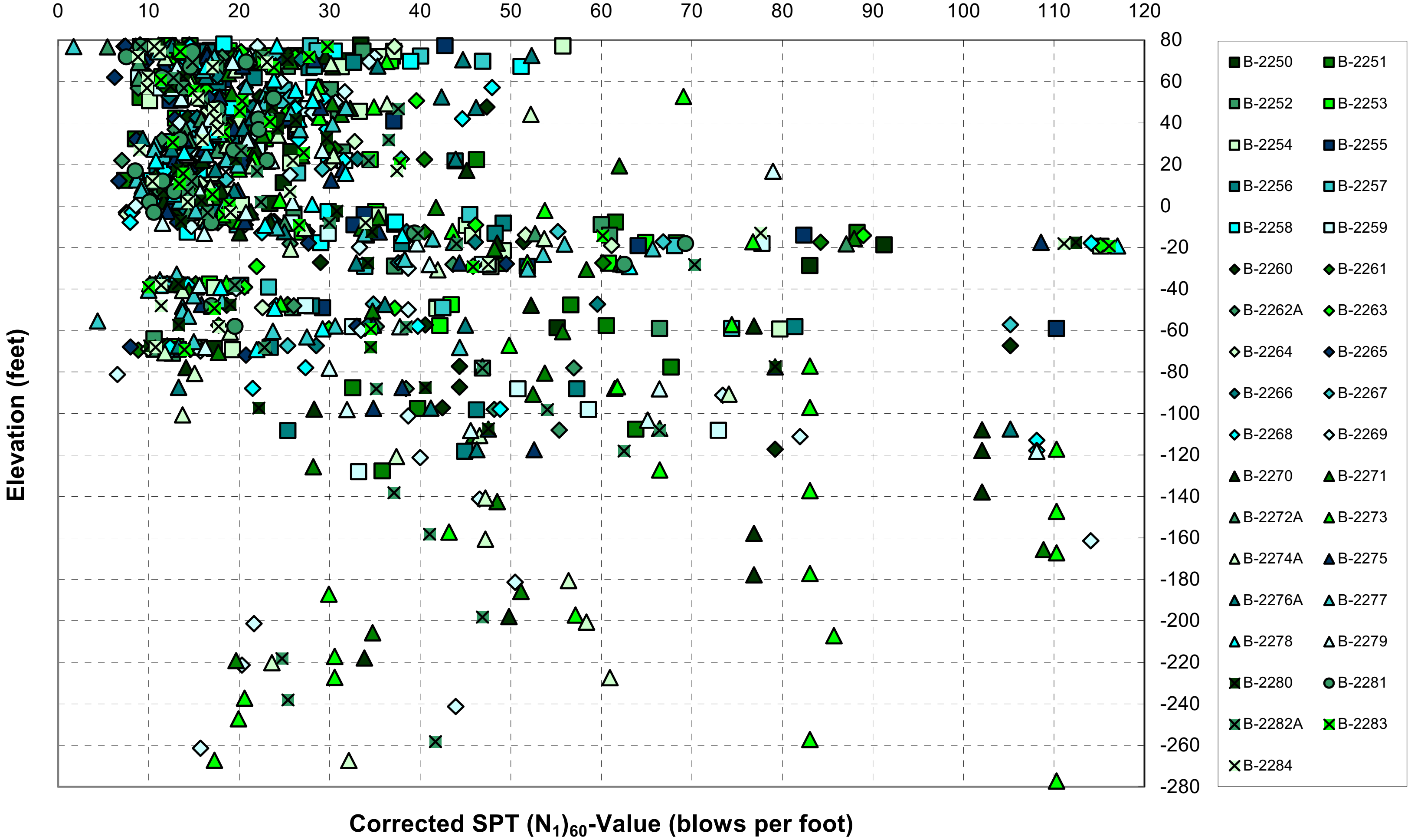


Figure 2.5.4-29 Corrected SPT $(N_1)_{60}$-Values; Unit 2 (Power Block Area)

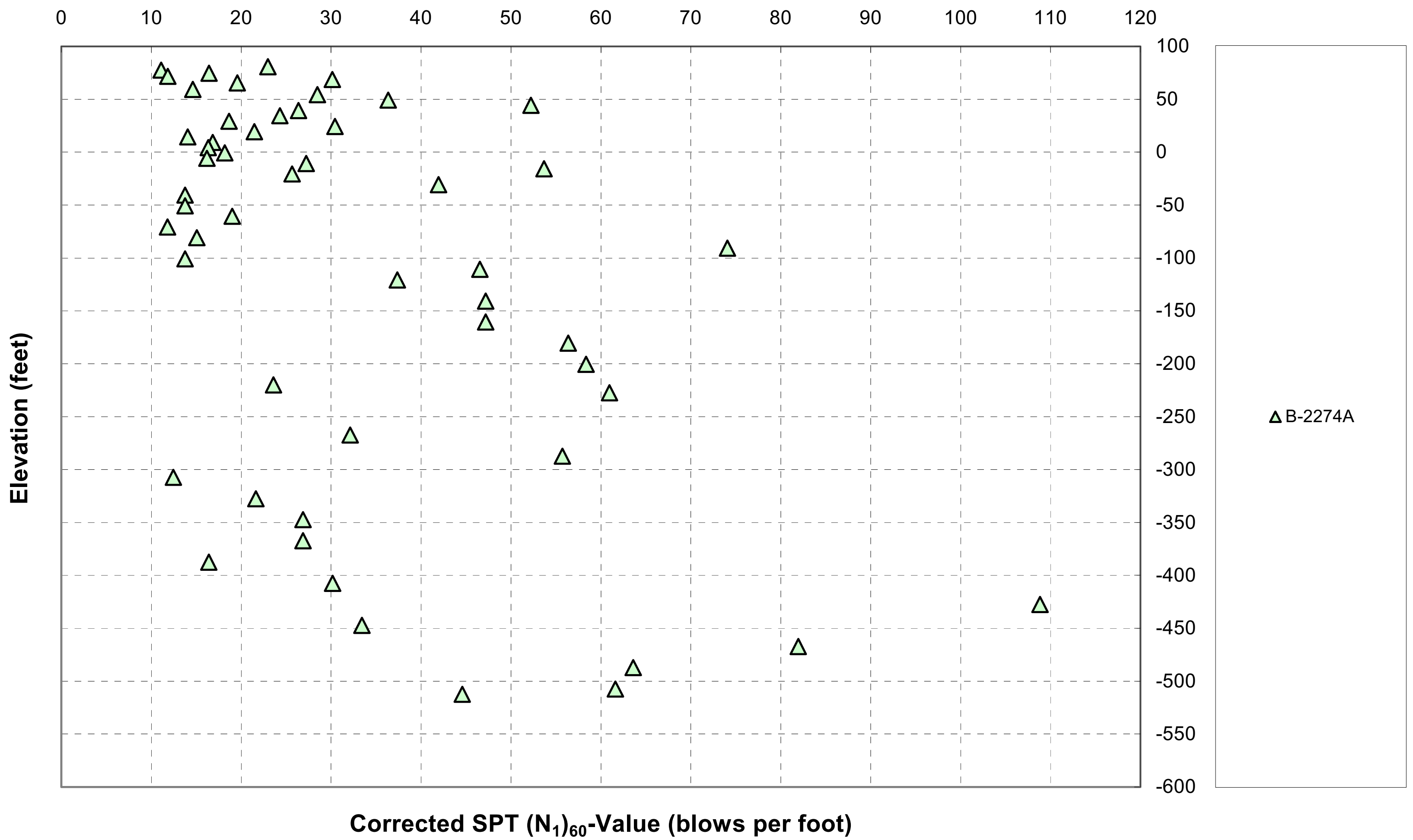


Figure 2.5.4-30 Corrected SPT $(N_1)_{60}$-Values; Unit 2; Boring B-2274A (Power Block Area)

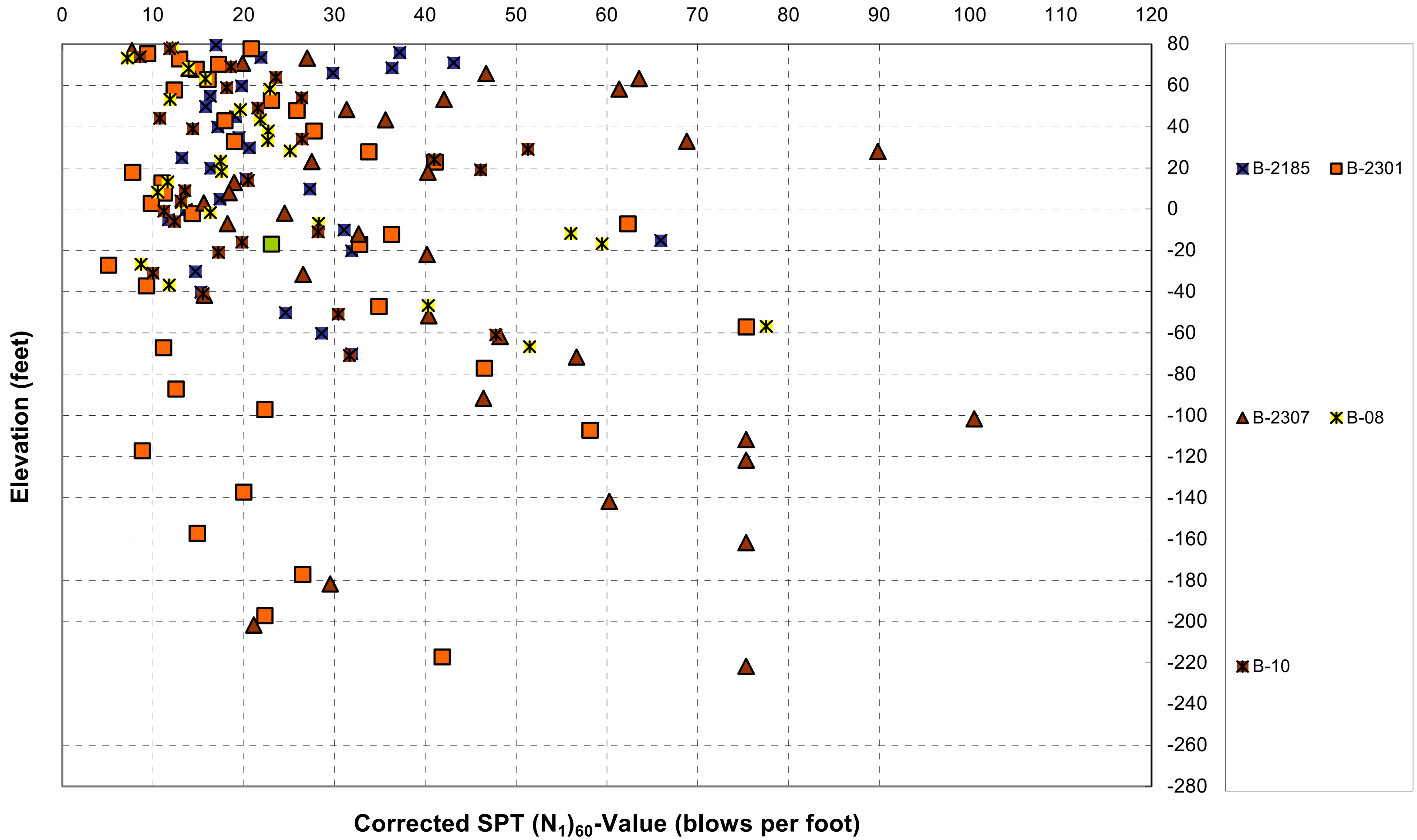


Figure 2.5.4-31 Corrected SPT $(N_1)_{60}$-Values; Investigations Outside Power Block Area

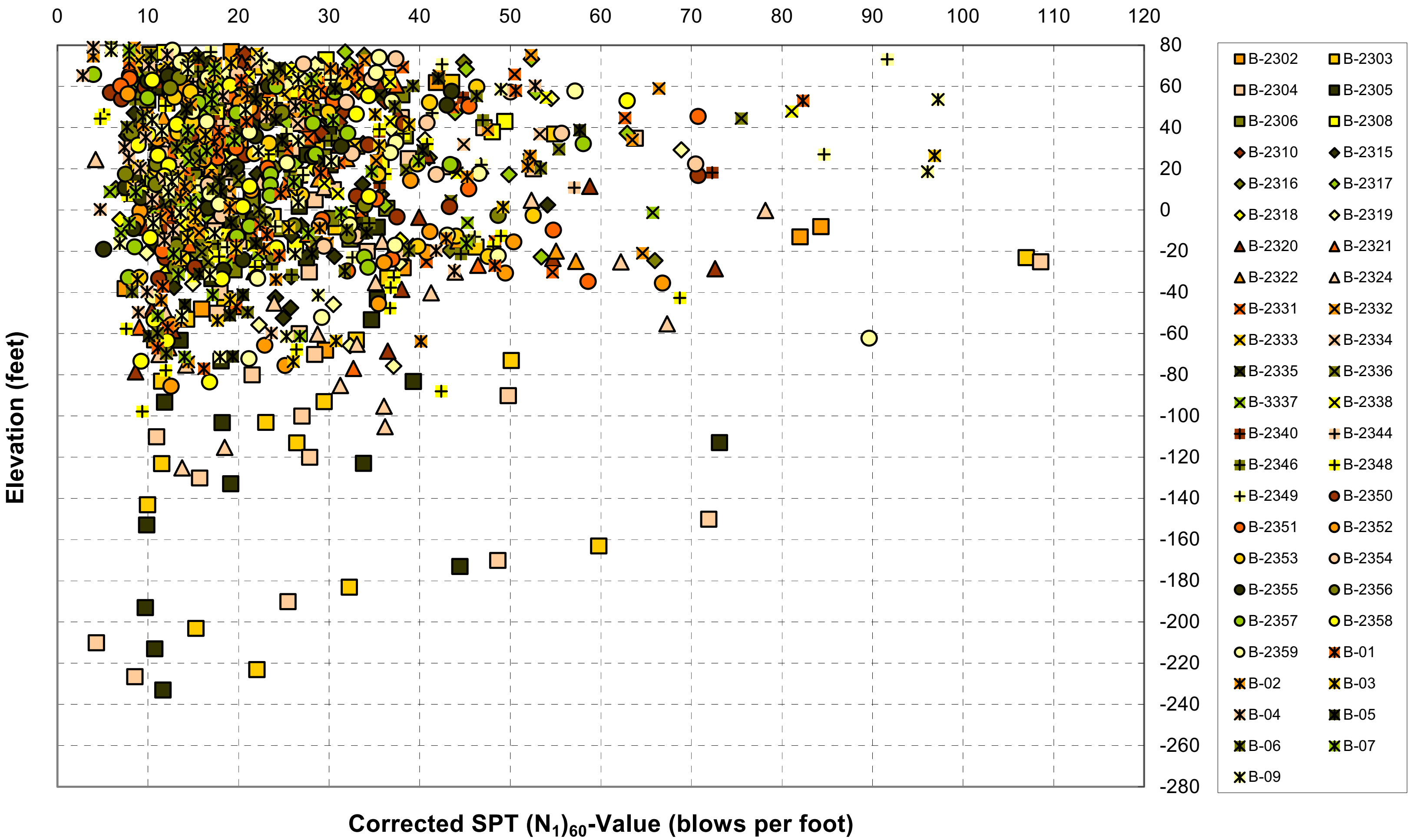


Figure 2.5.4-32 Corrected SPT $(N_1)_{60}$-Values (Cooling Basin)

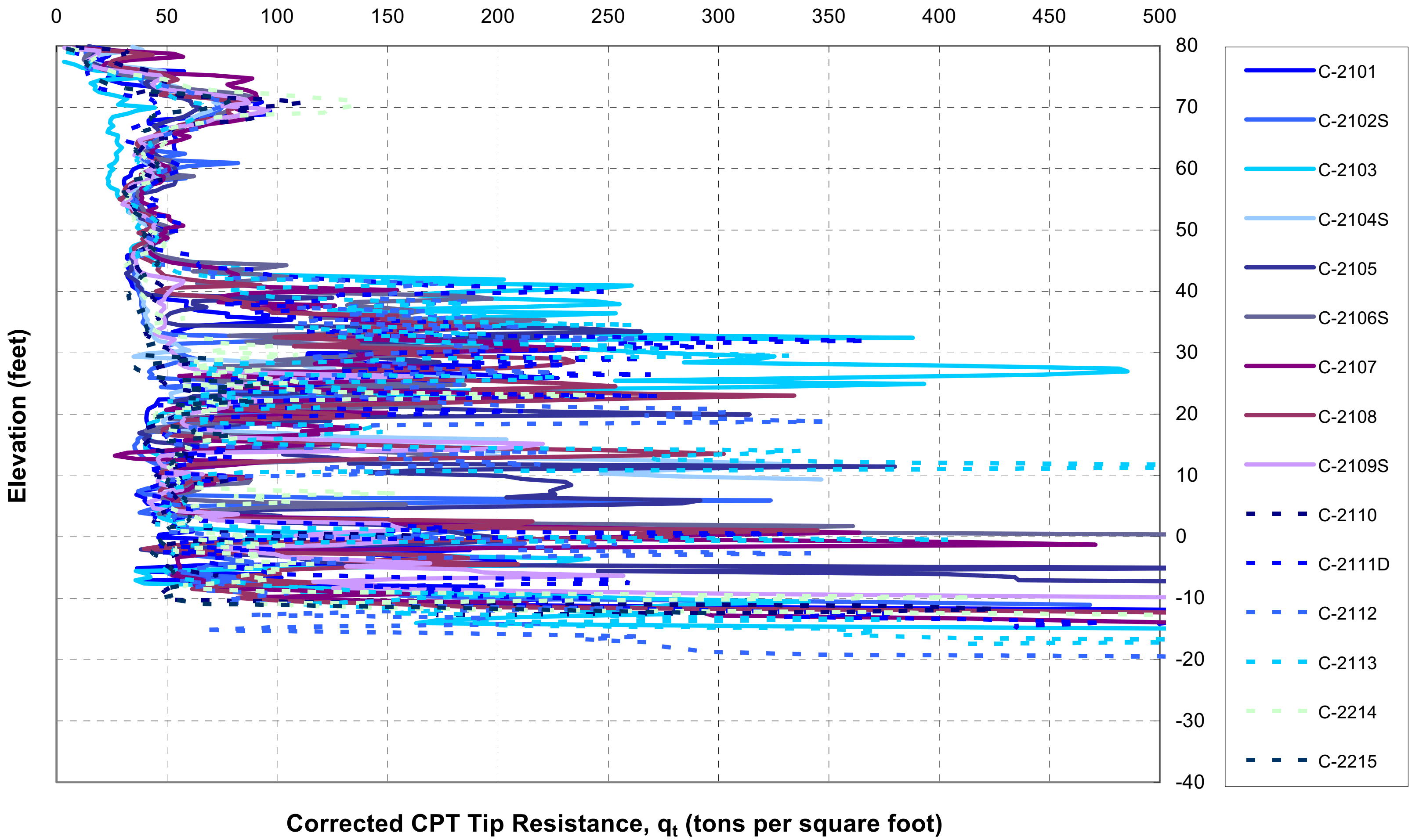


Figure 2.5.4-33 Corrected CPT q_t-Values; Unit 1 (Power Block Area)

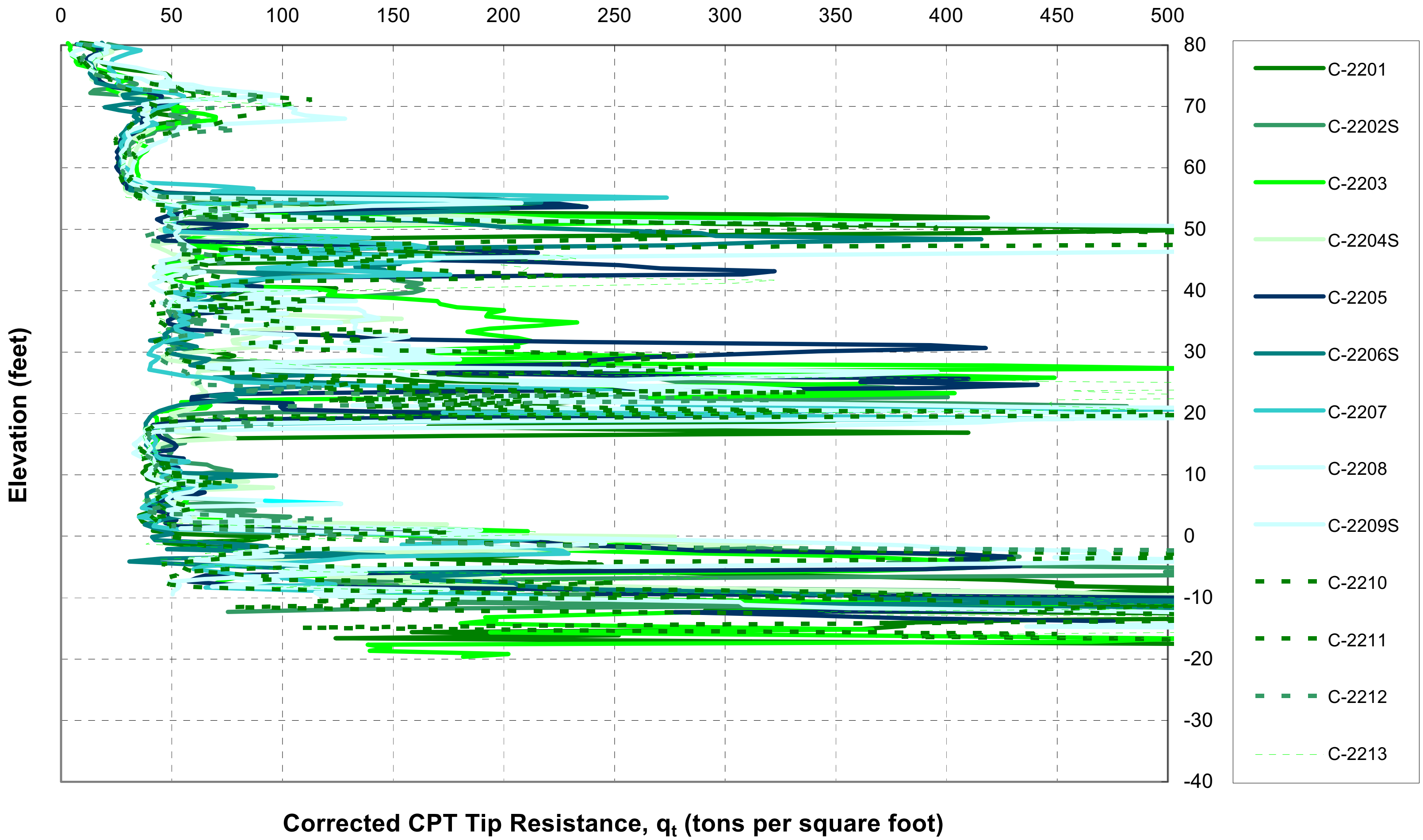


Figure 2.5.4-34 Corrected CPT q_t-Values; Unit 2 (Power Block Area)

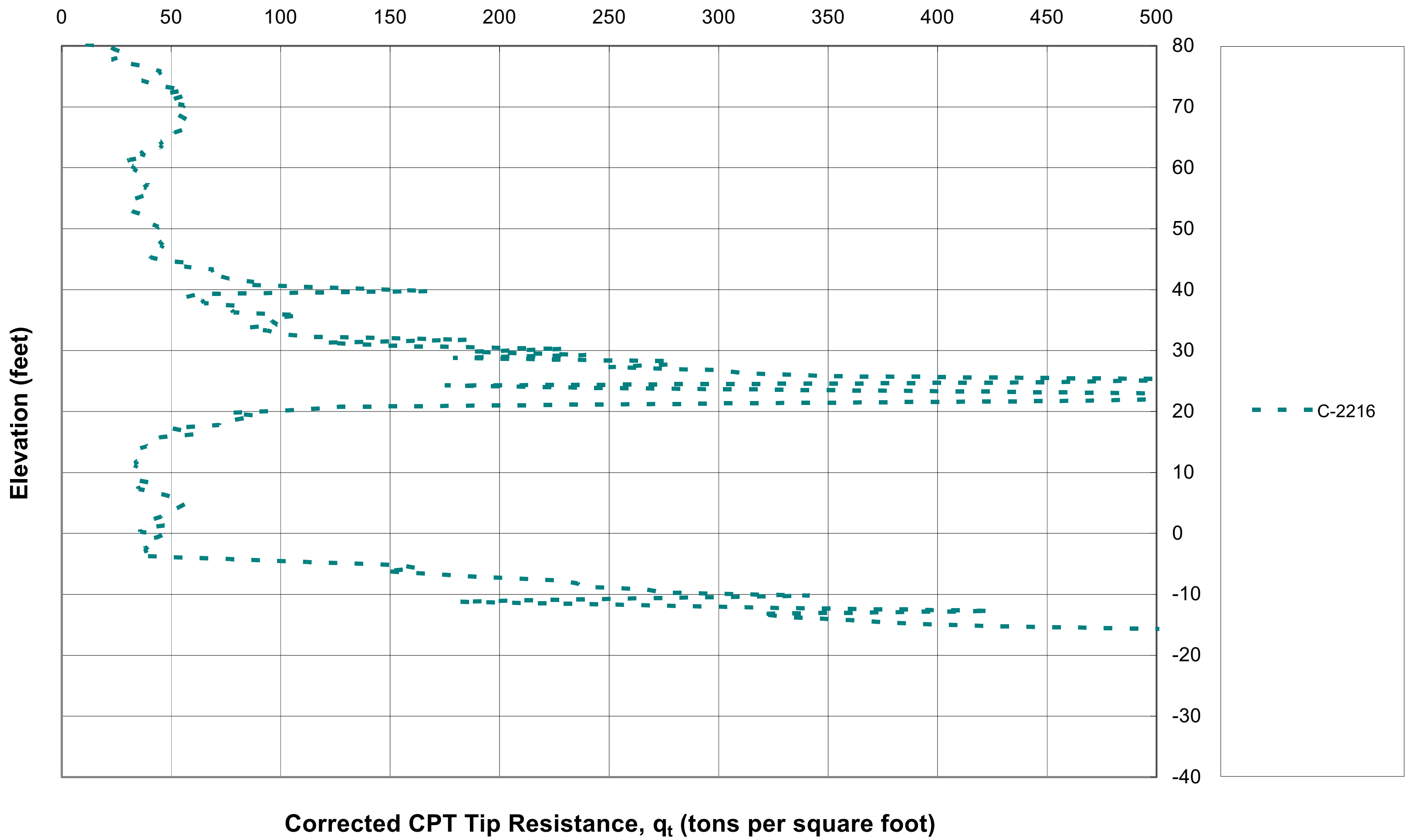


Figure 2.5.4-35 Corrected CPT q_t-Values; Investigations Outside Power Block Area

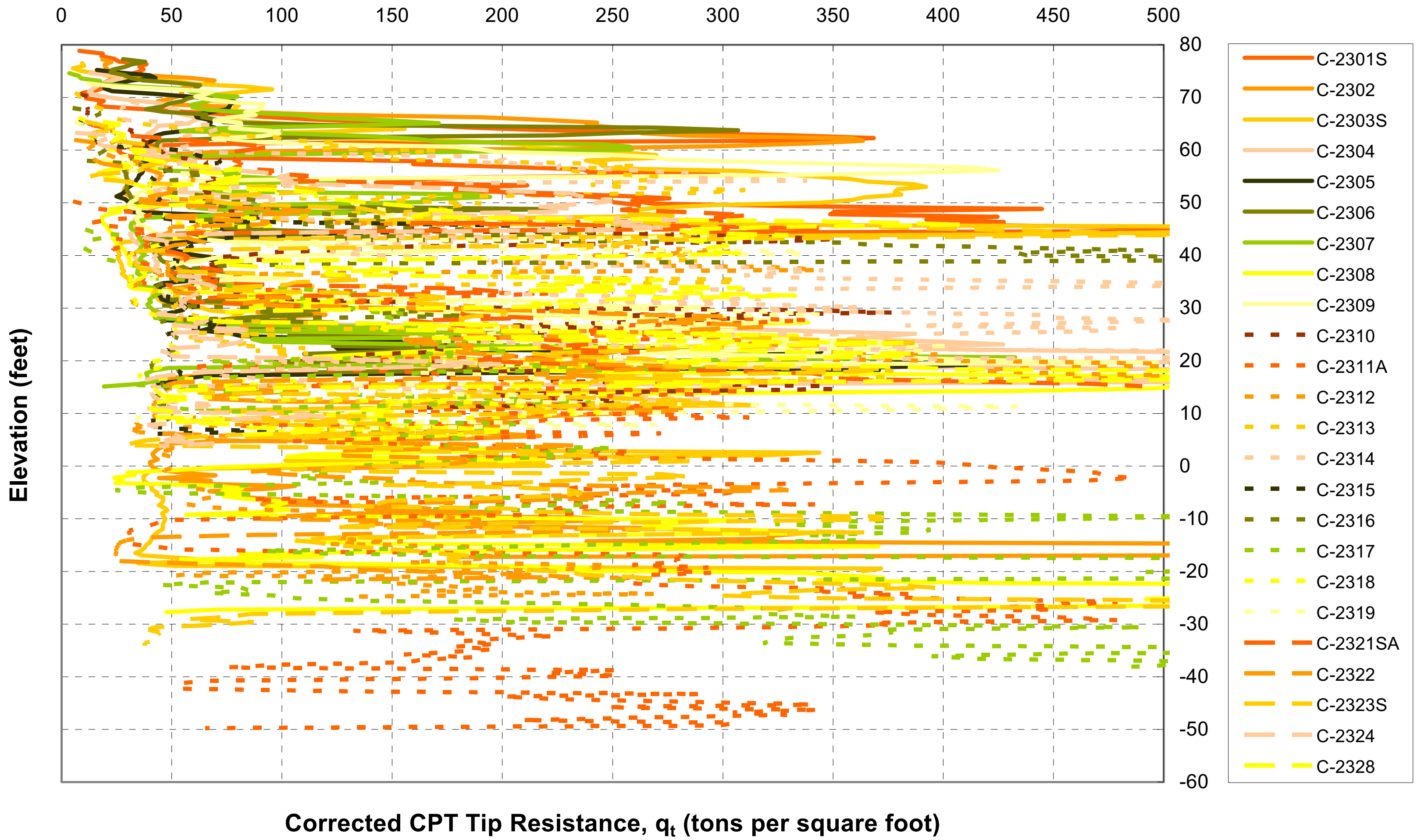


Figure 2.5.4-36 Corrected CPT q_t-Values (Cooling Basin)

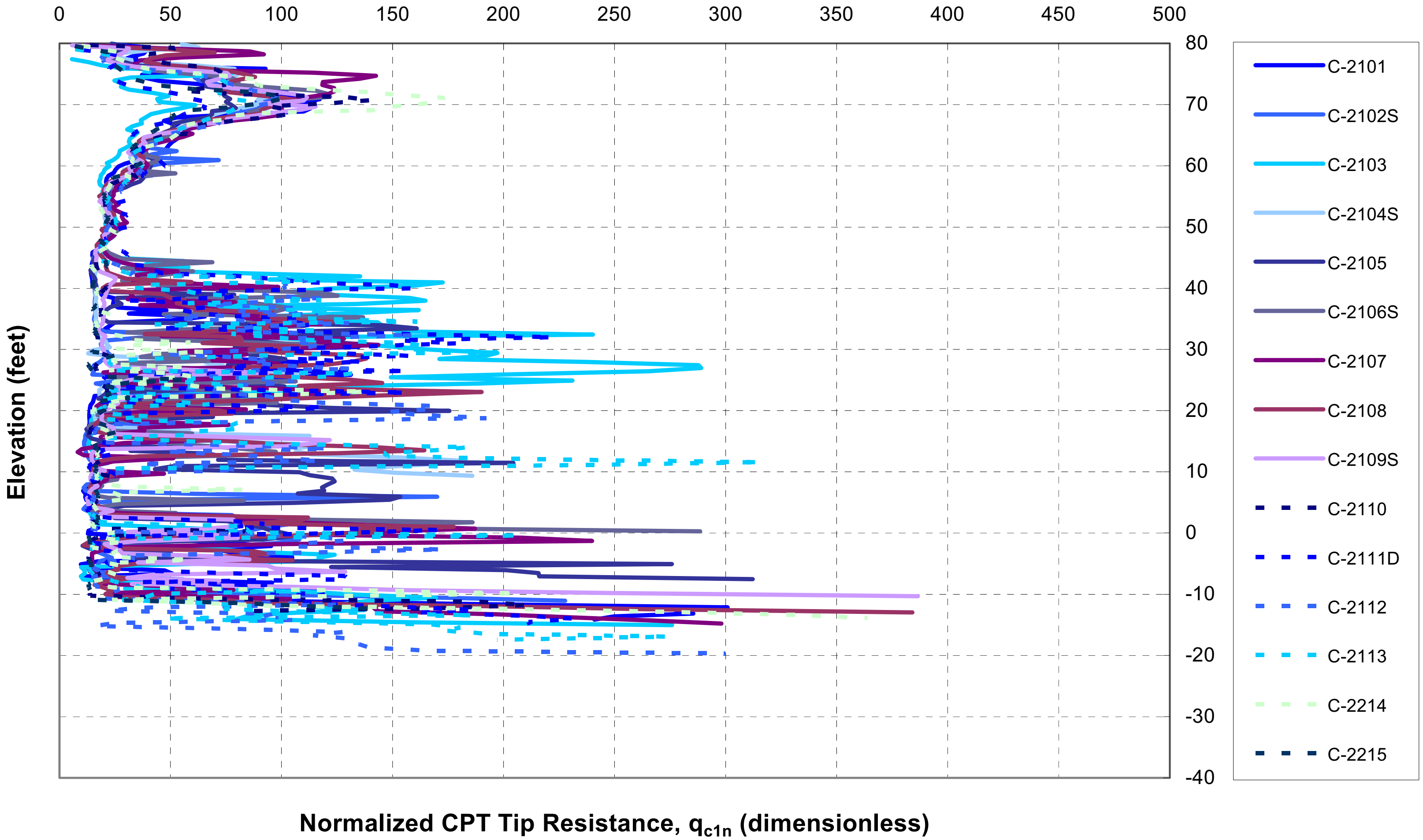


Figure 2.5.4-37 Normalized CPT q_{c1n}-Values; Unit 1 (Power Block Area)

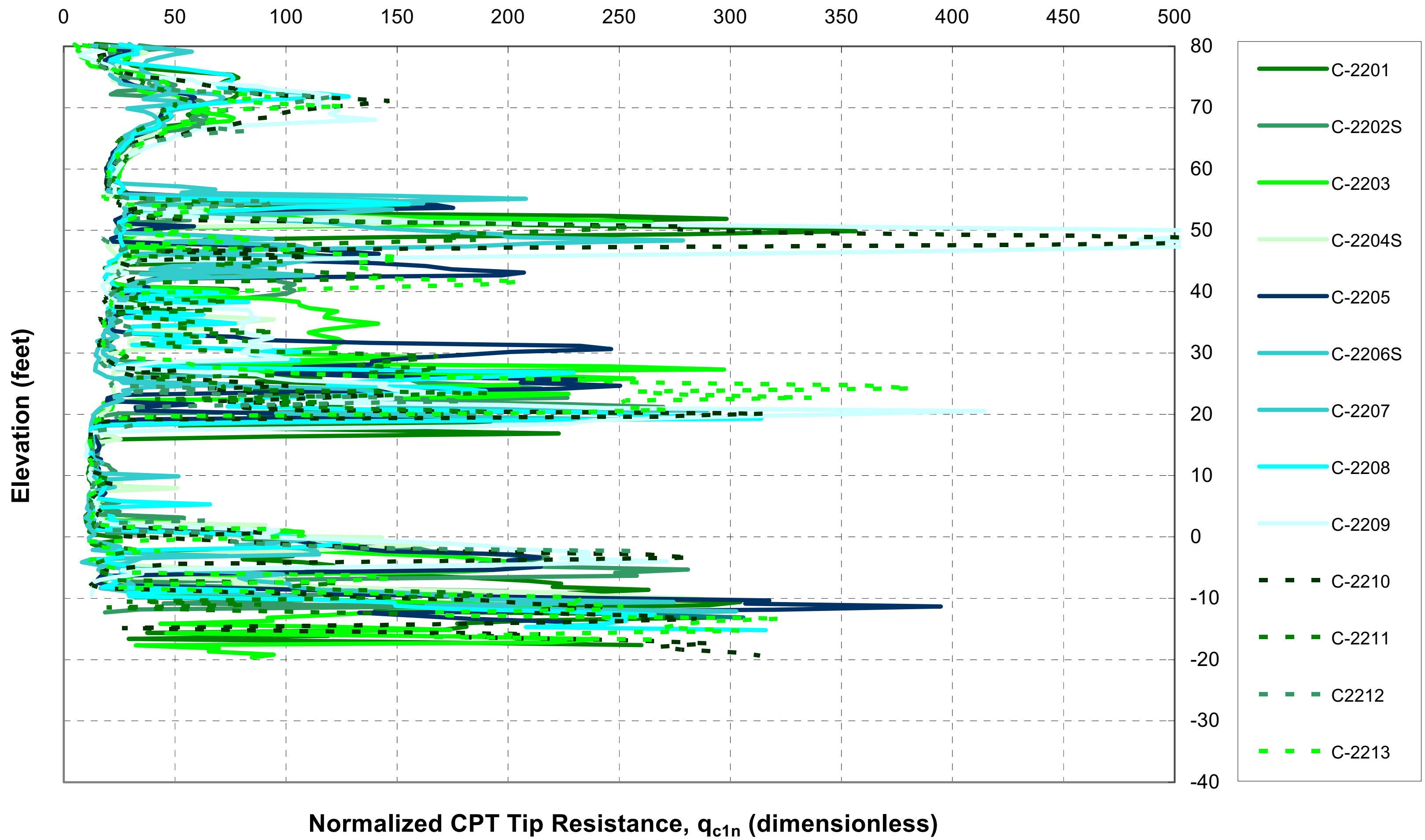


Figure 2.5.4-38 Normalized CPT q_{c1n}-Values; Unit 2 (Power Block Area)

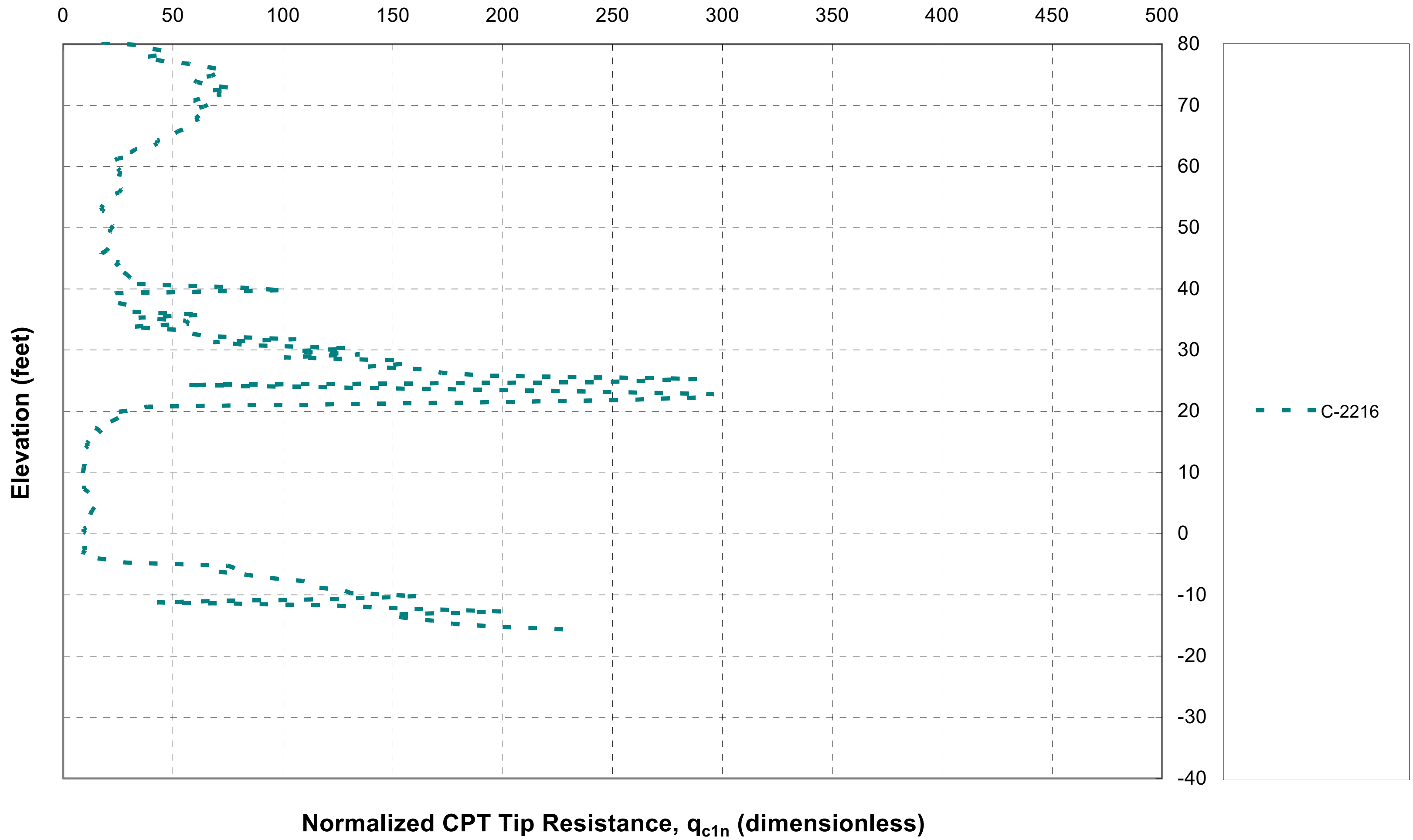


Figure 2.5.4-39 Normalized CPT q_{c1n}-Values; Investigations Outside Power Block Area

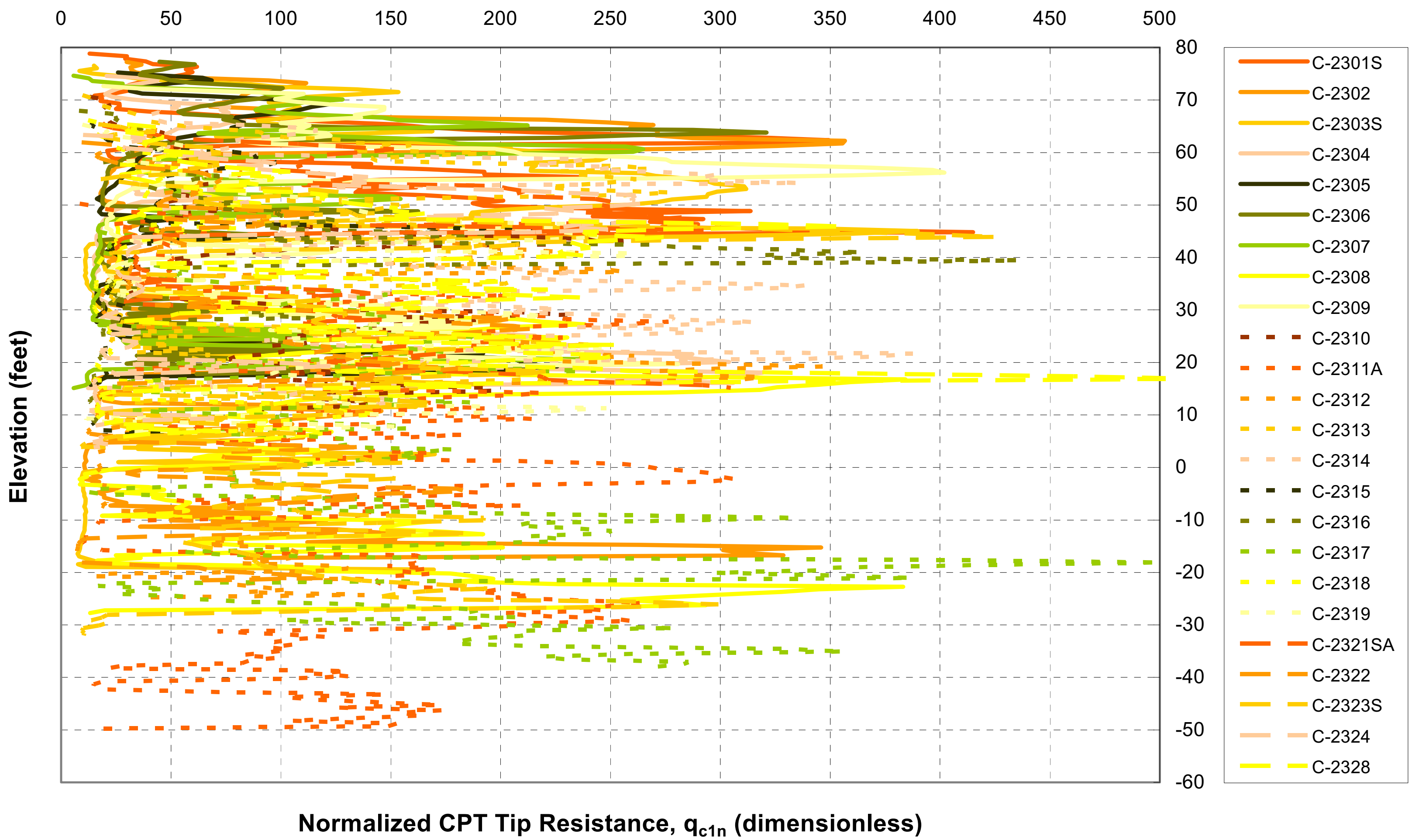


Figure 2.5.4-40 Normalized CPT q_{c1n}-Values (Cooling Basin)

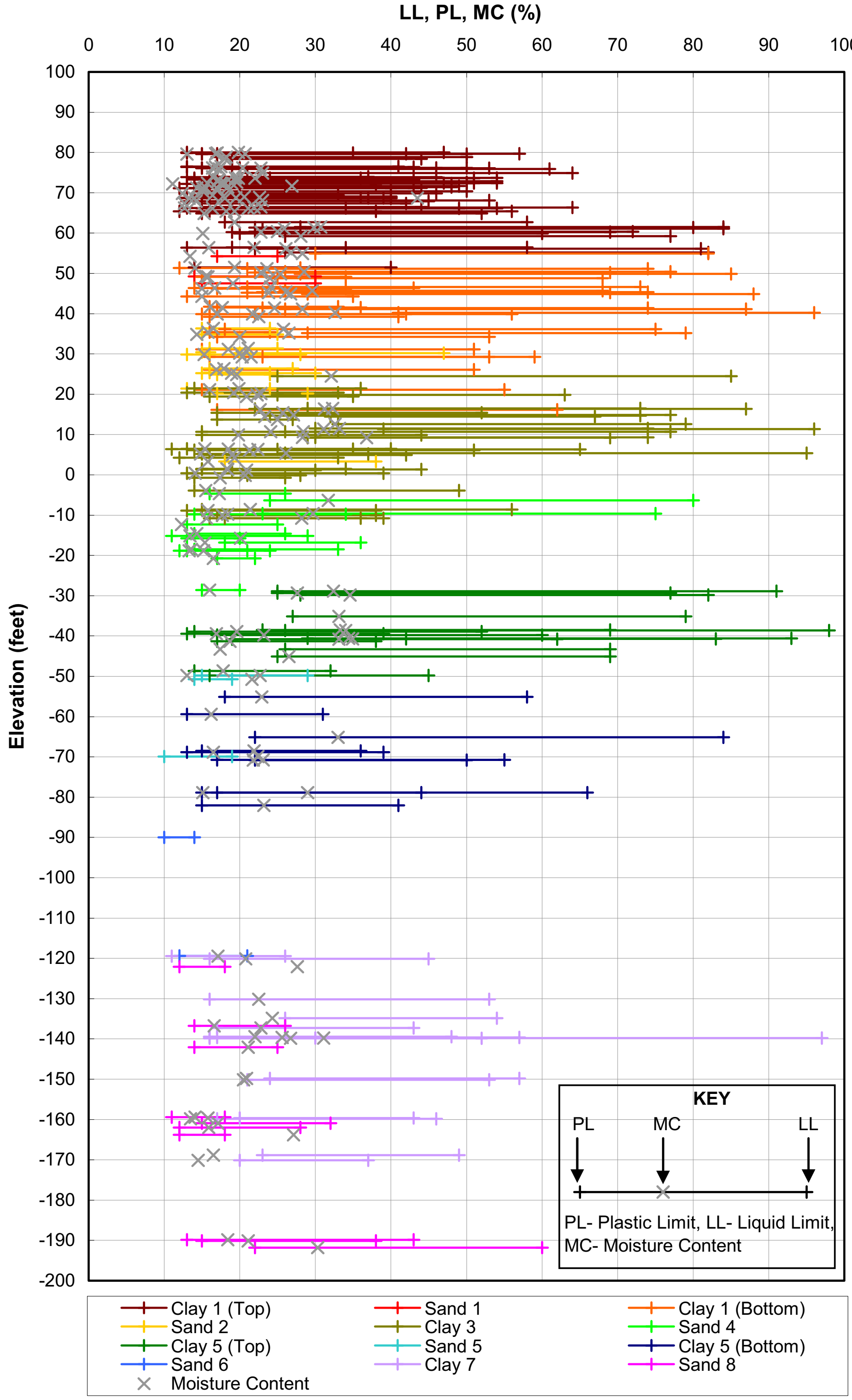


Figure 2.5.4-41 Atterberg Limits Test Results (Power Block Area) (Sheet 1 of 2)

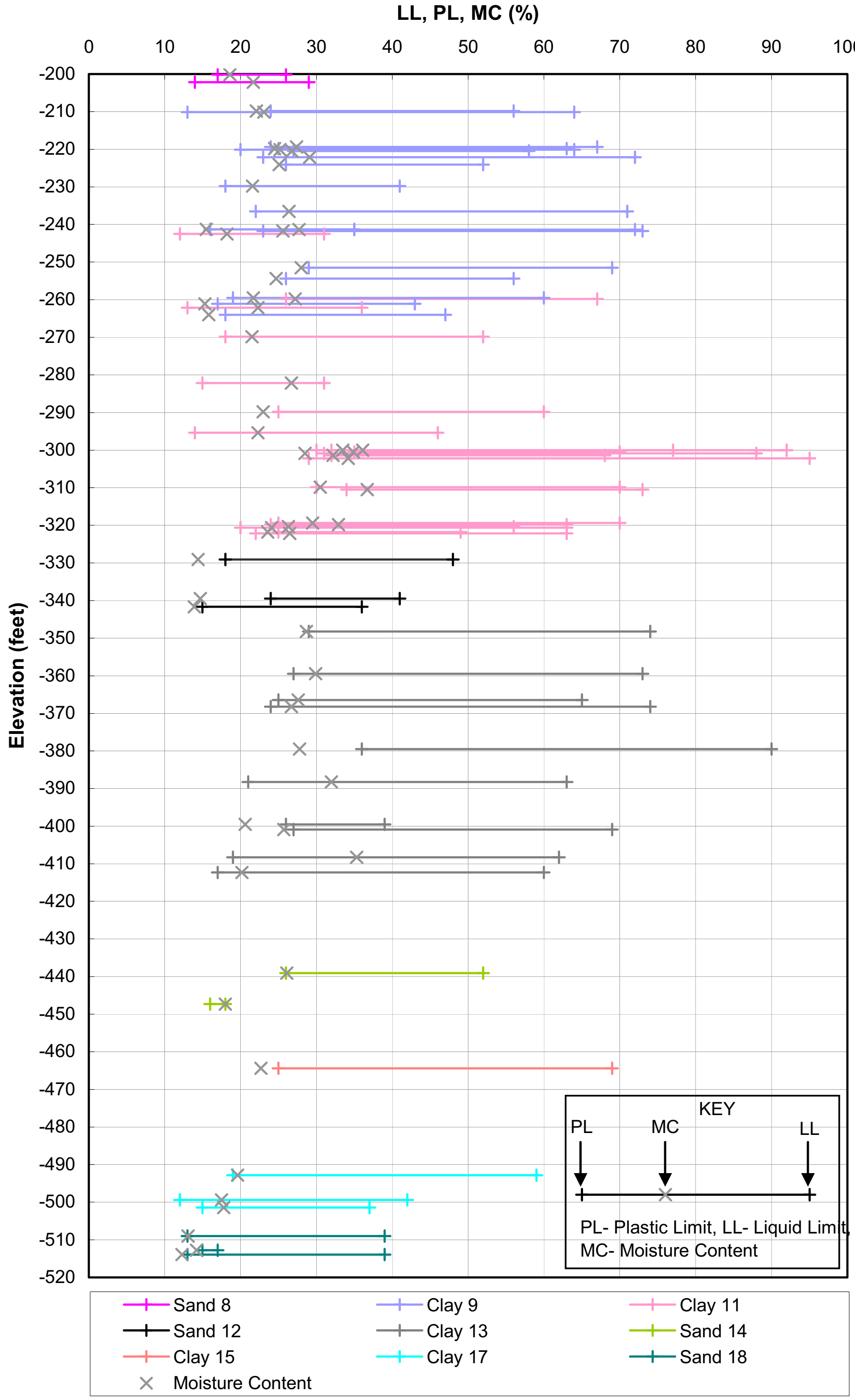


Figure 2.5.4-41 Atterberg Limits Test Results (Power Block Area) (Sheet 2 of 2)

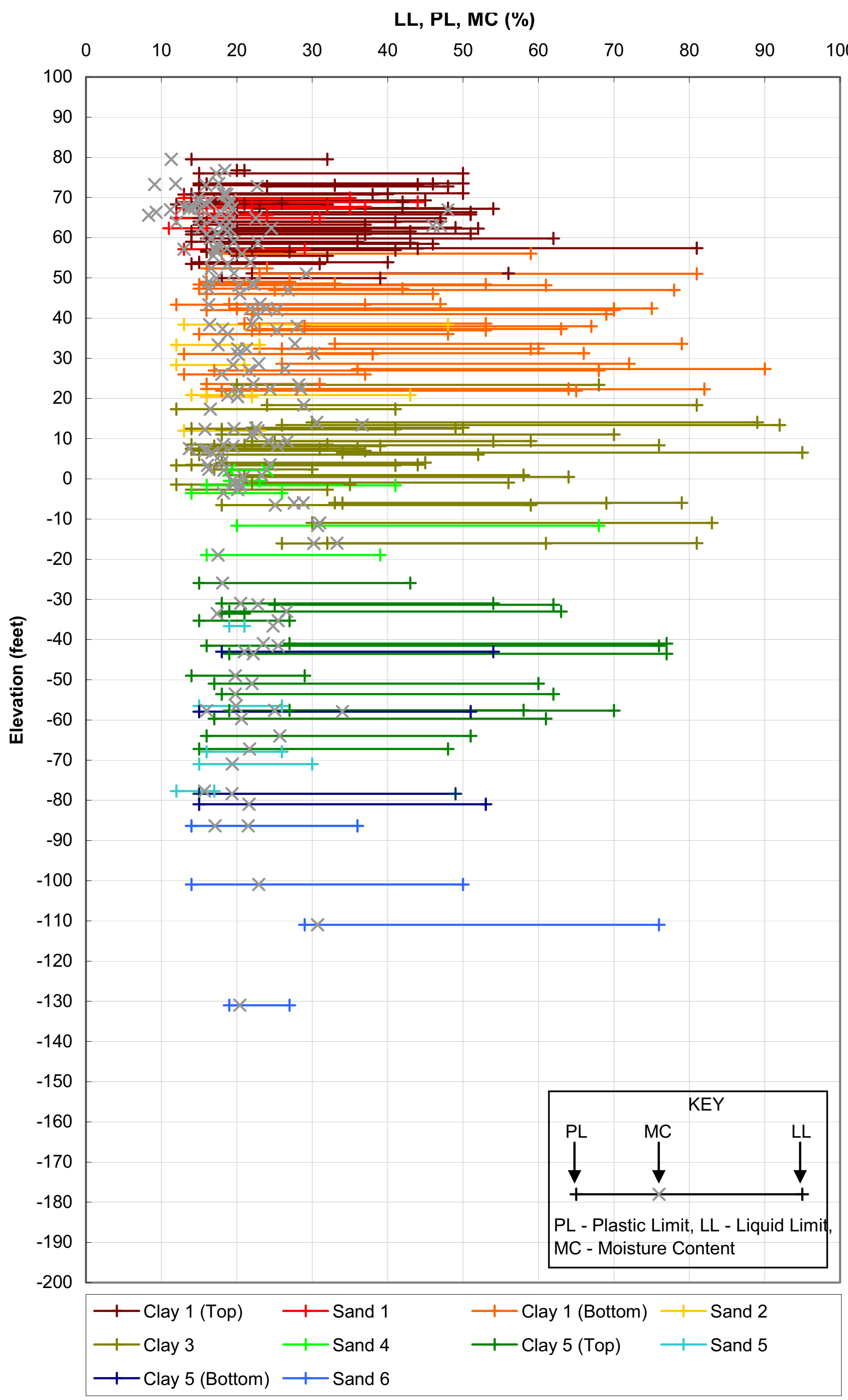


Figure 2.5.4-42 Atterberg Limits Test Results (Cooling Basin)

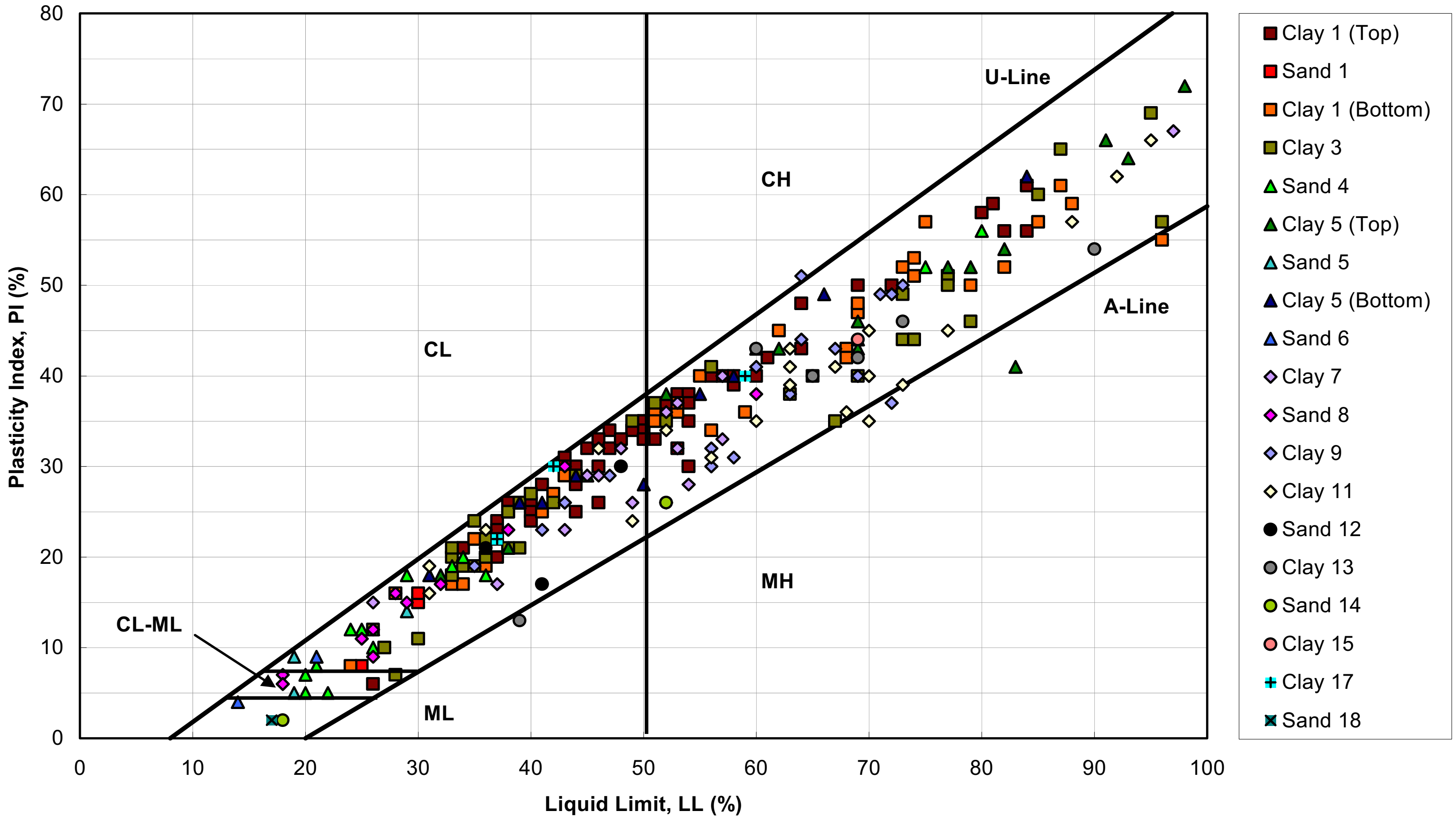


Figure 2.5.4-43 Plasticity Chart (Power Block Area)

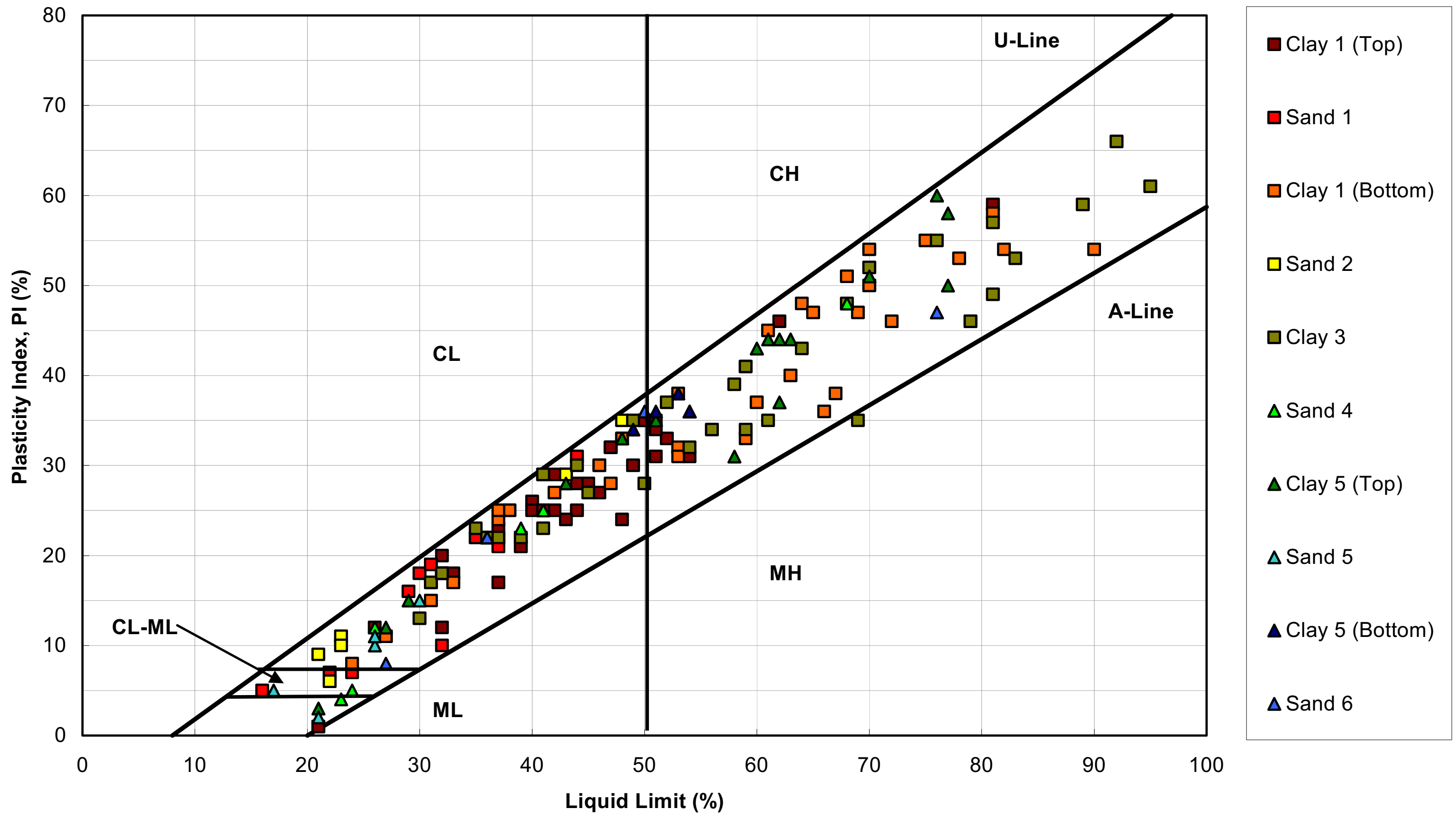


Figure 2.5.4-44 Plasticity Chart (Cooling Basin)

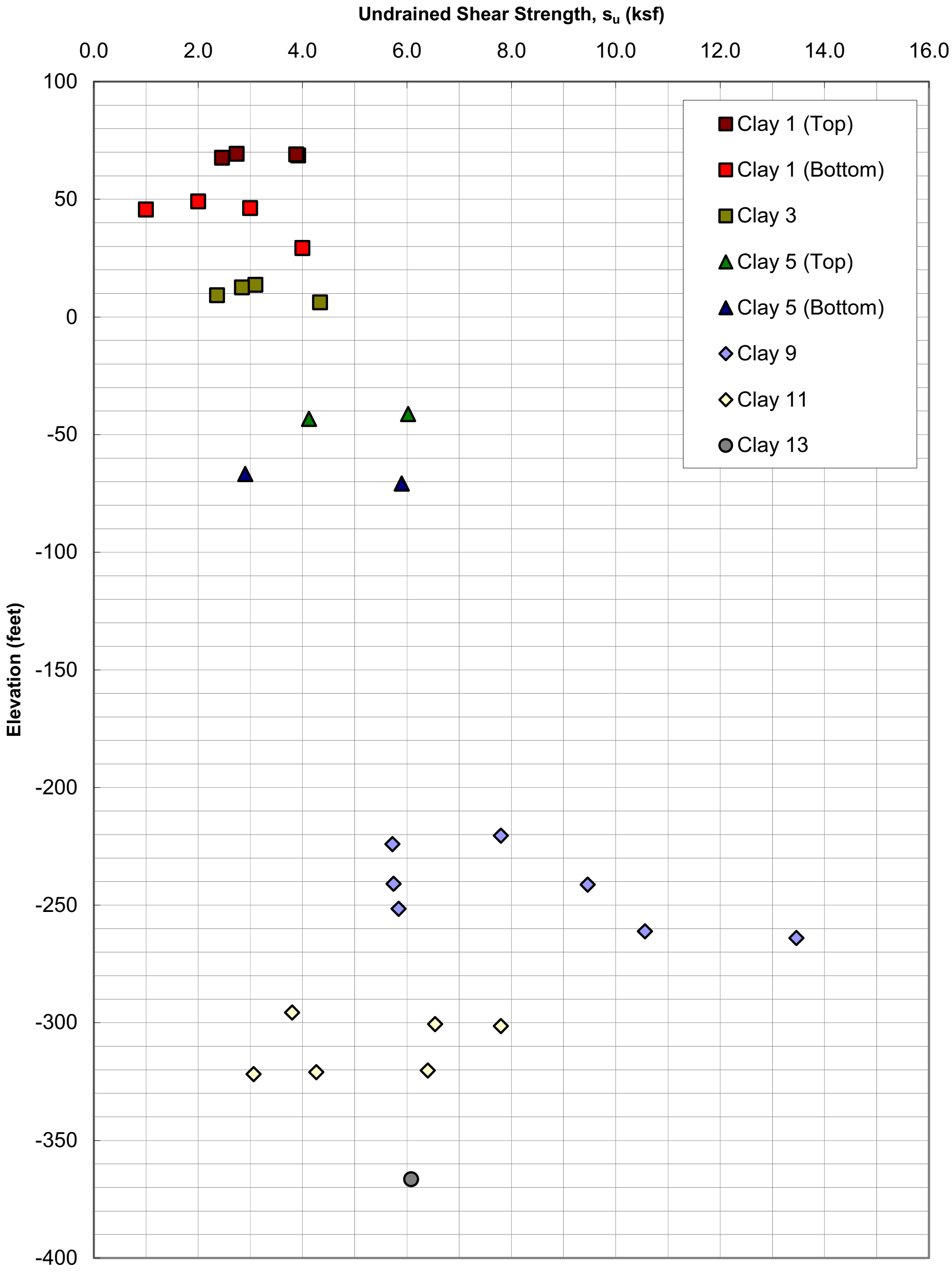


Figure 2.5.4-45 Undrained Shear Strengths of Cohesive Soil Strata from Laboratory Testing (Power Block Area)

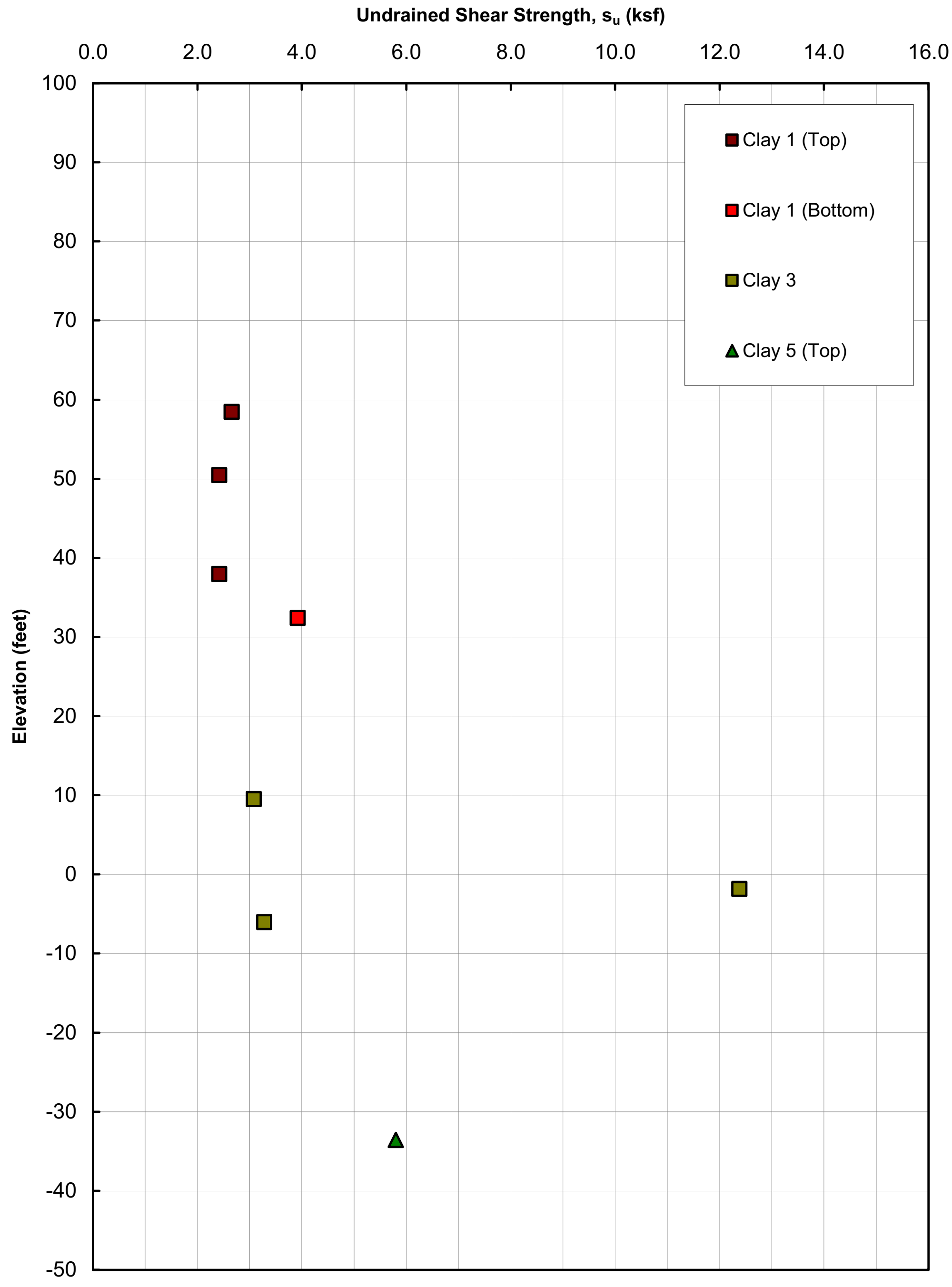


Figure 2.5.4-46 Undrained Shear Strengths of Cohesive Soil Strata from Laboratory Testing (Cooling Basin)

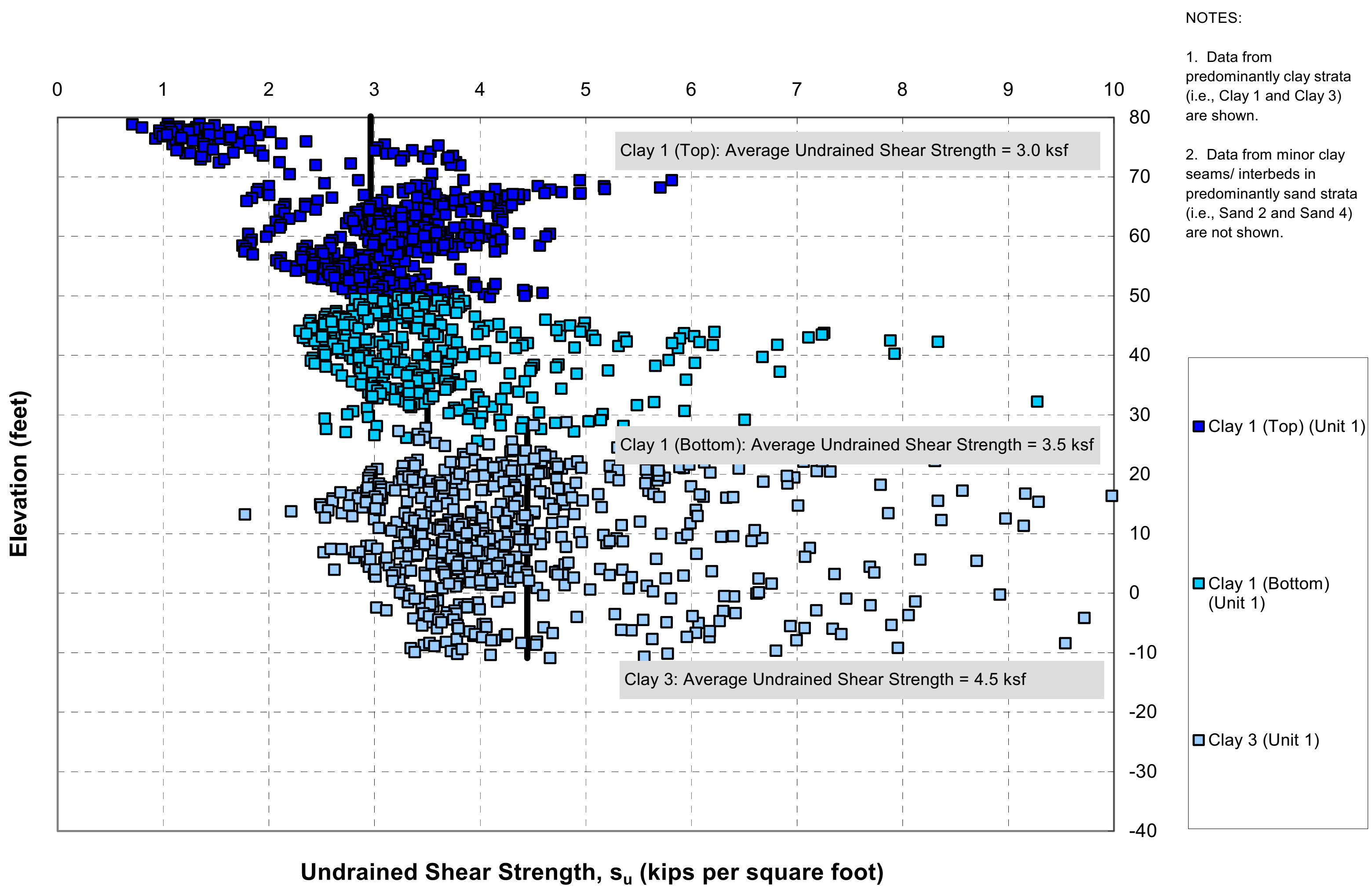
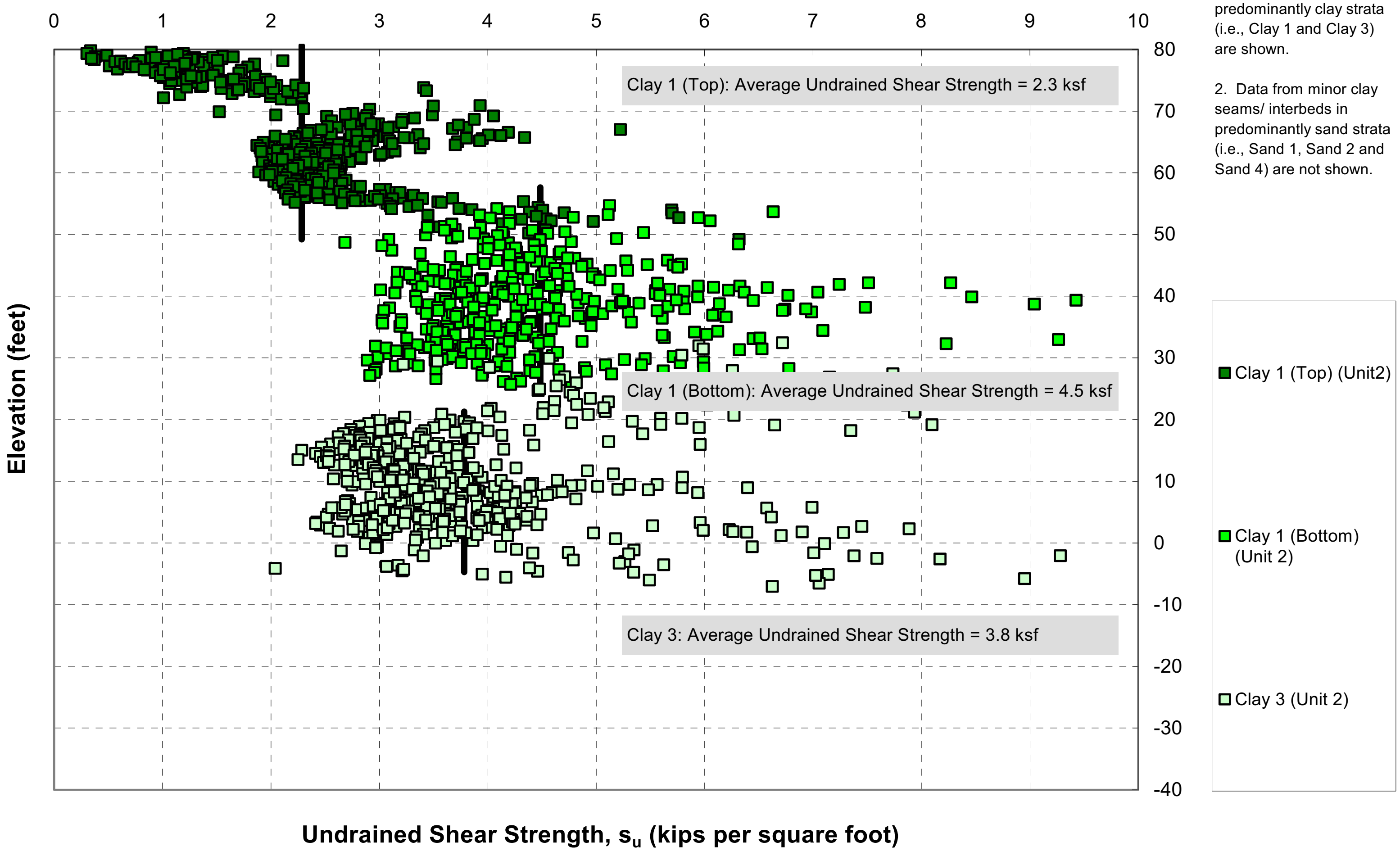


Figure 2.5.4-47 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 1 (Power Block Area)



NOTES:

1. Data from predominantly clay strata (i.e., Clay 1 and Clay 3) are shown.

2. Data from minor clay seams/ interbeds in predominantly sand strata (i.e., Sand 1, Sand 2 and Sand 4) are not shown.

Figure 2.5.4-48 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 2 (Power Block Area)

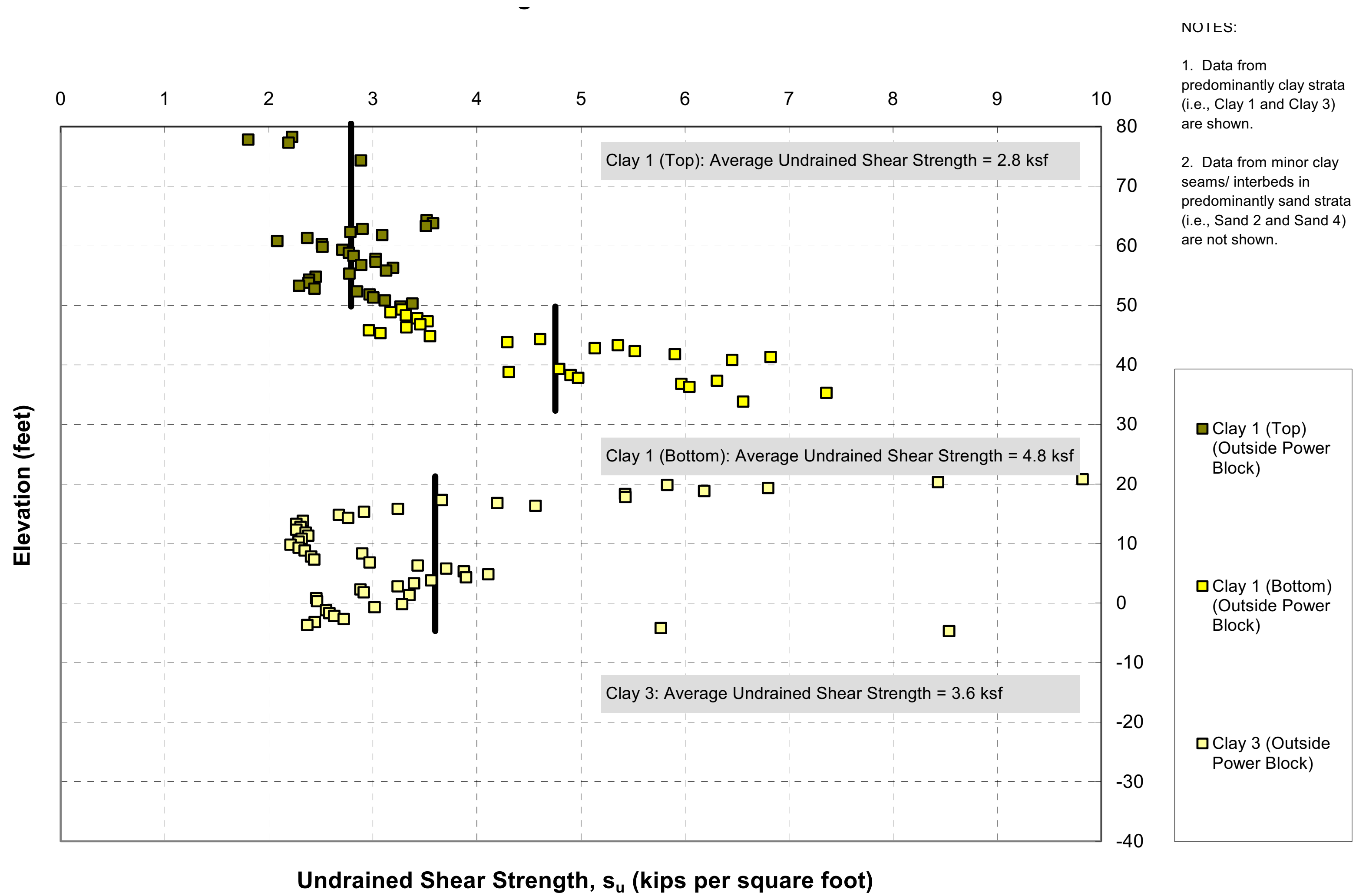


Figure 2.5.4-49 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Investigations Outside Power Block Area

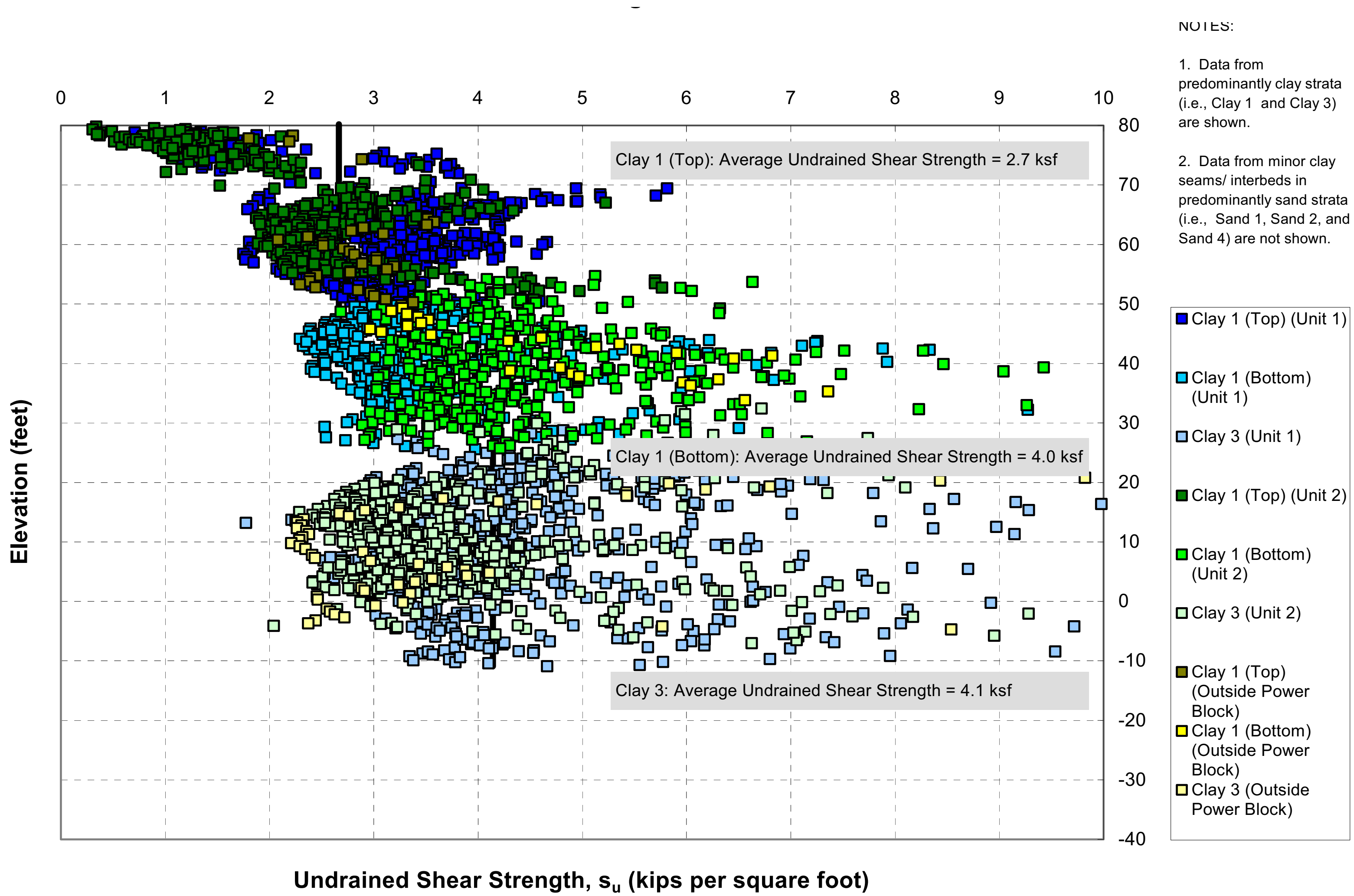


Figure 2.5.4-50 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area

Figure 2.5.4-51 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data (Cooling Basin)

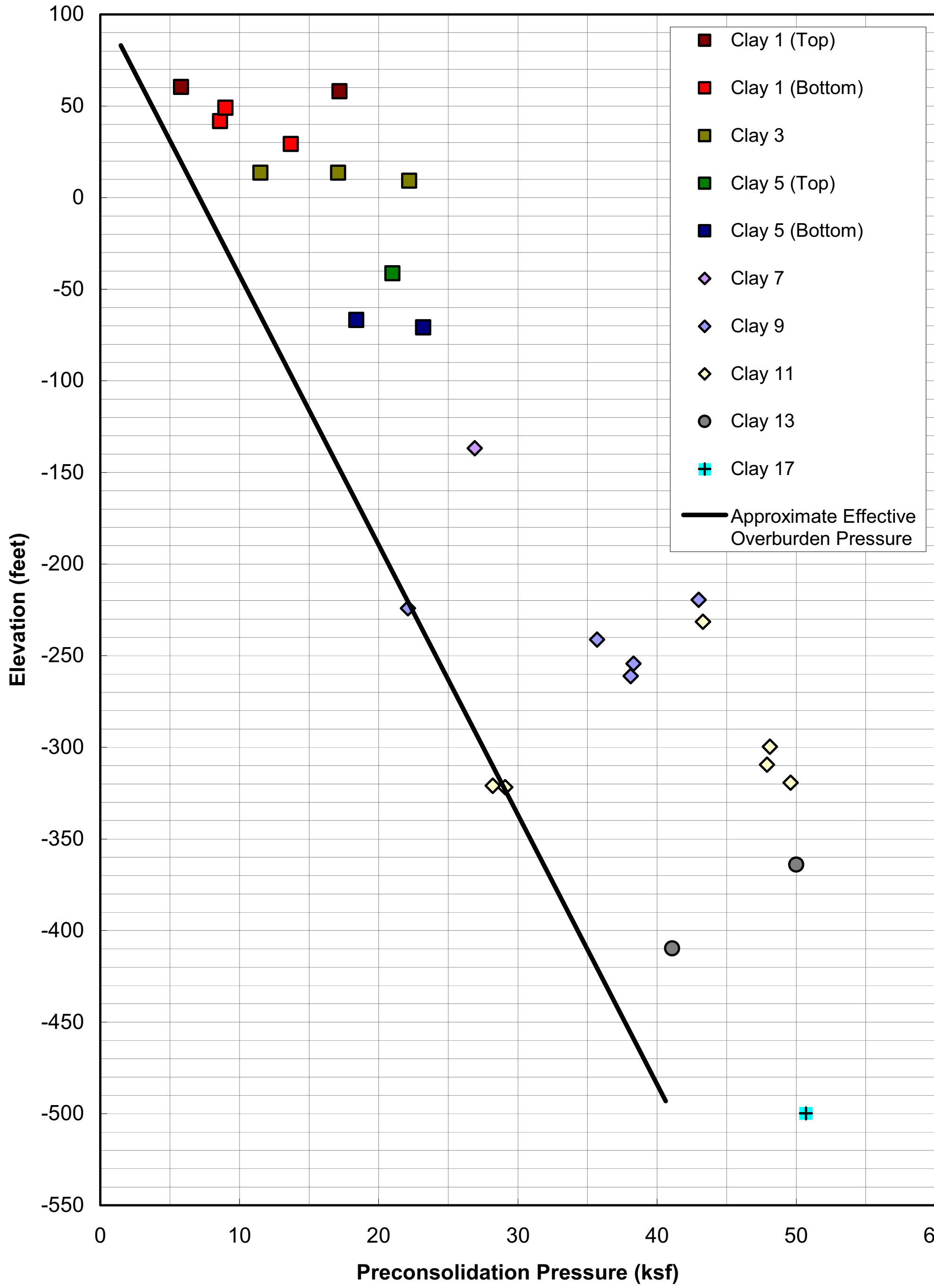


Figure 2.5.4-52 Preconsolidation Pressures (Pc') of Cohesive Soil Strata from Laboratory Testing (Power Block Area)

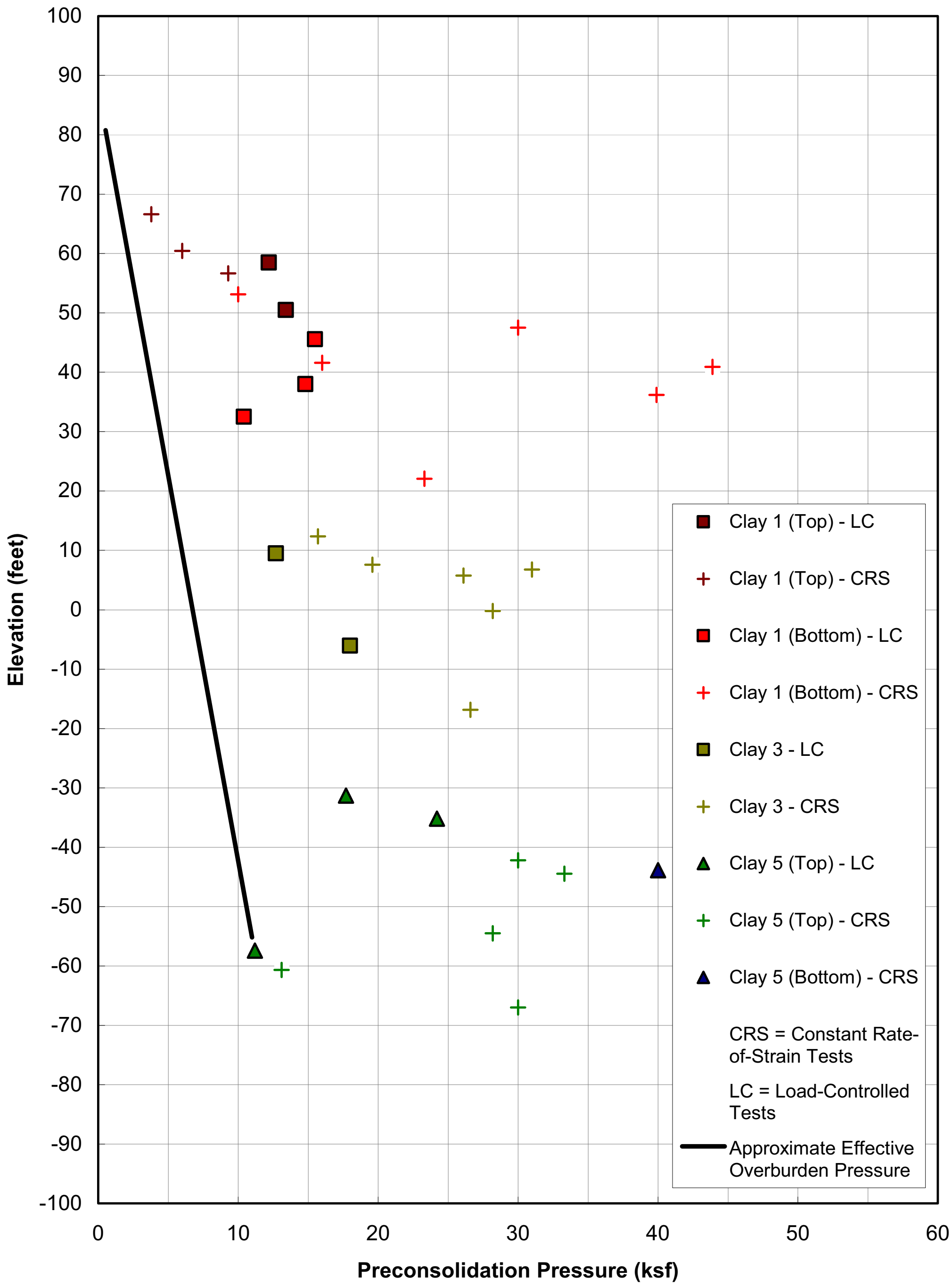


Figure 2.5.4-53 Preconsolidation Pressures (Pc') of Cohesive Soil Strata from Laboratory Testing (Cooling Basin)

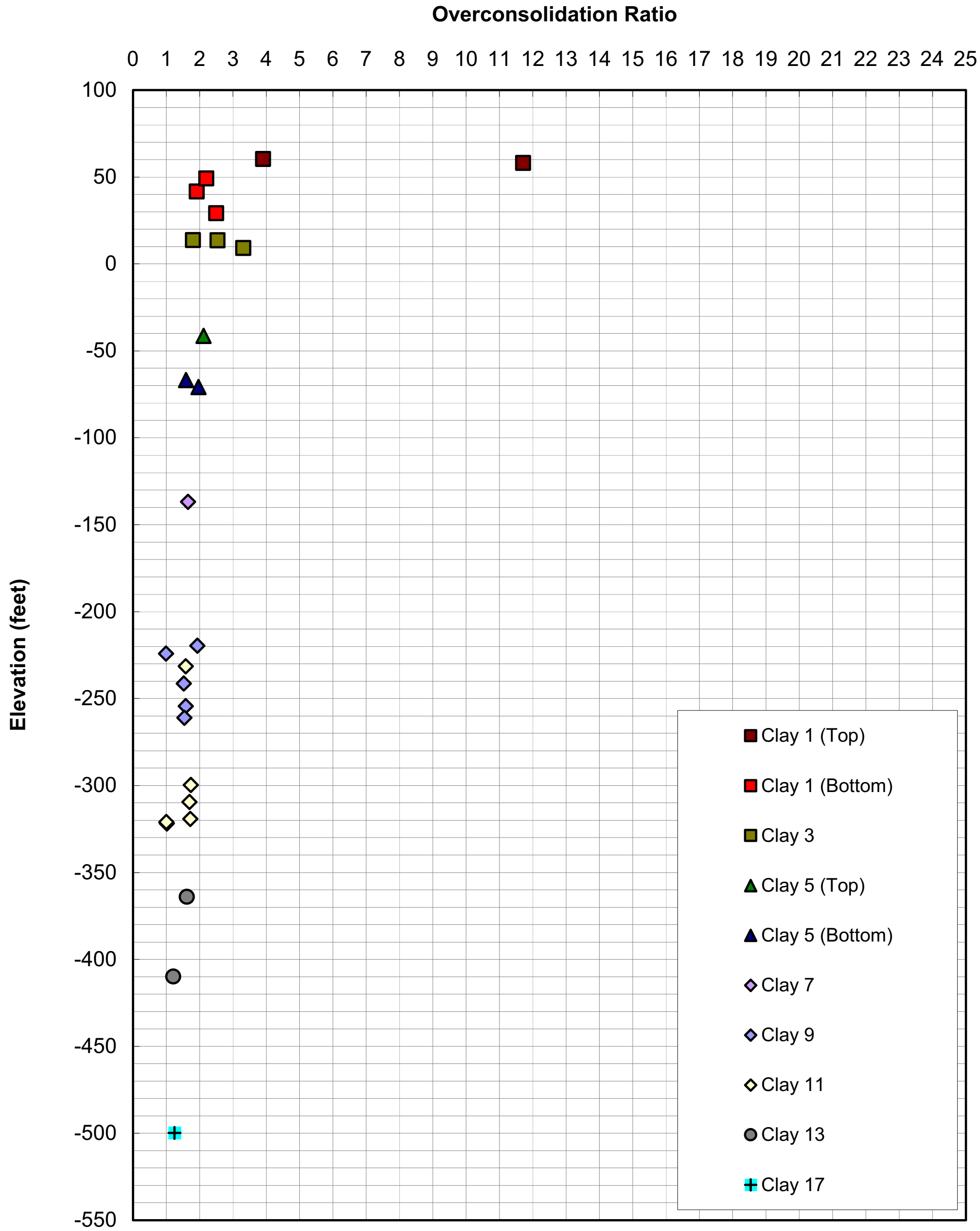


Figure 2.5.4-54 Overconsolidation Ratios of Cohesive Soil Strata from Laboratory Testing (Power Block Area)

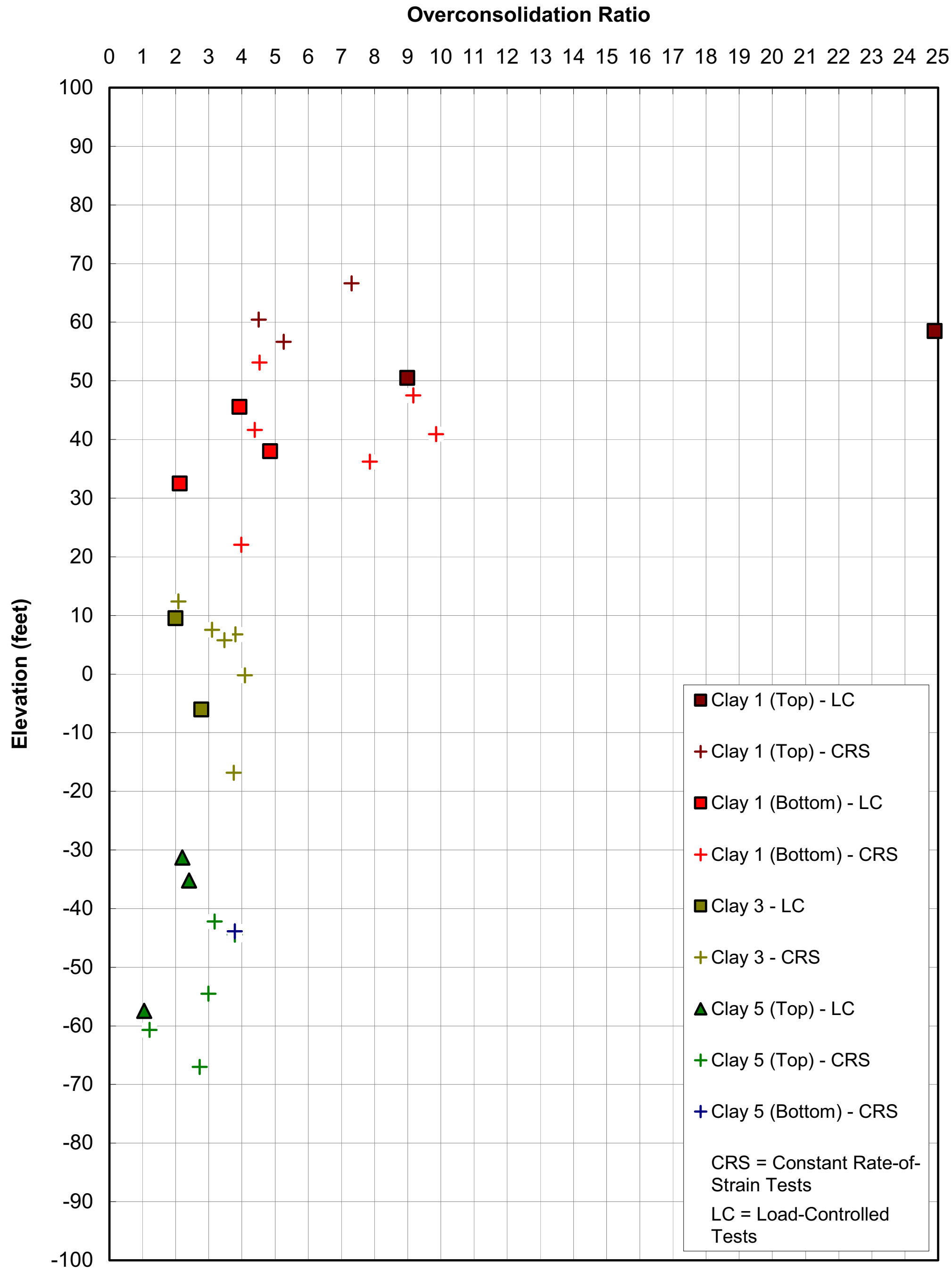


Figure 2.5.4-55 Overconsolidation Ratios of Cohesive Soil Strata from Laboratory Testing (Cooling Basin)

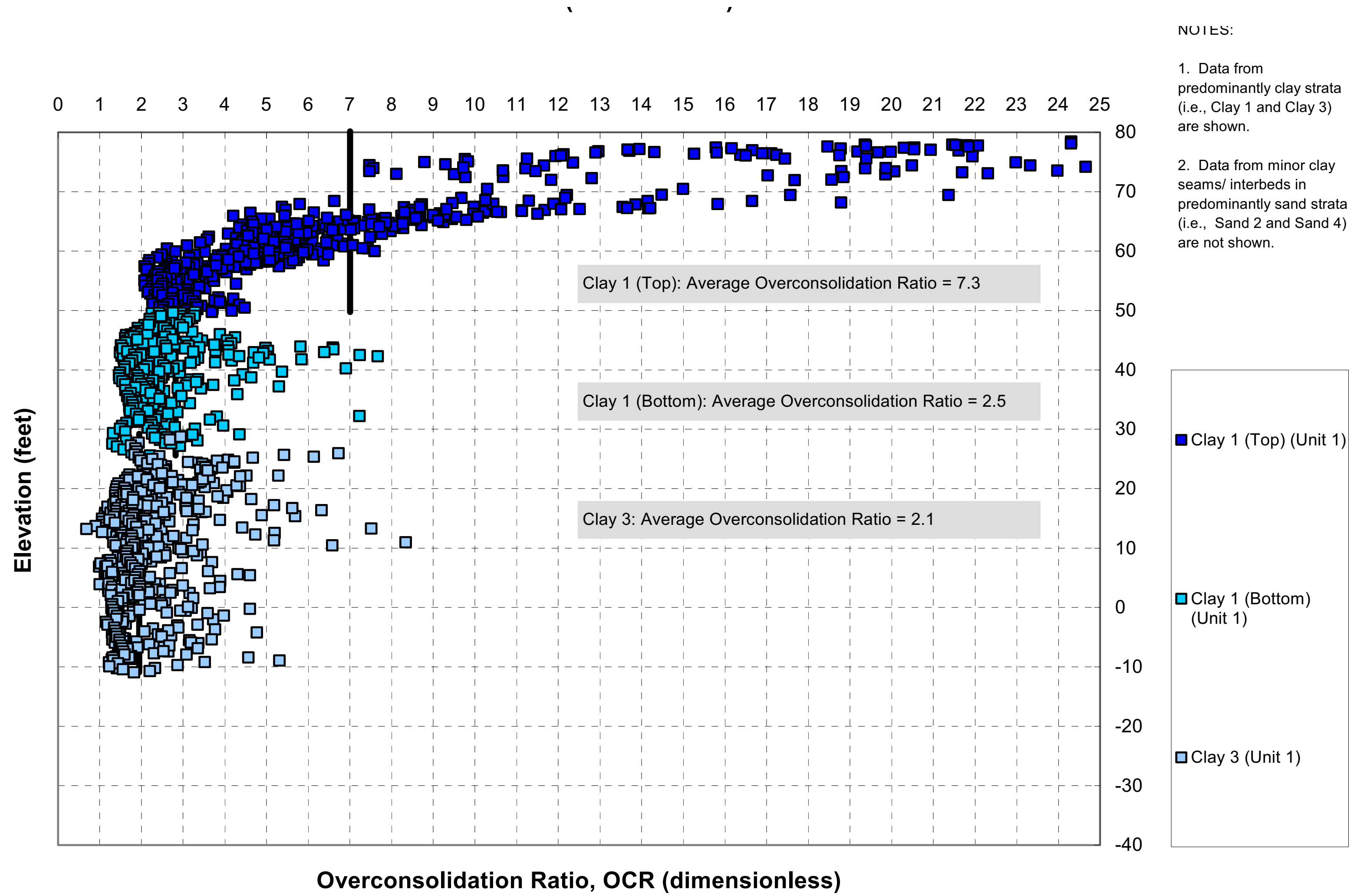


Figure 2.5.4-56 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 1 (Power Block Area)

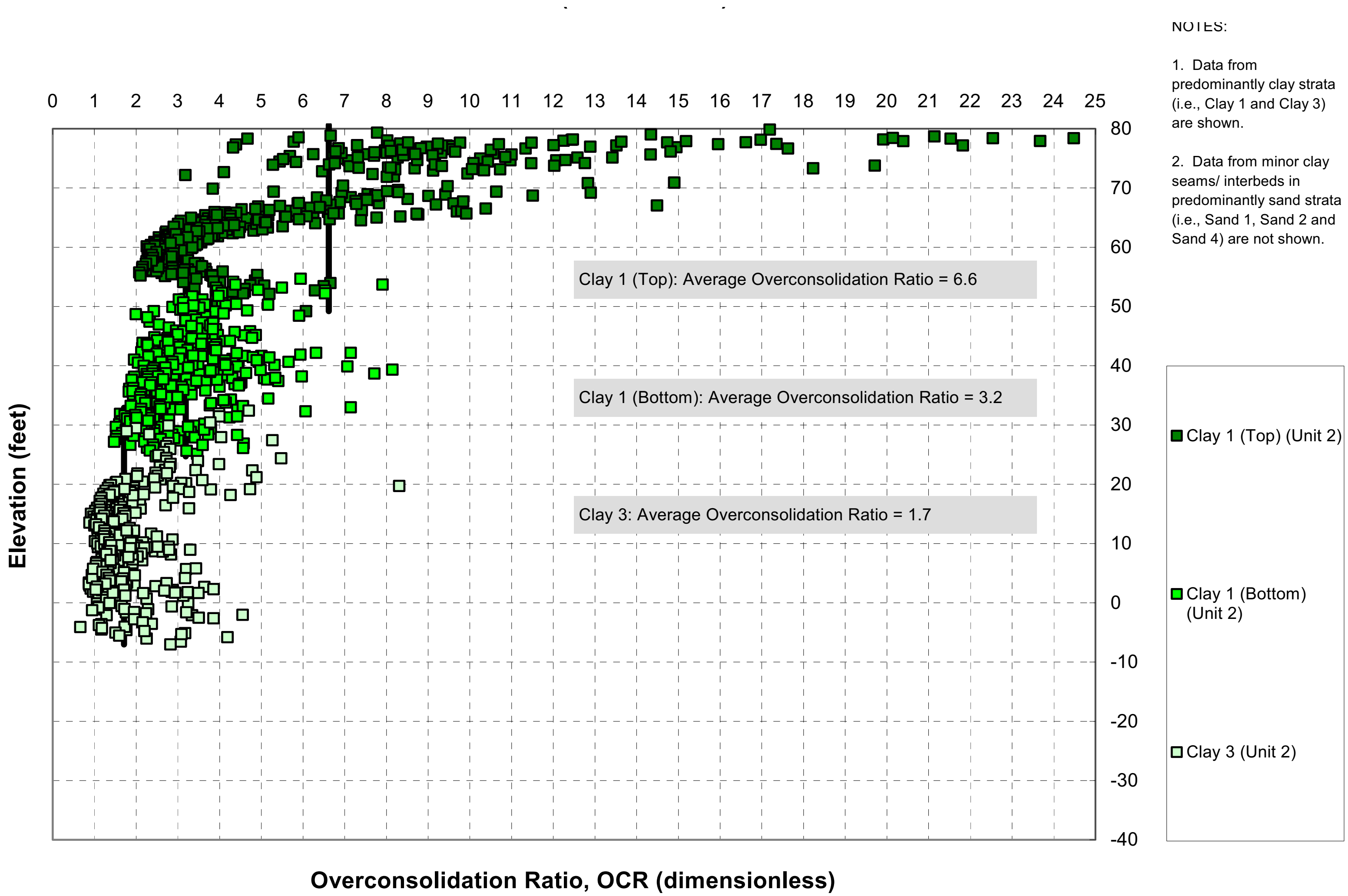


Figure 2.5.4-57 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 2 (Power Block Area)

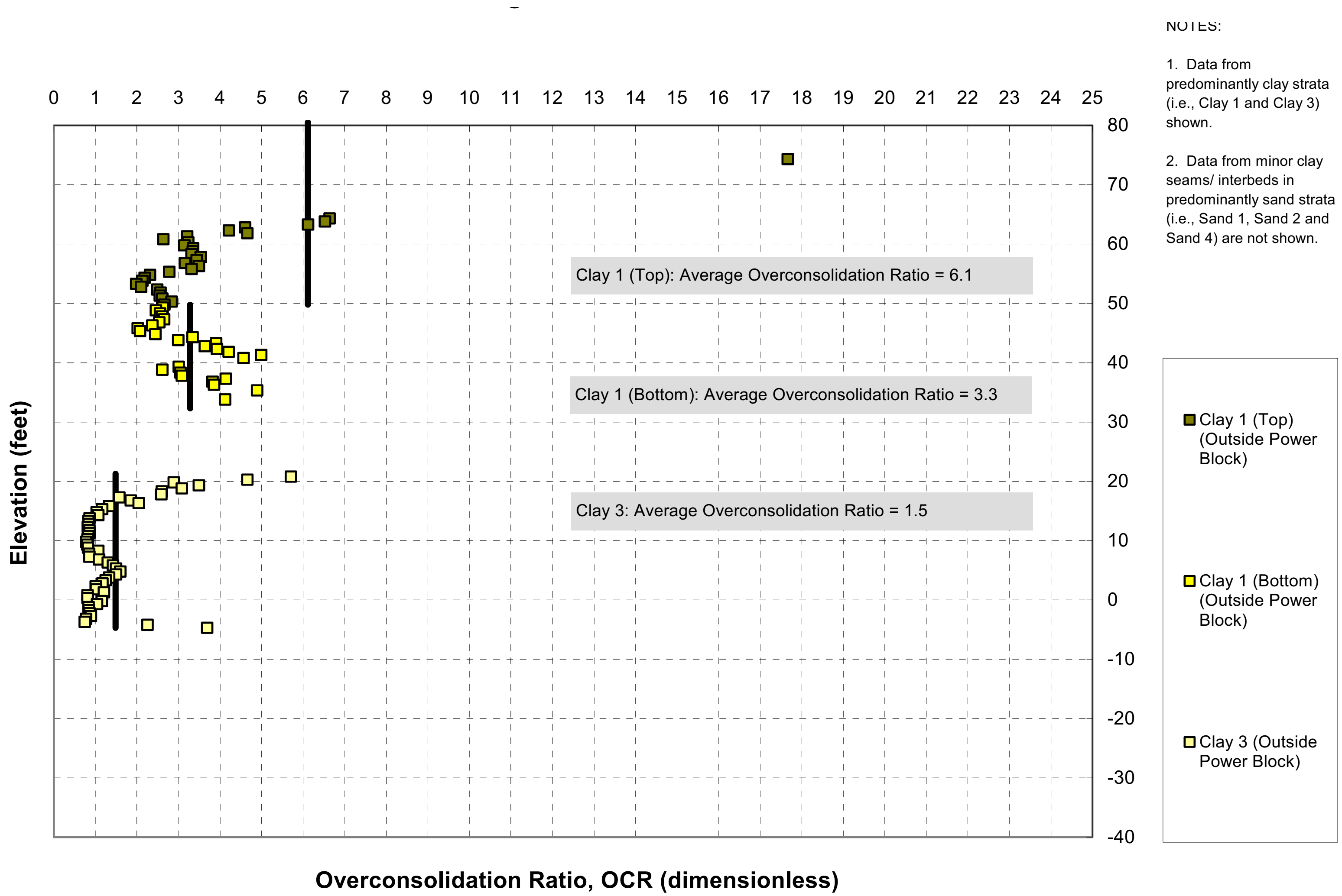


Figure 2.5.4-58 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Investigations Outside Power Block Area

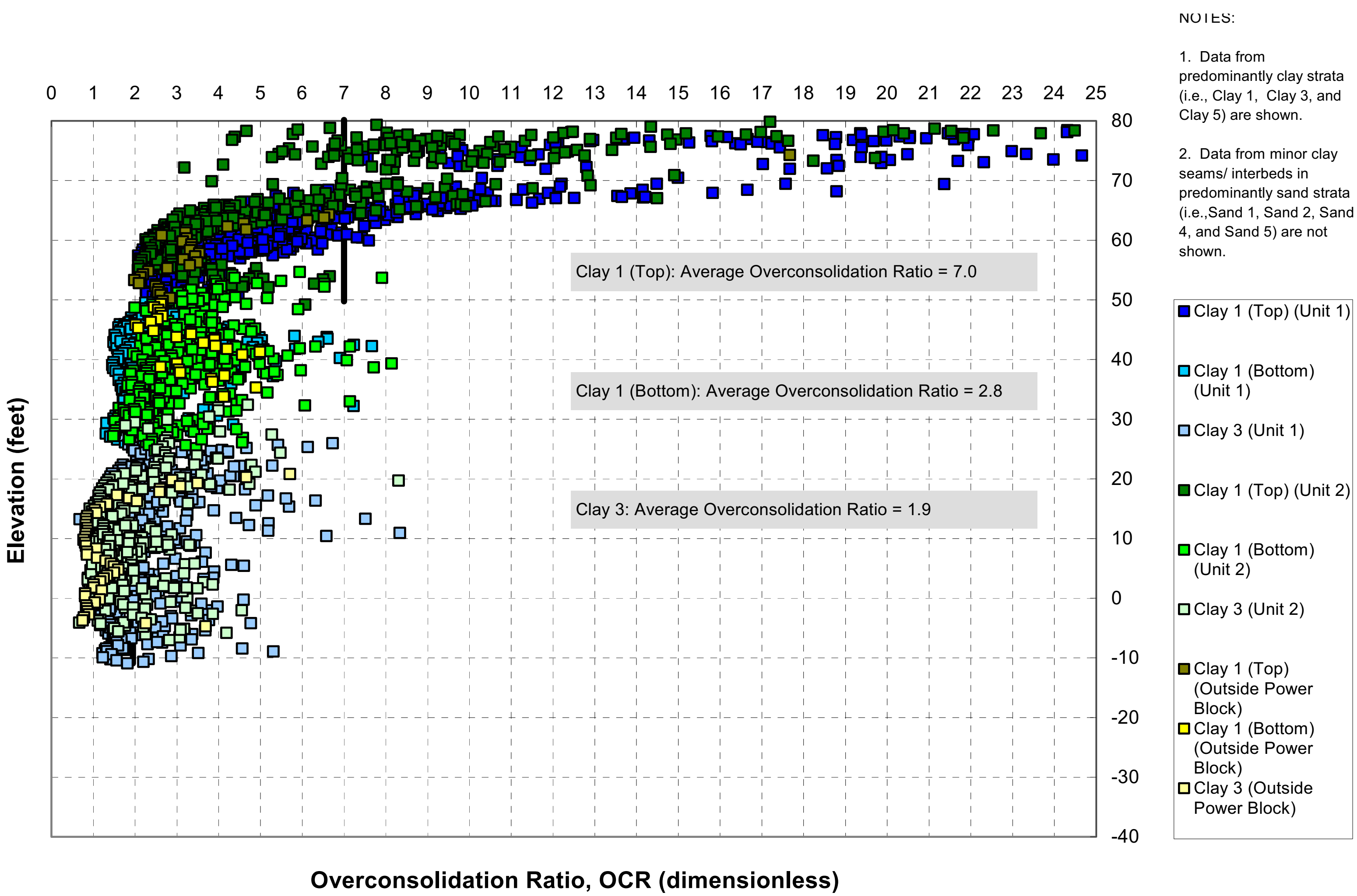


Figure 2.5.4-59 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area

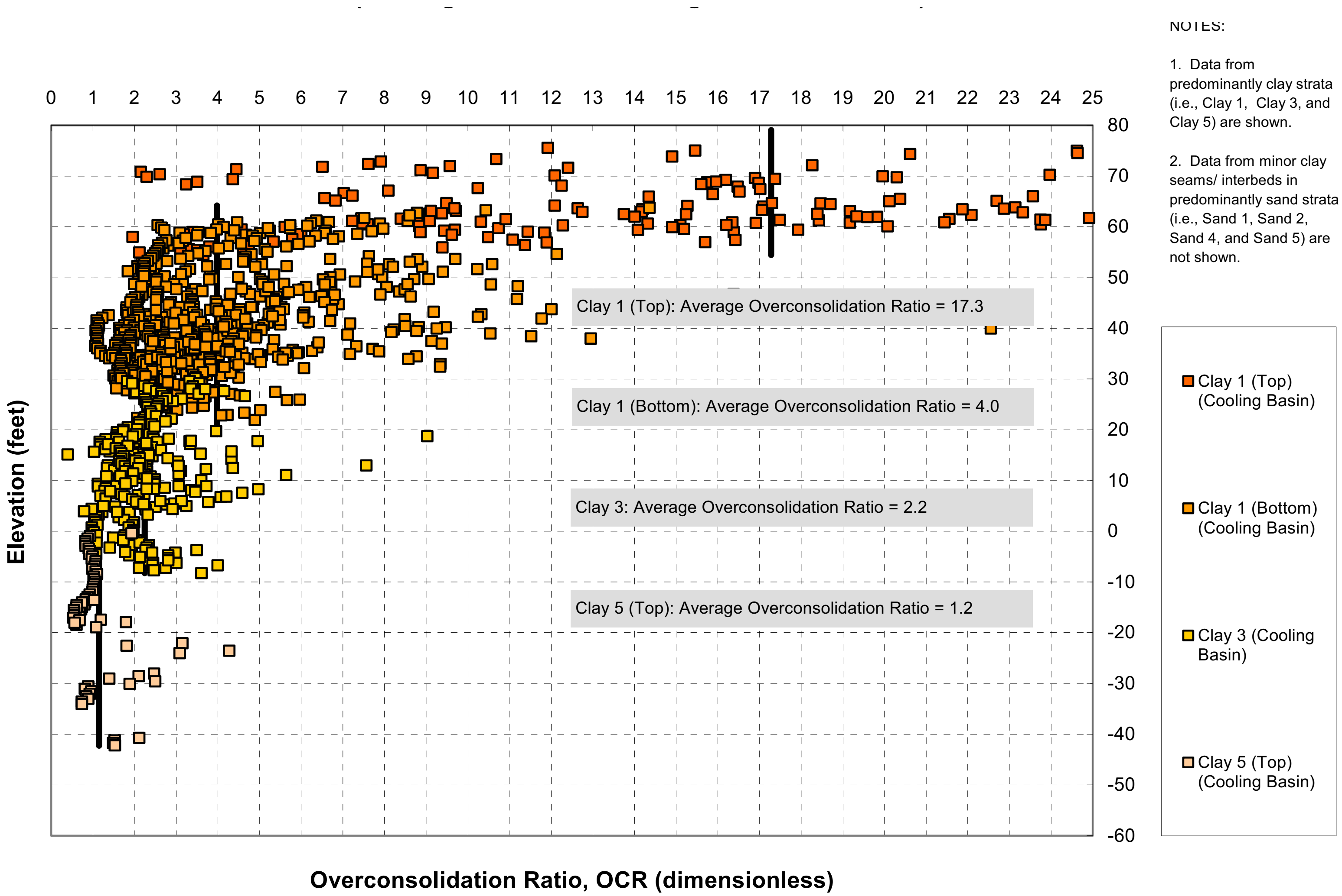


Figure 2.5.4-60 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data (Cooling Basin)

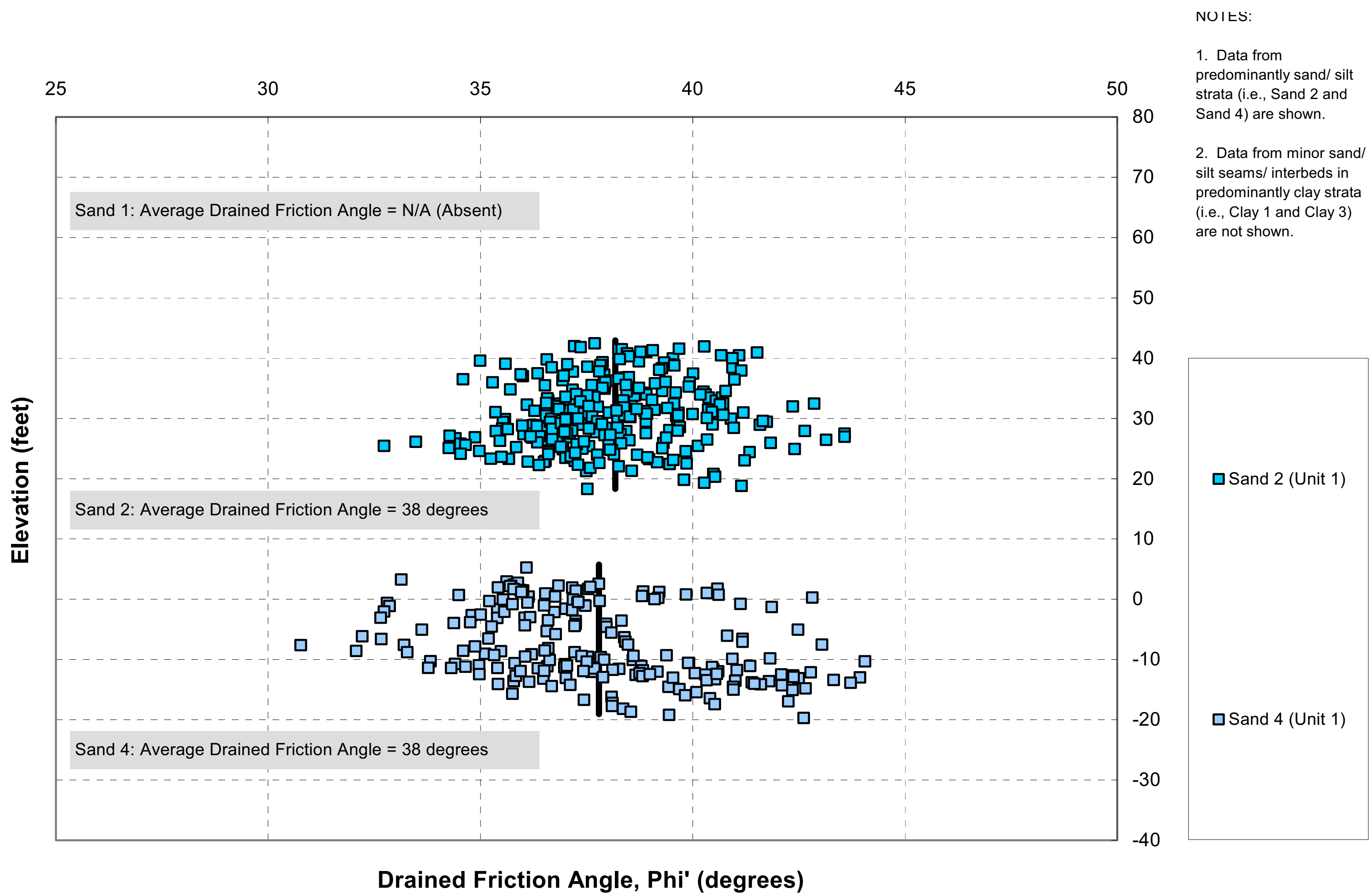


Figure 2.5.4-61 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 1 (Power Block Area)

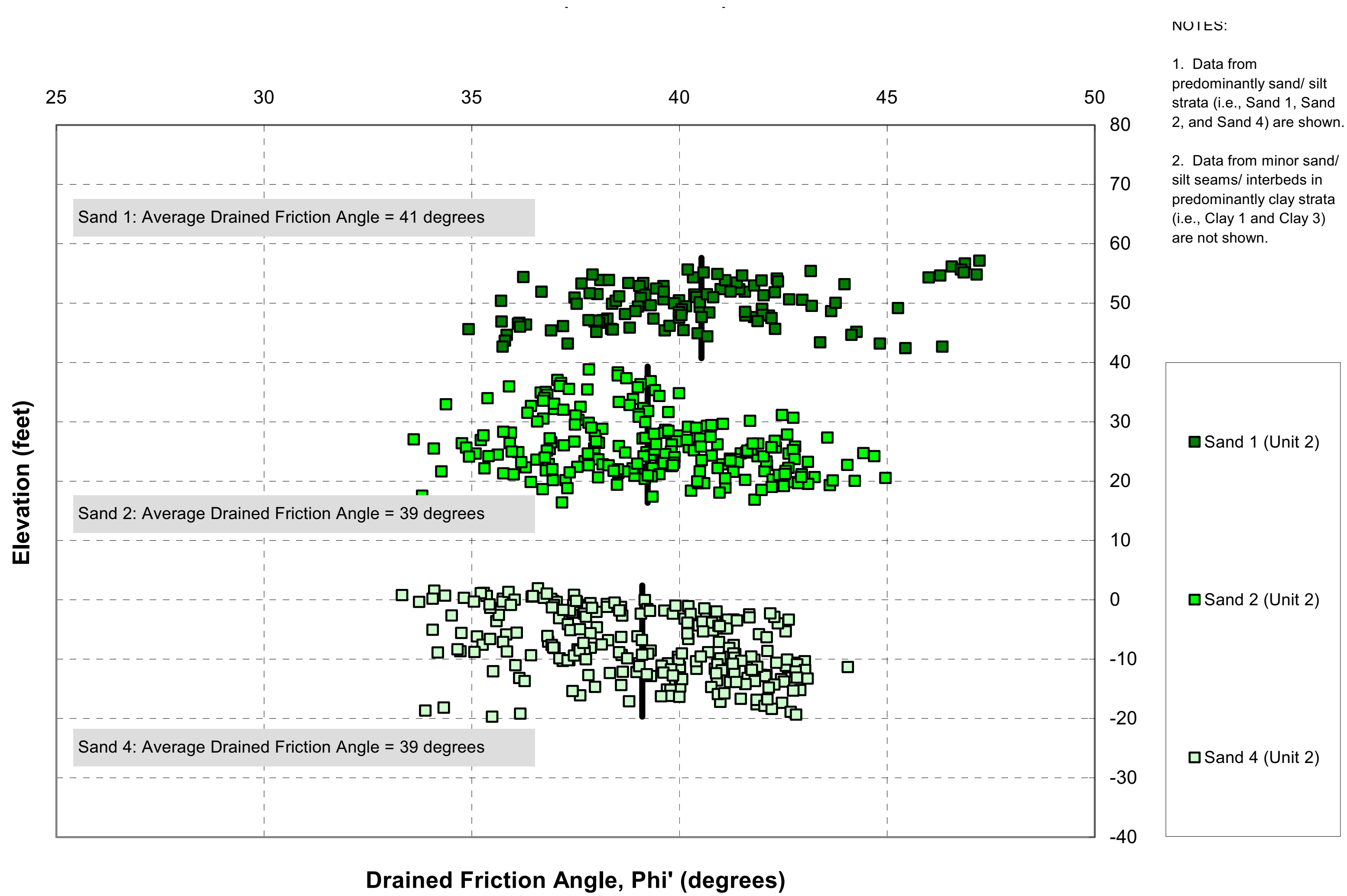


Figure 2.5.4-62 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 2 (Power Block Area)

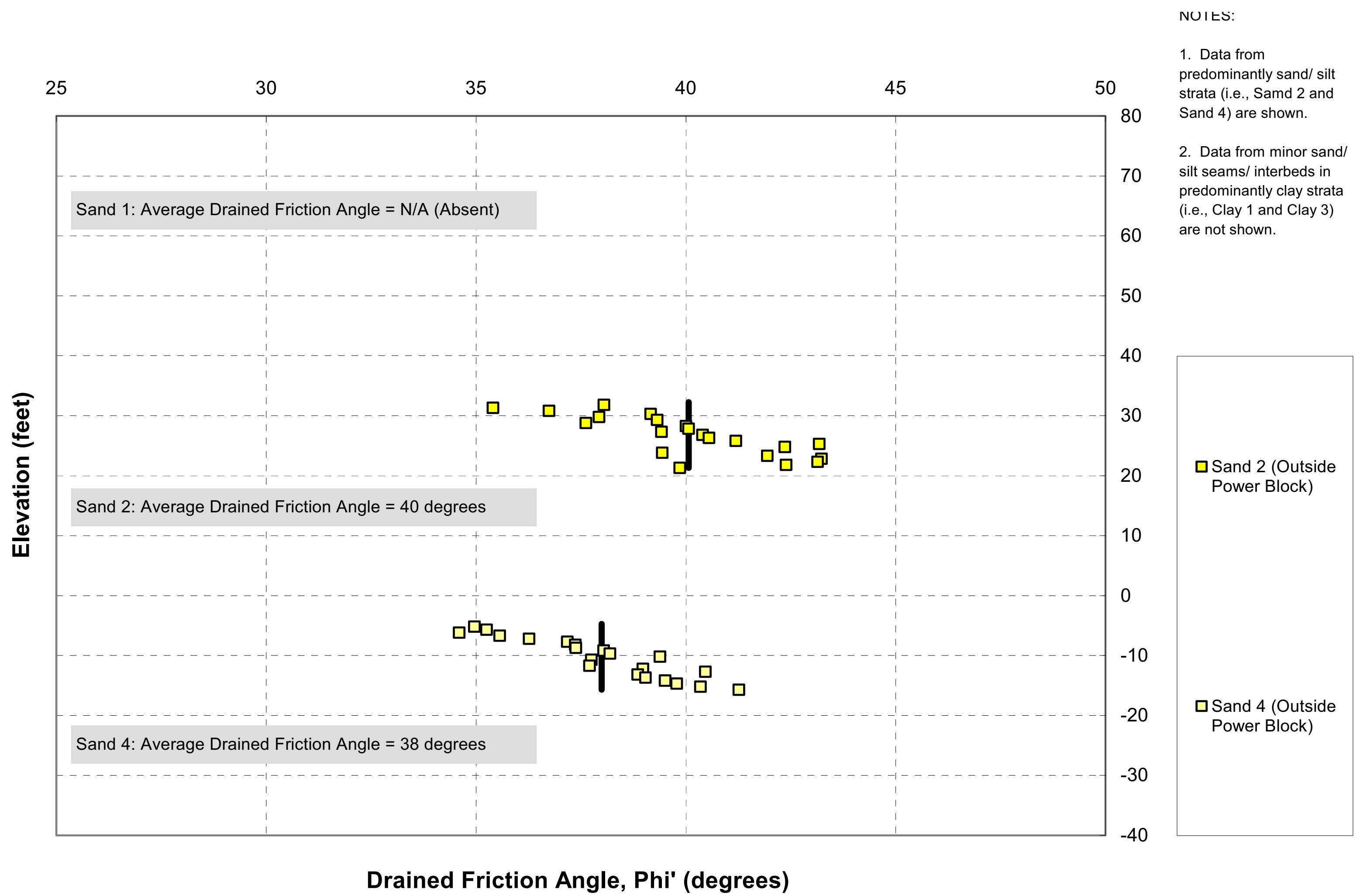


Figure 2.5.4-63 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Investigations Outside Power Block Area

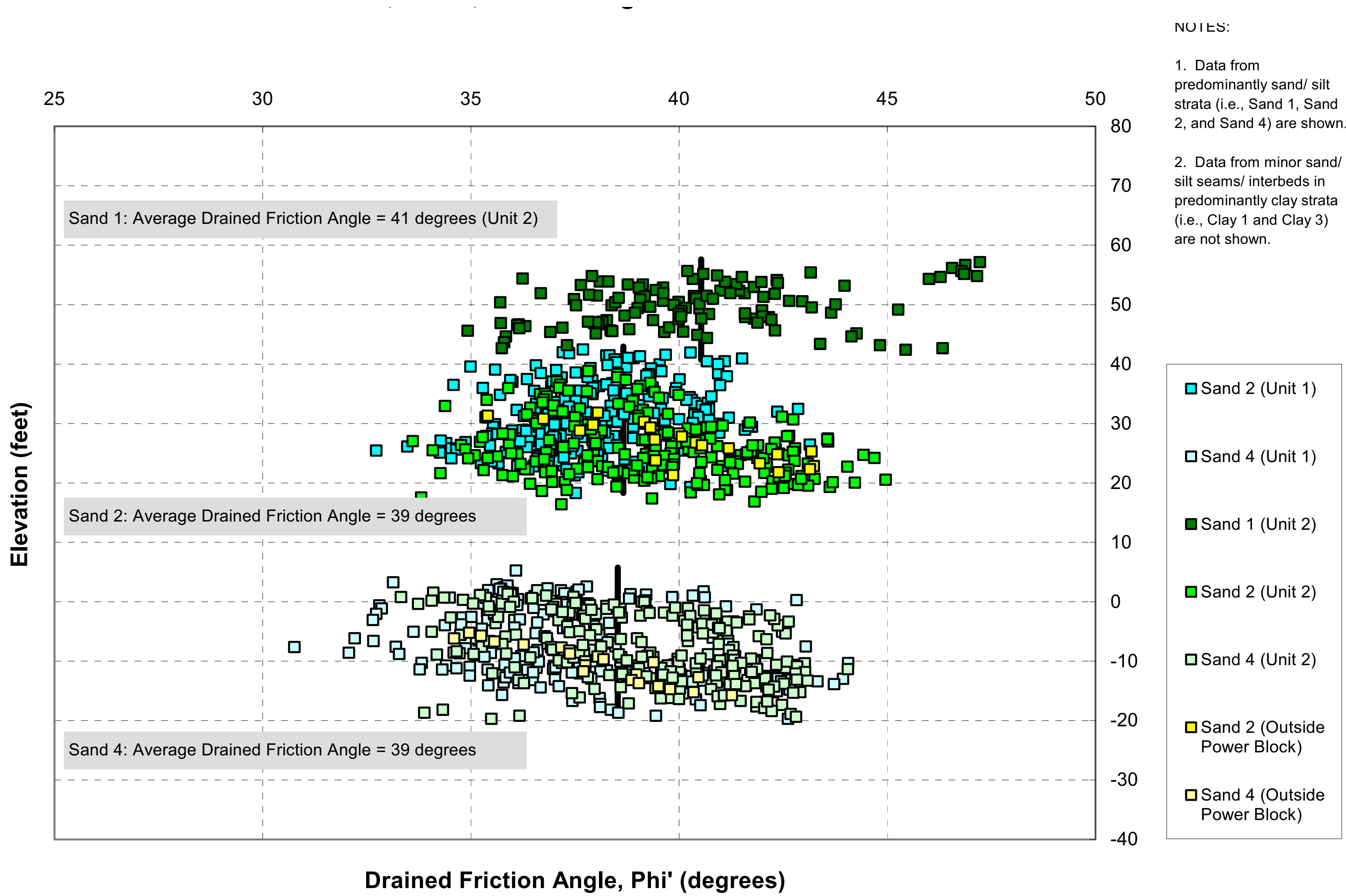
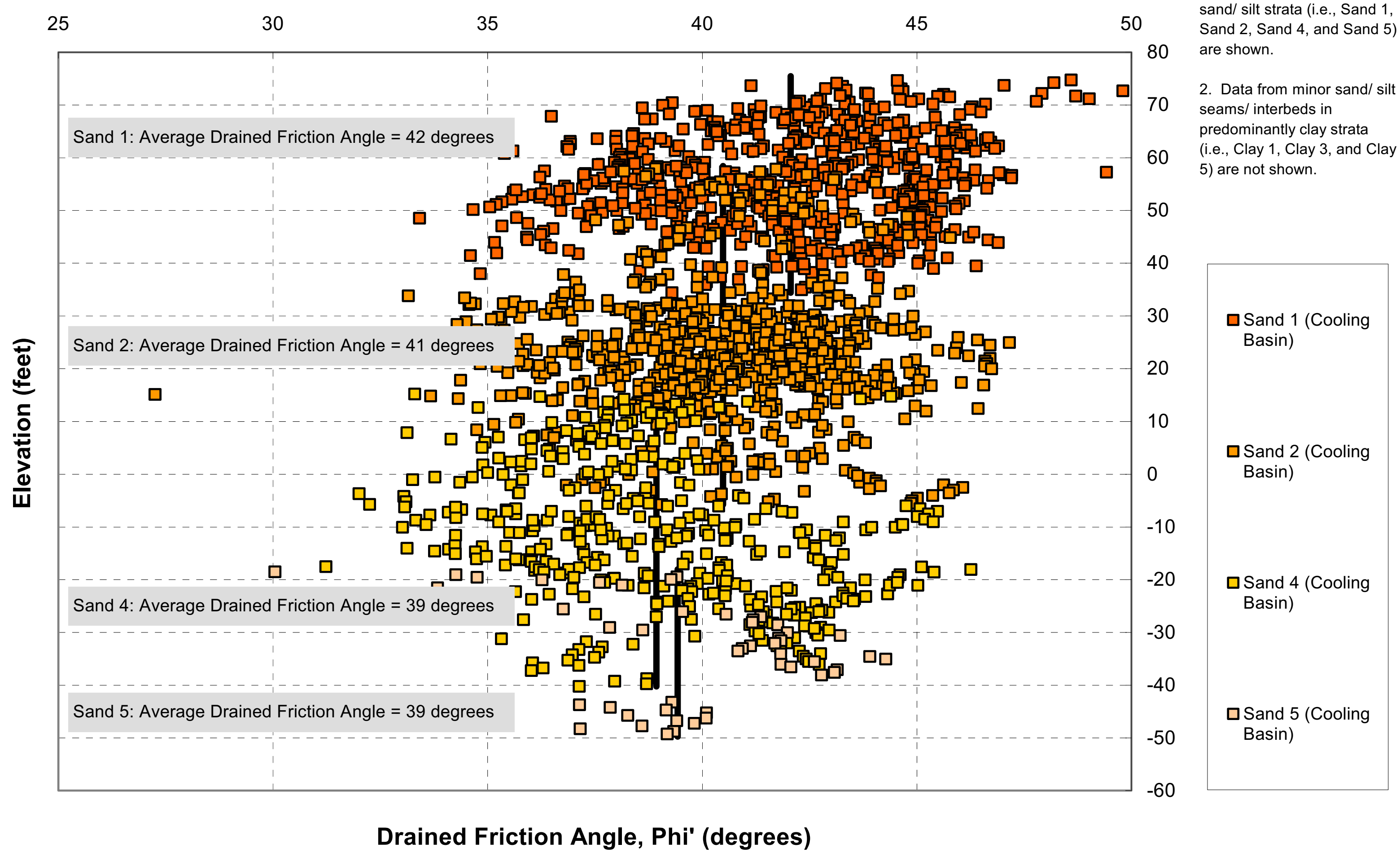


Figure 2.5.4-64 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area



NOTES:

1. Data from predominantly sand/ silt strata (i.e., Sand 1, Sand 2, Sand 4, and Sand 5) are shown.

2. Data from minor sand/ silt seams/ interbeds in predominantly clay strata (i.e., Clay 1, Clay 3, and Clay 5) are not shown.

Figure 2.5.4-65 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data (Cooling Basin)

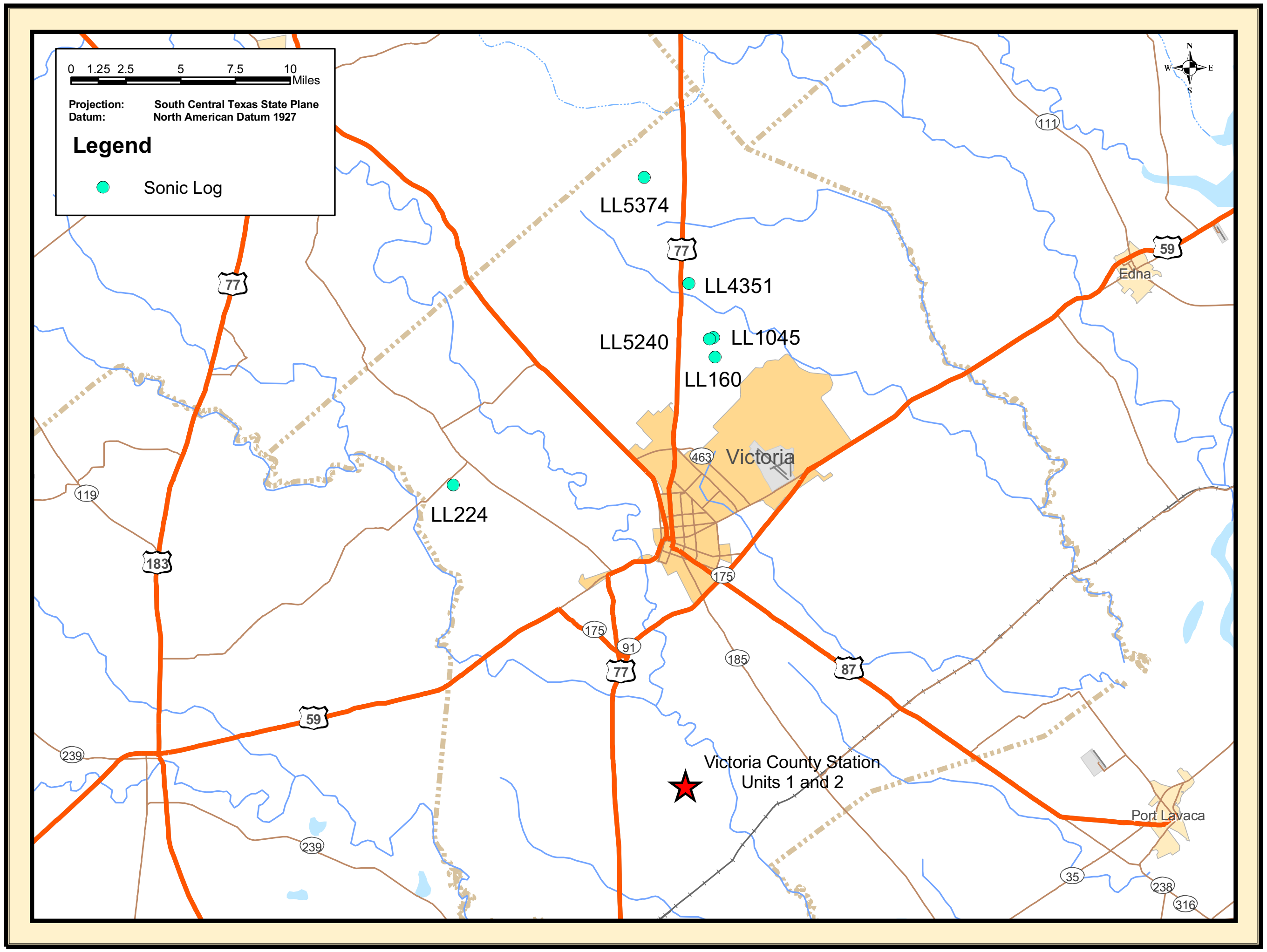


Figure 2.5.4-66 Regional/Oil Field Sonic Logging Locations

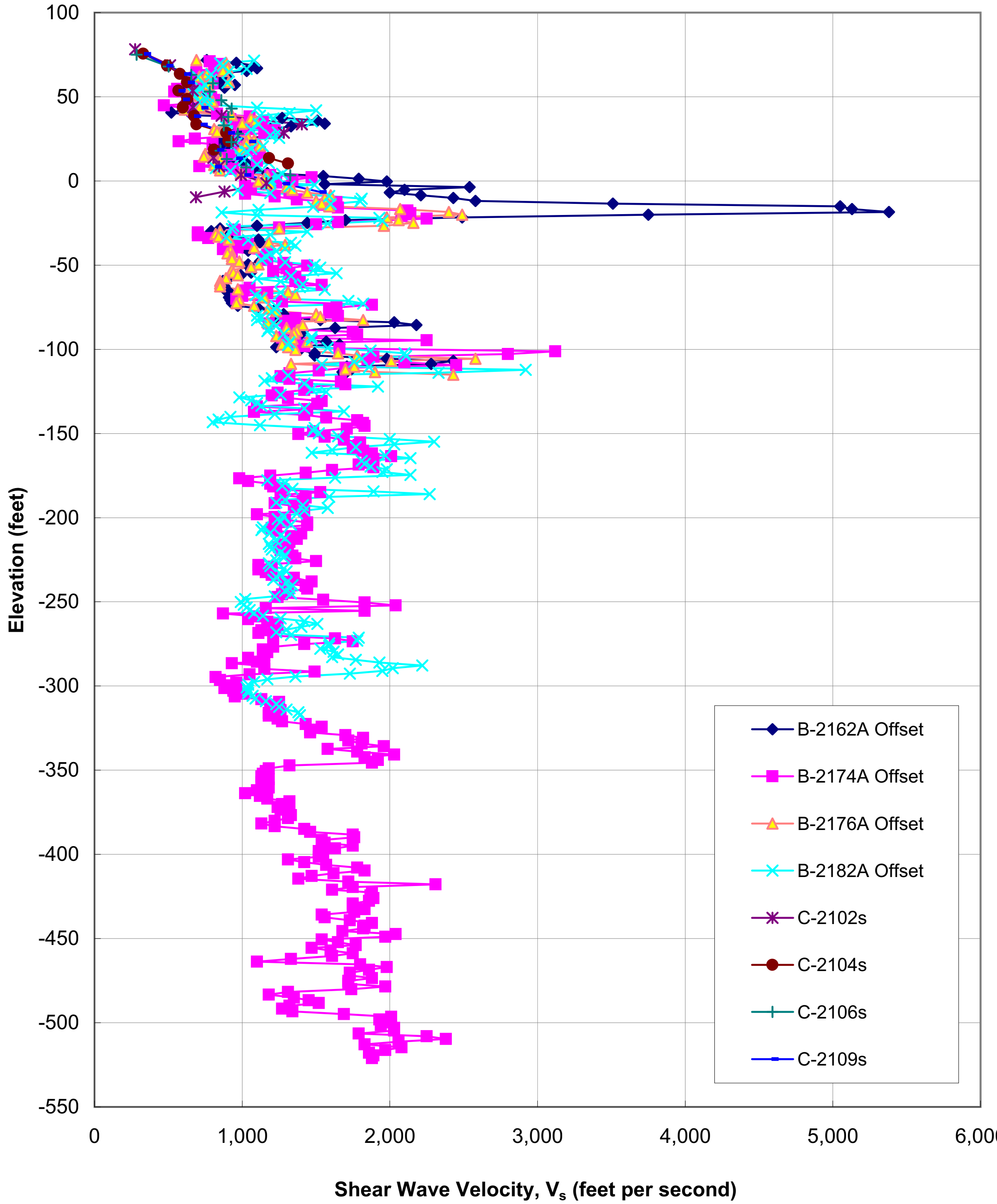


Figure 2.5.4-67 S-Wave Velocity versus Elevation; Unit 1; Upper Approximately 600 Feet of Site Soils (Power Block Area)

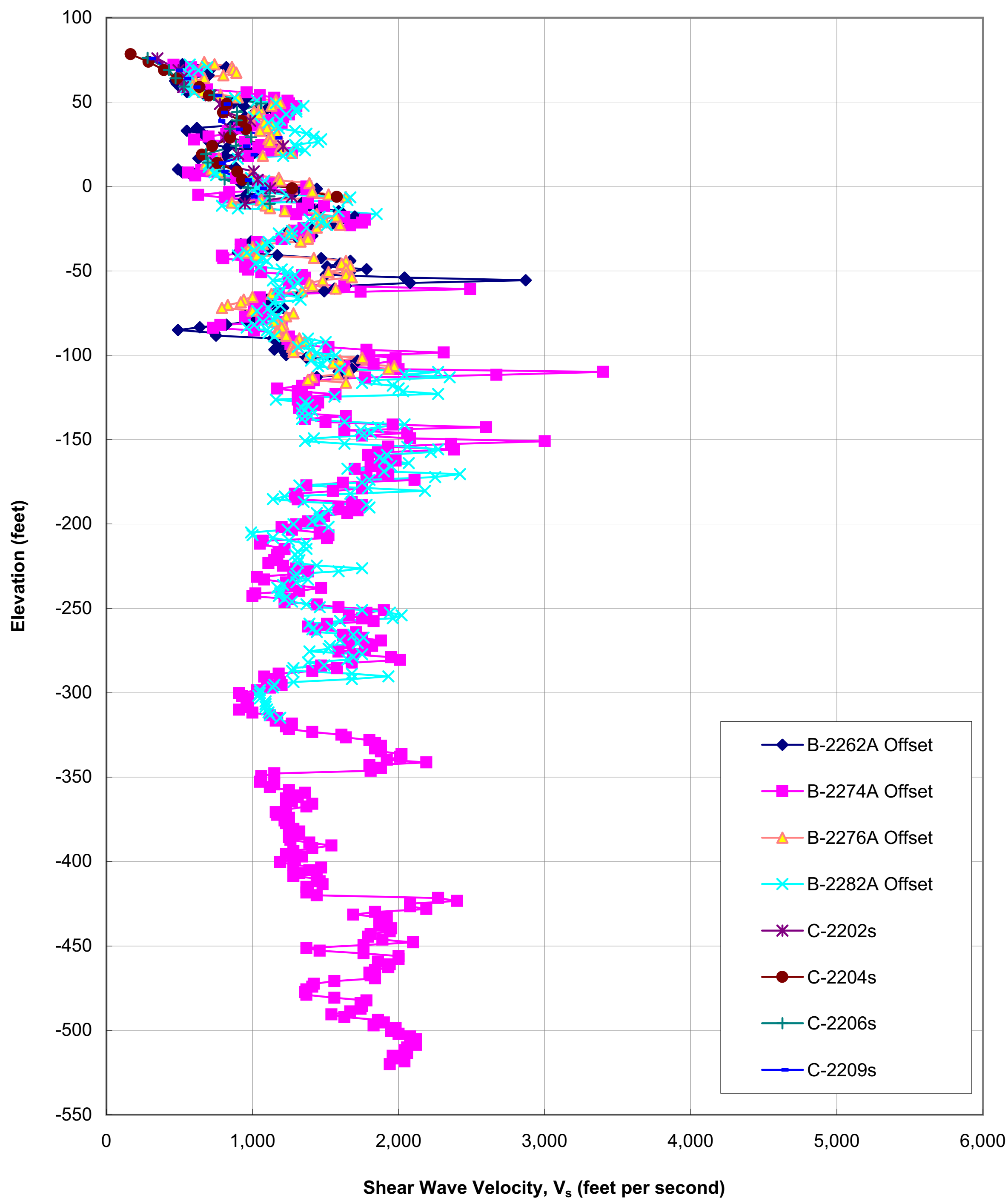


Figure 2.5.4-68 S-Wave Velocity versus Elevation; Unit 2; Upper Approximately 600 Feet of Site Soils (Power Block Area)

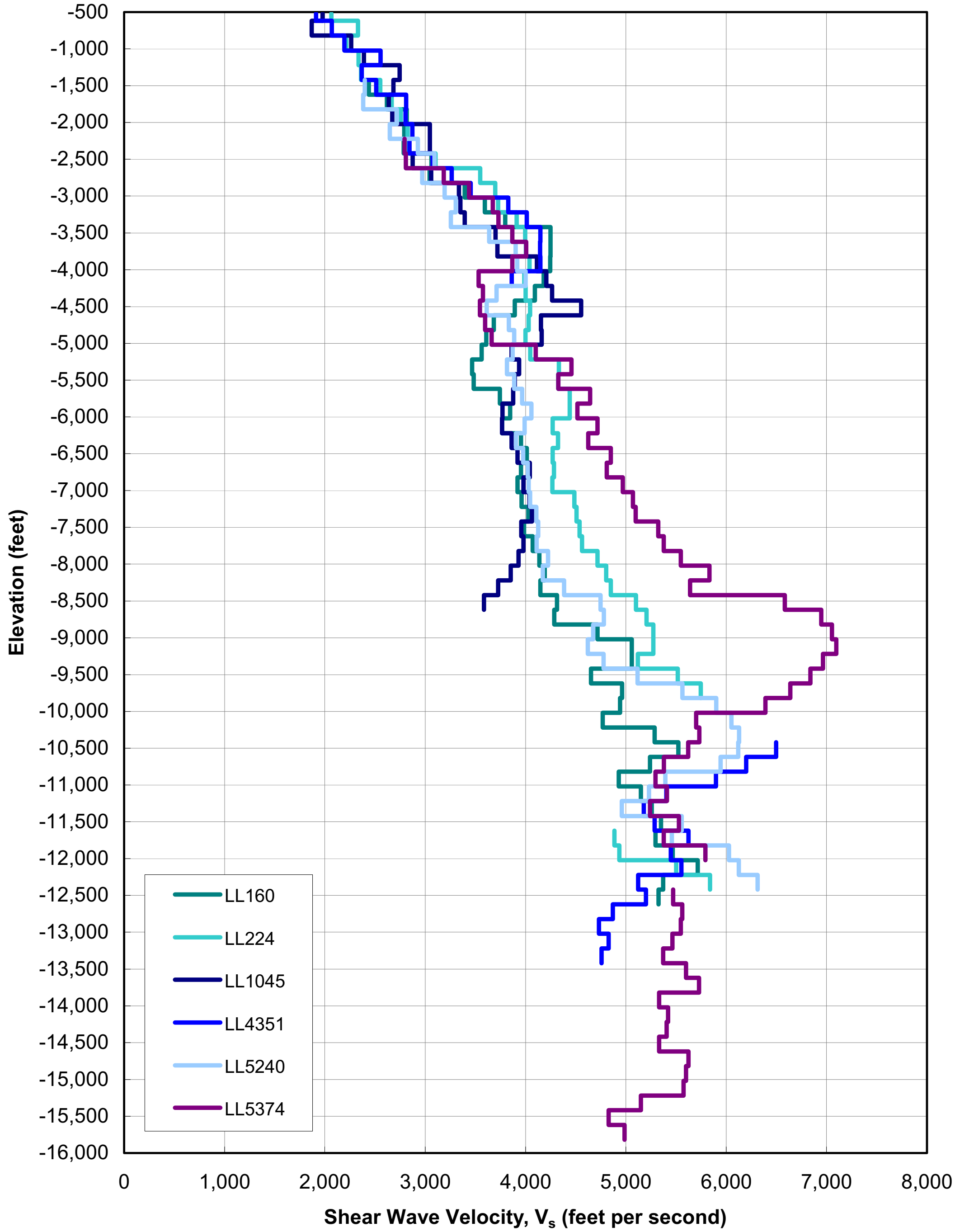


Figure 2.5.4-69 S-Wave Velocity versus Elevation; Unit 1 and Unit 2; Deeper than Approximately 600 Feet Below Existing Ground Surface (Power Block Area)

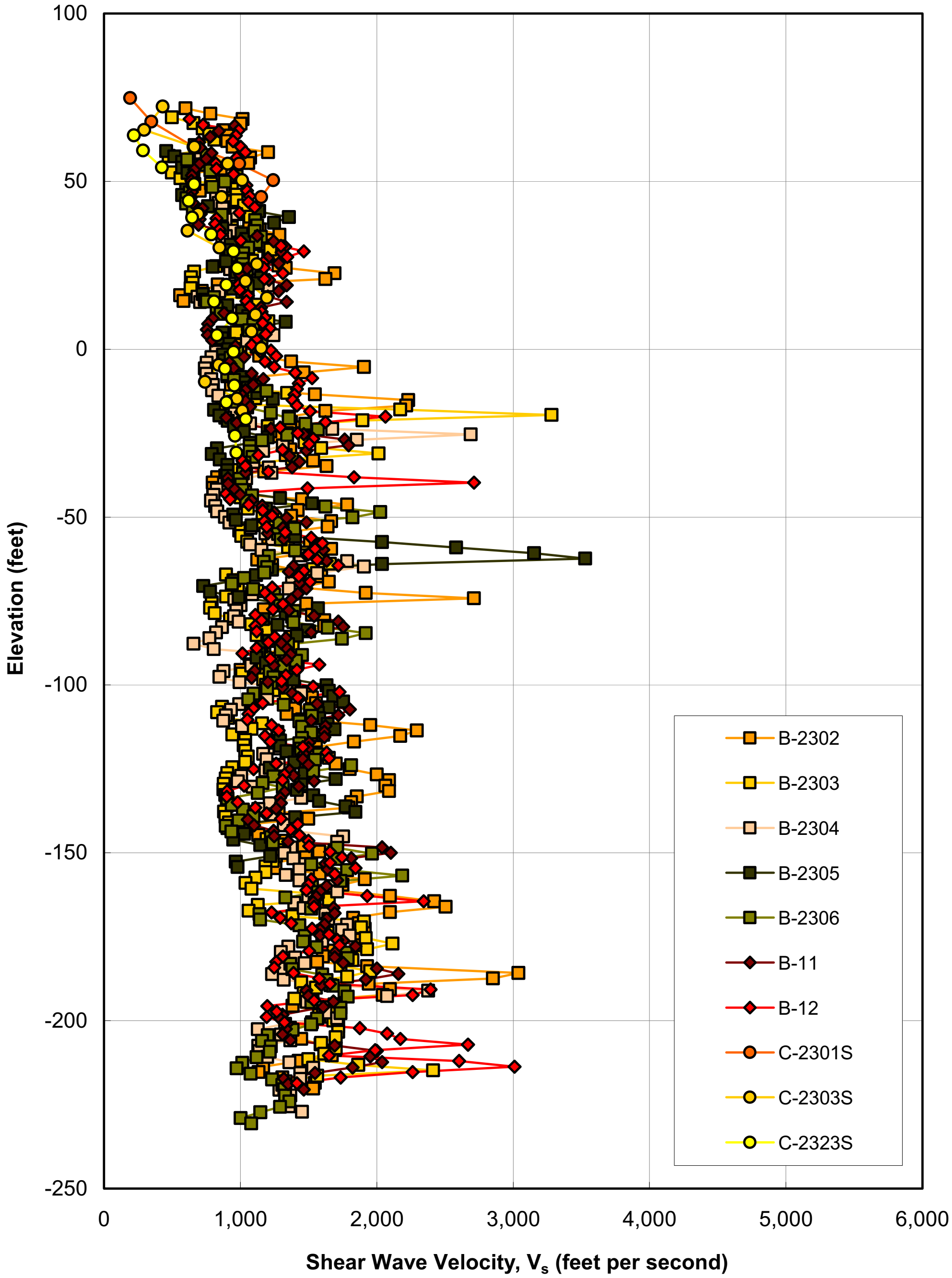


Figure 2.5.4-70 S-Wave Velocity versus Elevation (Cooling Basin)

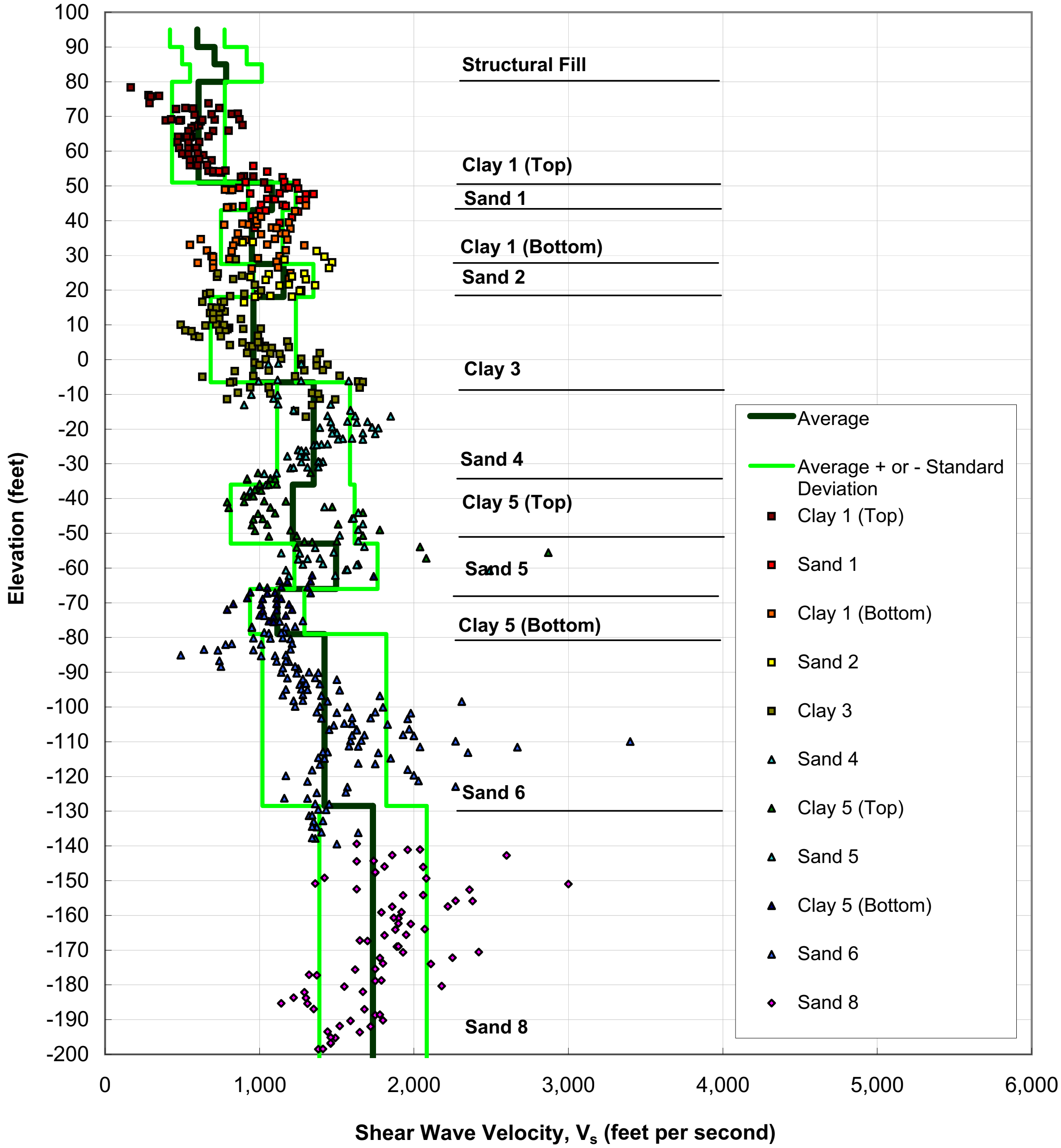


Figure 2.5.4-71 Average S-Wave Velocity Profile; Unit 1 (Power Block Area) (Sheet 1 of 2)

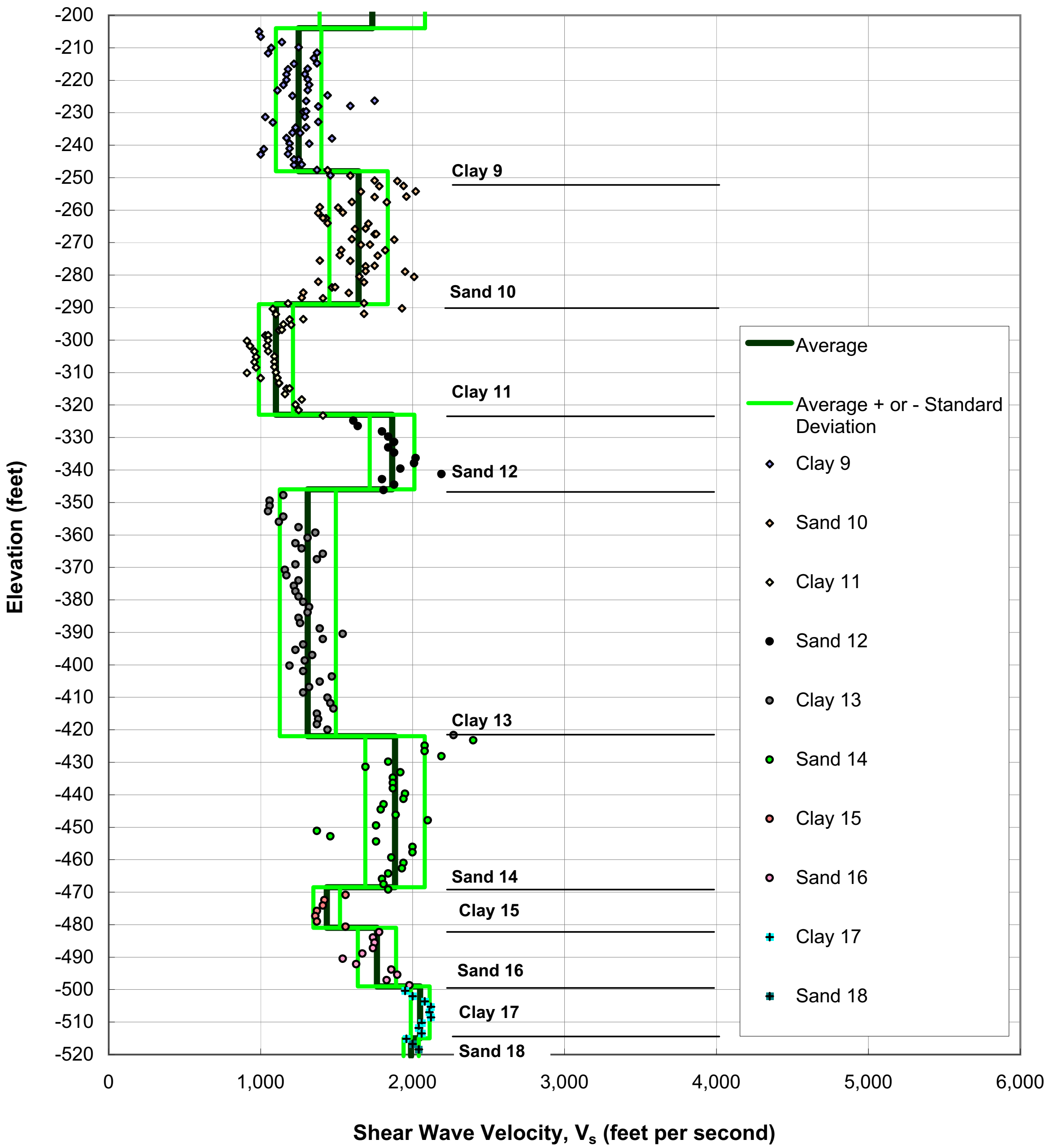


Figure 2.5.4-71 Average S-Wave Velocity Profile; Unit 1 (Power Block Area) (Sheet 2 of 2)

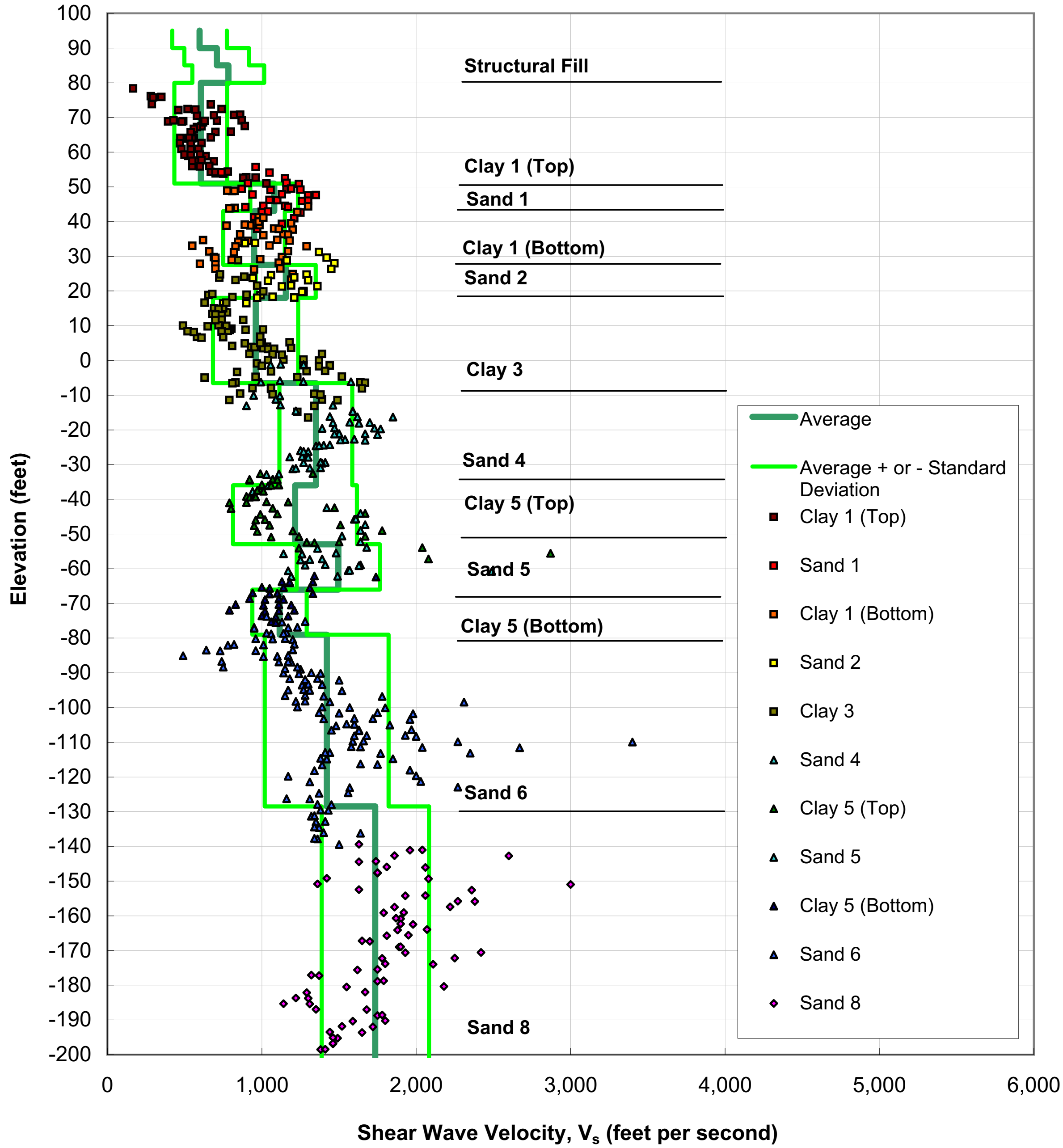


Figure 2.5.4-72 Average S-Wave Velocity Profile; Unit 2 (Power Block Area) (Sheet 1 of 2)

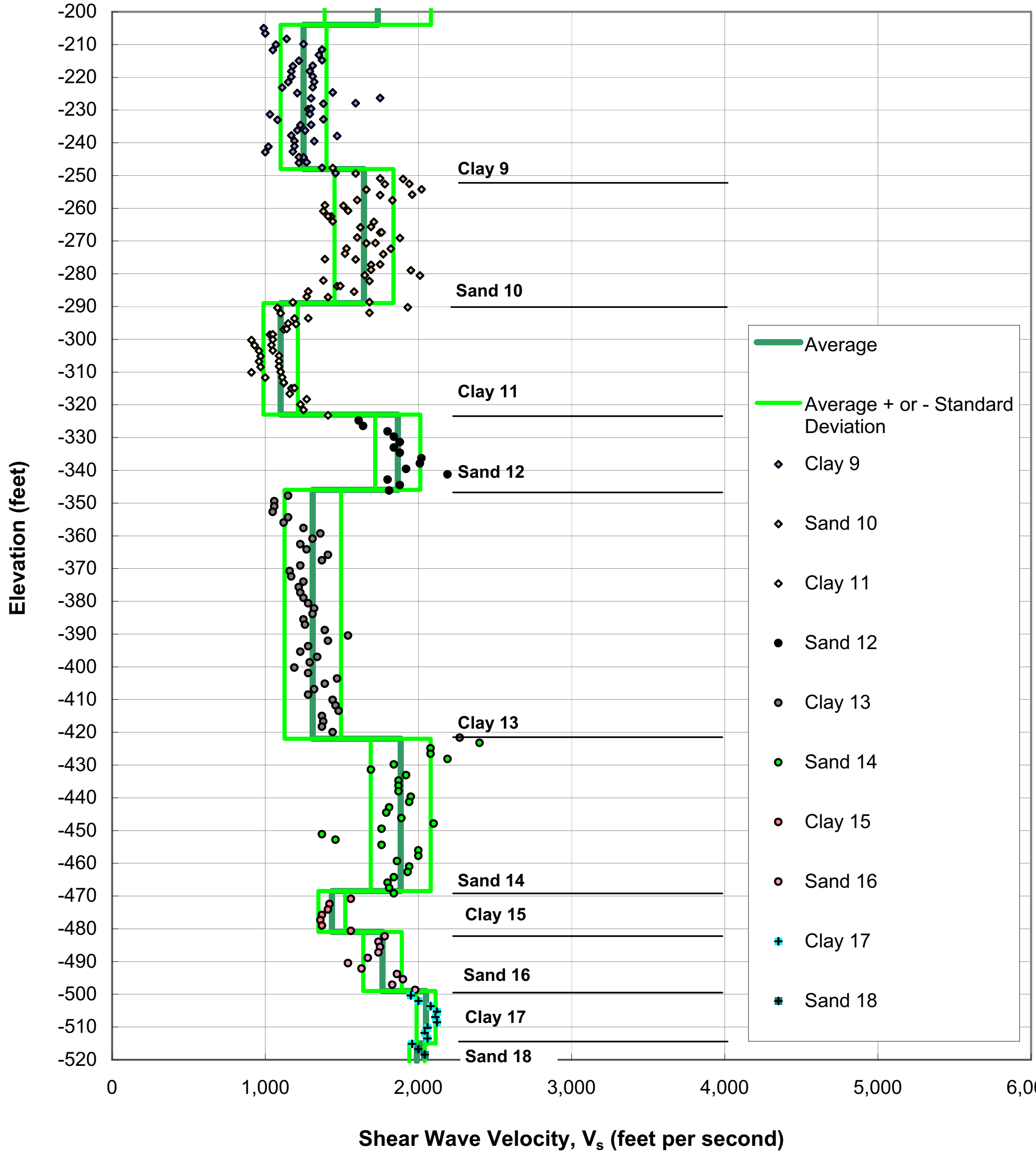


Figure 2.5.4-72 Average S-Wave Velocity Profile; Unit 2 (Power Block Area) (Sheet 2 of 2)

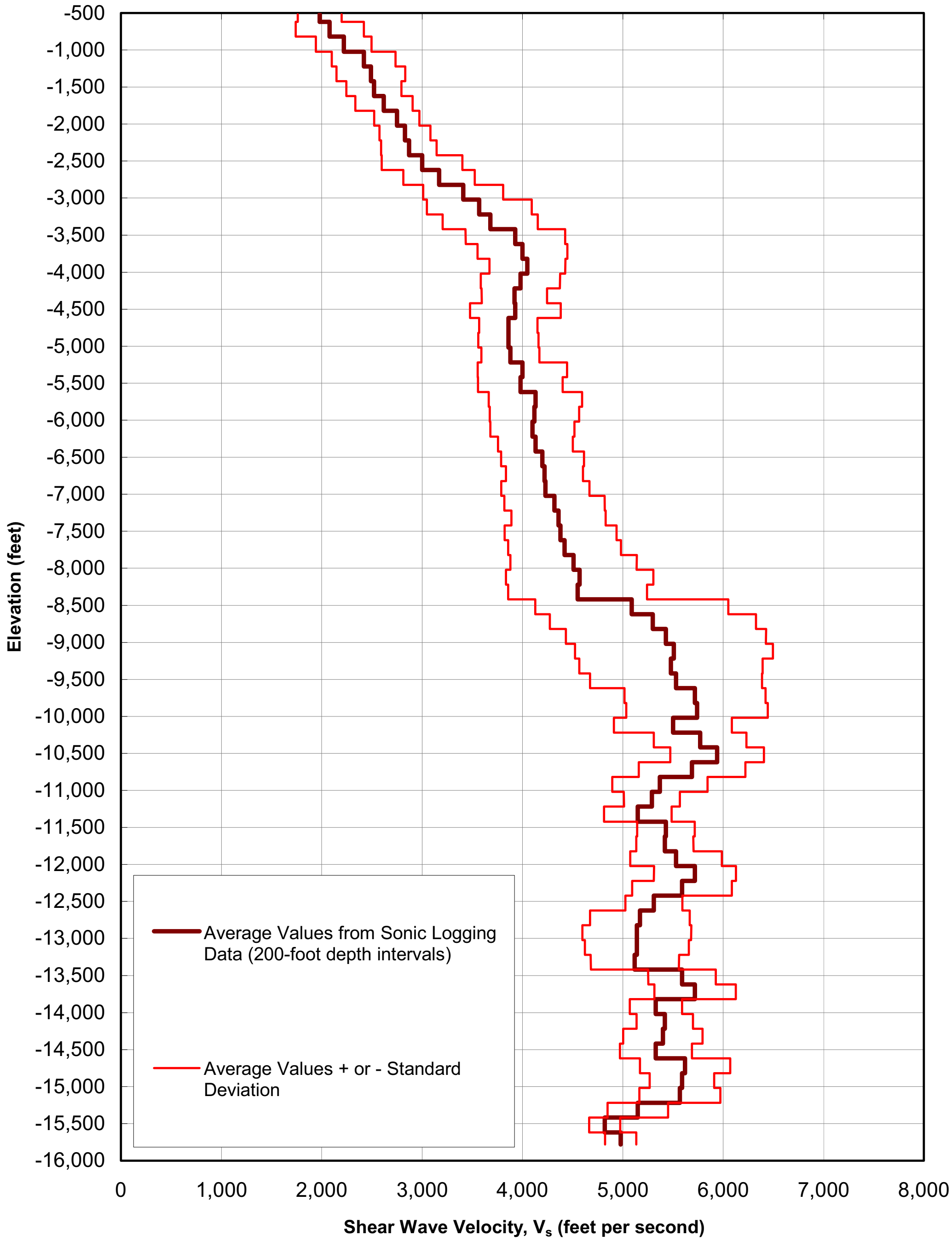


Figure 2.5.4-73 Average S-Wave Velocity versus Elevation; Unit 1 and Unit 2; Deeper than Approximately 600 Feet Below Existing Ground Surface (Power Block Area)

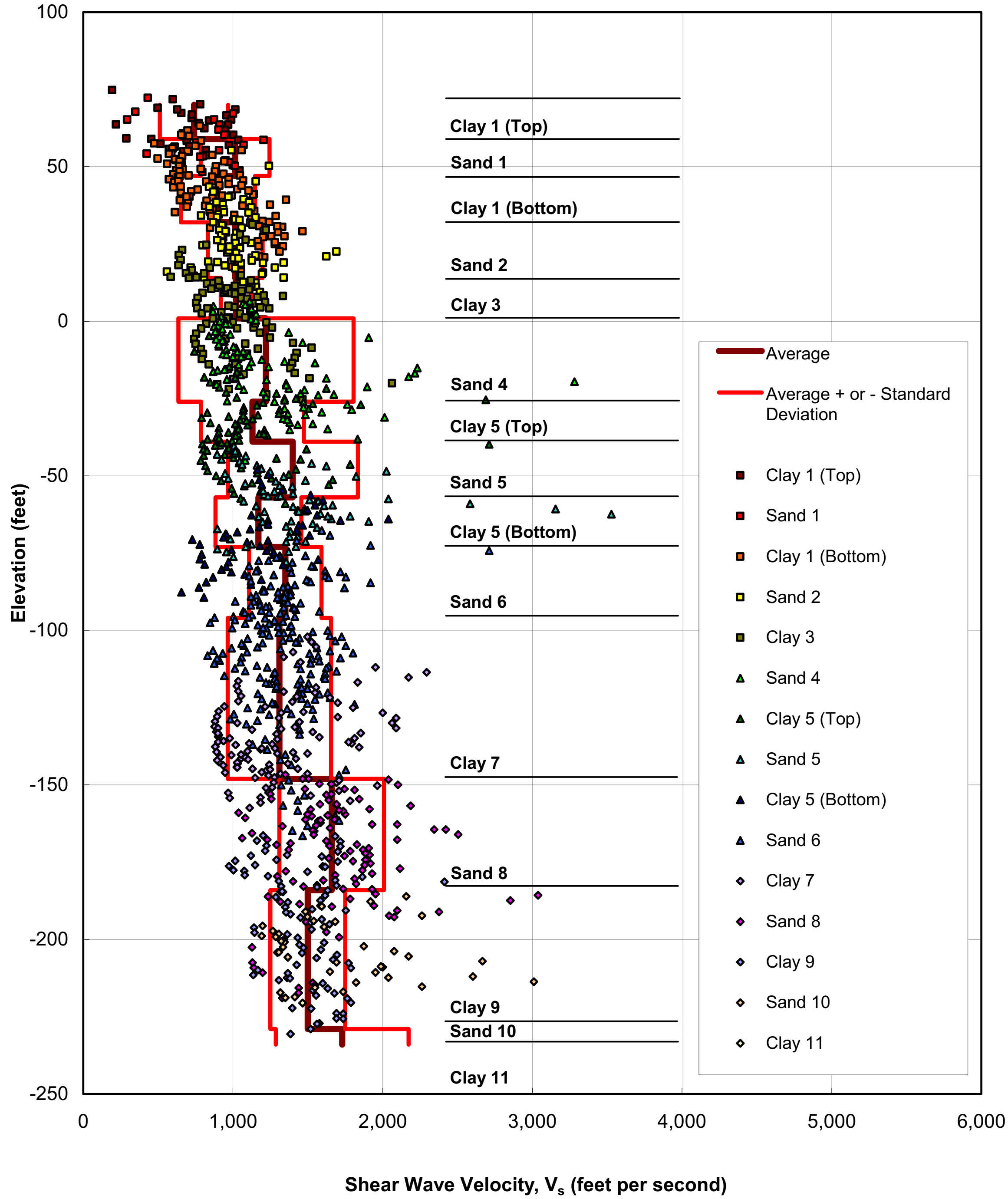


Figure 2.5.4-74 Average S-Wave Velocity Profile (Cooling Basin)

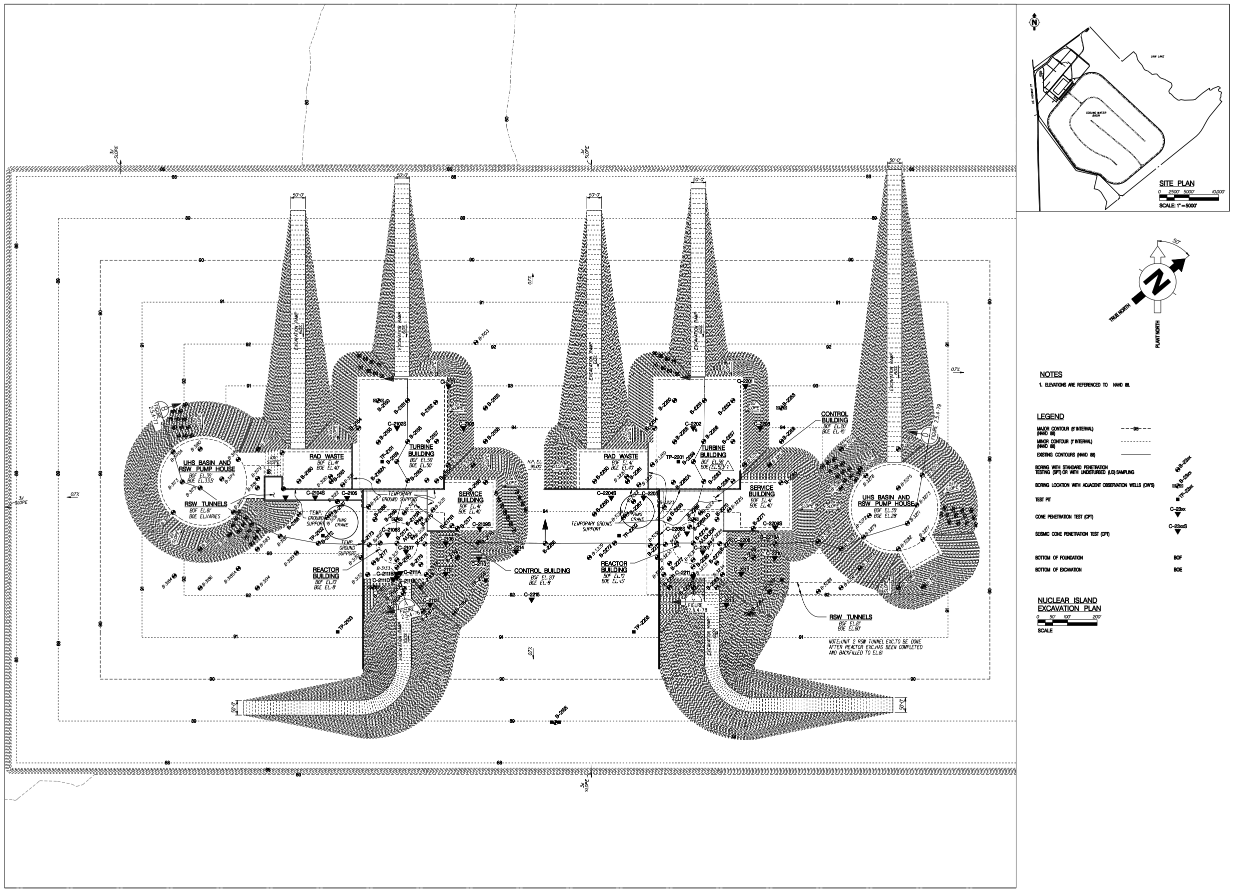


Figure 2.5.4-75 Representative Excavation Plan (Power Block Area) (Based on a Typical LWR with an Independent UHS)

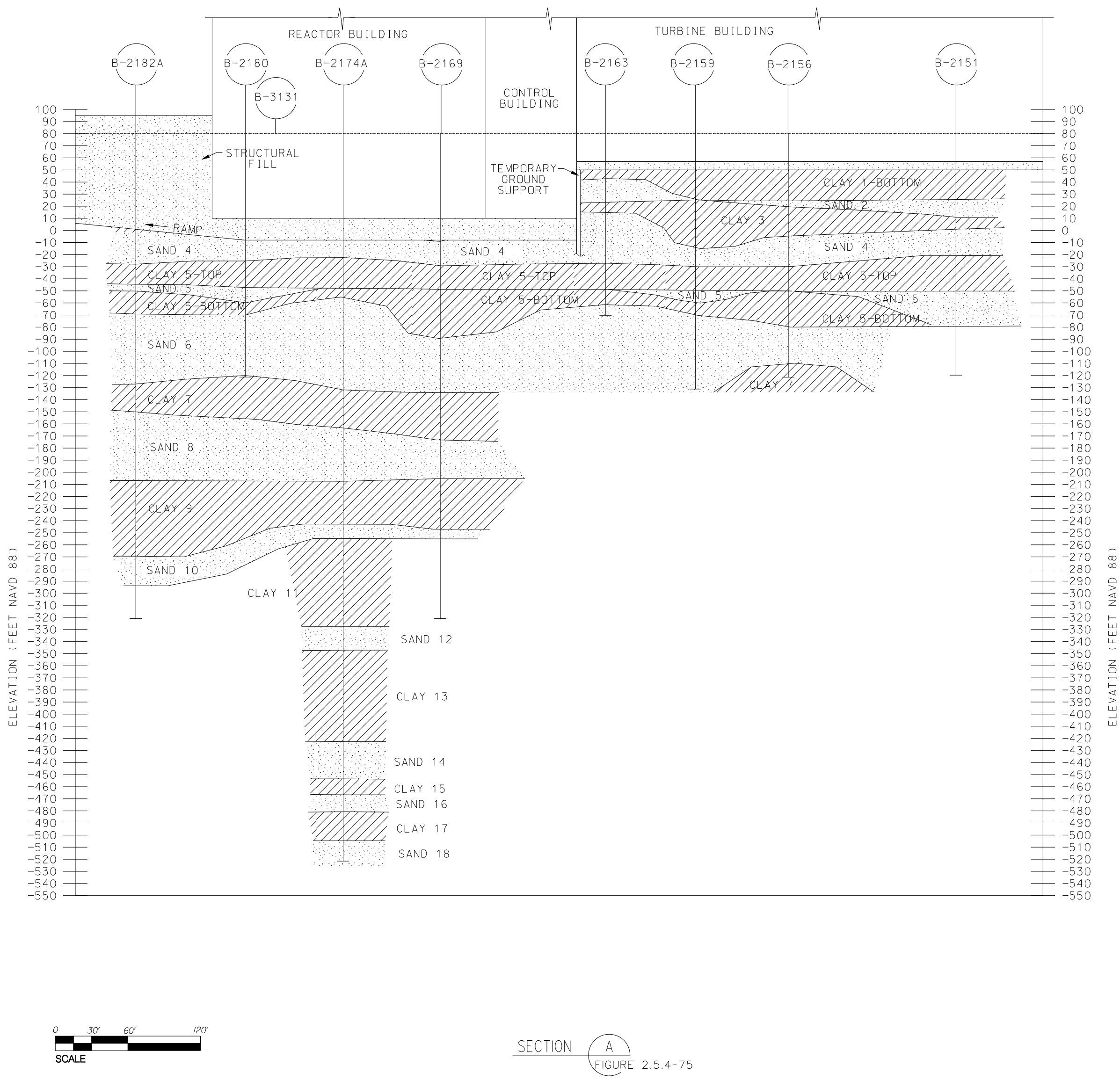


Figure 2.5.4-76 Representative Excavation Profile A; Unit 1 (North-South) (Power Block Area) (Based on a Typical LWR (with an Independent UHS))

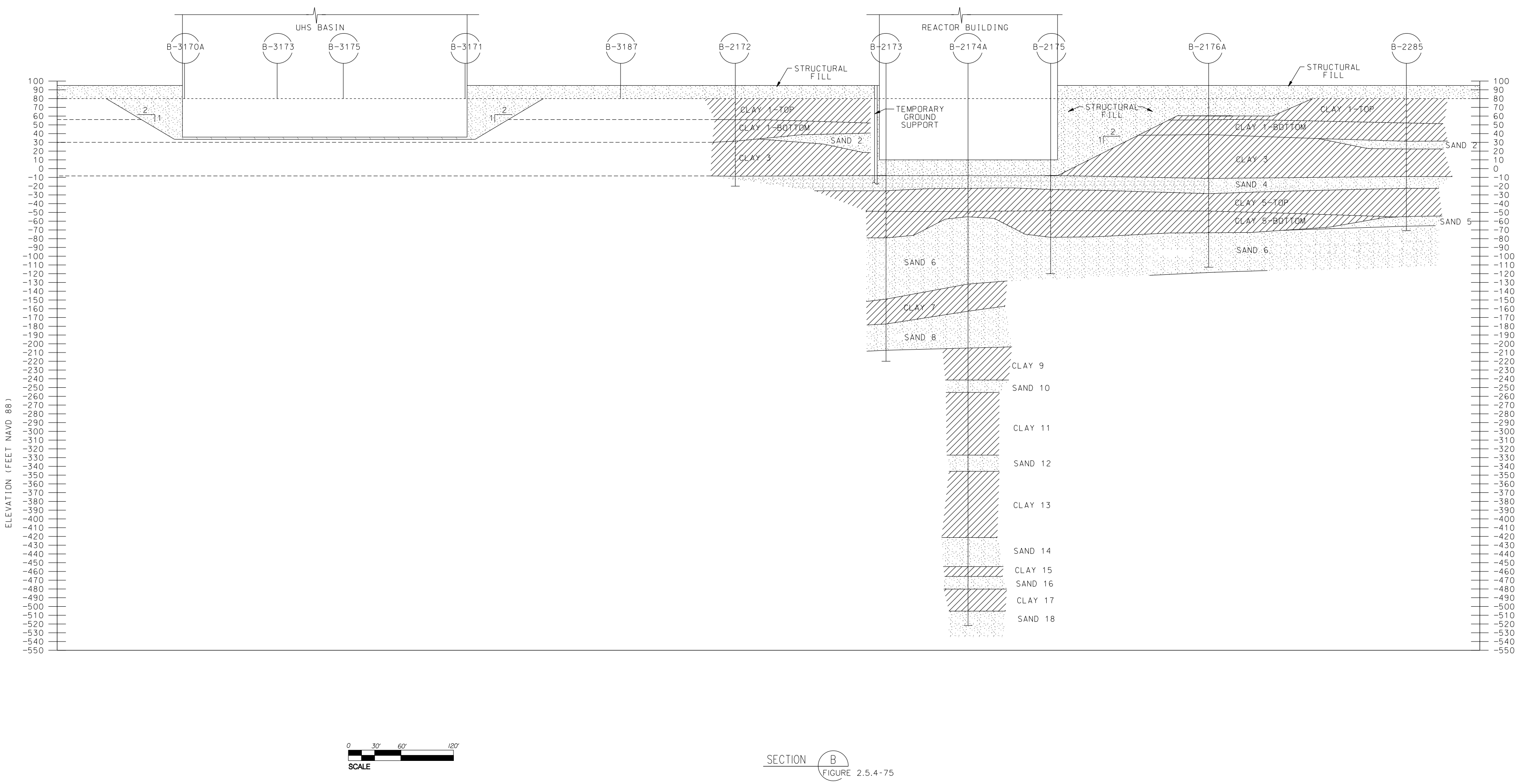


Figure 2.5.4-77 Representative Excavation Profile B; Unit 1 (East-West) (Power Block Area) (Based on a Typical LWR (with an Independent UHS))

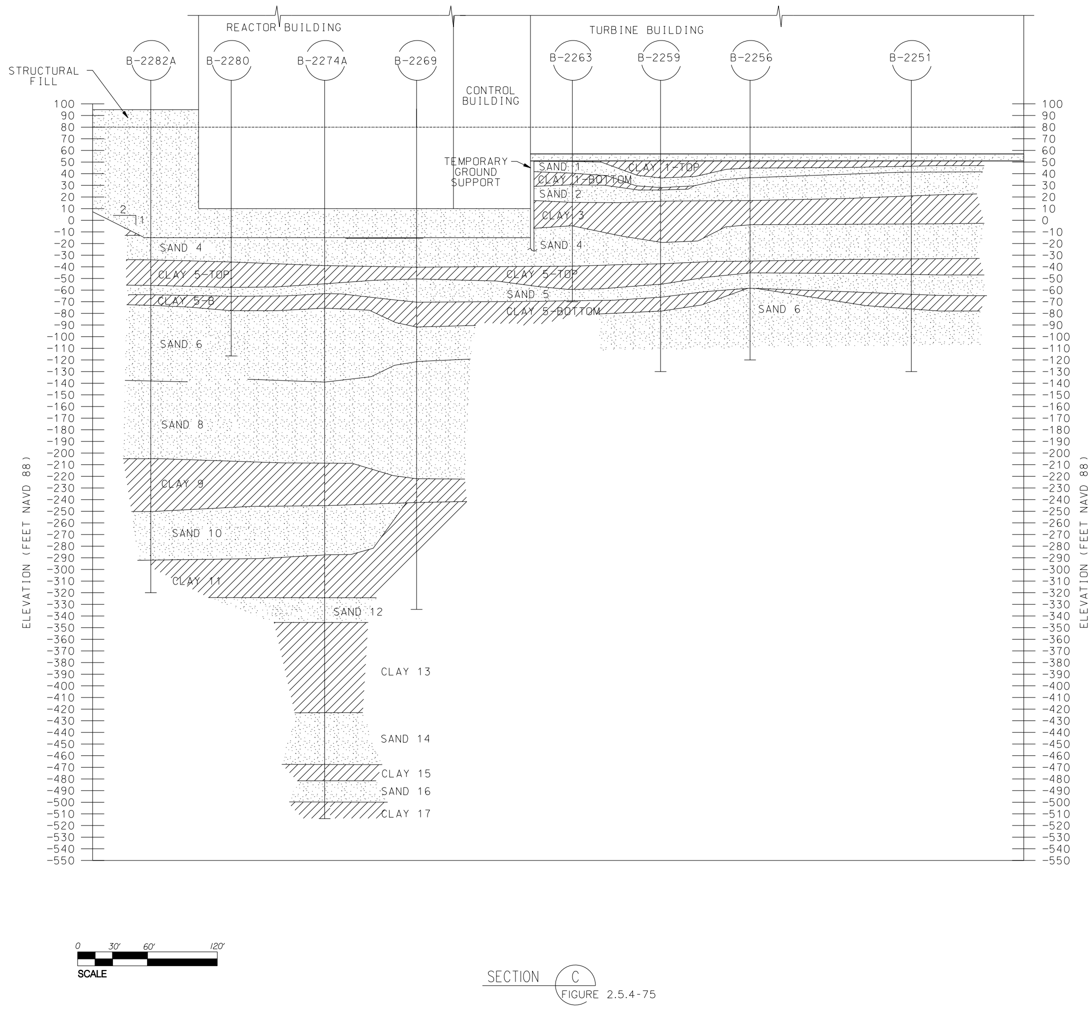


Figure 2.5.4-78 Representative Excavation Profile C; Unit 2 (North-South) (Power Block Area) (Based on a Typical LWR (with an Independent UHS))

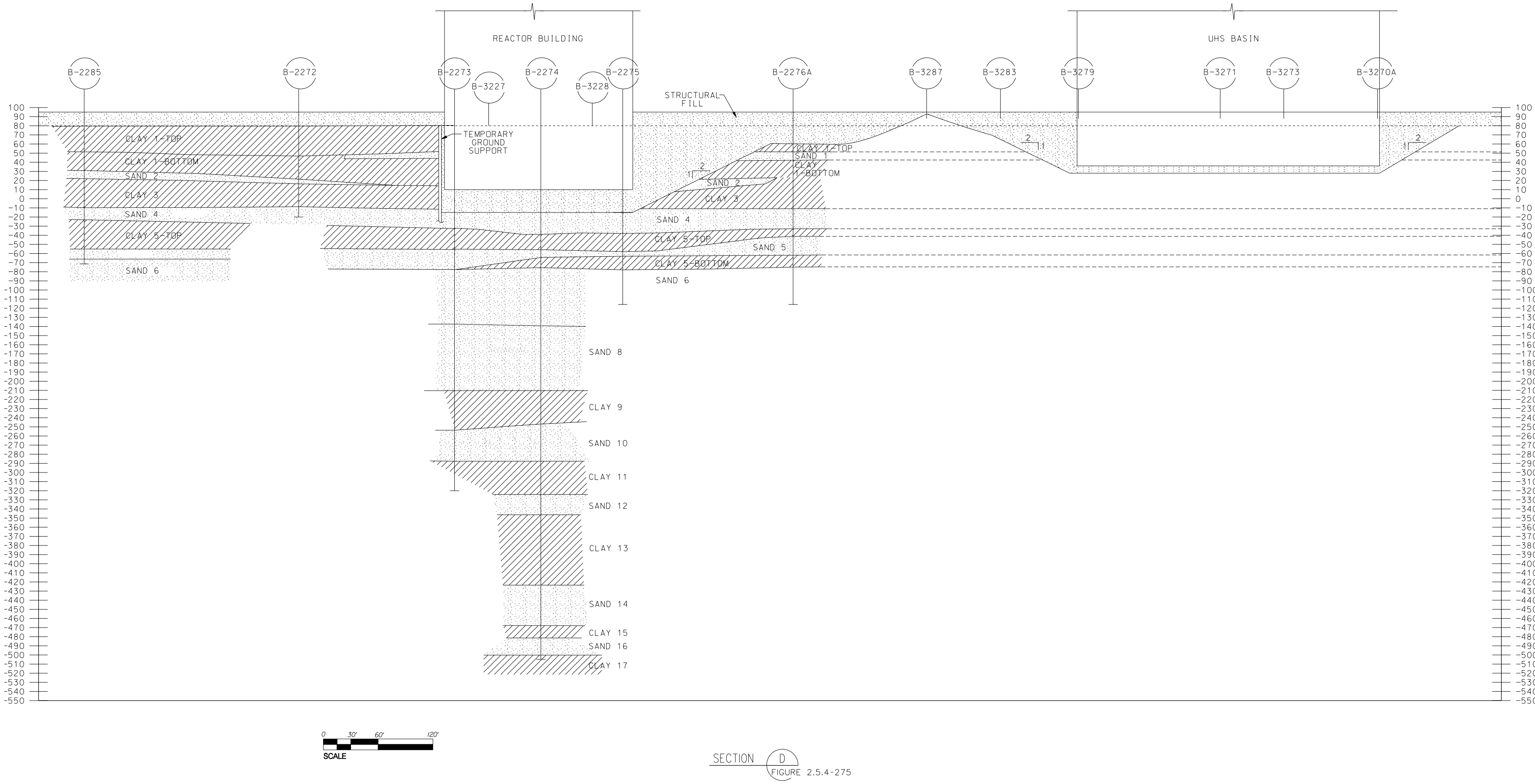


Figure 2.5.4-79 Representative Excavation Profile D; Unit 2 (East-West) (Power Block Area) (Based on a Typical LWR (with an Independent UHS))

Figure 2.5.4-80 Excavation Plan (Cooling Basin)

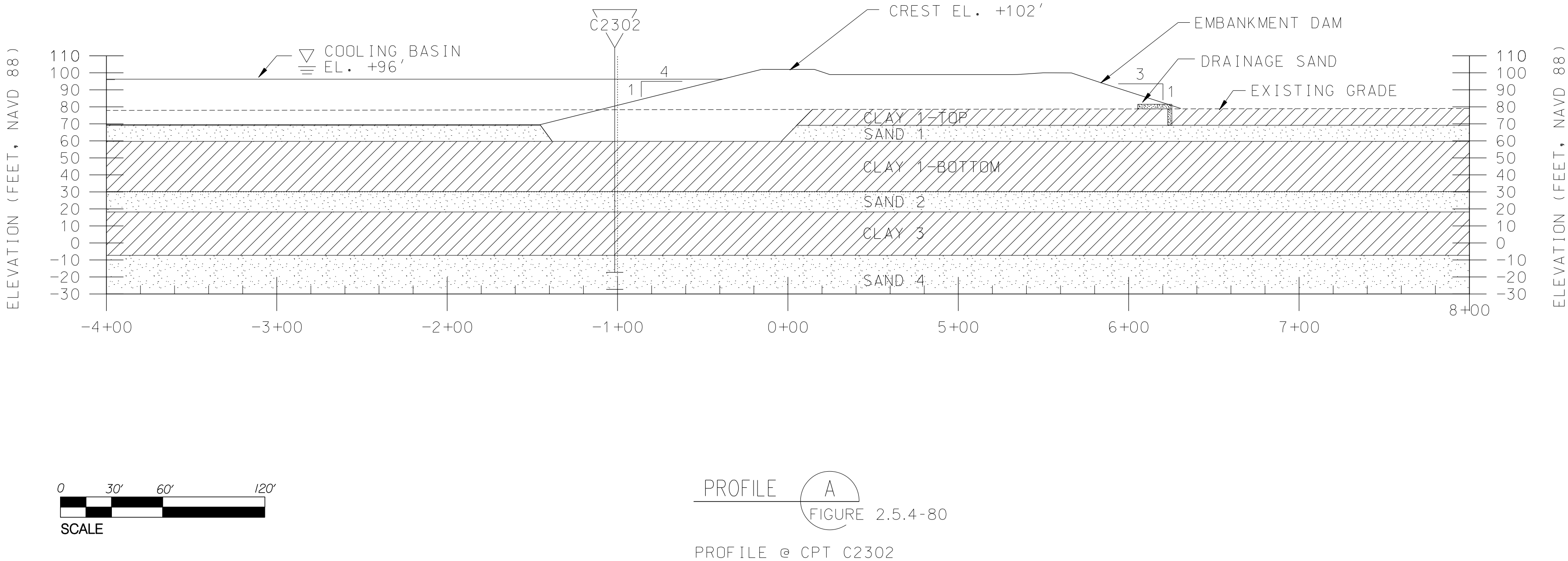


Figure 2.5.4-81 Embankment Profile A; North Embankment Dam of Cooling Basin at Cone Penetration Test C-2302 (North-South) (Cooling Basin)

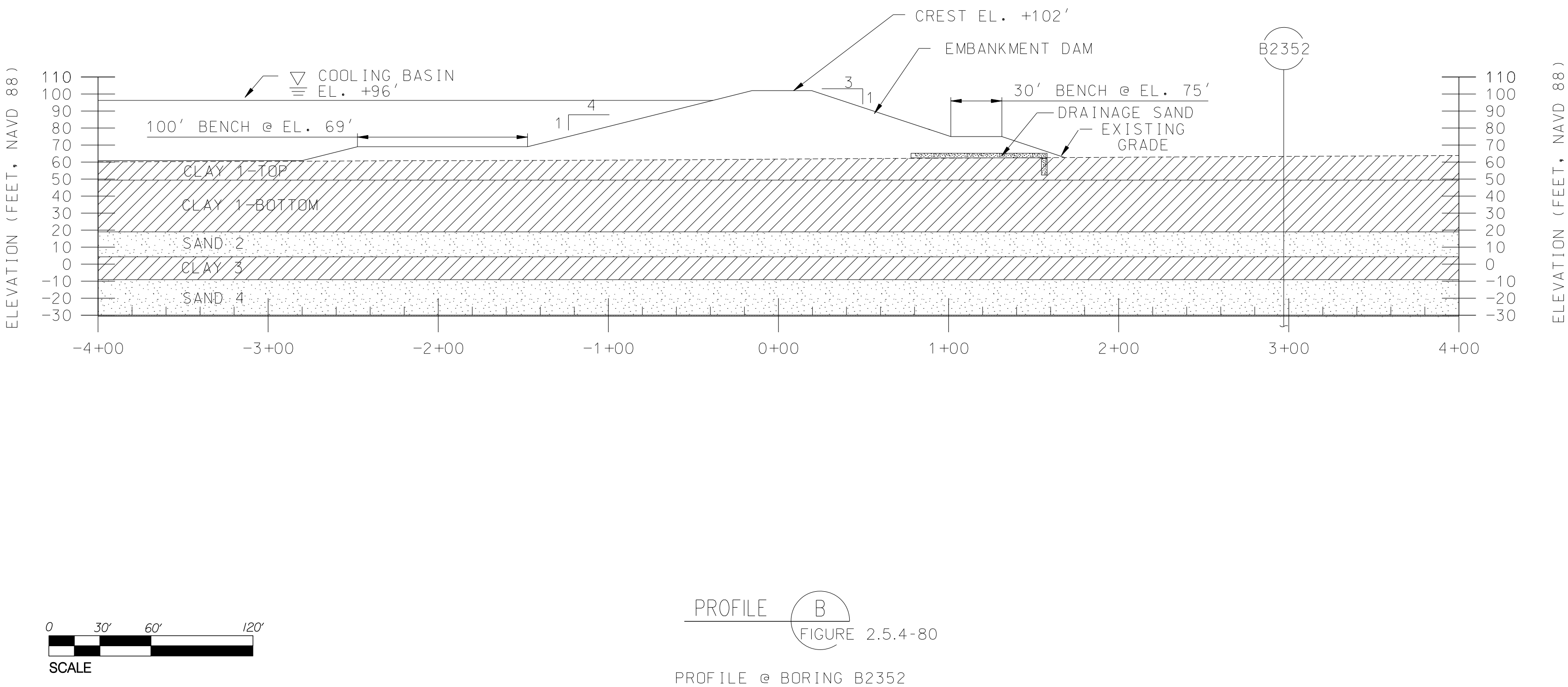


Figure 2.5.4-82 Embankment Profile B; South Embankment Dam of Cooling Basin at Boring B-2352 (North-South) (Cooling Basin)

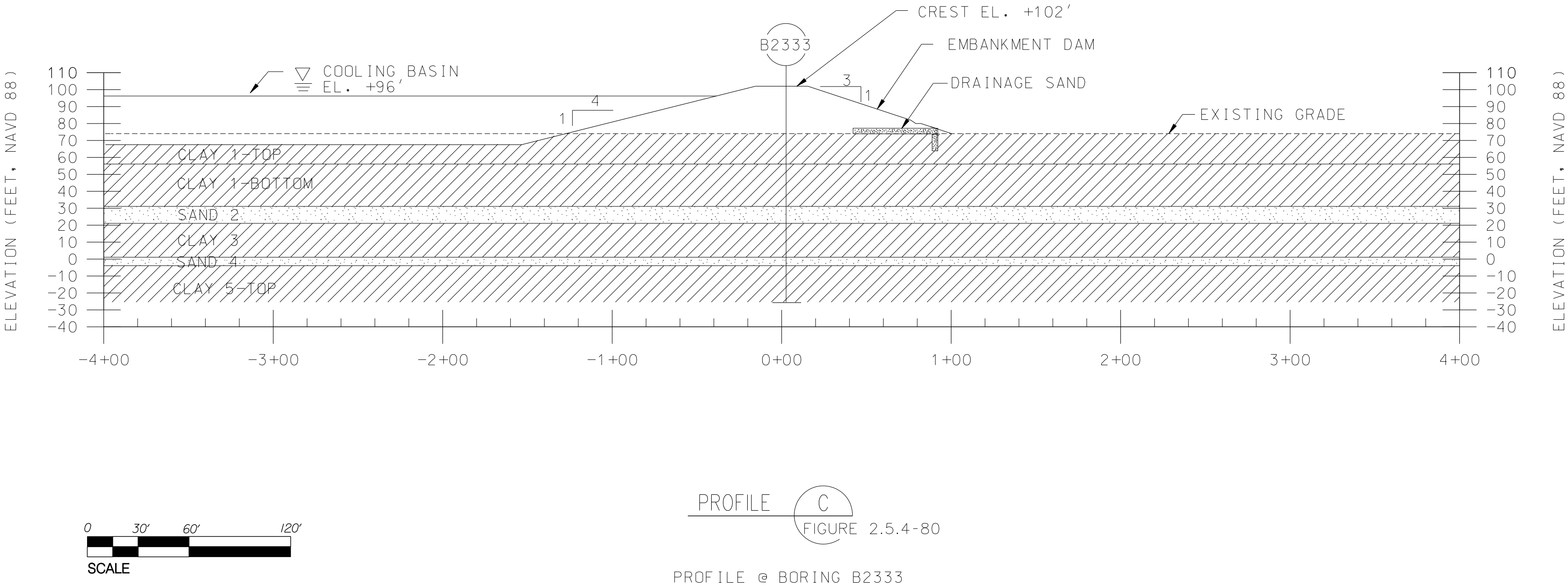


Figure 2.5.4-83 Embankment Profile C; West Embankment Dam of Cooling Basin at Boring B-2333 (East-West) (Cooling Basin)

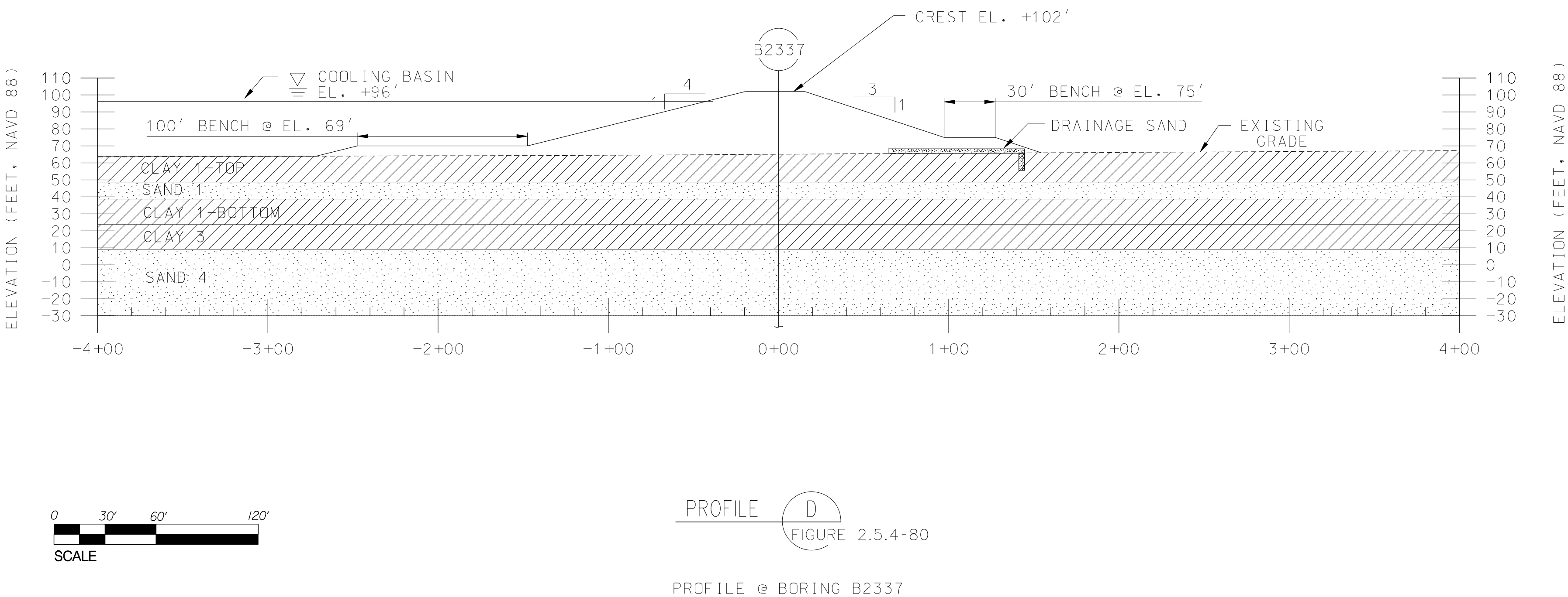


Figure 2.5.4-84 Embankment Profile D; East Embankment Dam of Cooling Basin at Boring B-2337 (East-West) (Cooling Basin)

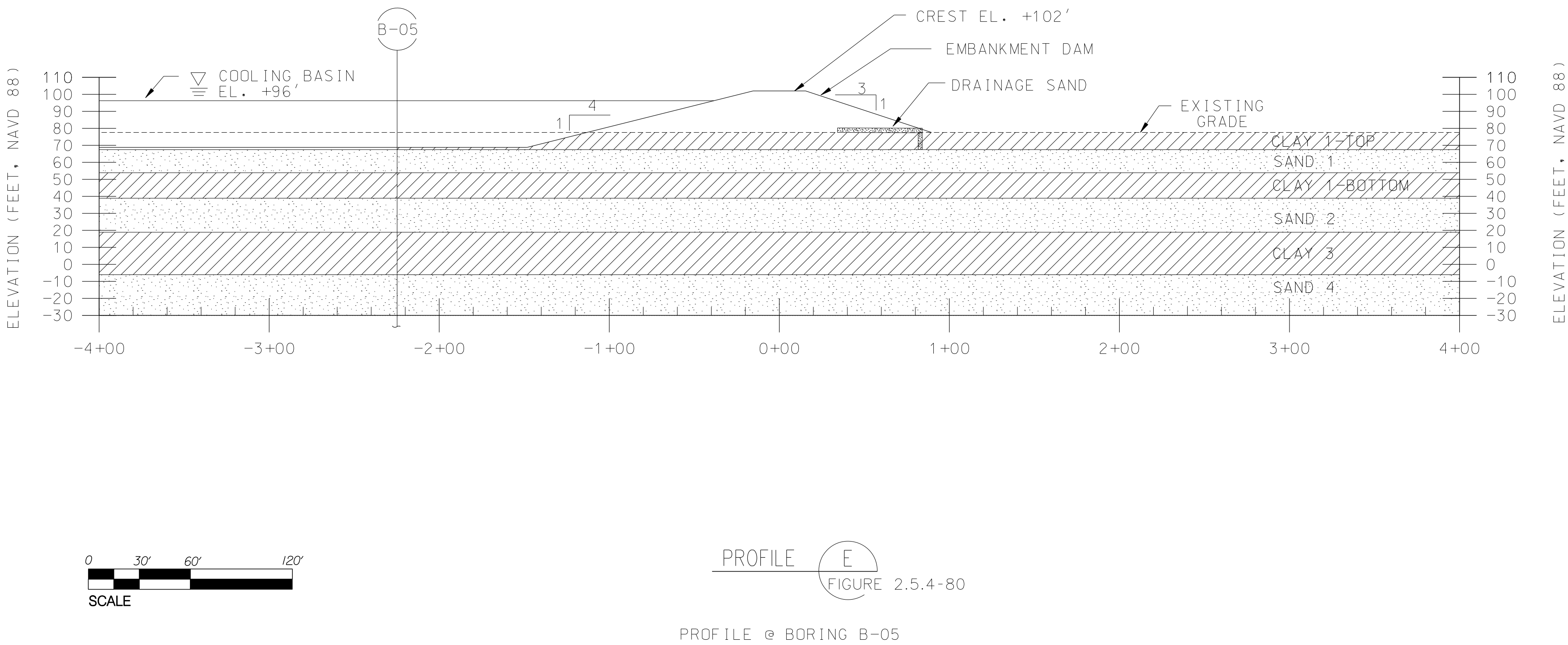


Figure 2.5.4-85 Embankment Profile E; East Embankment Dam of Cooling Basin at Boring B-05 (East-West) (Cooling Basin)

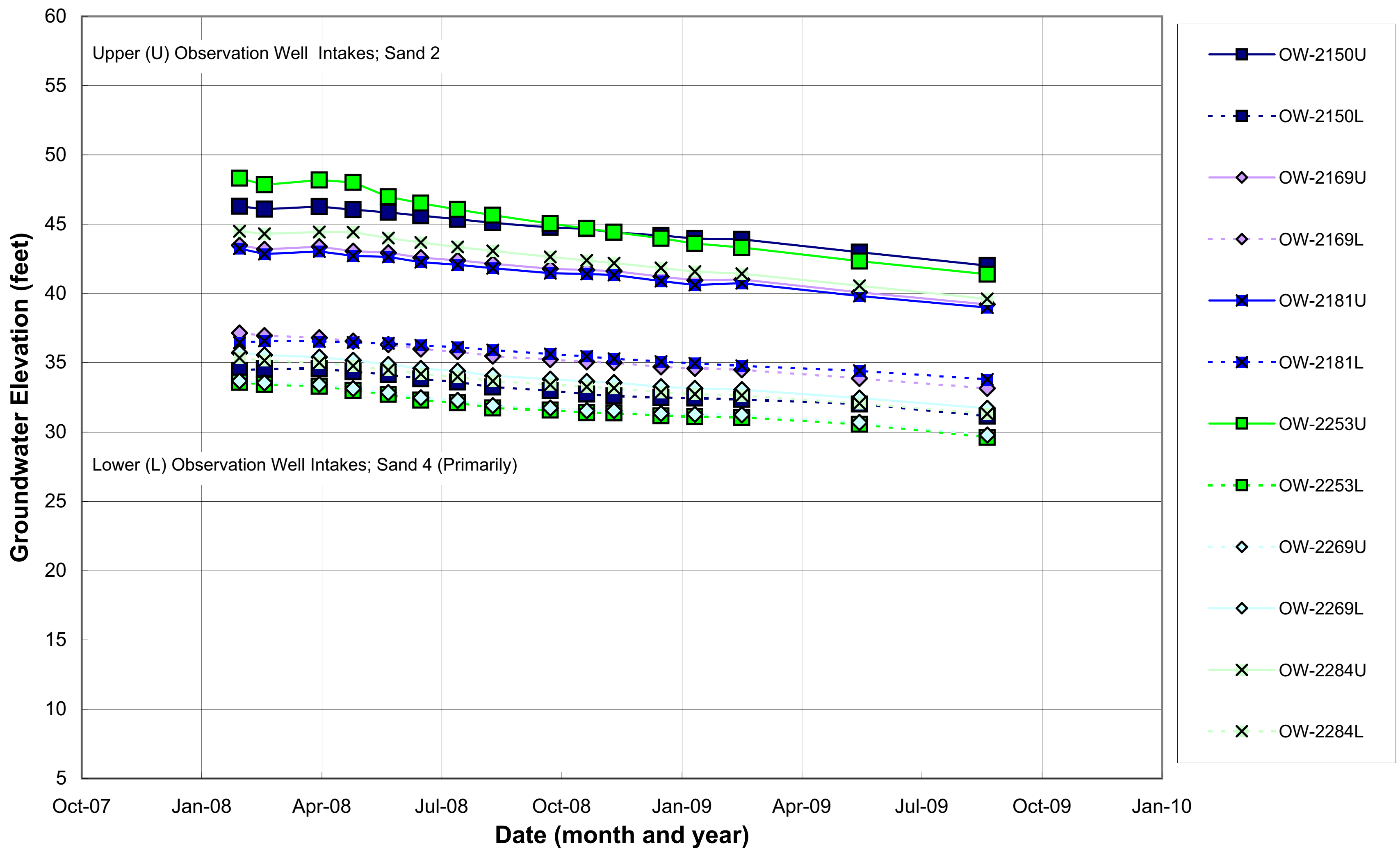


Figure 2.5.4-86 Measured Groundwater Levels; Unit 1 and Unit 2 (Power Block Area)

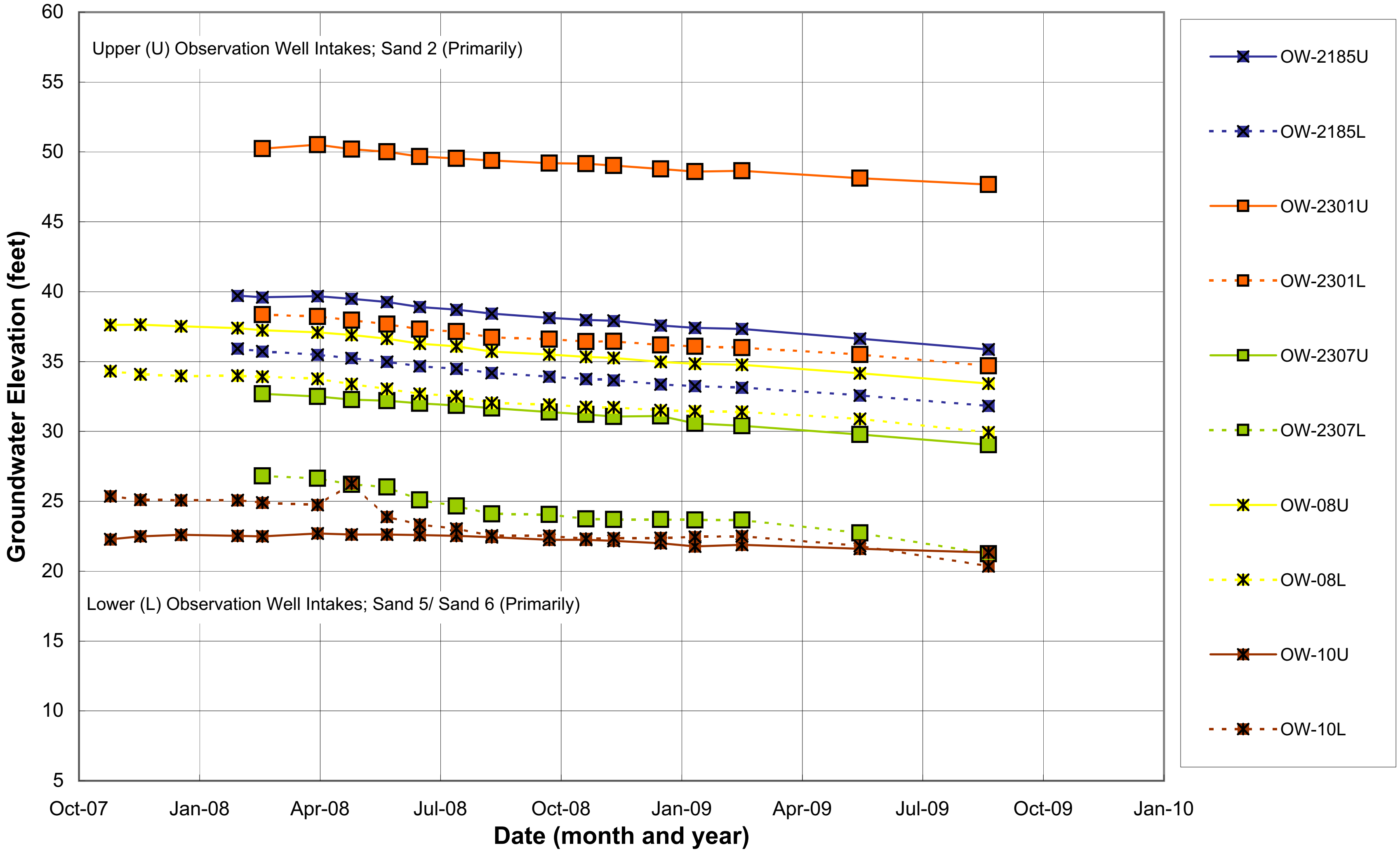


Figure 2.5.4-87 Measured Groundwater Levels; Investigations Outside Power Block Area

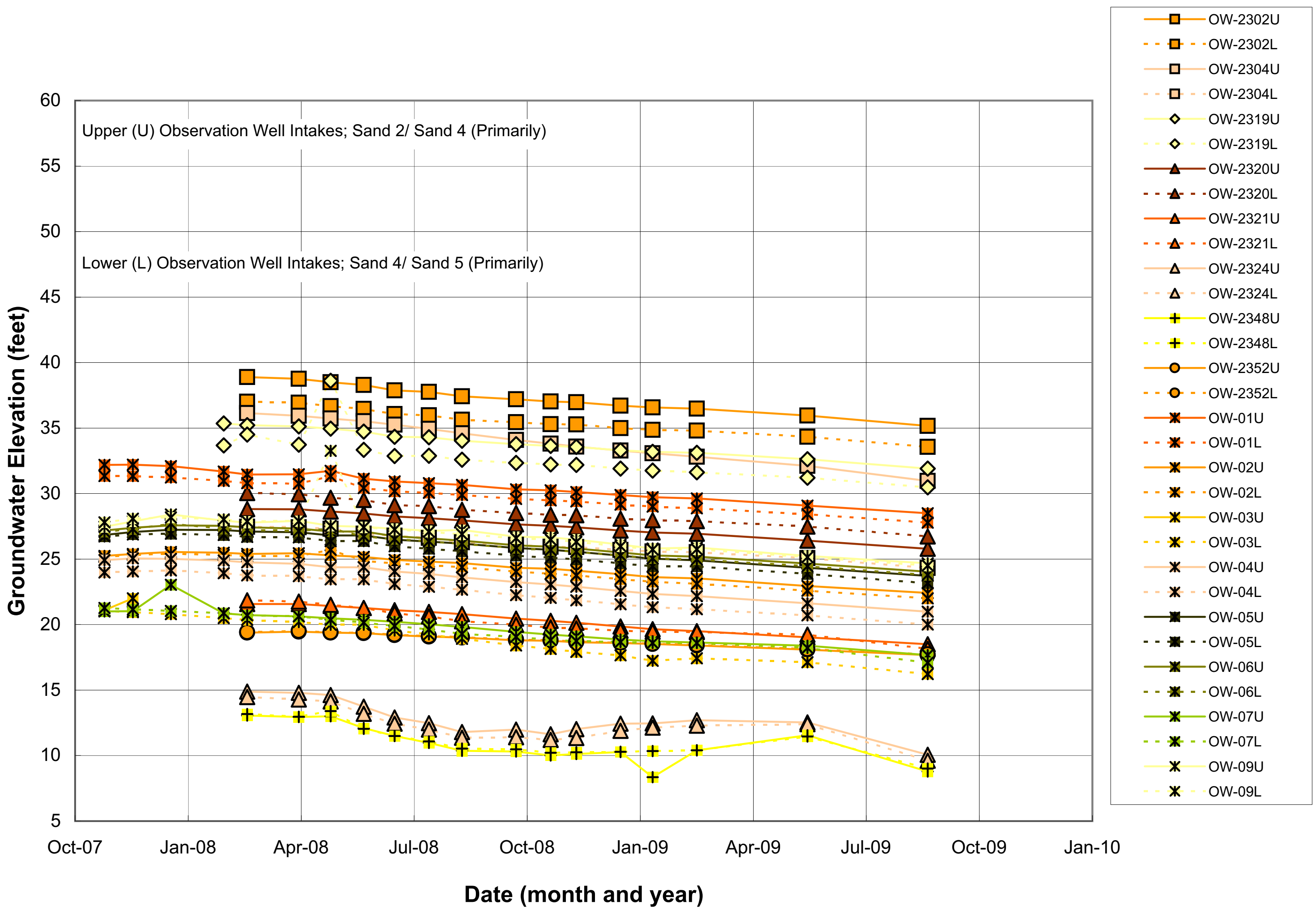


Figure 2.5.4-88 Measured Groundwater Levels; All Measurements; Cooling Basin

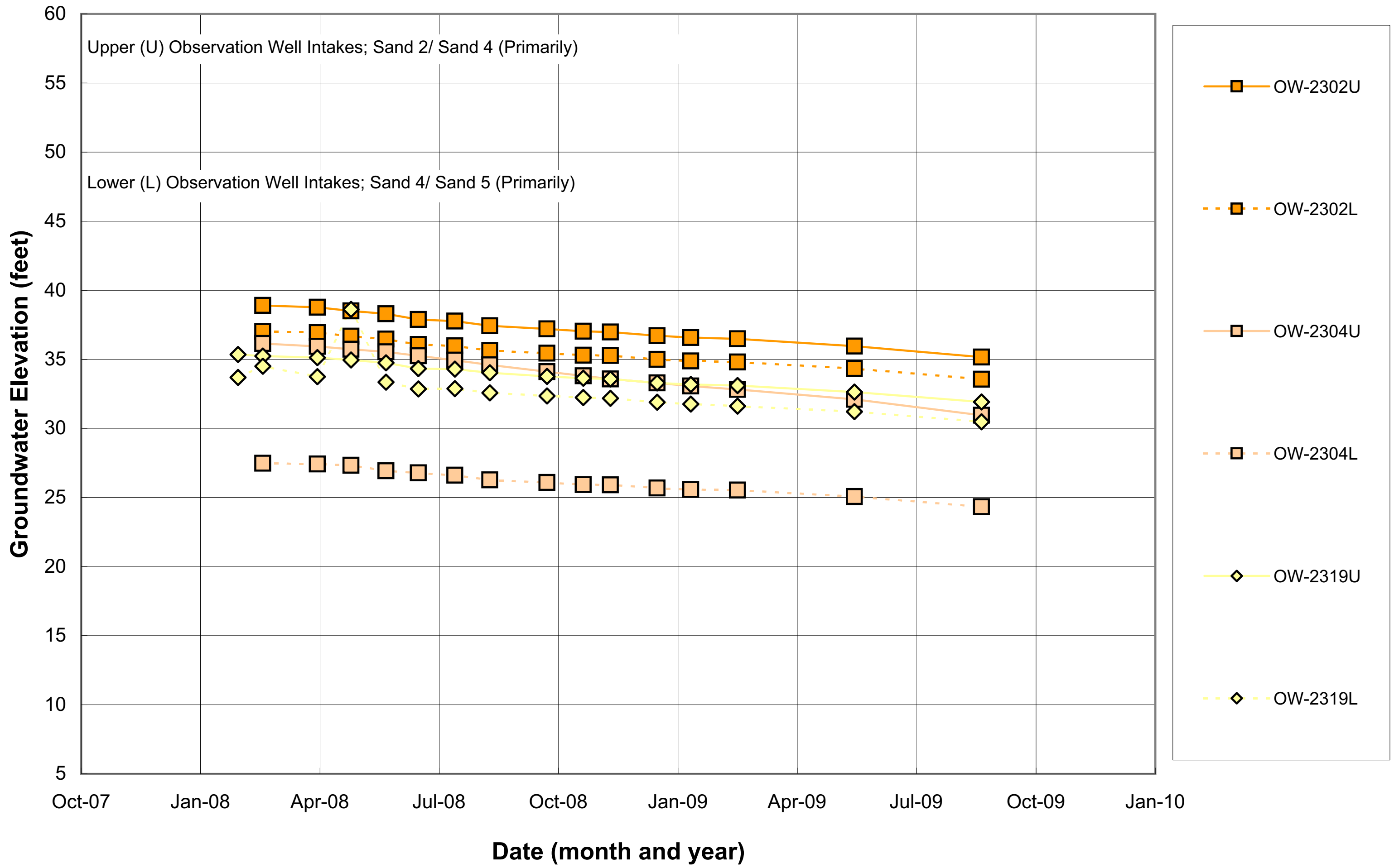


Figure 2.5.4-89 Measured Groundwater Levels; West Area Measurements; Cooling Basin

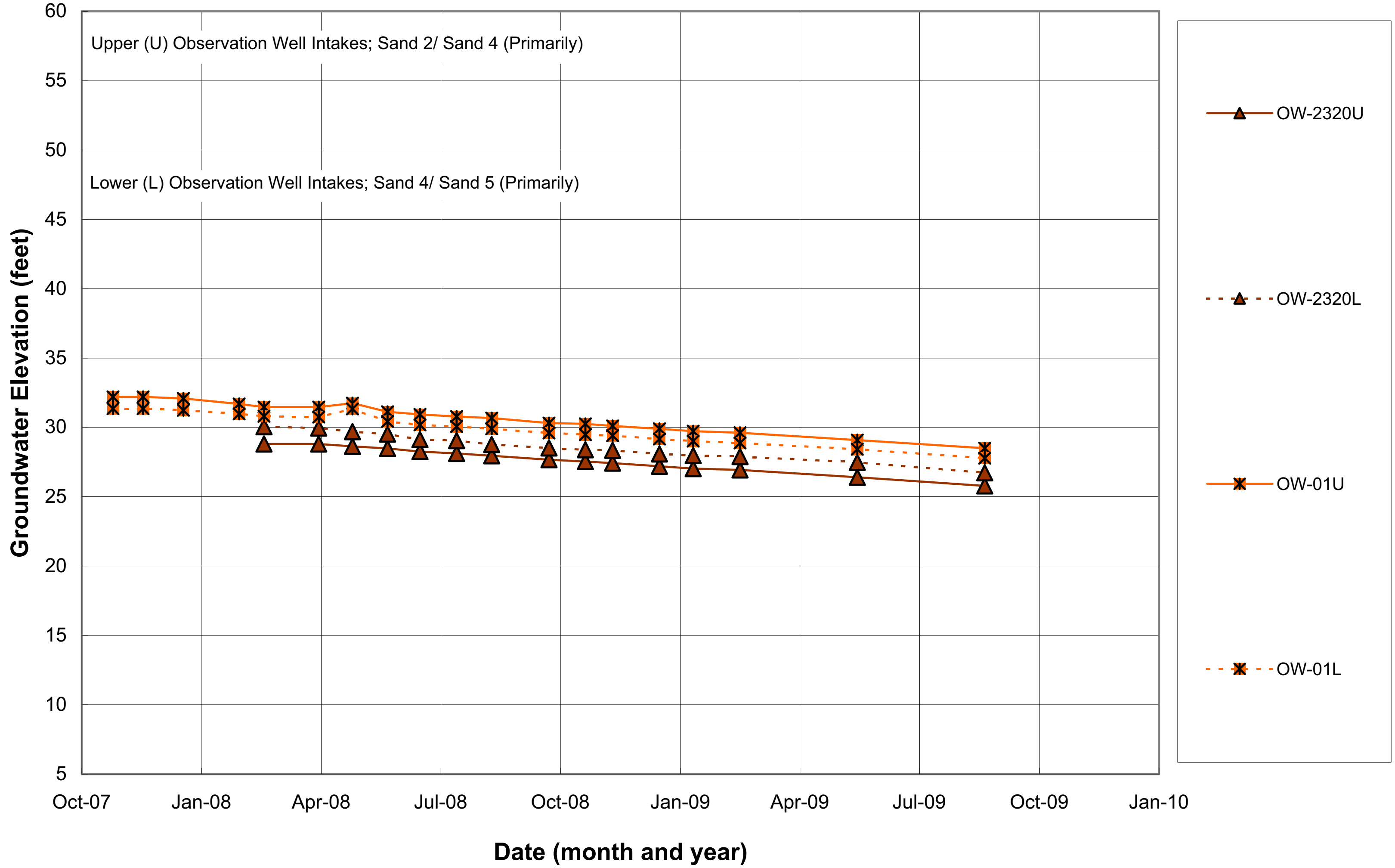


Figure 2.5.4-90   Measured Groundwater Levels; Central Area Measurements; Cooling Basin

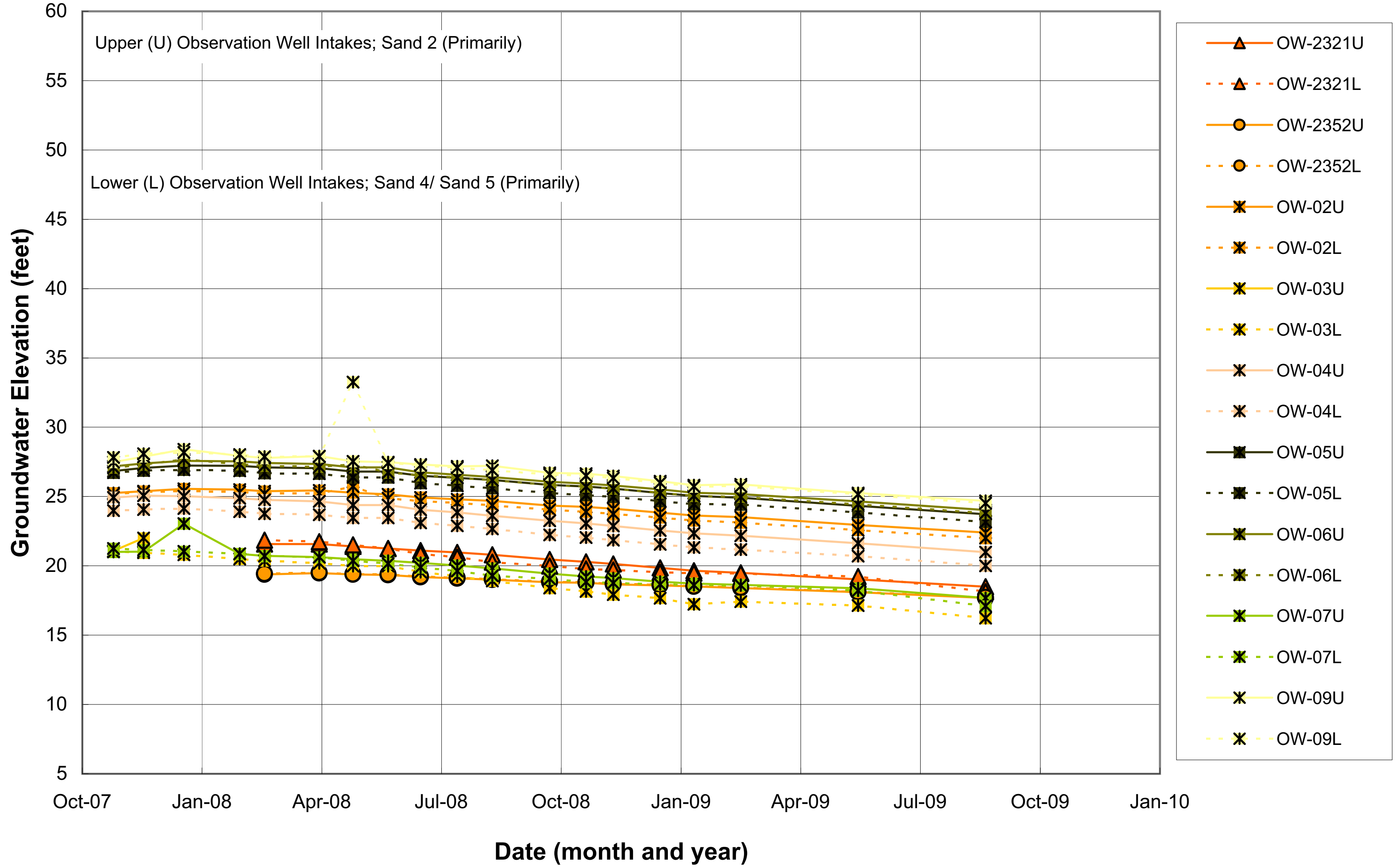


Figure 2.5.4-91 Measured Groundwater Levels; East Area Measurements; Cooling Basin

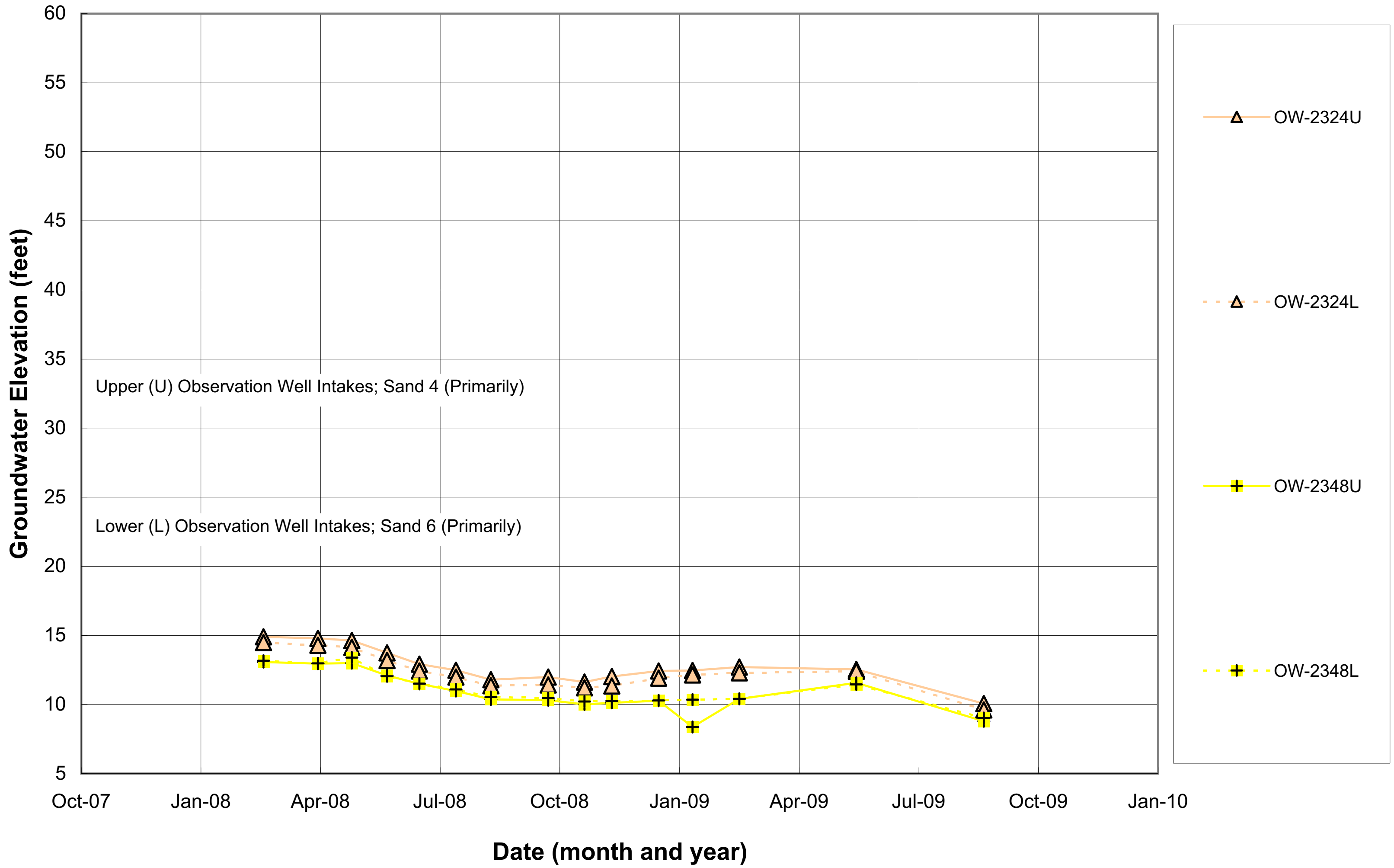


Figure 2.5.4-92 Measured Groundwater Levels; Linn Lake Area Measurements; East of Cooling Basin

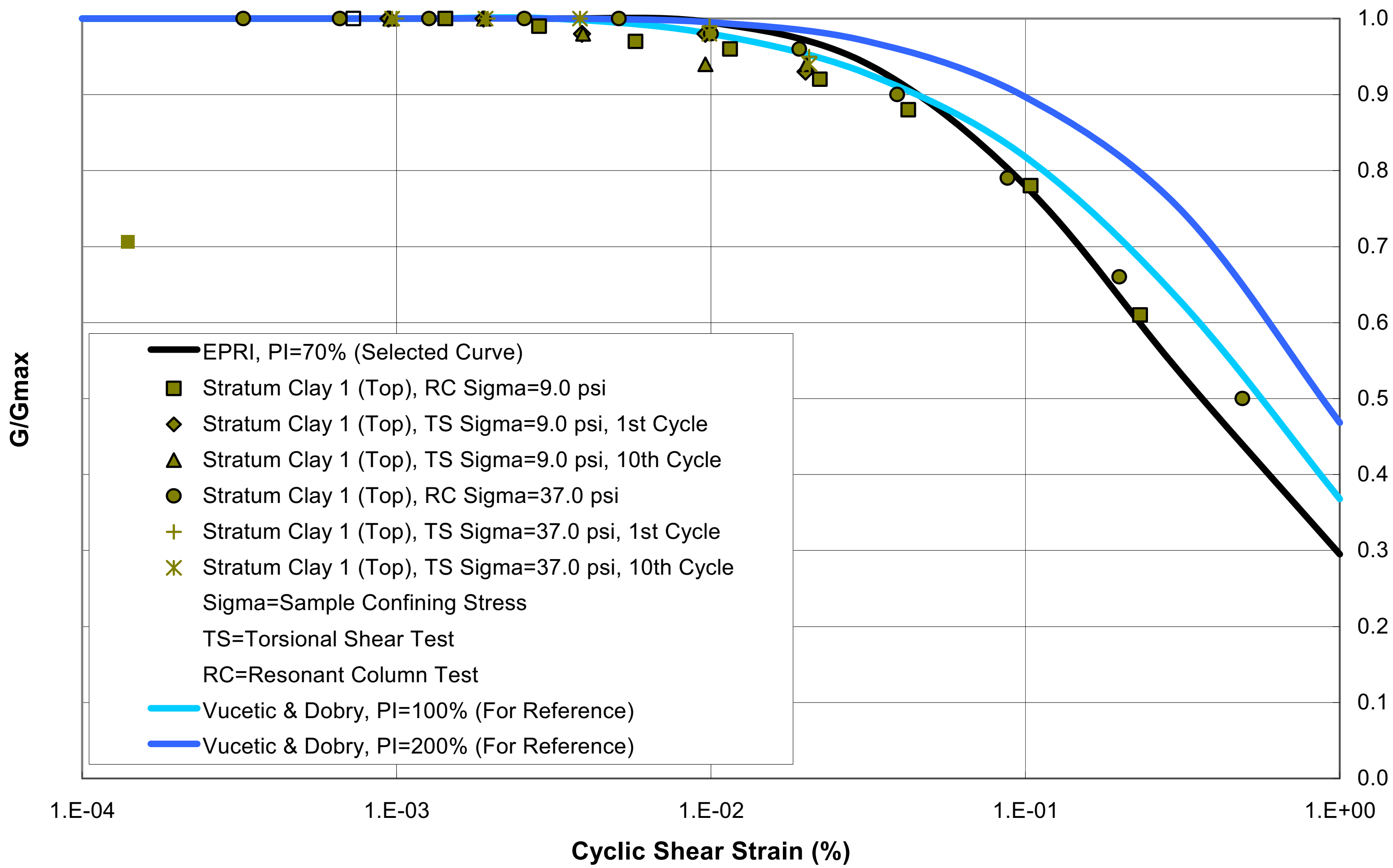


Figure 2.5.4-93 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 1 (Top) (Power Block Area)

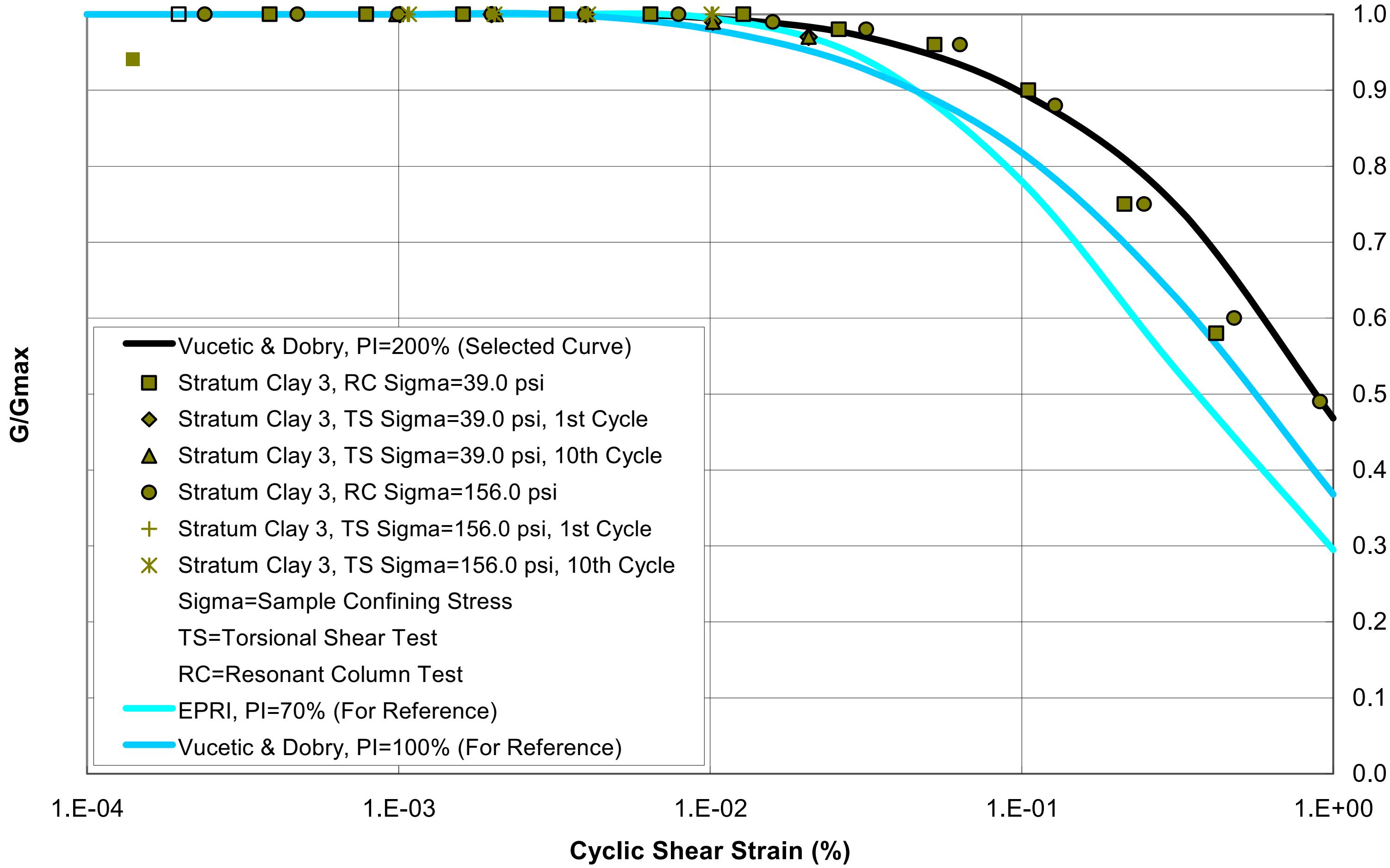


Figure 2.5.4-94 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 3 (Power Block Area)

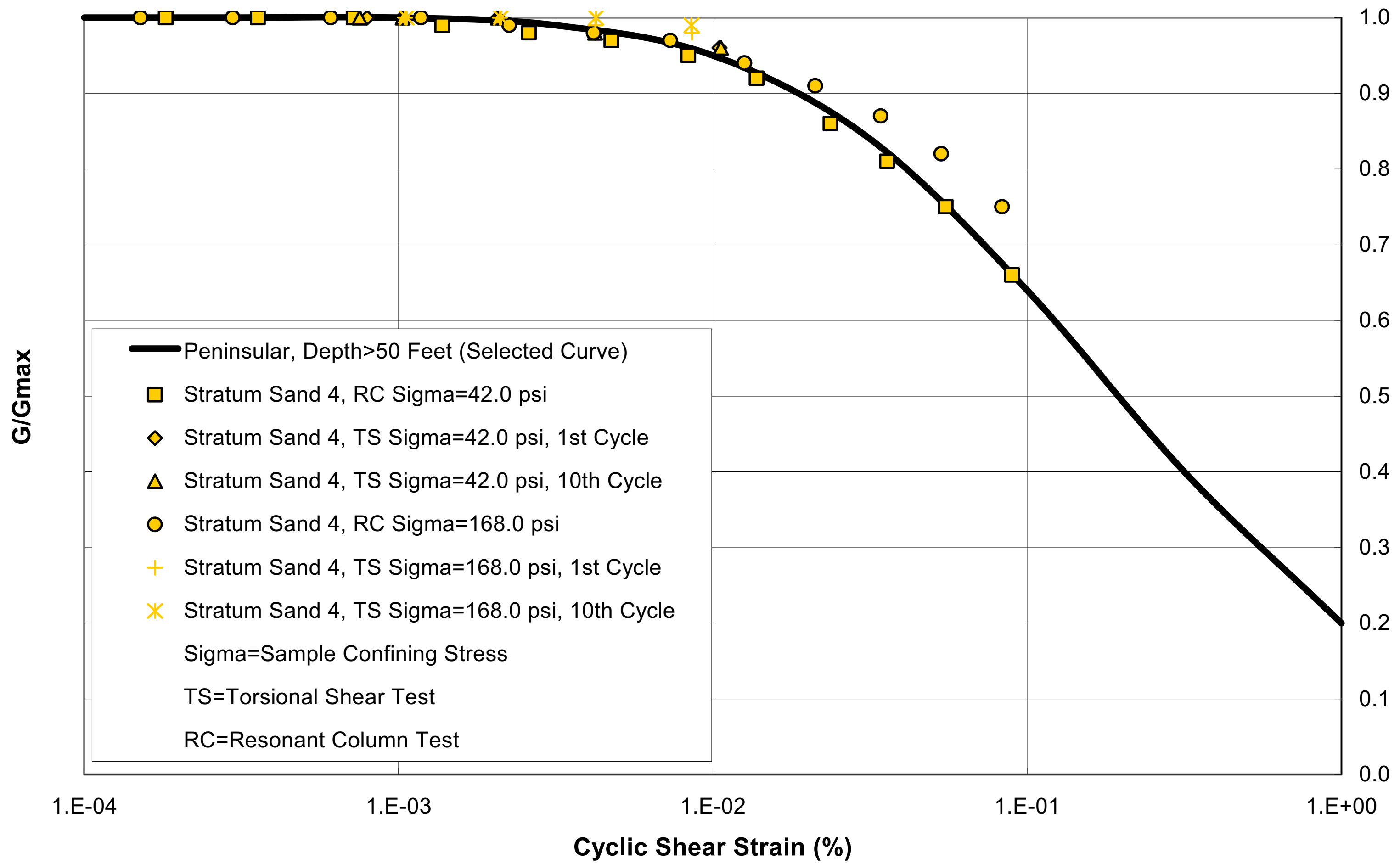


Figure 2.5.4-95 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 4 (Power Block Area)

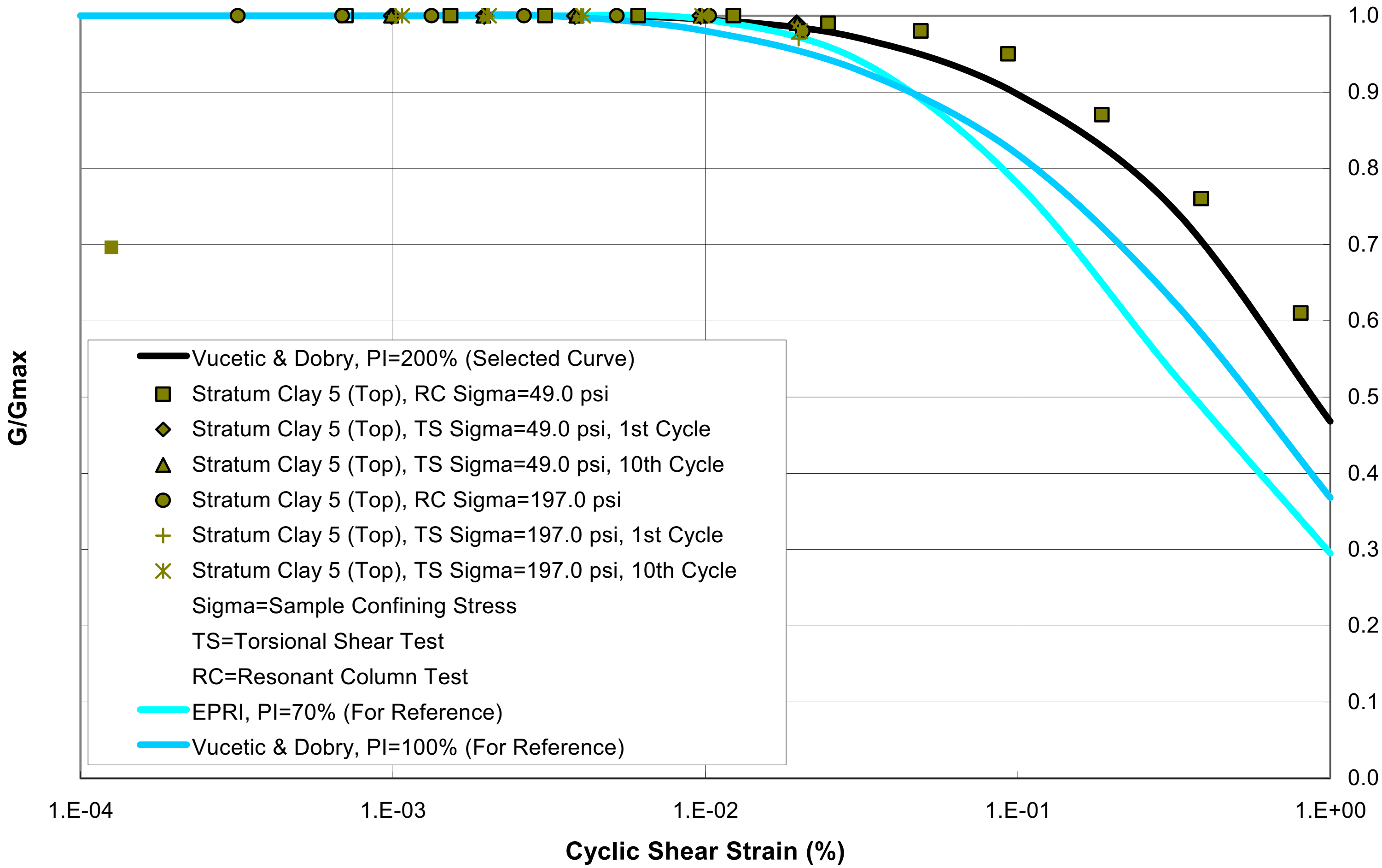


Figure 2.5.4-96 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 5 (Top) (Power Block Area)

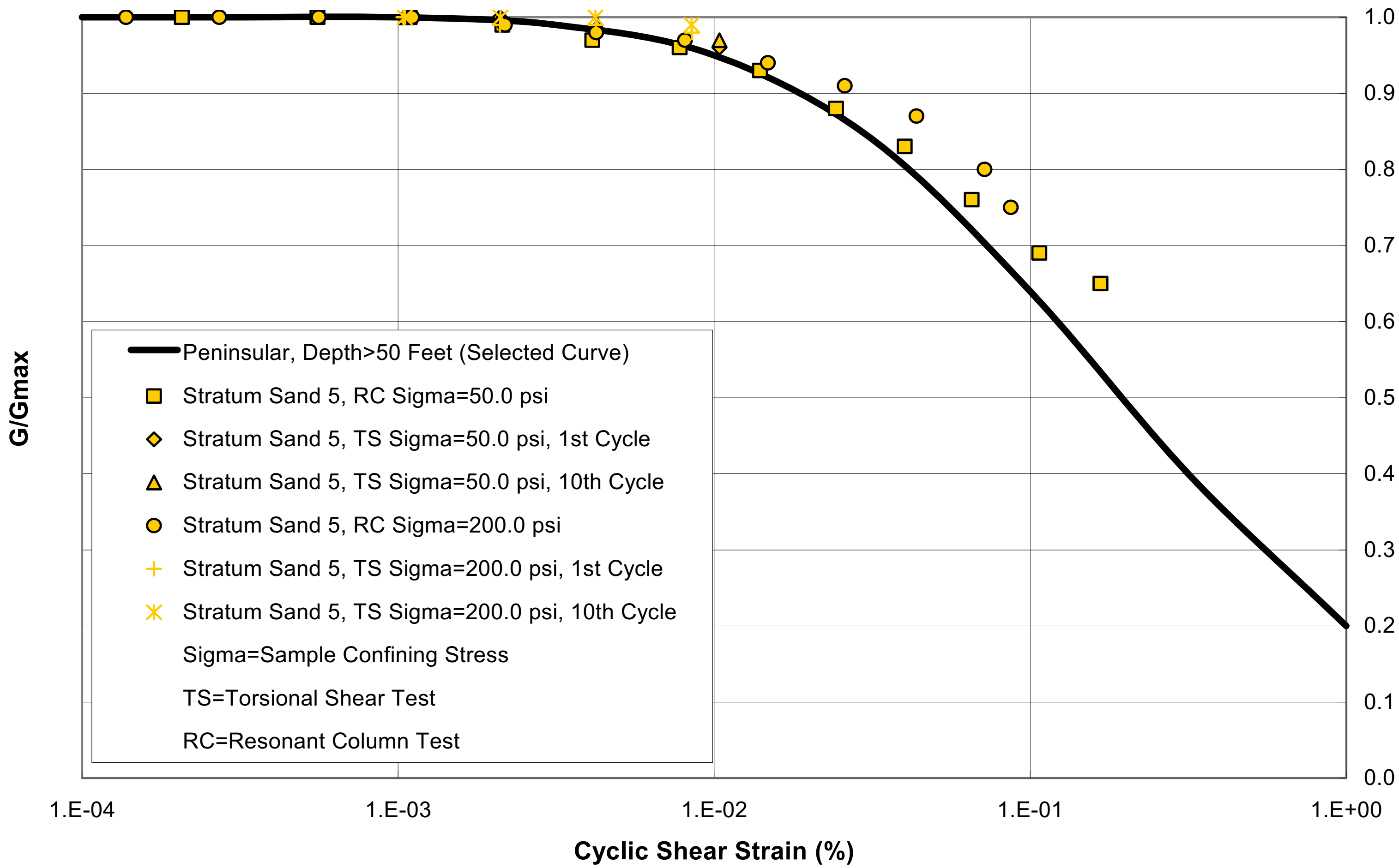


Figure 2.5.4-97 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 5 (Power Block Area)

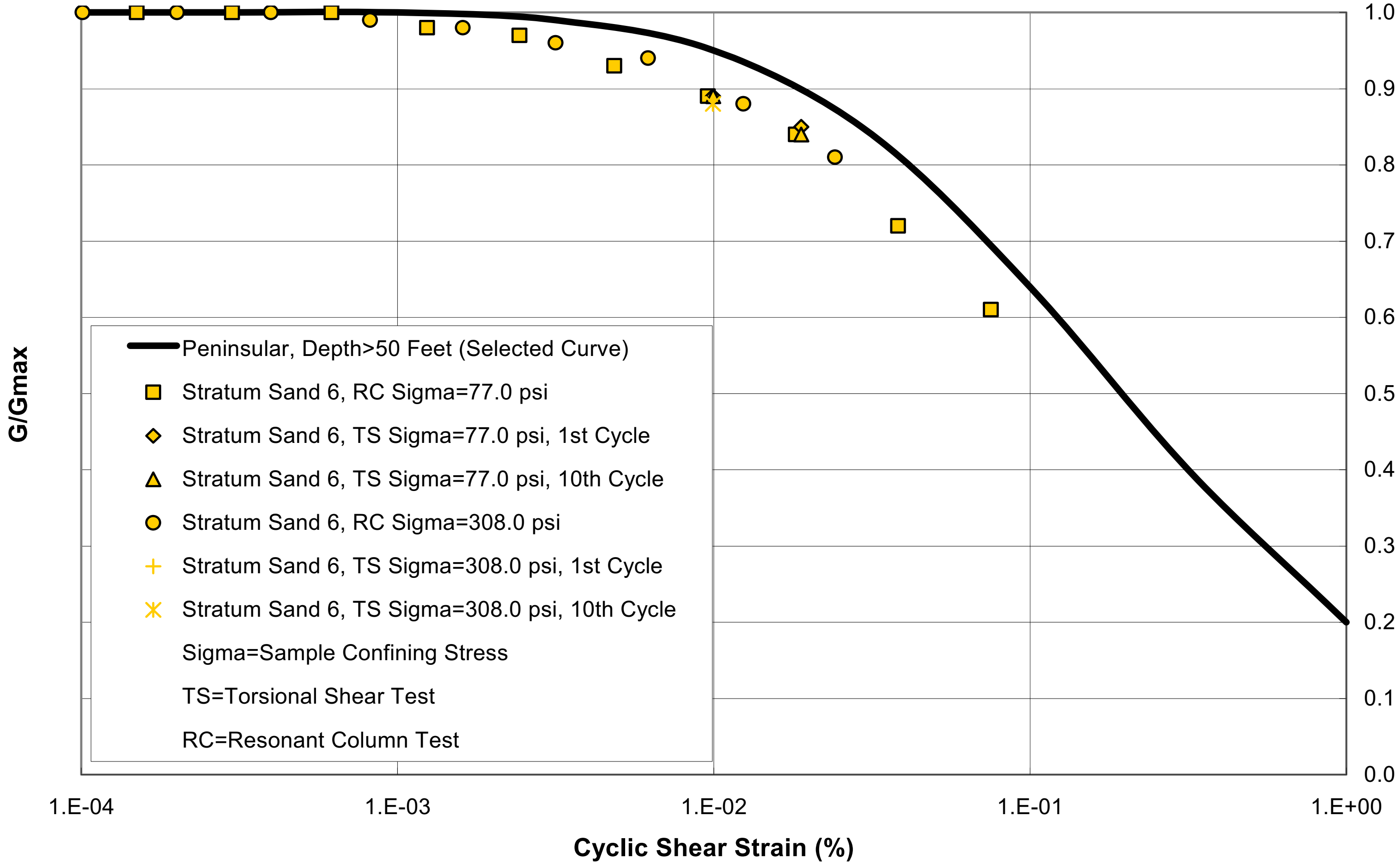


Figure 2.5.4-98 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 6 (Power Block Area)

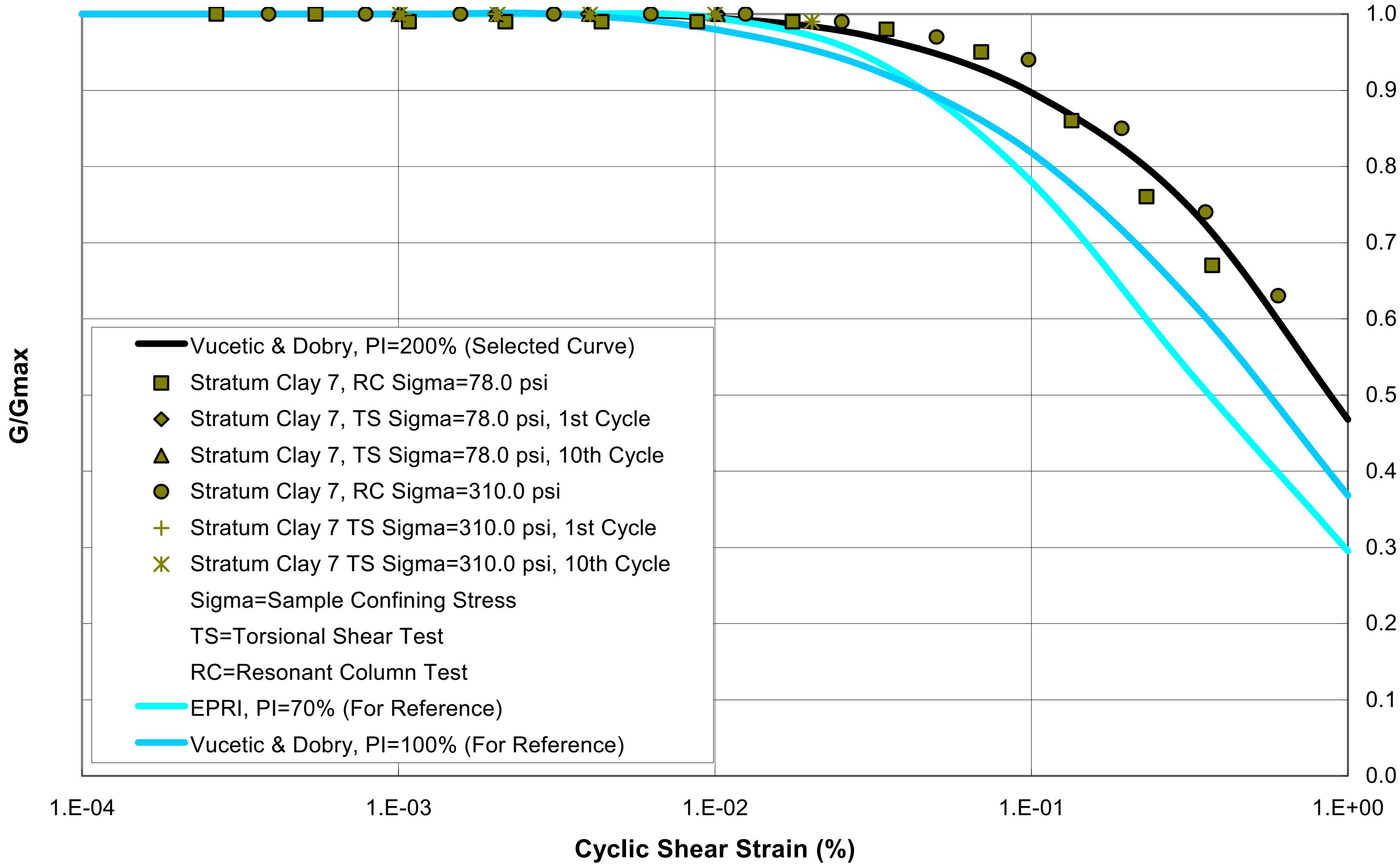


Figure 2.5.4-99 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 7 (Power Block Area)

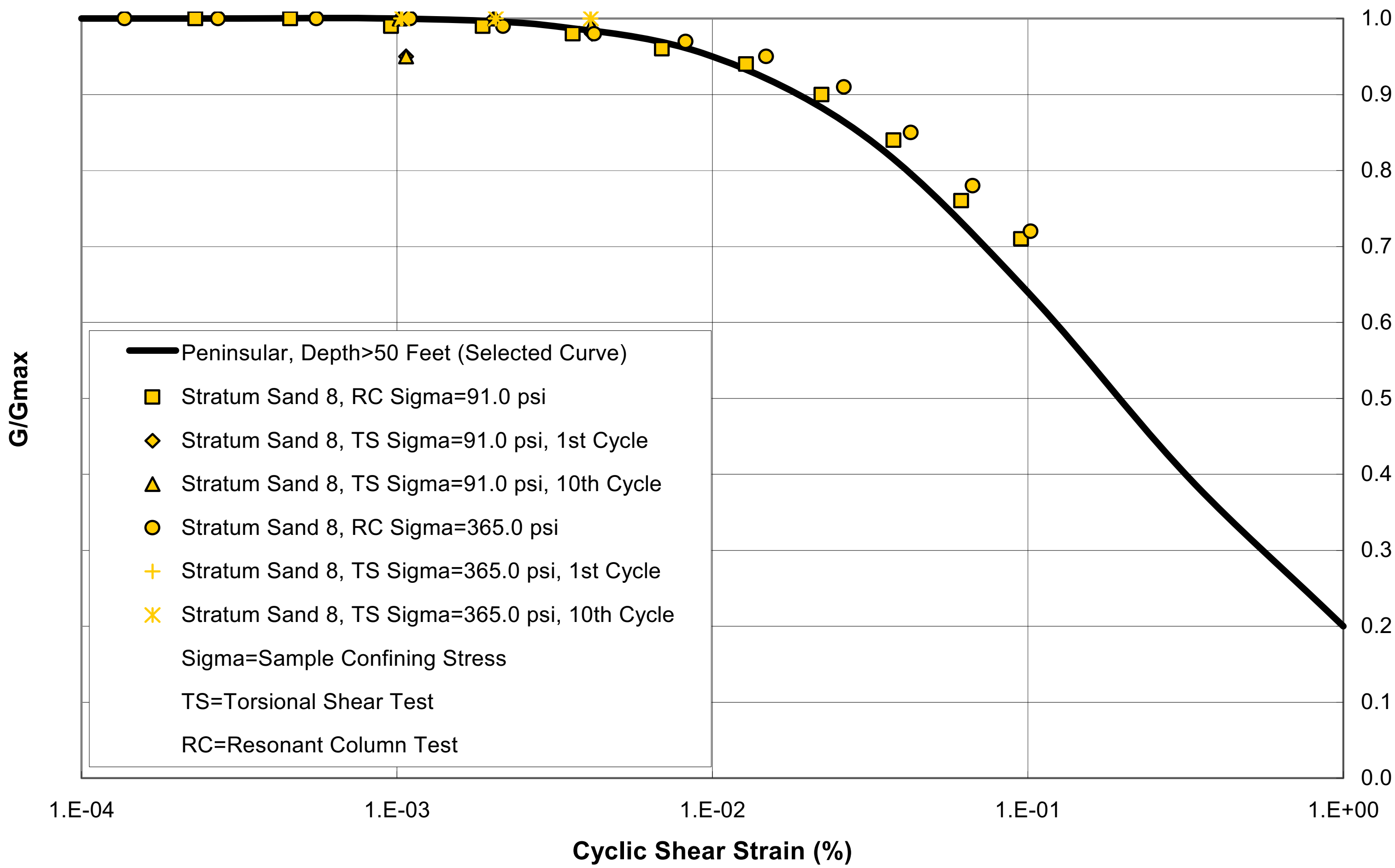


Figure 2.5.4-100 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 8 (Power Block Area)

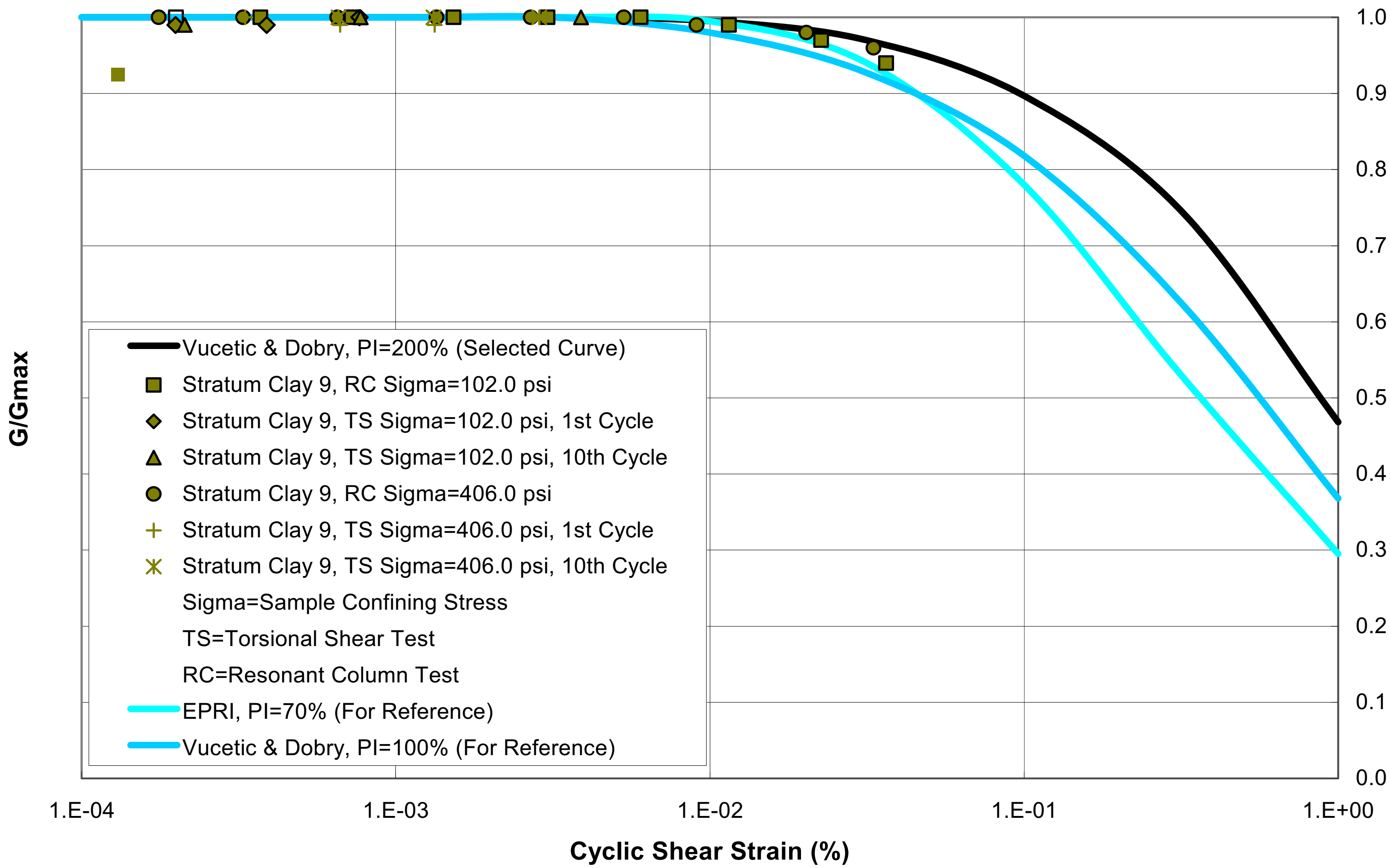


Figure 2.5.4-101 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 9 (Power Block Area)

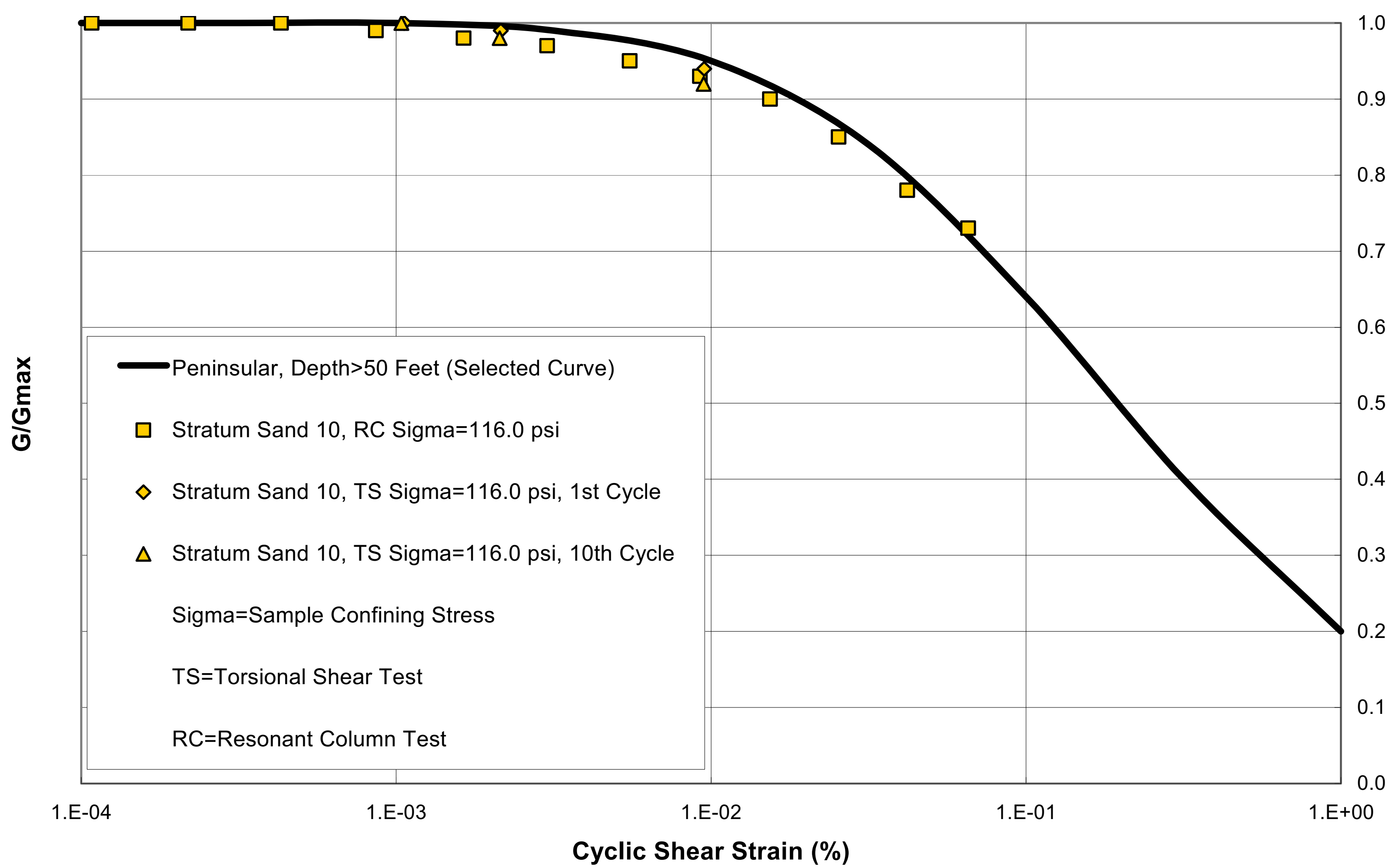


Figure 2.5.4-102 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 10 (Power Block Area)

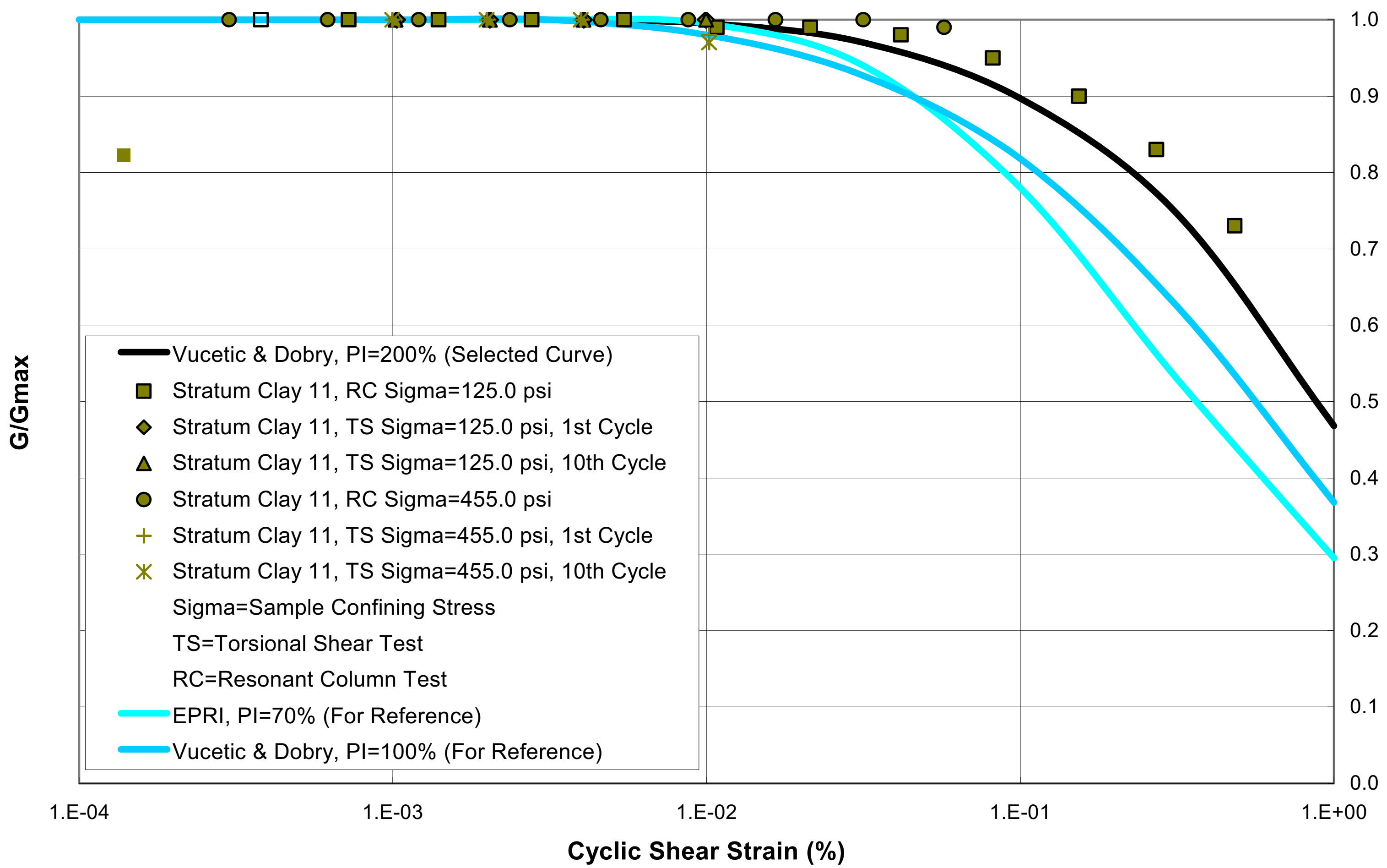


Figure 2.5.4-103 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 11 (Power Block Area)

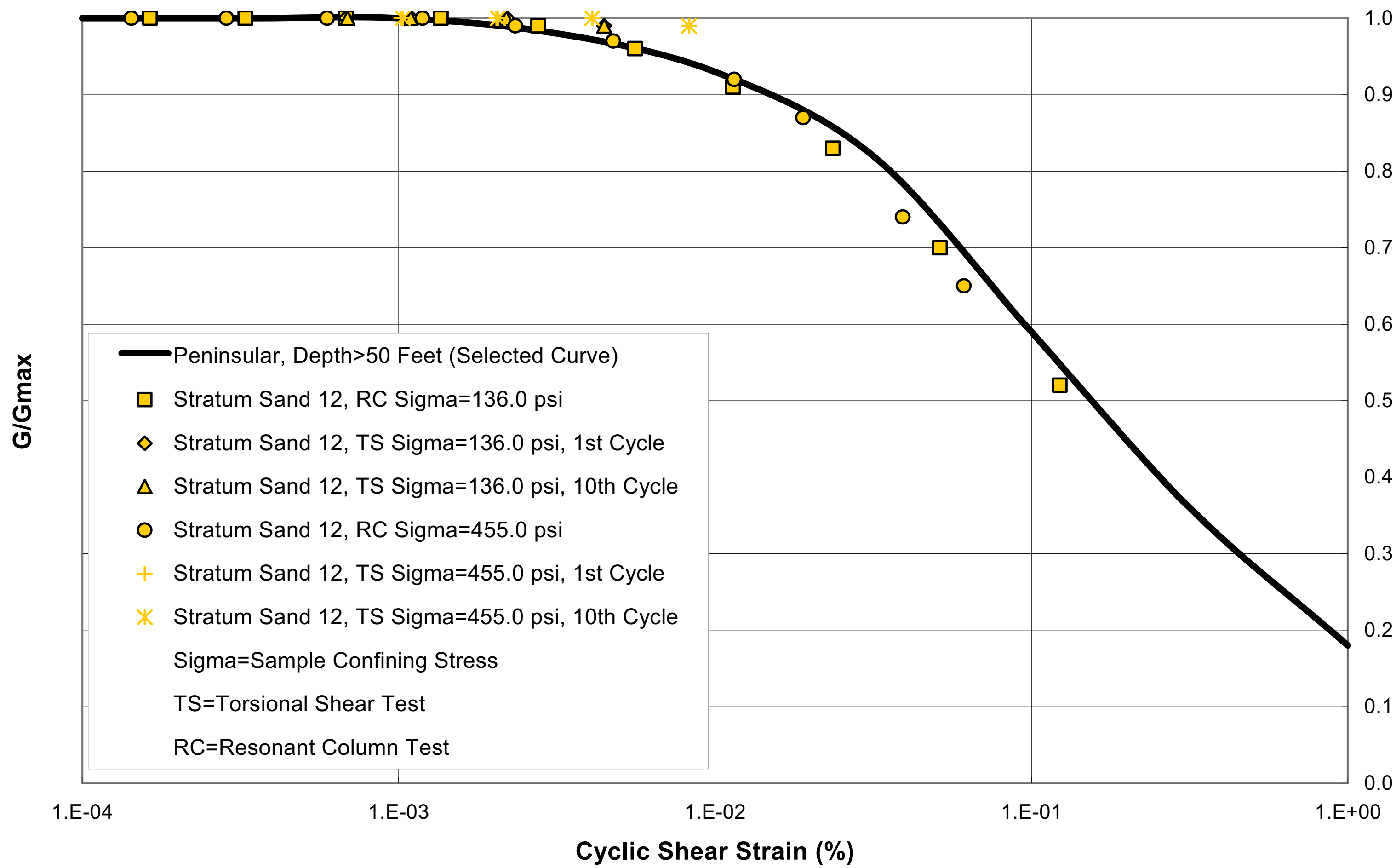


Figure 2.5.4-104 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 12 (Power Block Area)

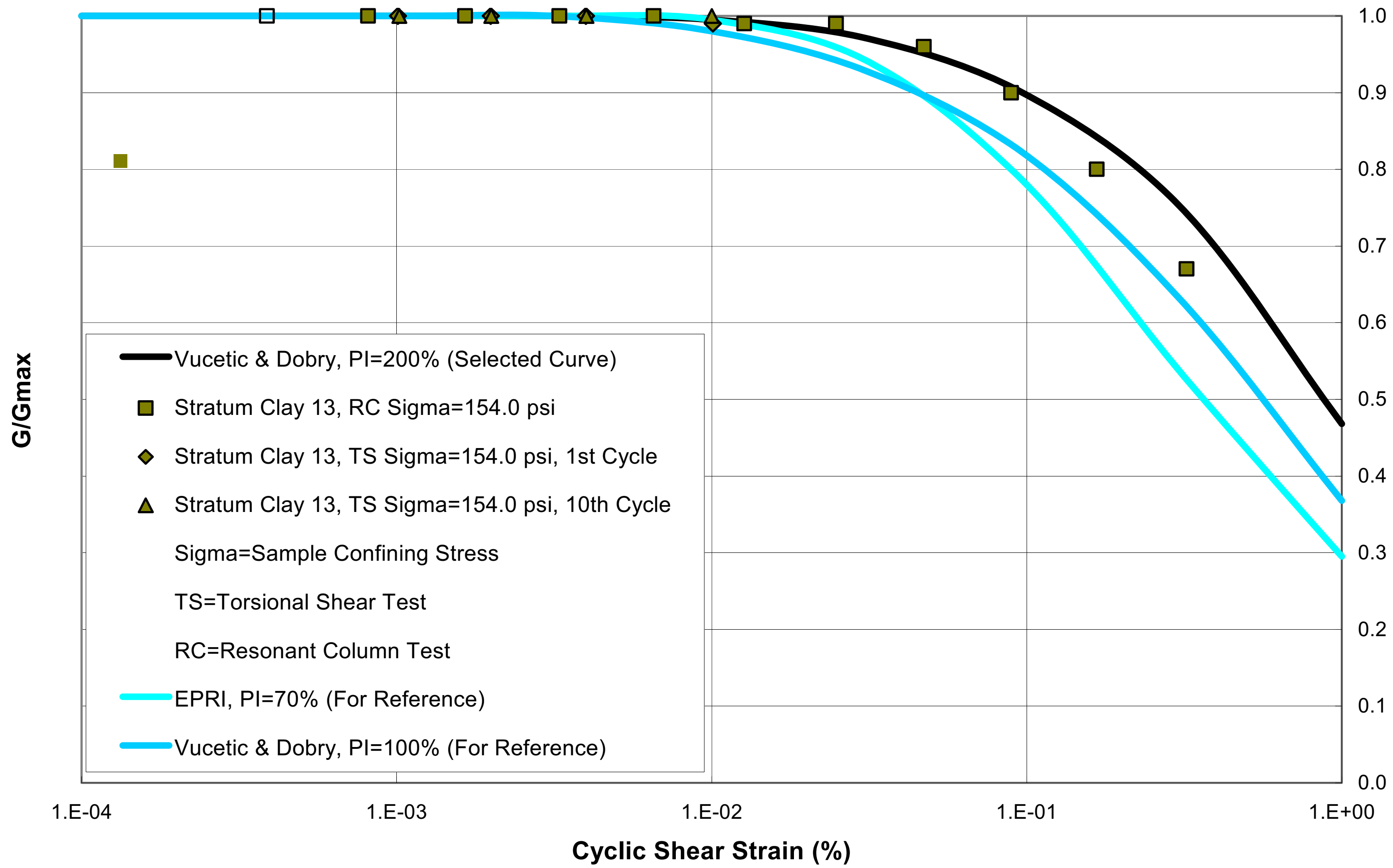


Figure 2.5.4-105 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 13 (Power Block Area)

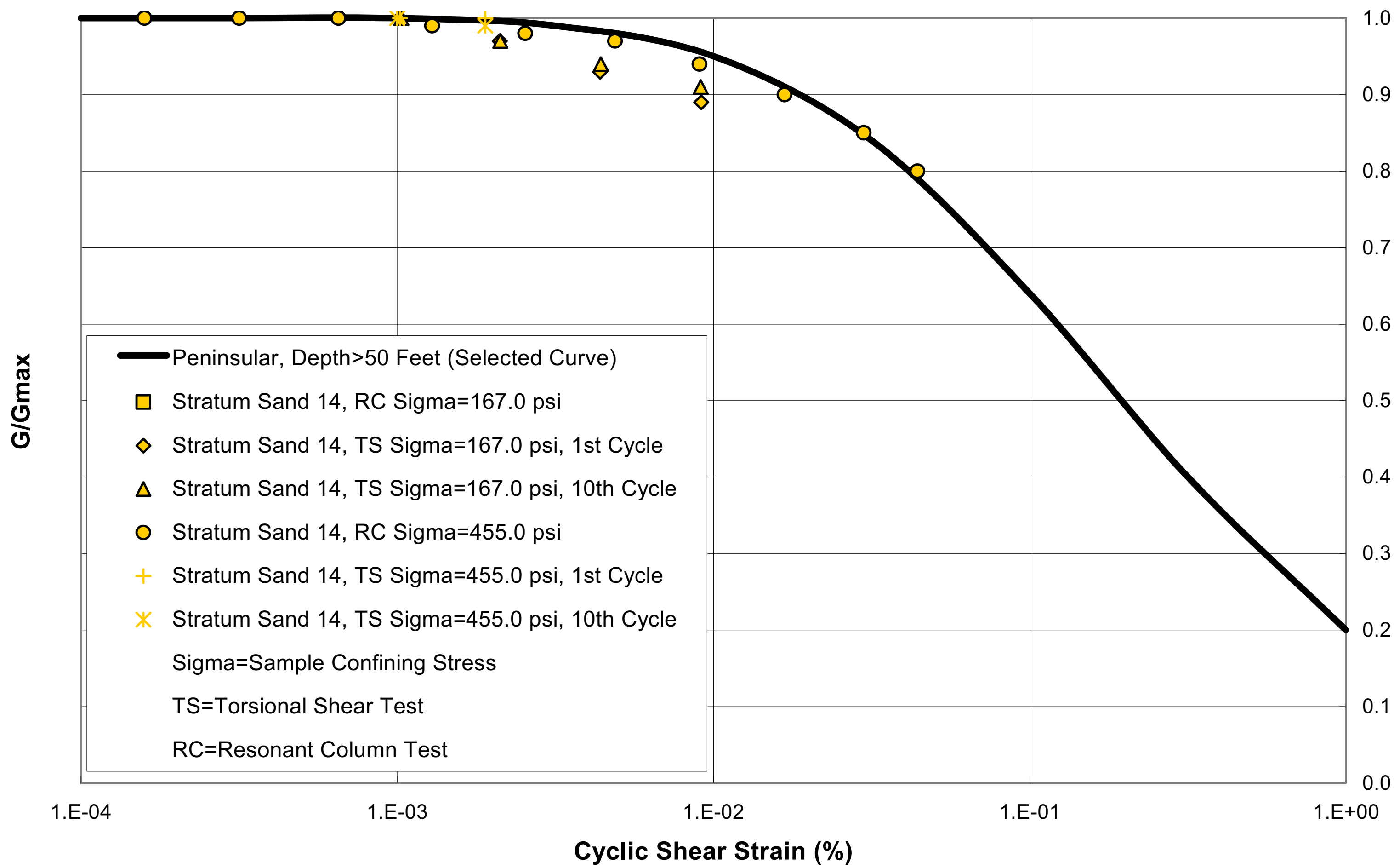


Figure 2.5.4-106 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 14 (Power Block Area)

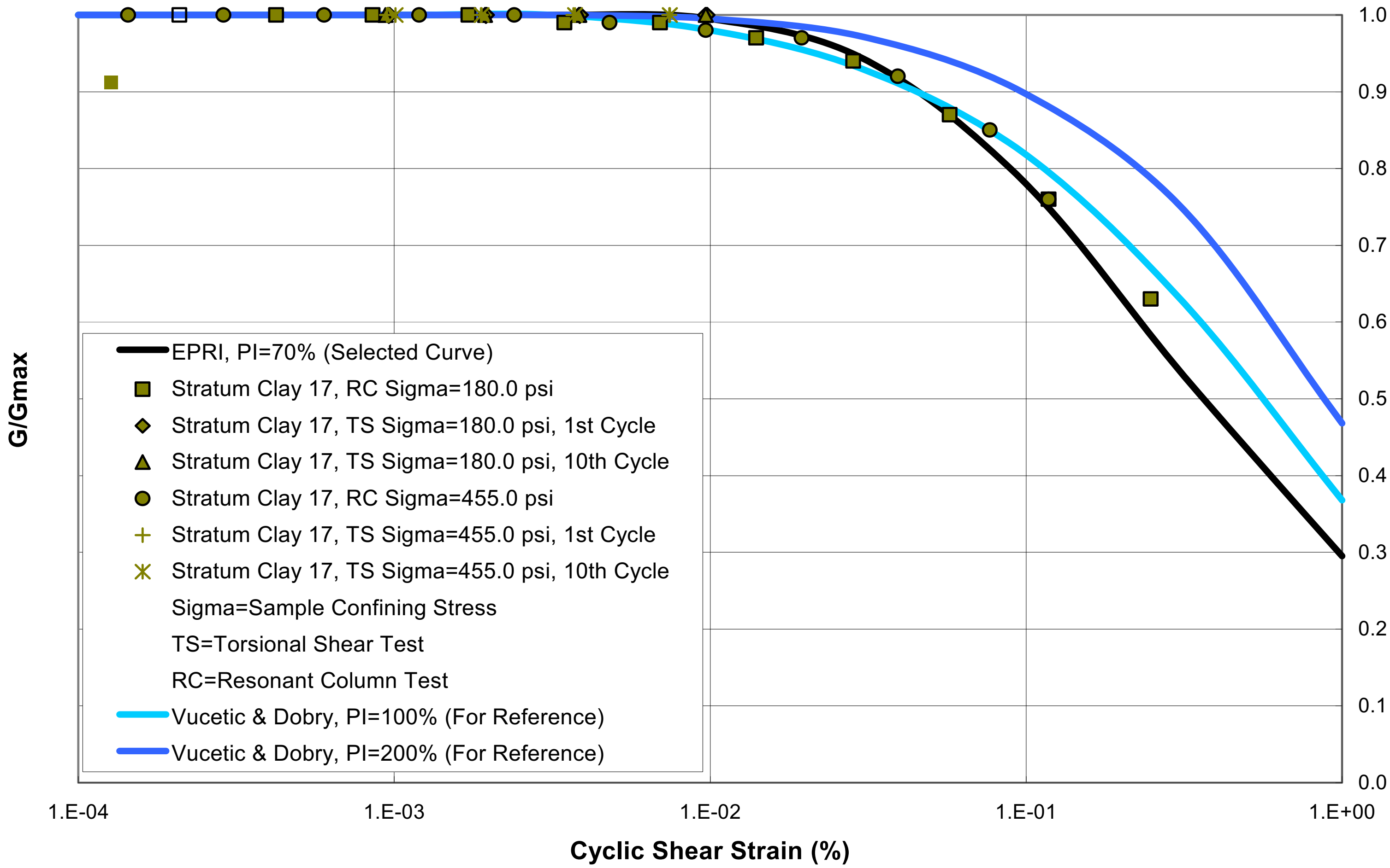


Figure 2.5.4-107 RCTS Test Results; Shear Modulus Degradation; Stratum Clay 17 (Power Block Area)

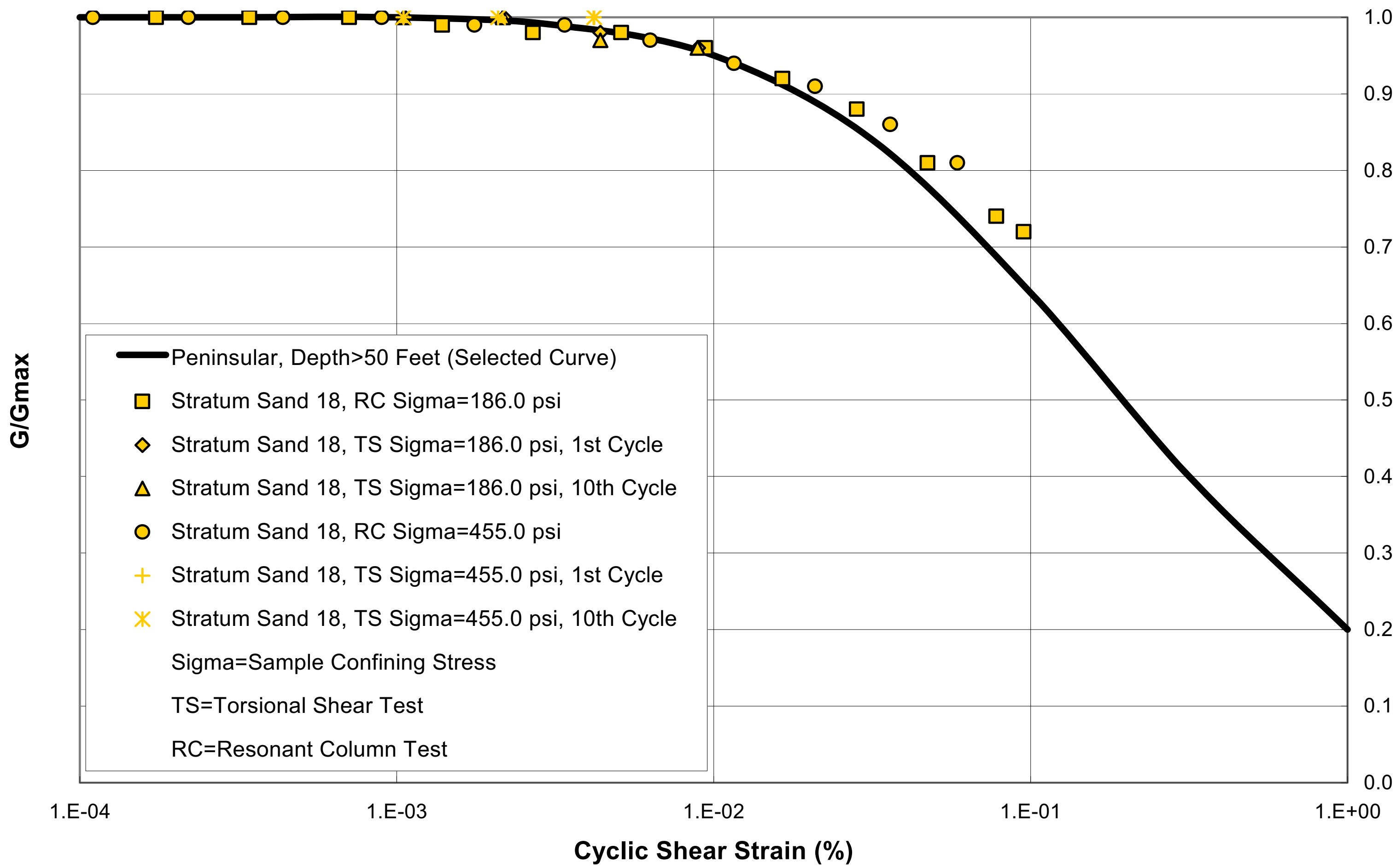


Figure 2.5.4-108 RCTS Test Results; Shear Modulus Degradation; Stratum Sand 18 (Power Block Area)

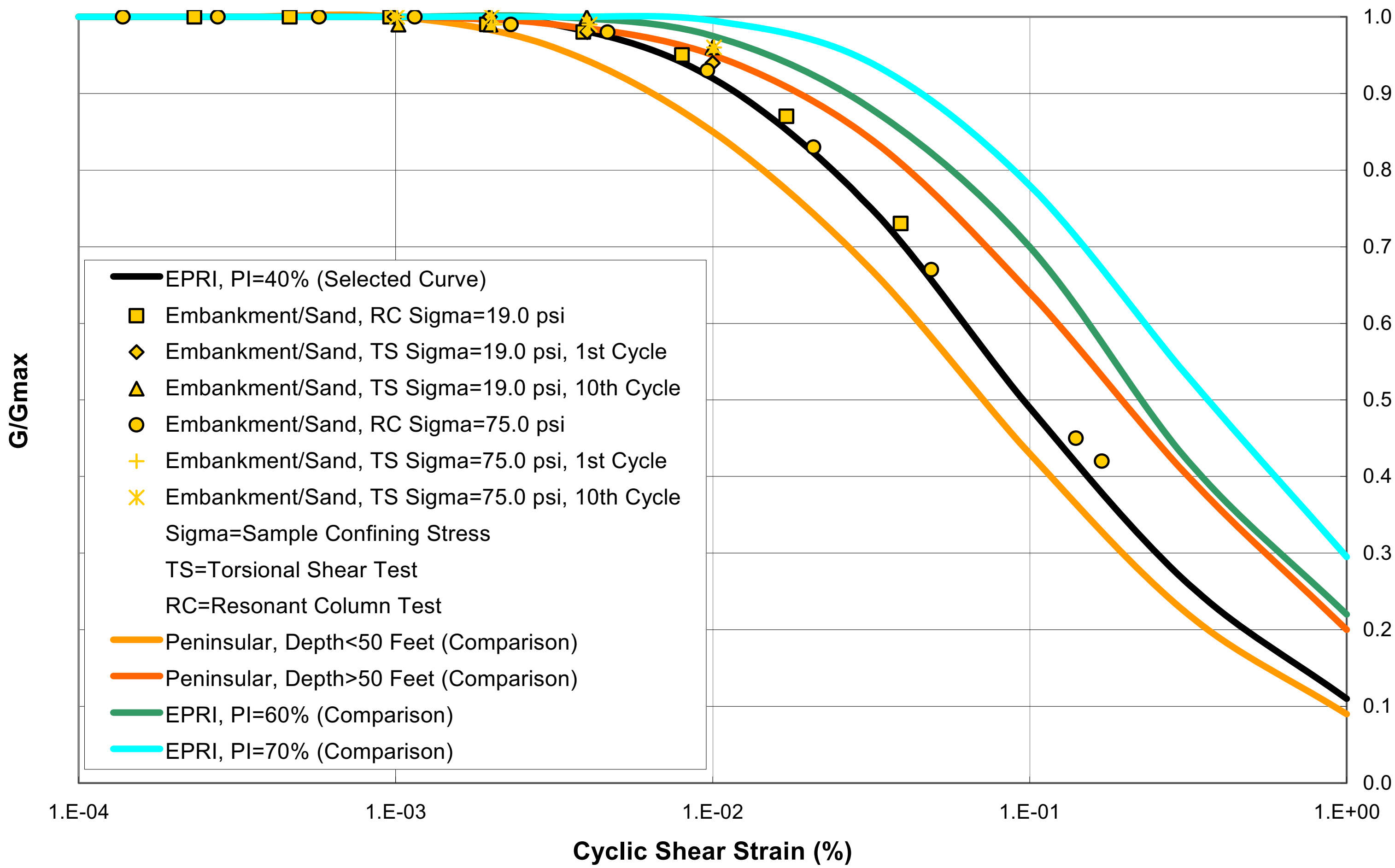


Figure 2.5.4-109 RCTS Test Results; Shear Modulus Degradation; Embankment Fill/Sand; Composite A Sample (Cooling Basin)

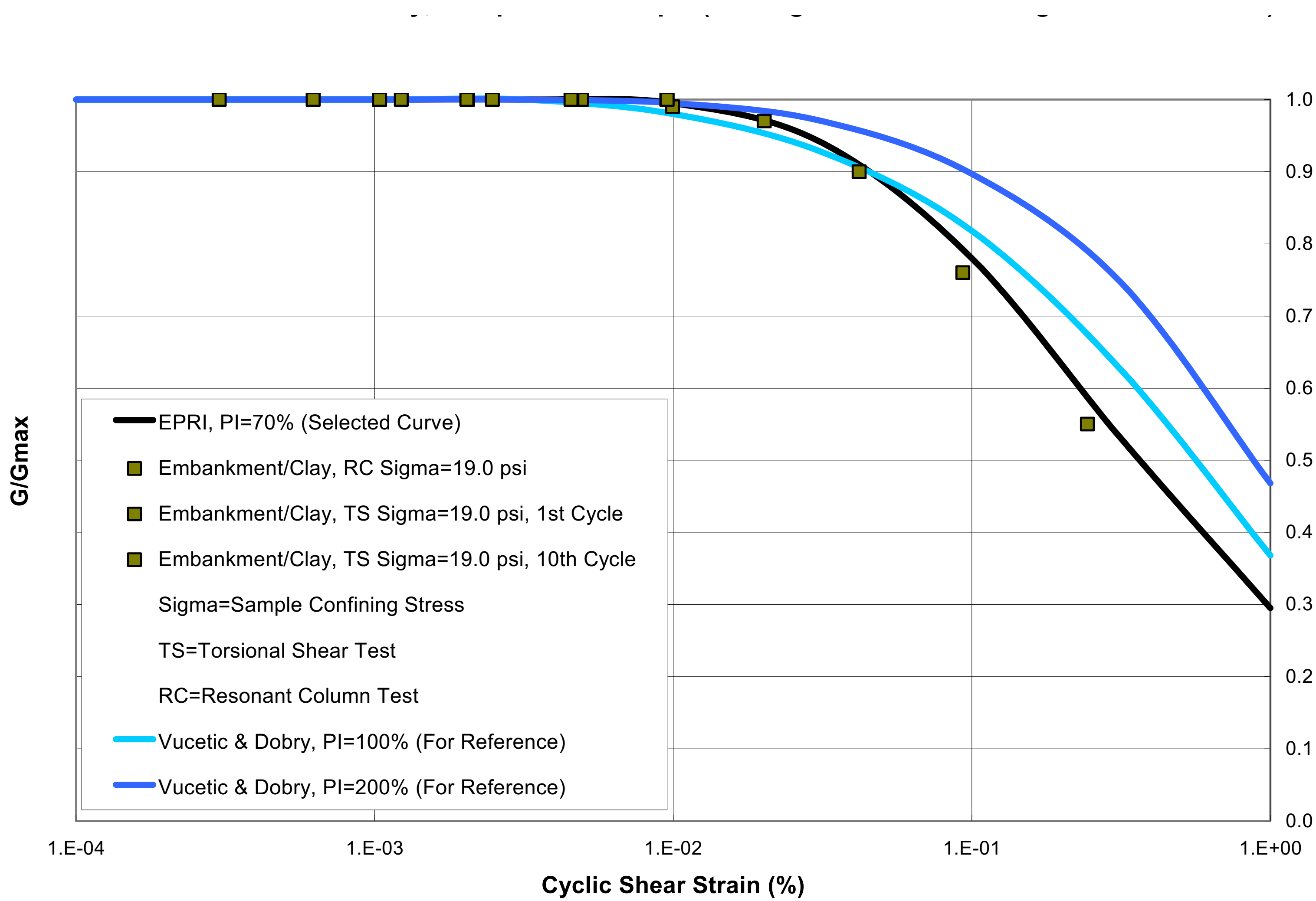


Figure 2.5.4-110 RCTS Test Results; Shear Modulus Degradation; Embankment Fill/Clay; Composite B Sample (Cooling Basin)

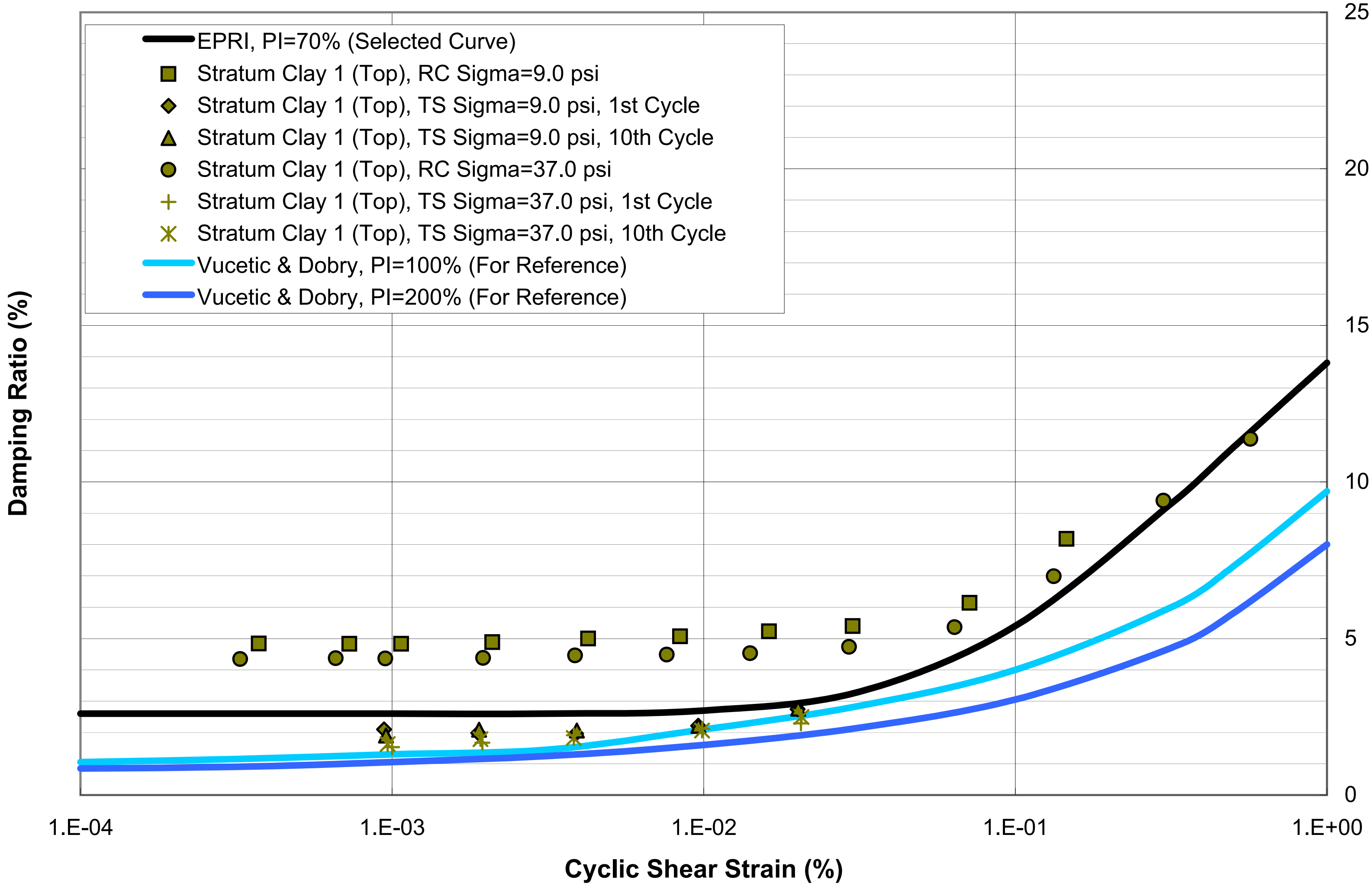


Figure 2.5.4-111 RCTS Test Results; Damping Ratio; Stratum Clay 1 (Top) (Power Block Area)

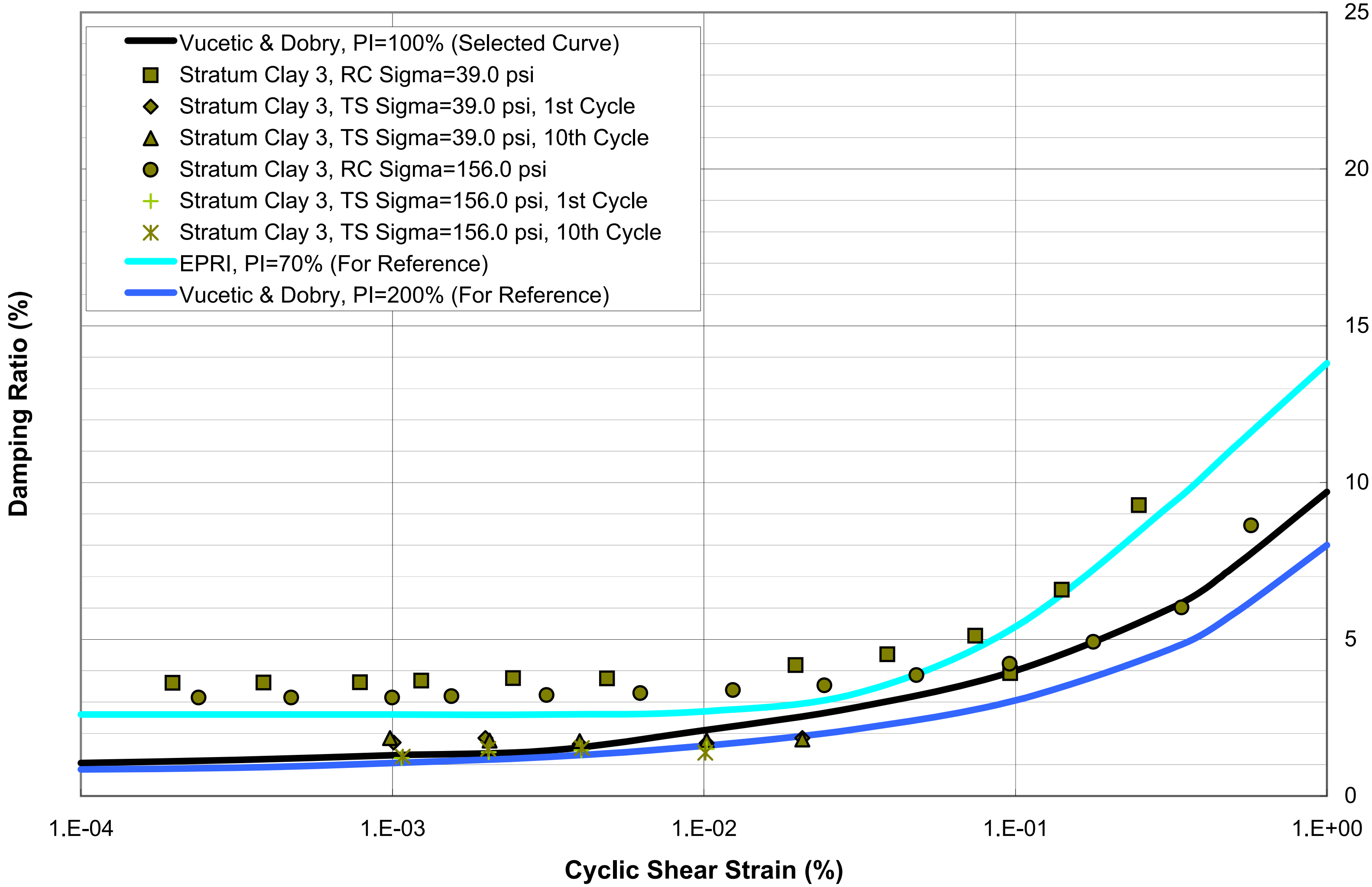


Figure 2.5.4-112 RCTS Test Results; Damping Ratio; Stratum Clay 3 (Power Block Area)

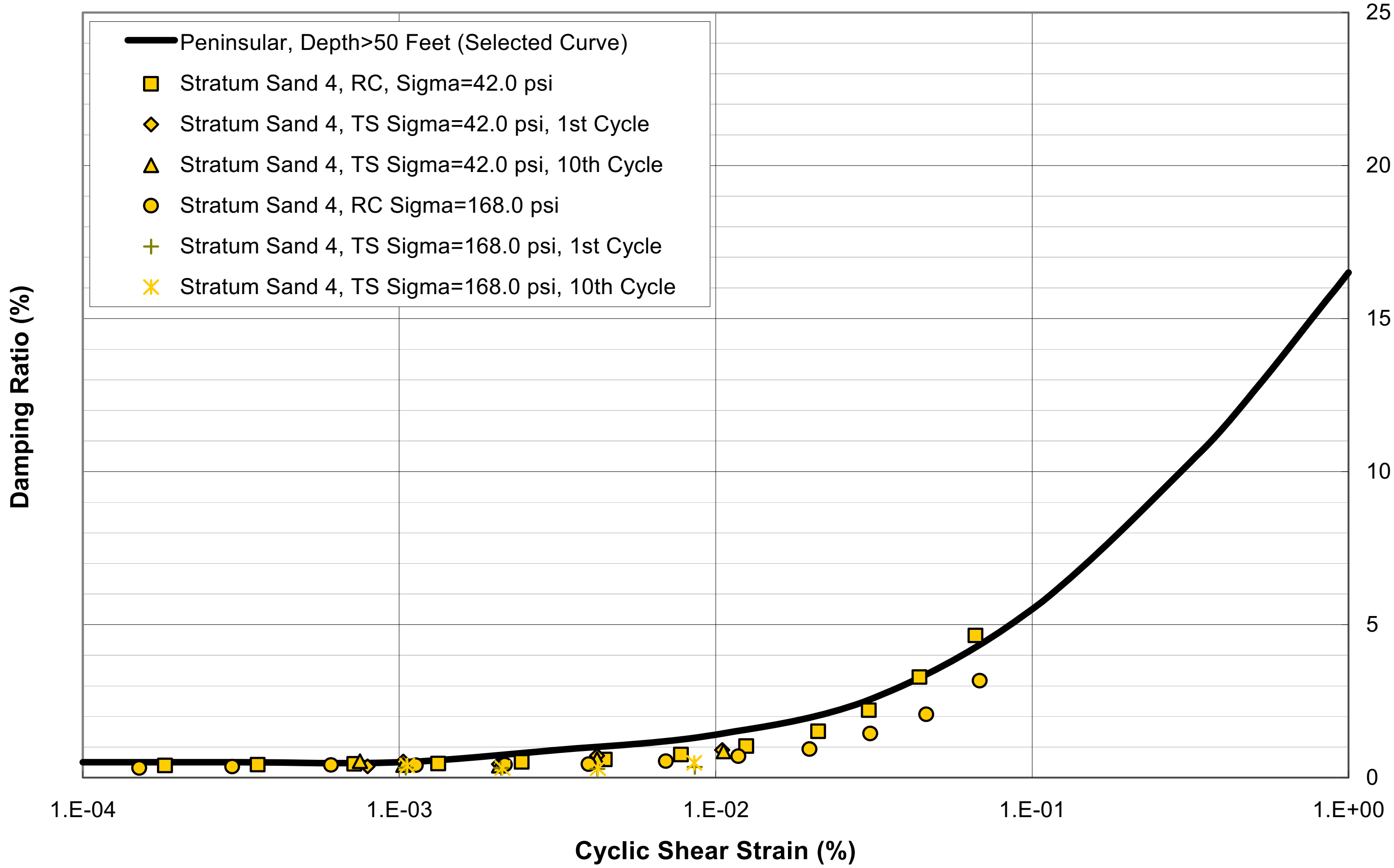


Figure 2.5.4-113 RCTS Test Results; Damping Ratio; Stratum Sand 4 (Power Block Area)

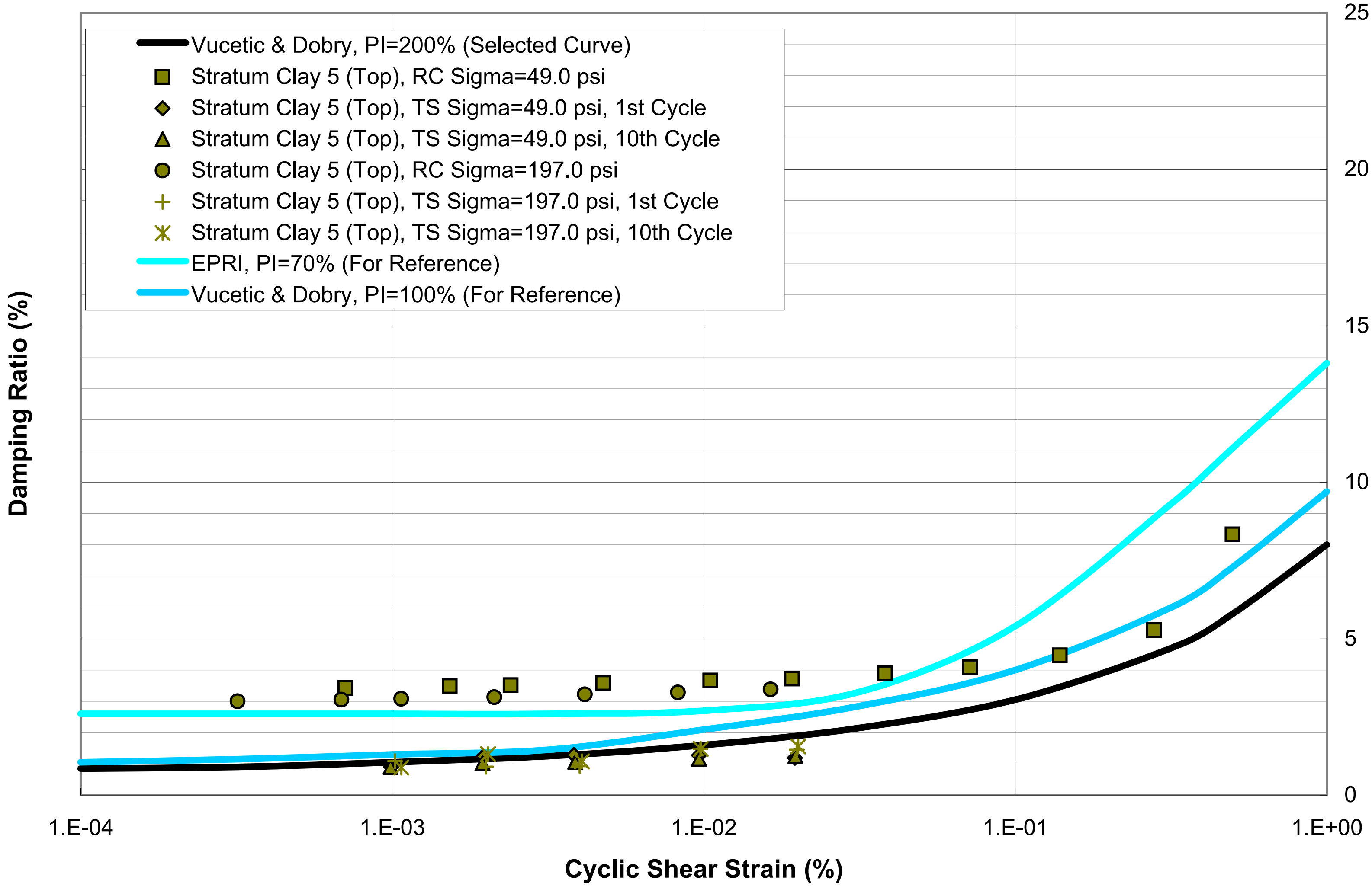


Figure 2.5.4-114 RCTS Test Results; Damping Ratio; Stratum Clay 5 (Top) (Power Block Area)

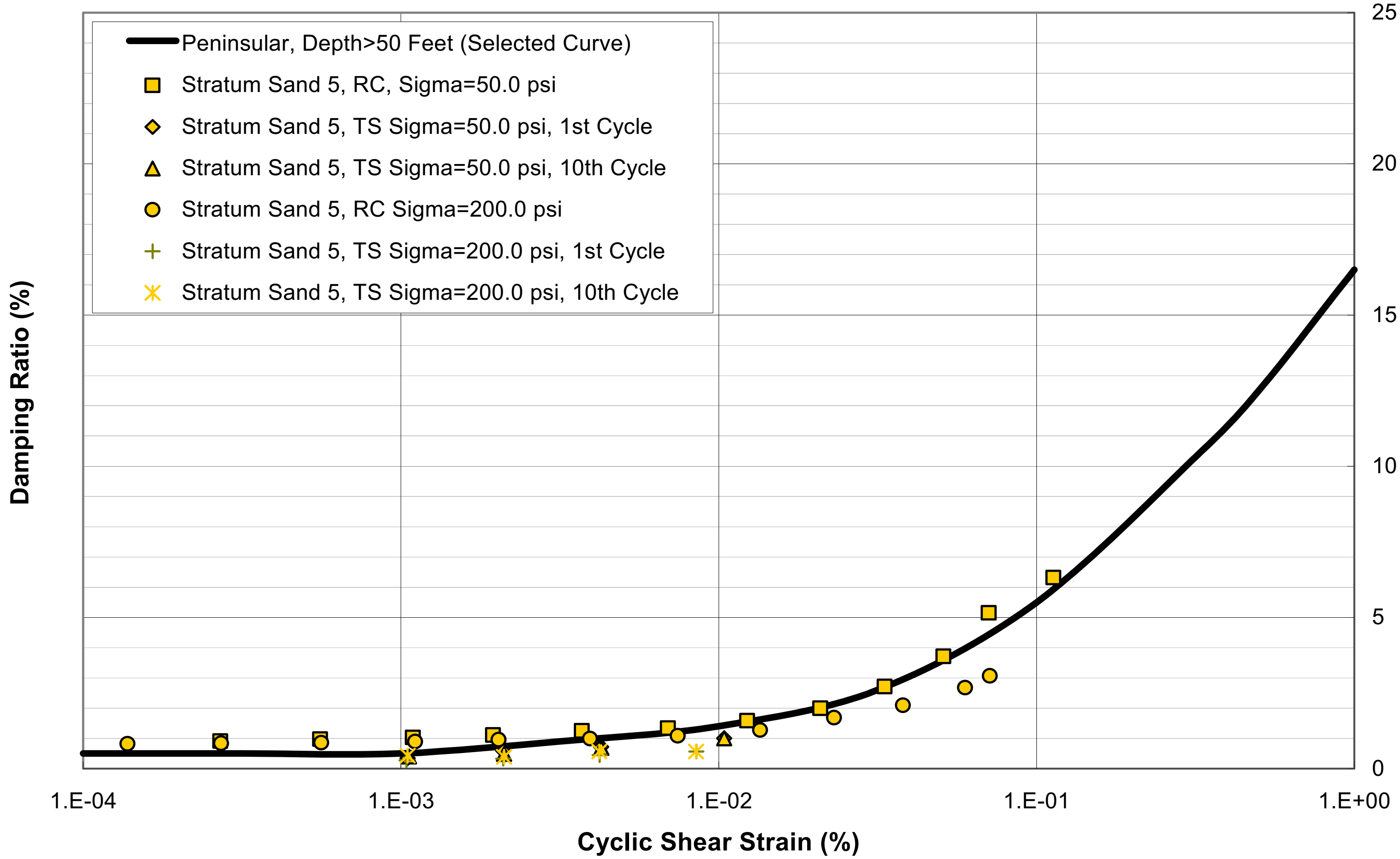


Figure 2.5.4-115 RCTS Test Results; Damping Ratio; Stratum Sand 5 (Power Block Area)

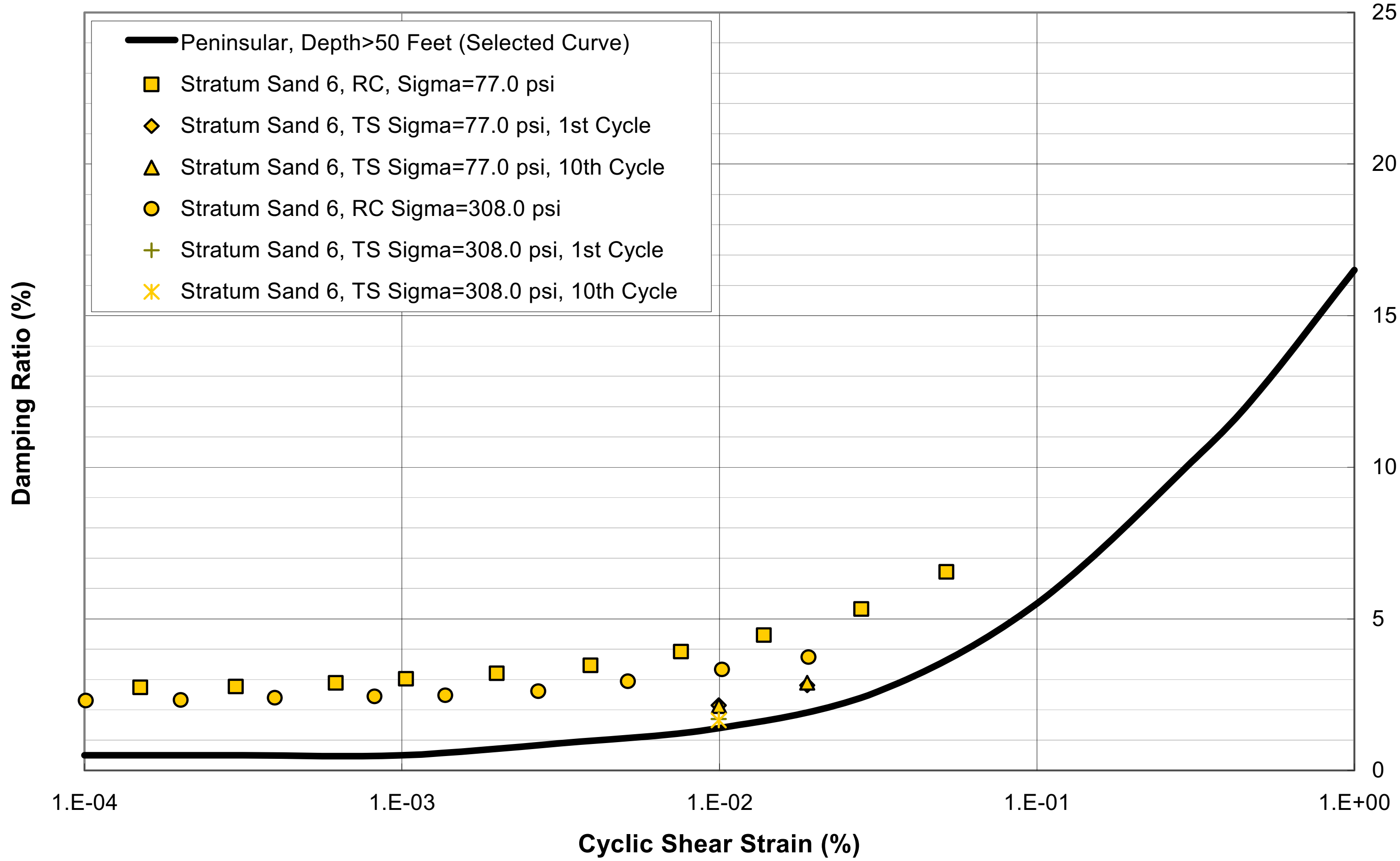


Figure 2.5.4-116 RCTS Test Results; Damping Ratio; Stratum Sand 6 (Power Block Area)

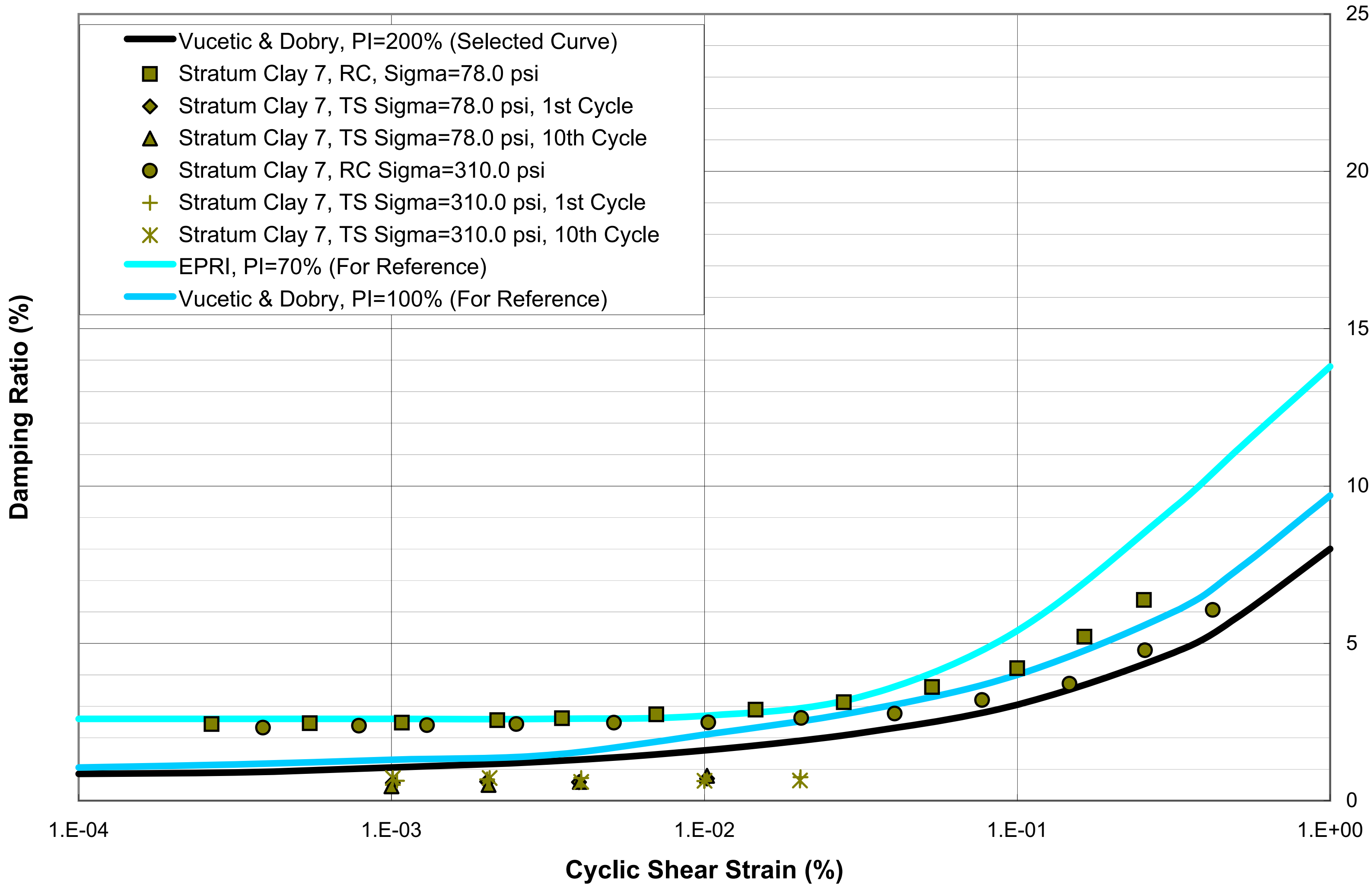


Figure 2.5.4-117 RCTS Test Results; Damping Ratio; Stratum Clay 7 (Power Block Area)

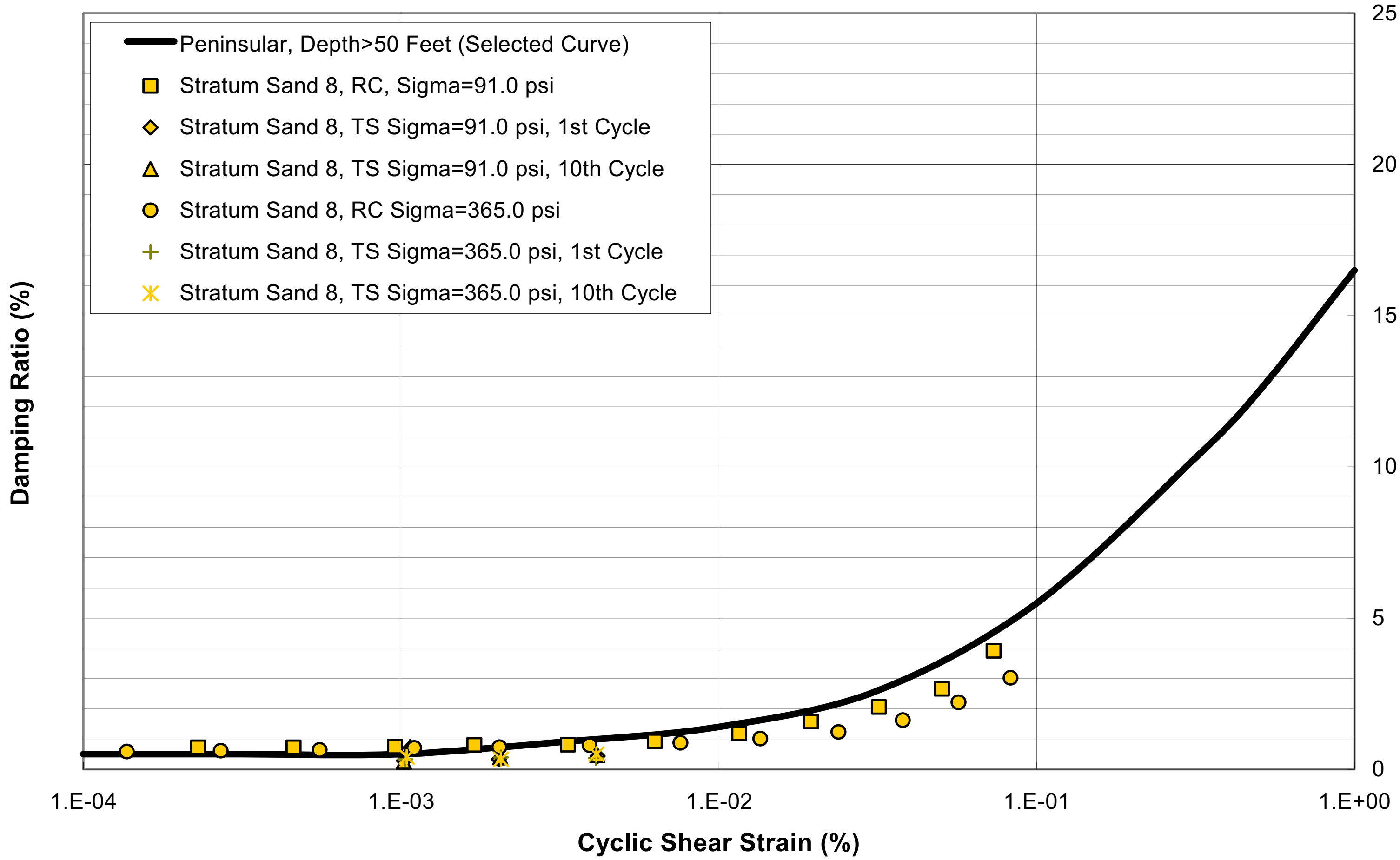


Figure 2.5.4-118 RCTS Test Results; Damping Ratio; Stratum Sand 8 (Power Block Area)

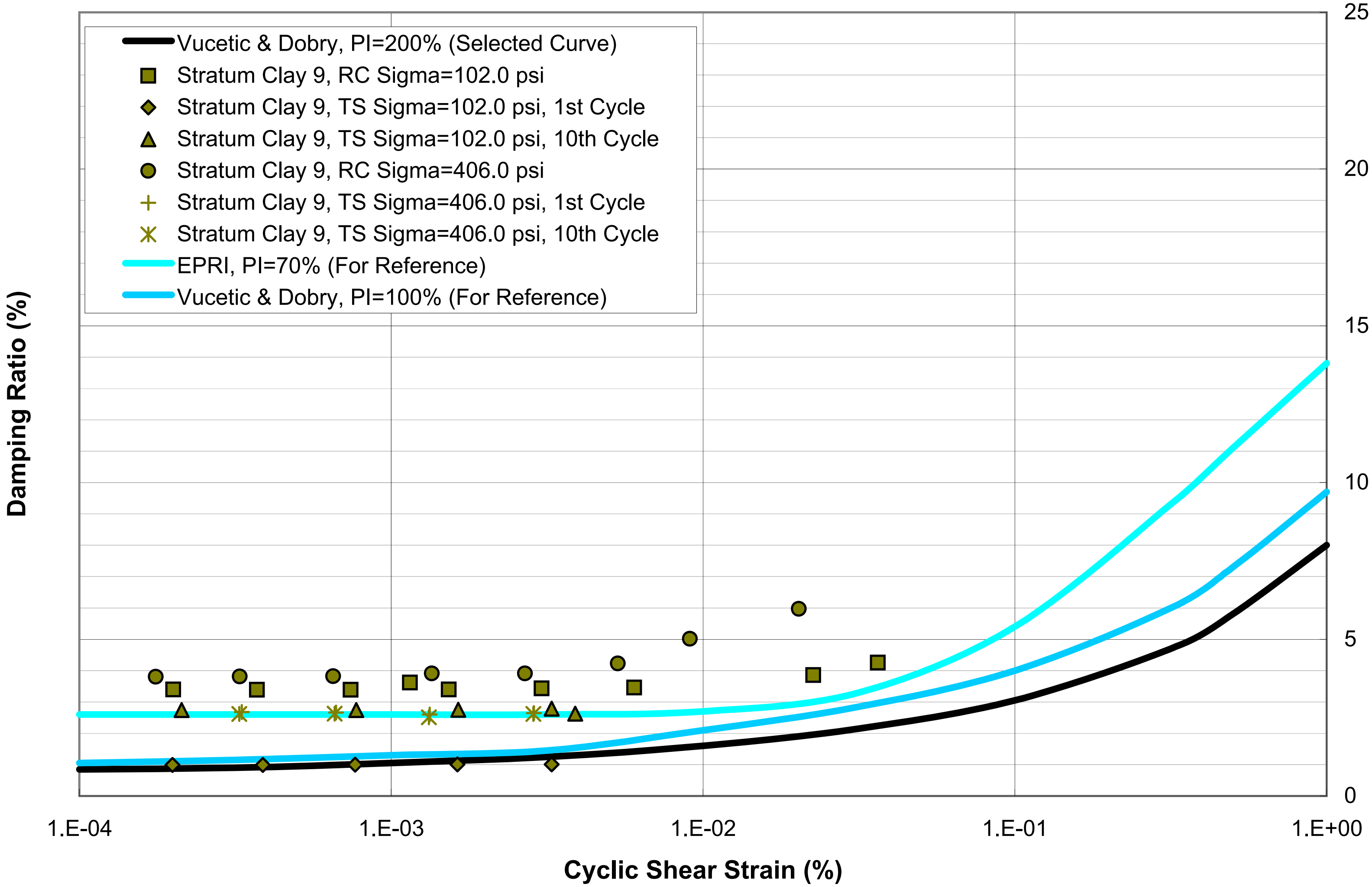


Figure 2.5.4-119 RCTS Test Results; Damping Ratio; Stratum Clay 9 (Power Block Area)

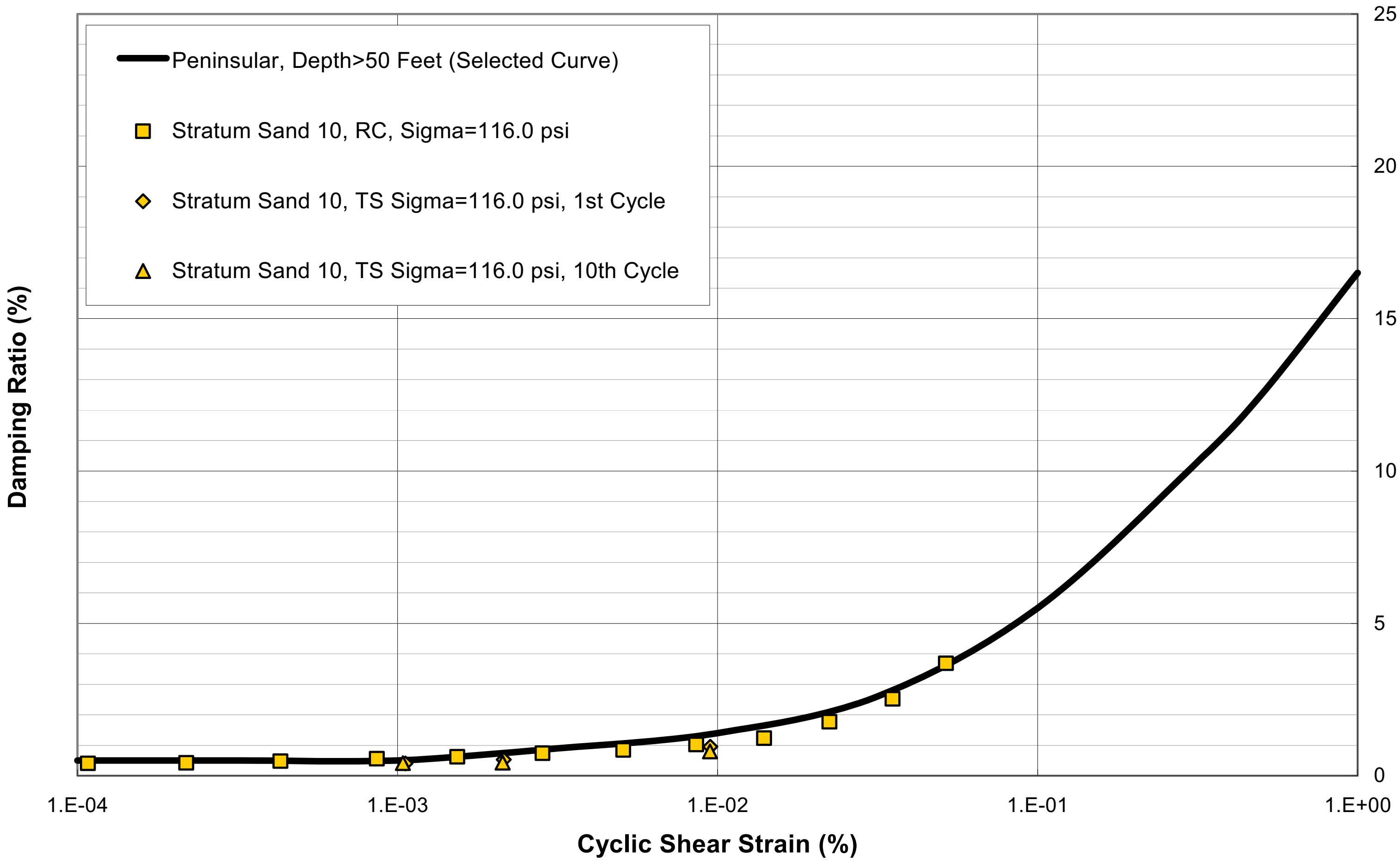


Figure 2.5.4-120 RCTS Test Results; Damping Ratio; Stratum Sand 10 (Power Block Area)

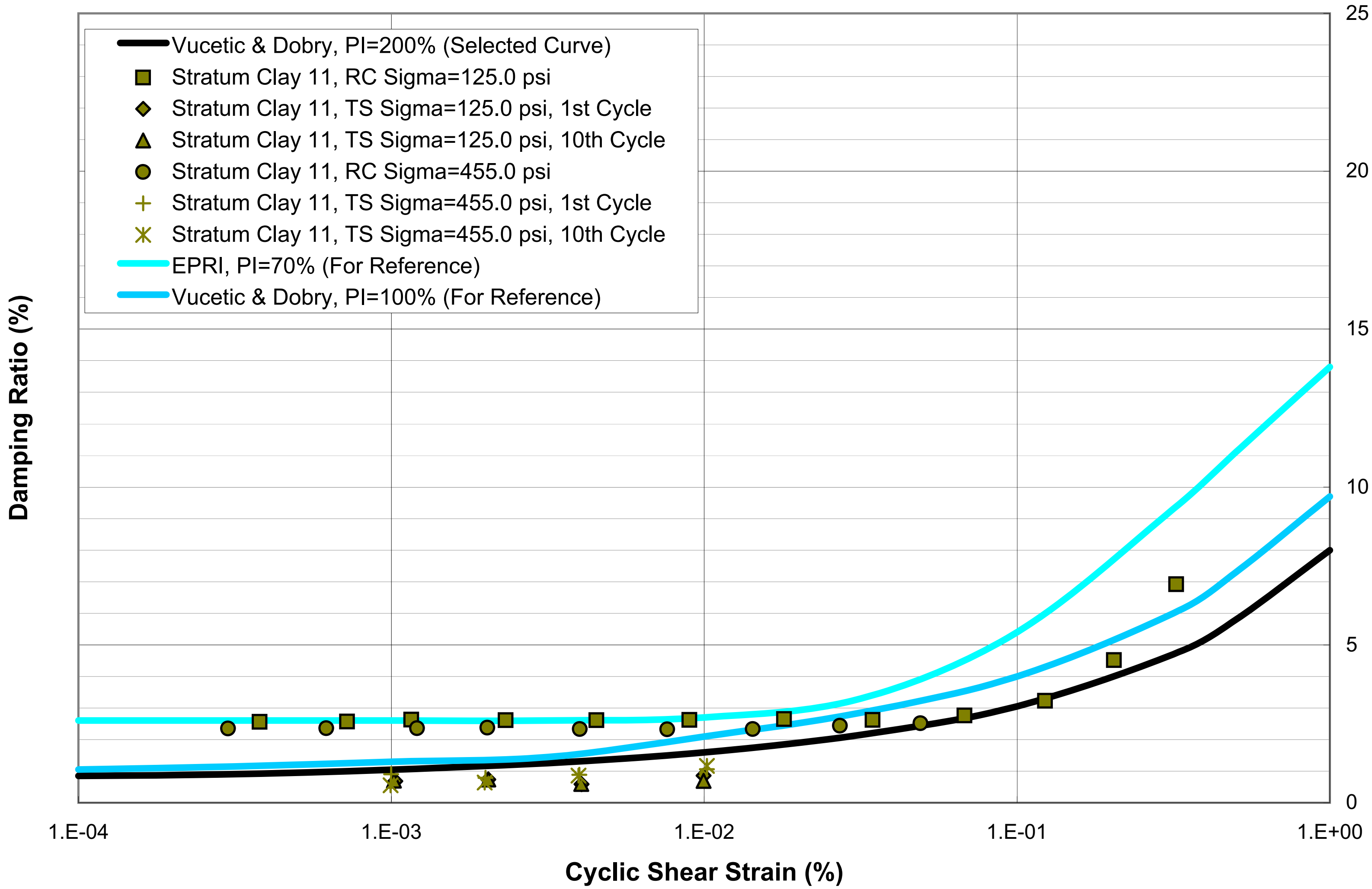


Figure 2.5.4-121 RCTS Test Results; Damping Ratio; Stratum Clay 11 (Power Block Area)

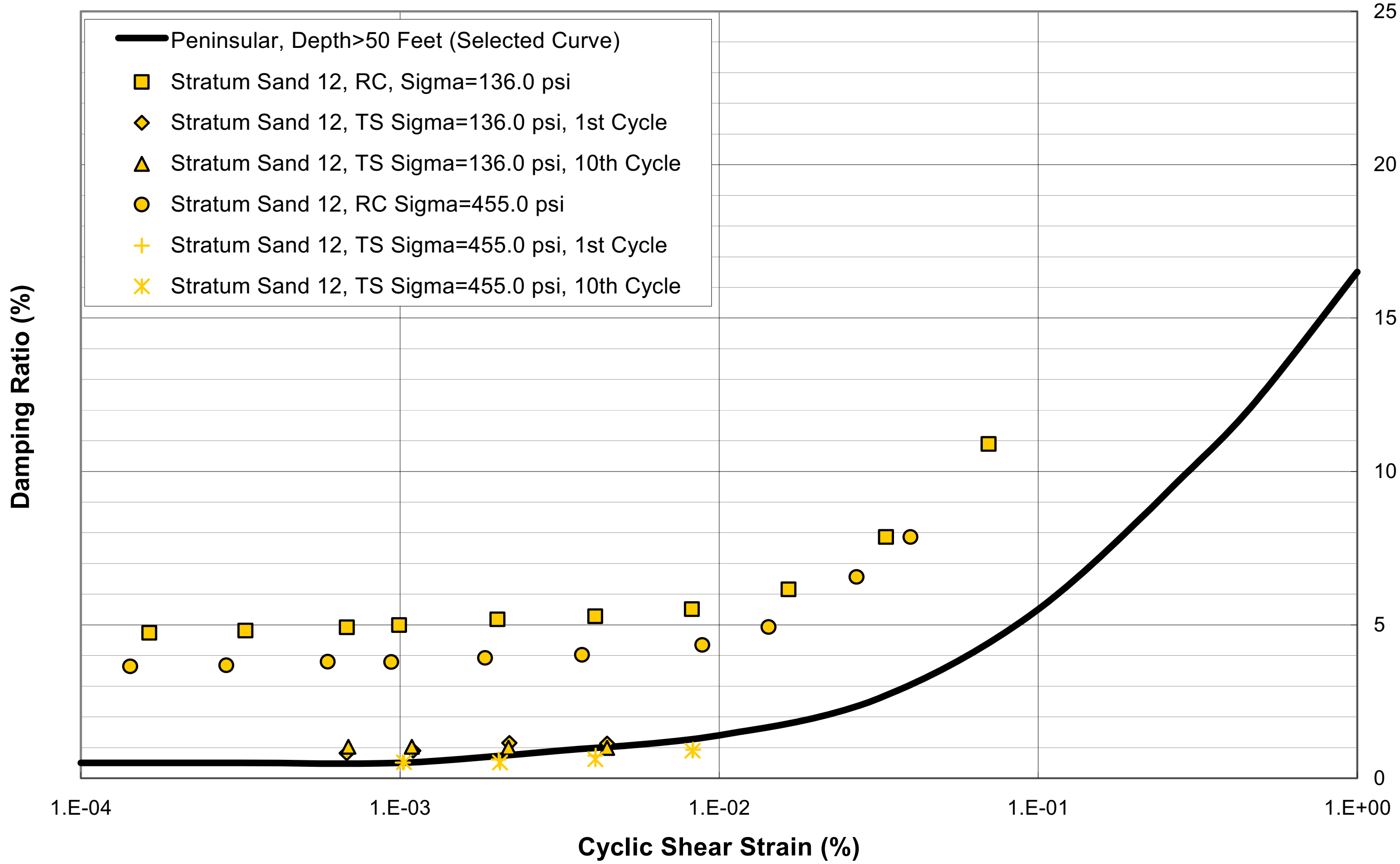


Figure 2.5.4-122 RCTS Test Results; Damping Ratio; Stratum Sand 12 (Power Block Area)

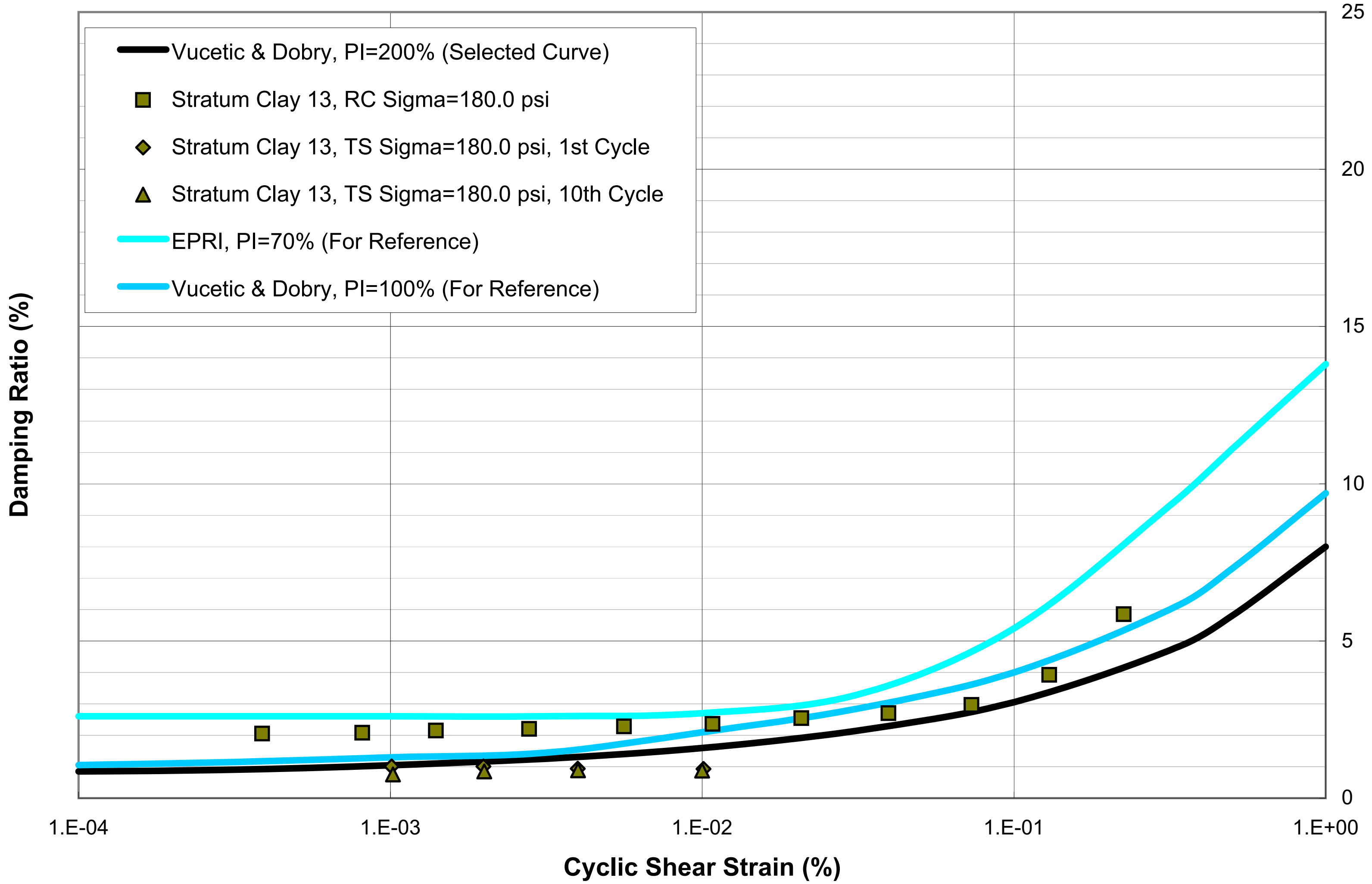


Figure 2.5.4-123 RCTS Test Results; Damping Ratio; Stratum Clay 13 (Power Block Area)

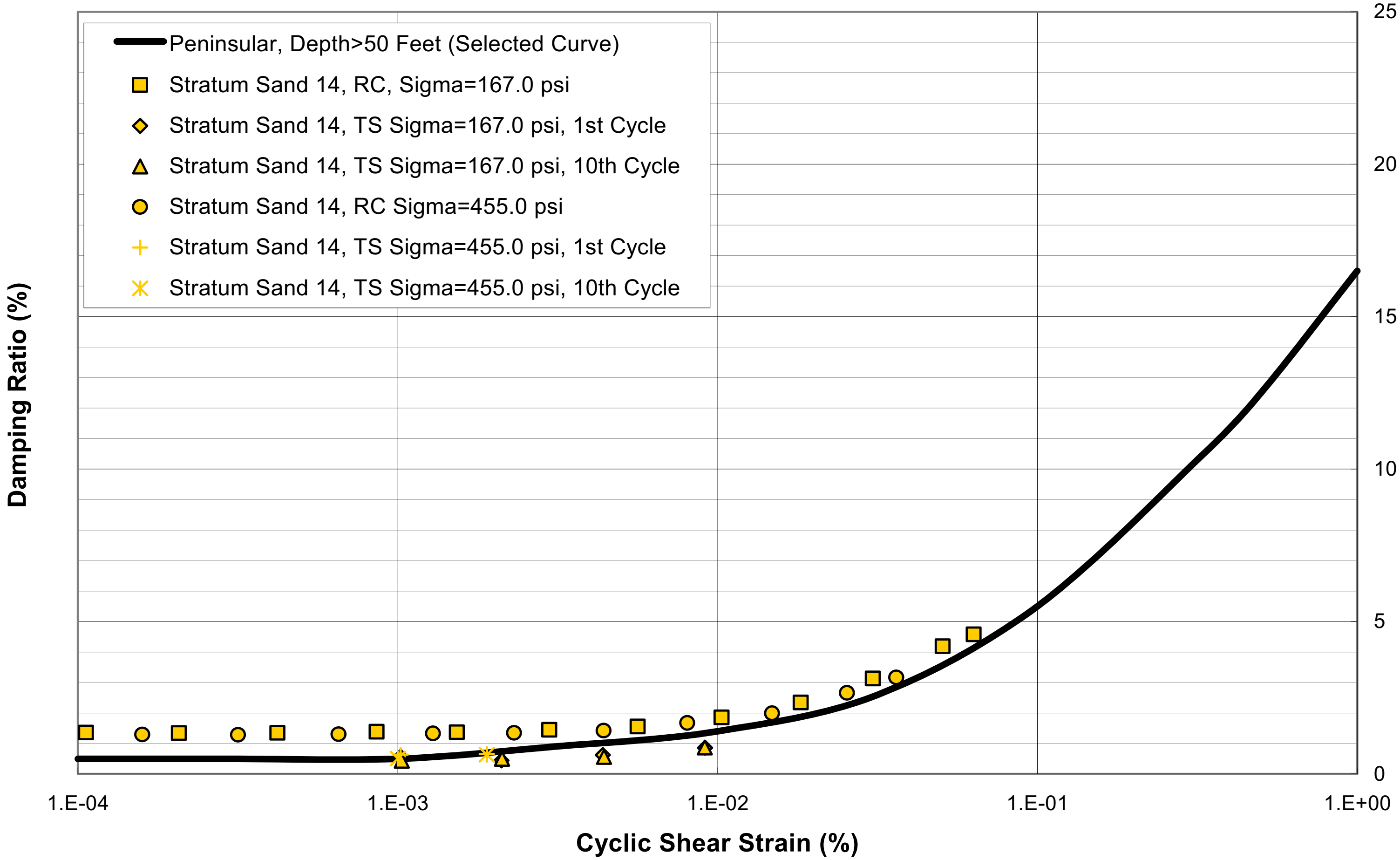


Figure 2.5.4-124 RCTS Test Results; Damping Ratio; Stratum Sand 14 (Power Block Area)

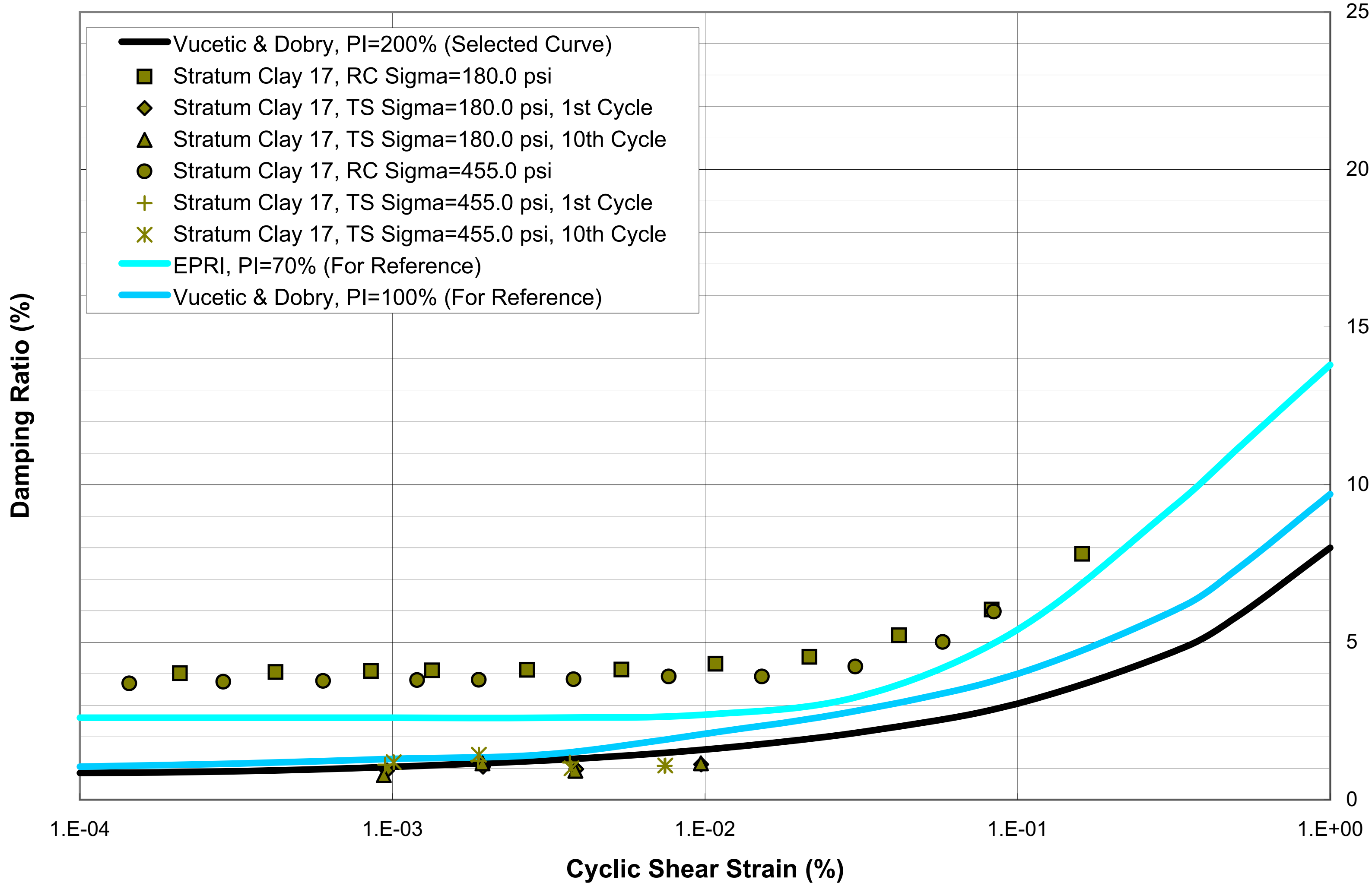


Figure 2.5.4-125 RCTS Test Results; Damping Ratio; Stratum Clay 17 (Power Block Area)

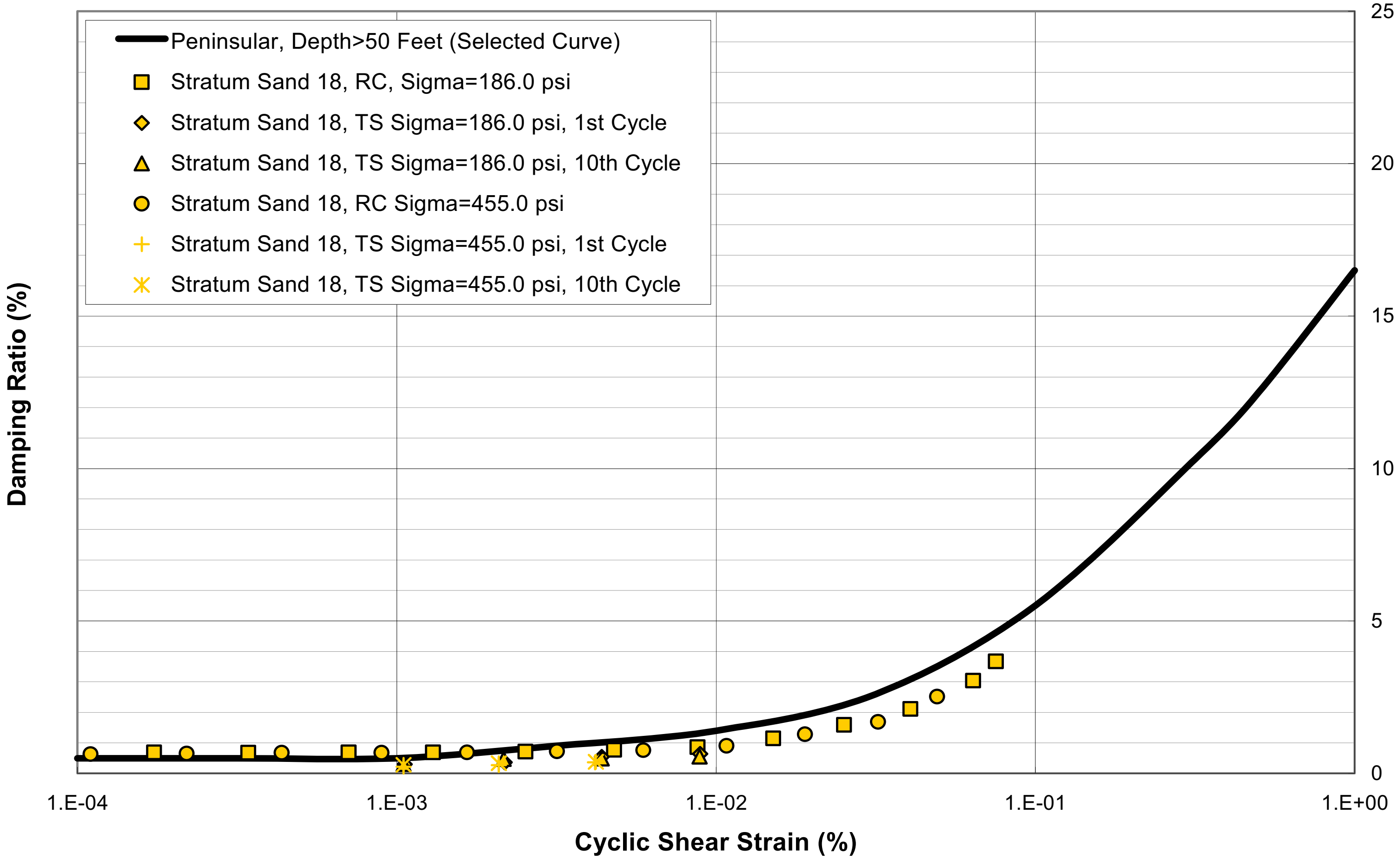


Figure 2.5.4-126 RCTS Test Results; Damping Ratio; Stratum Sand 18 (Power Block Area)

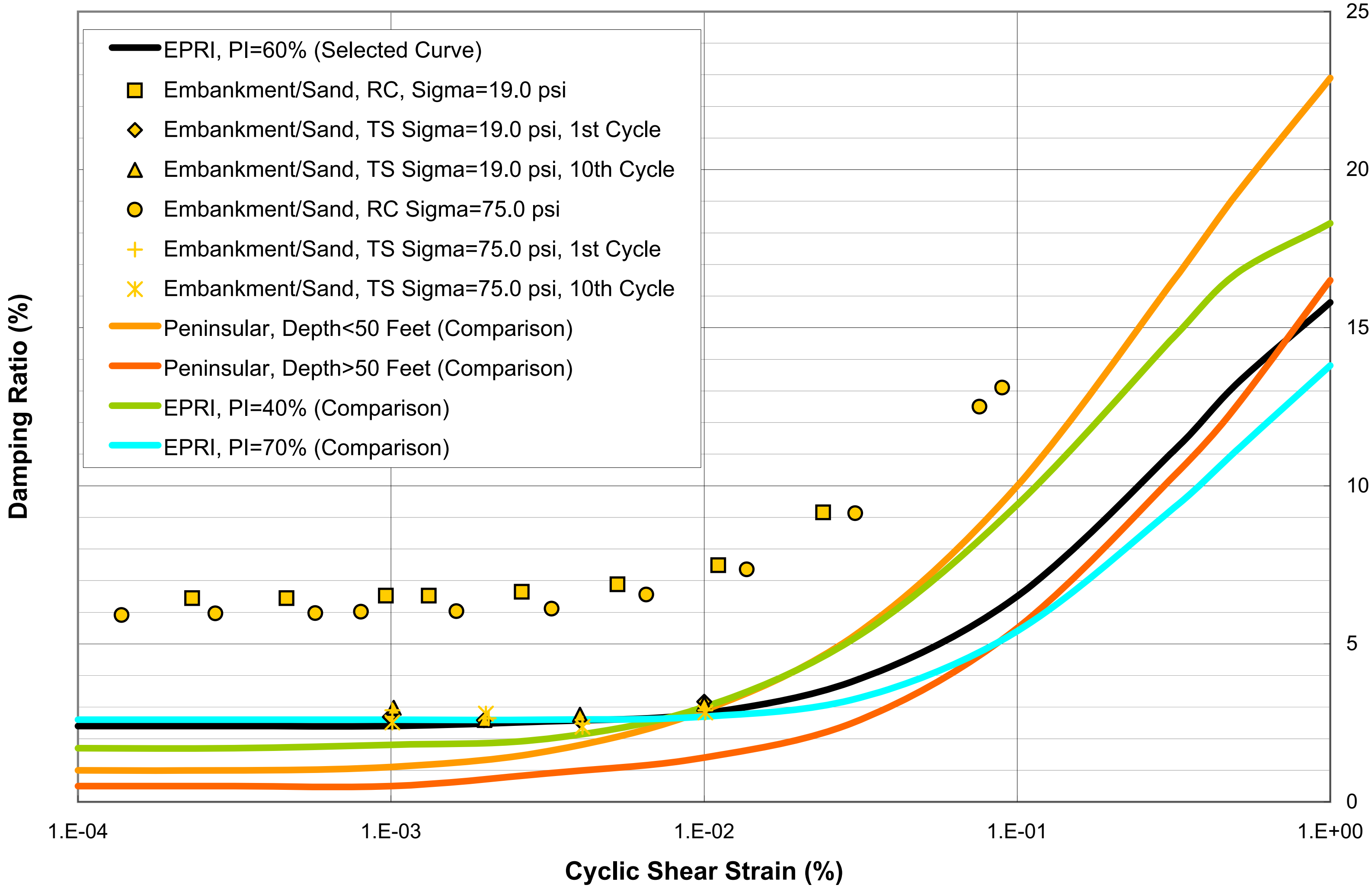


Figure 2.5.4-127 RCTS Test Results; Damping Ratio; Embankment Fill/Sand; Composite A Sample (Cooling Basin)

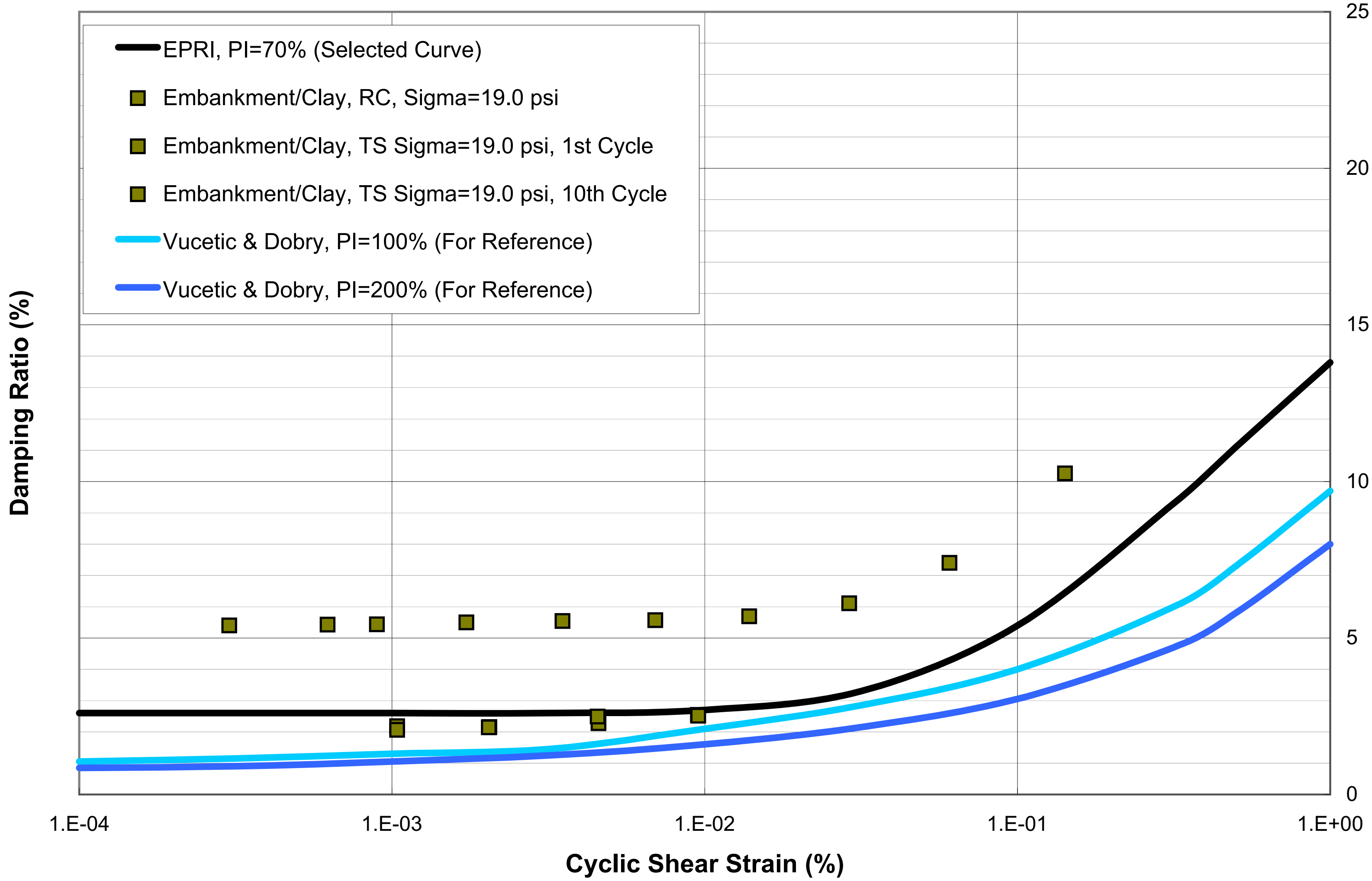


Figure 2.5.4-128 RCTS Test Results; Damping Ratio; Embankment Fill/Clay; Composite B Sample (Cooling Basin)

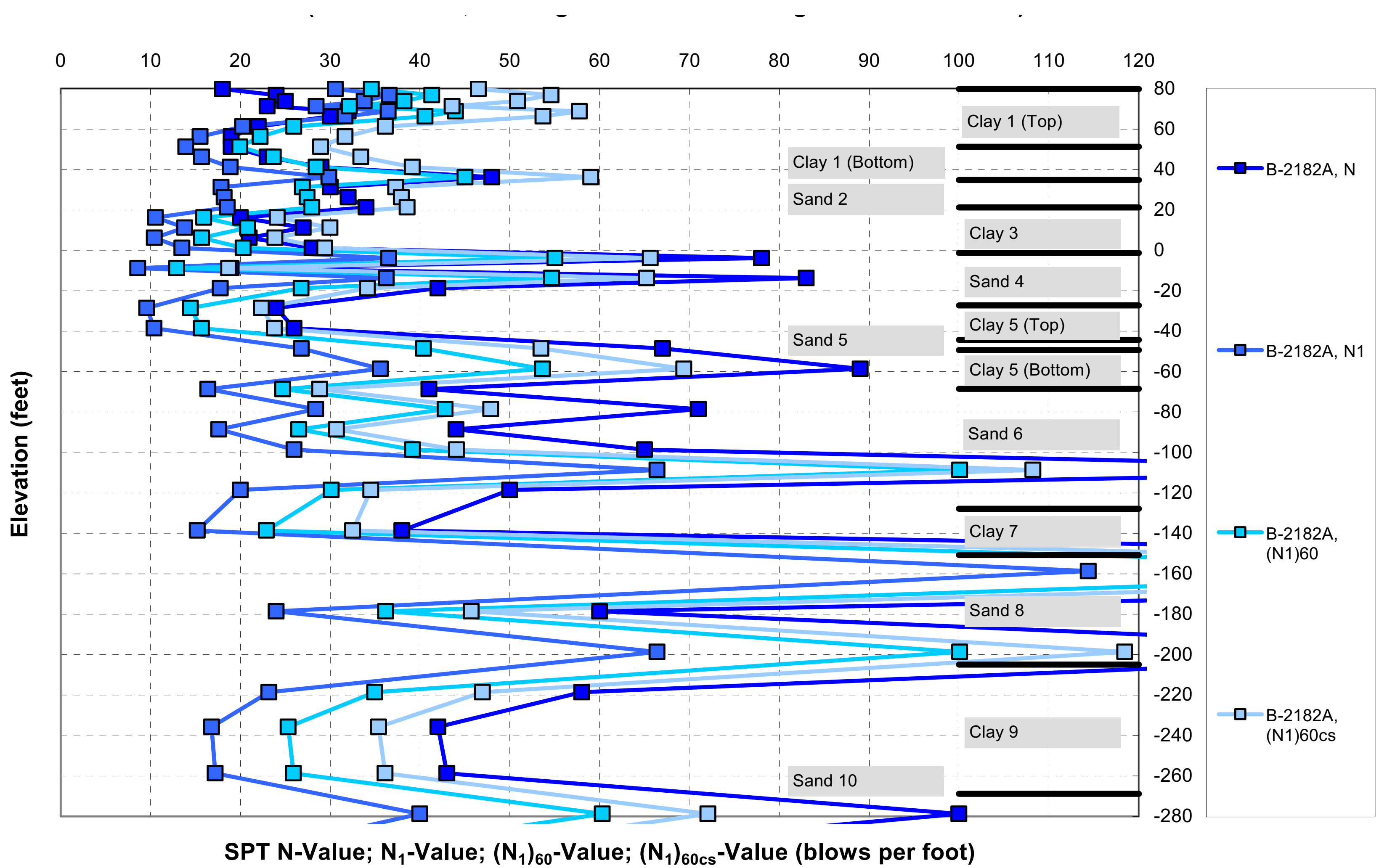
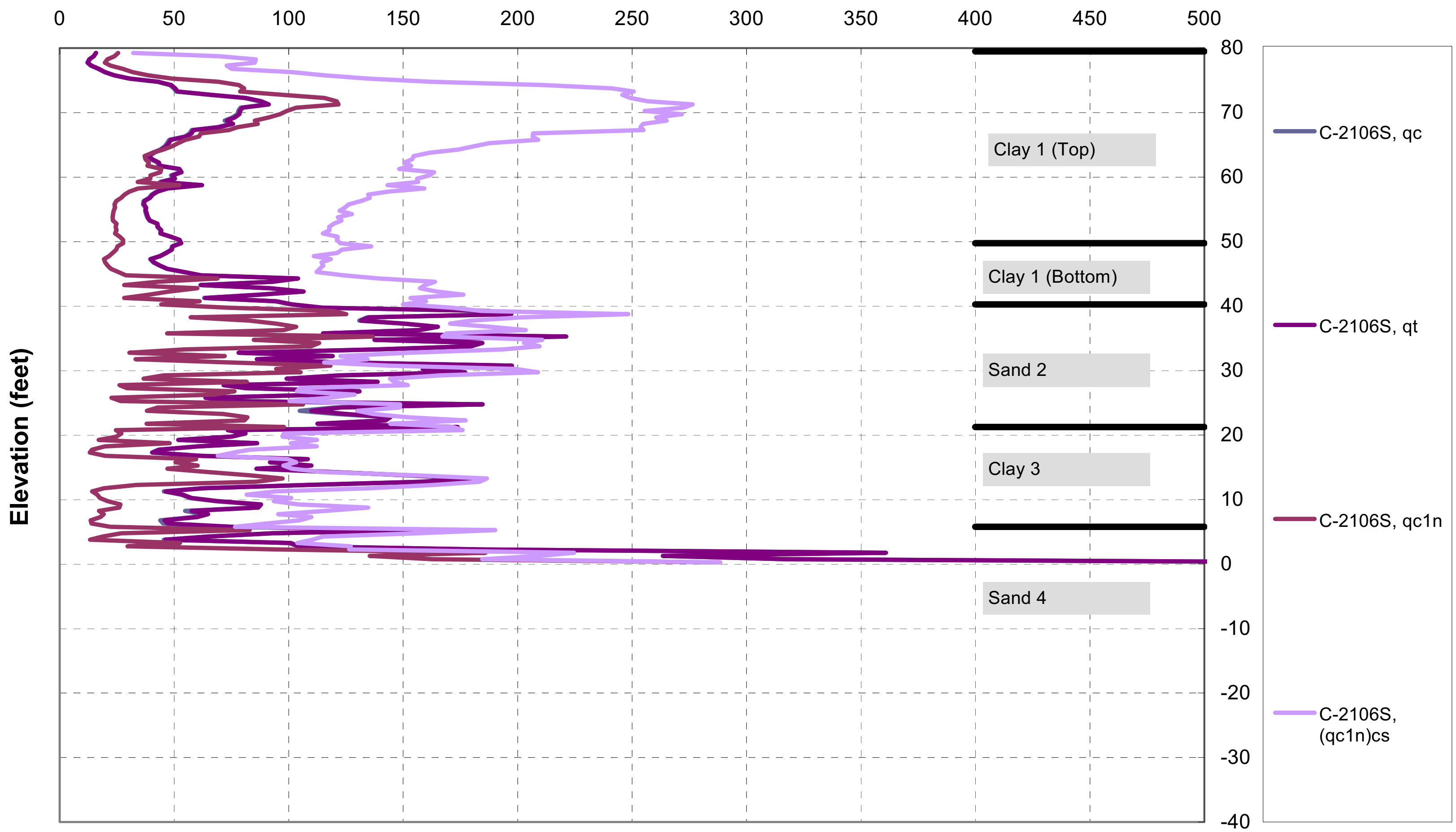


Figure 2.5.4-129 Example — SPT N- to N_1- to $(N_1)_{60}$- to $(N_1)_{60cs}$-Values; Boring B-2182A (Power Block Area; Cooling Basin)



CPT Tip Resistance, q_c and q_t (tons per square foot); Normalized CPT Tip Resistance, q_{c1n} and $(q_{c1n})_{cs}$ (dimensionless)

Figure 2.5.4-130 Example — CPT q_c- to q_t- to q_{c1n}- to $(q_{1n})_{cs}$-Values; Cone Penetration Test C-2106S (Power Block Area; Cooling Basin)

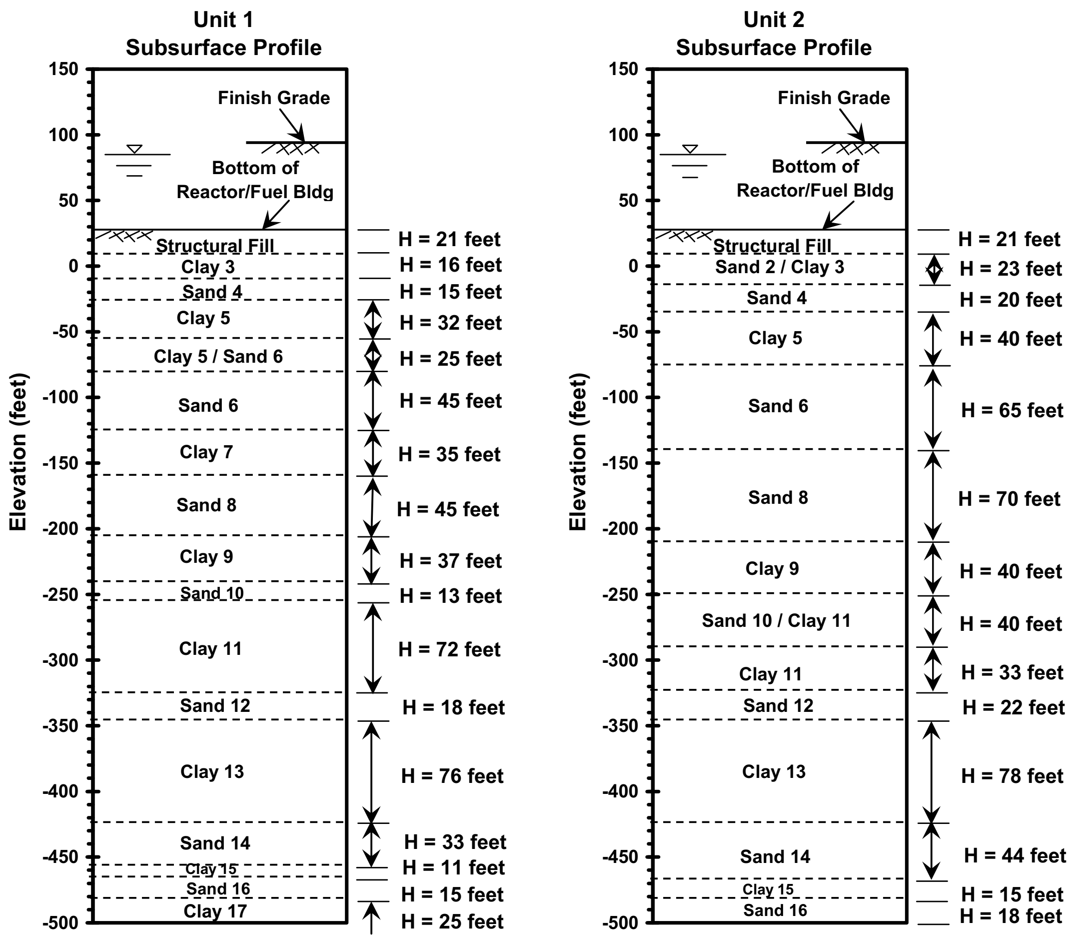


Figure 2.5.4-131 Adopted Subsurface Profiles; (Typical LWR (with an Integral UHS) Reactor/Fuel Building) (Power Block Area)

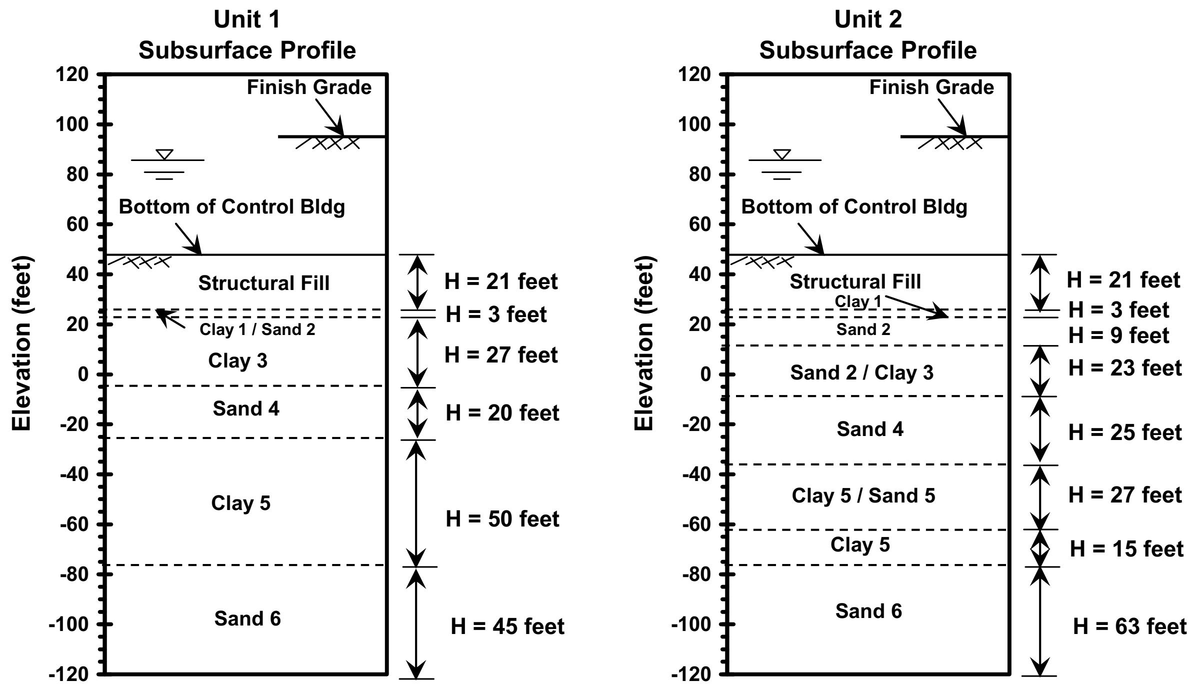


Figure 2.5.4-132 Adopted Subsurface Profiles; (Typical LWR (with an Integral UHS) Control Building) (Power Block Area)

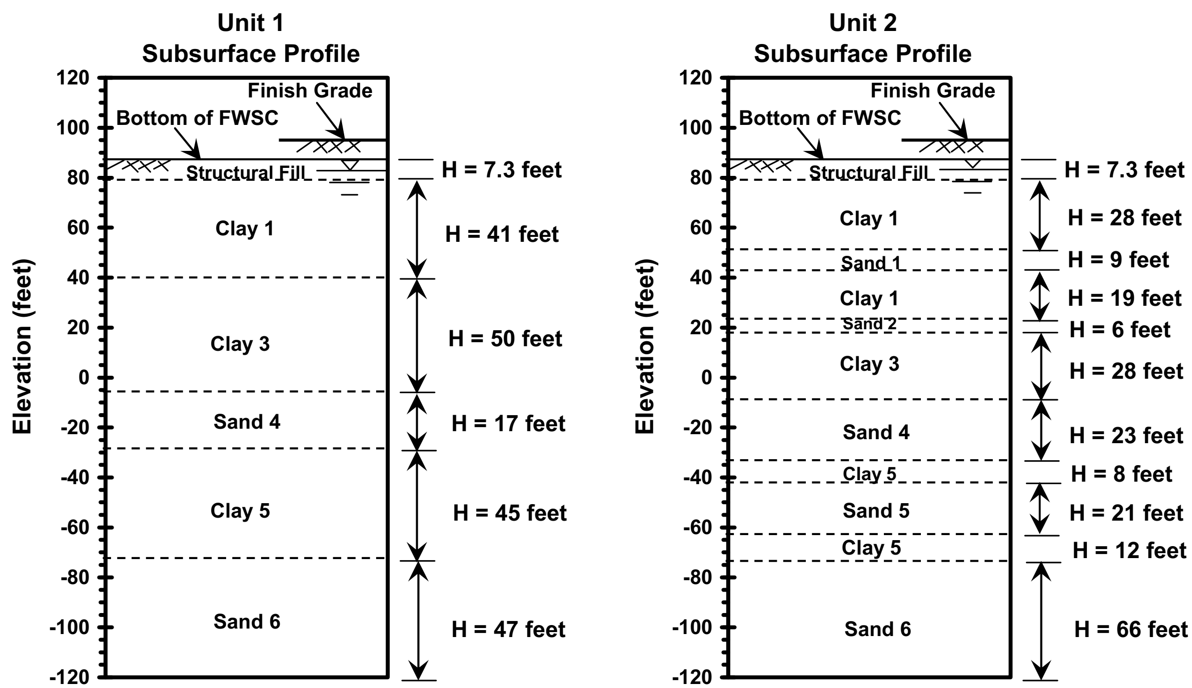
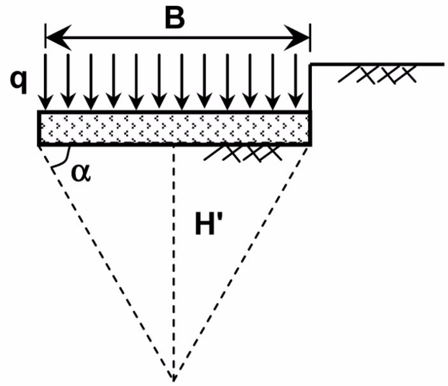


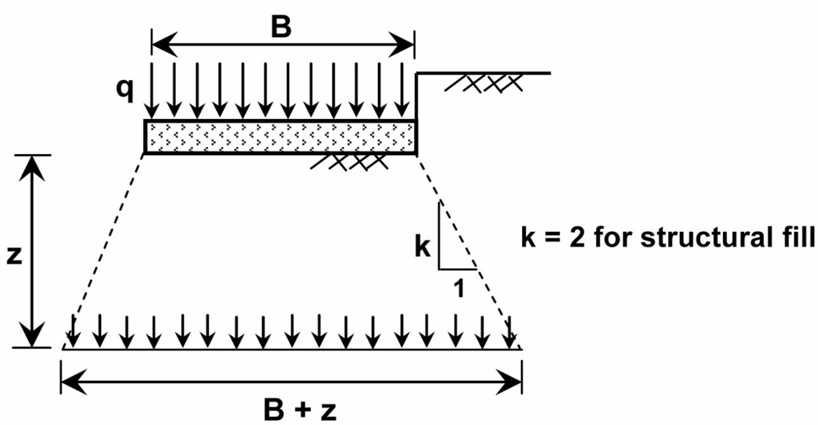
Figure 2.5.4-133 Adopted Subsurface Profiles; (Typical LWR (with an Integral UHS) Fire Water Service Complex) (Power Block Area)

FOUNDATION WEDGE



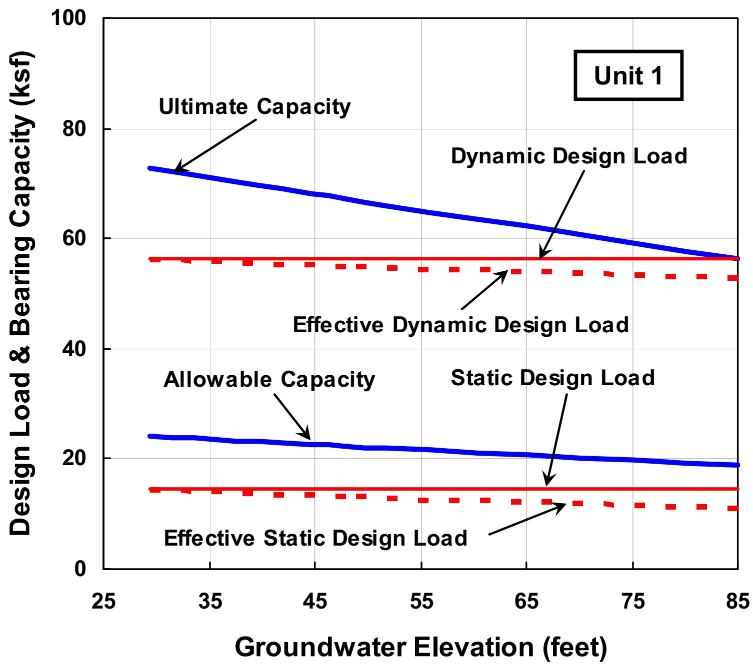
H' = foundation deformation zone (height of the wedge), estimated as H' = 0.5 B tan (α), where α = 45 + Φ/2, and Φ = friction angle of the soil

PRESSURE DISTRIBUTION



B = foundation width, q = foundation pressure, z = structural fill thickness, k= distribution factor

Figure 2.5.4-134 Nomenclature for Foundation Wedge and Pressure Distribution Diagrams (Power Block Area)



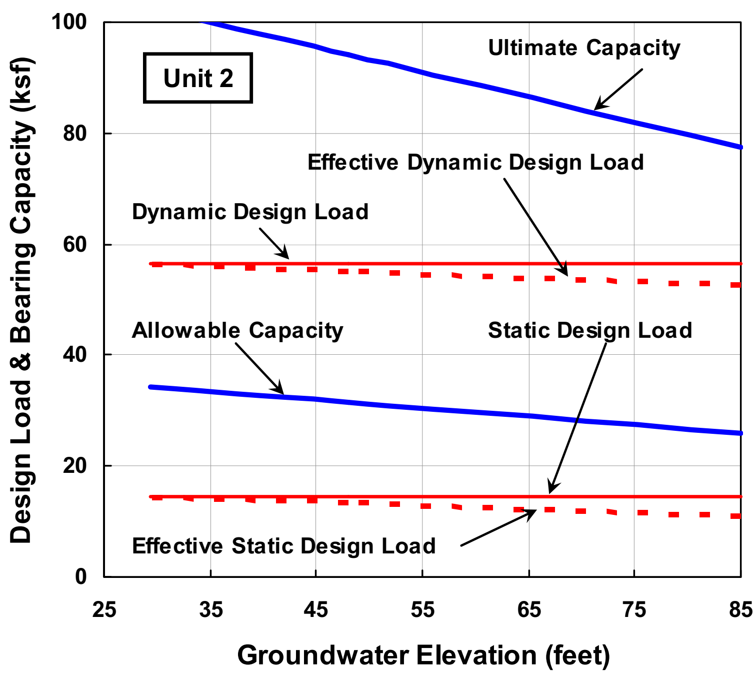


Figure 2.5.4-135 Comparison of Design Loads and Bearing Capacities versus Groundwater Table Elevations (Typical LWR (with an Integral UHS) Reactor/Fuel Building)

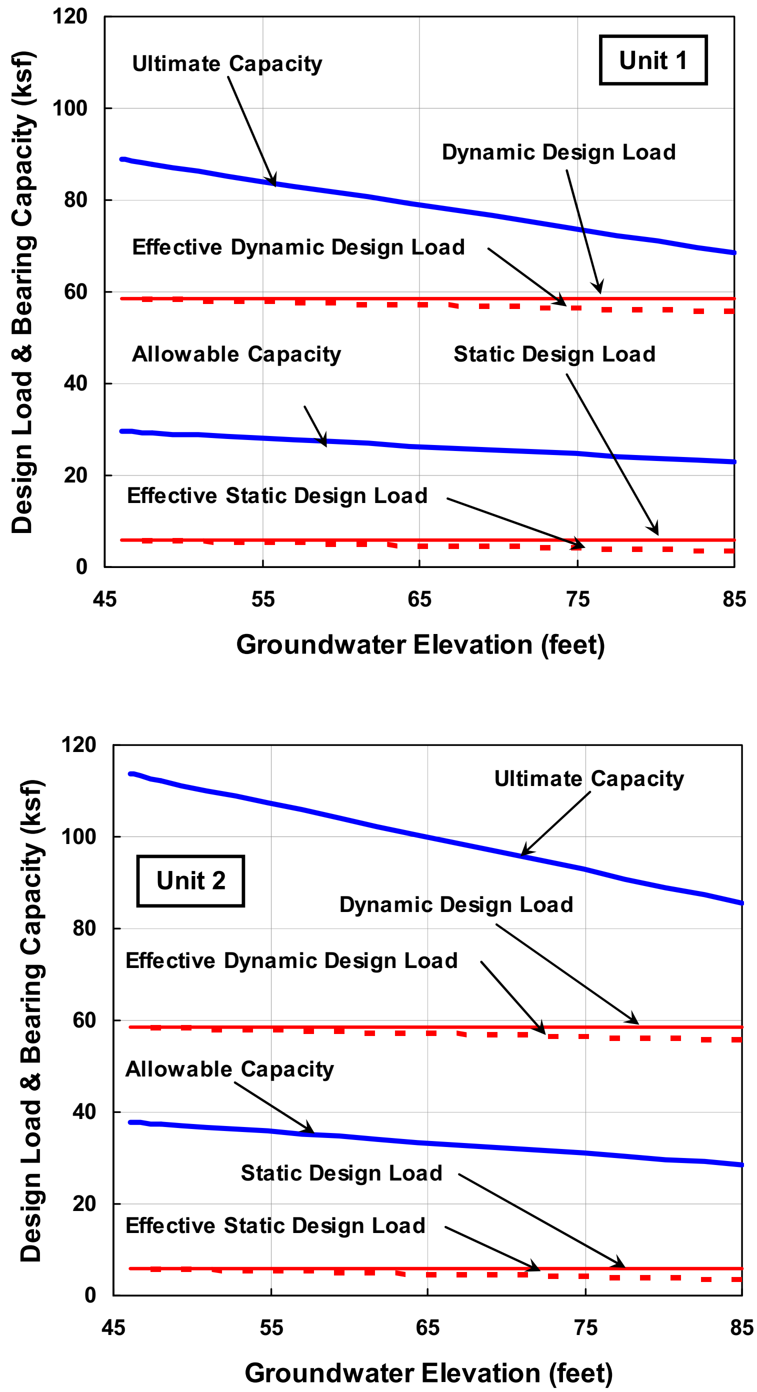


Figure 2.5.4-136 Comparison of Design Loads and Bearing Capacities versus Groundwater Table Elevations (Typical LWR (with an Integral UHS) Control Building)

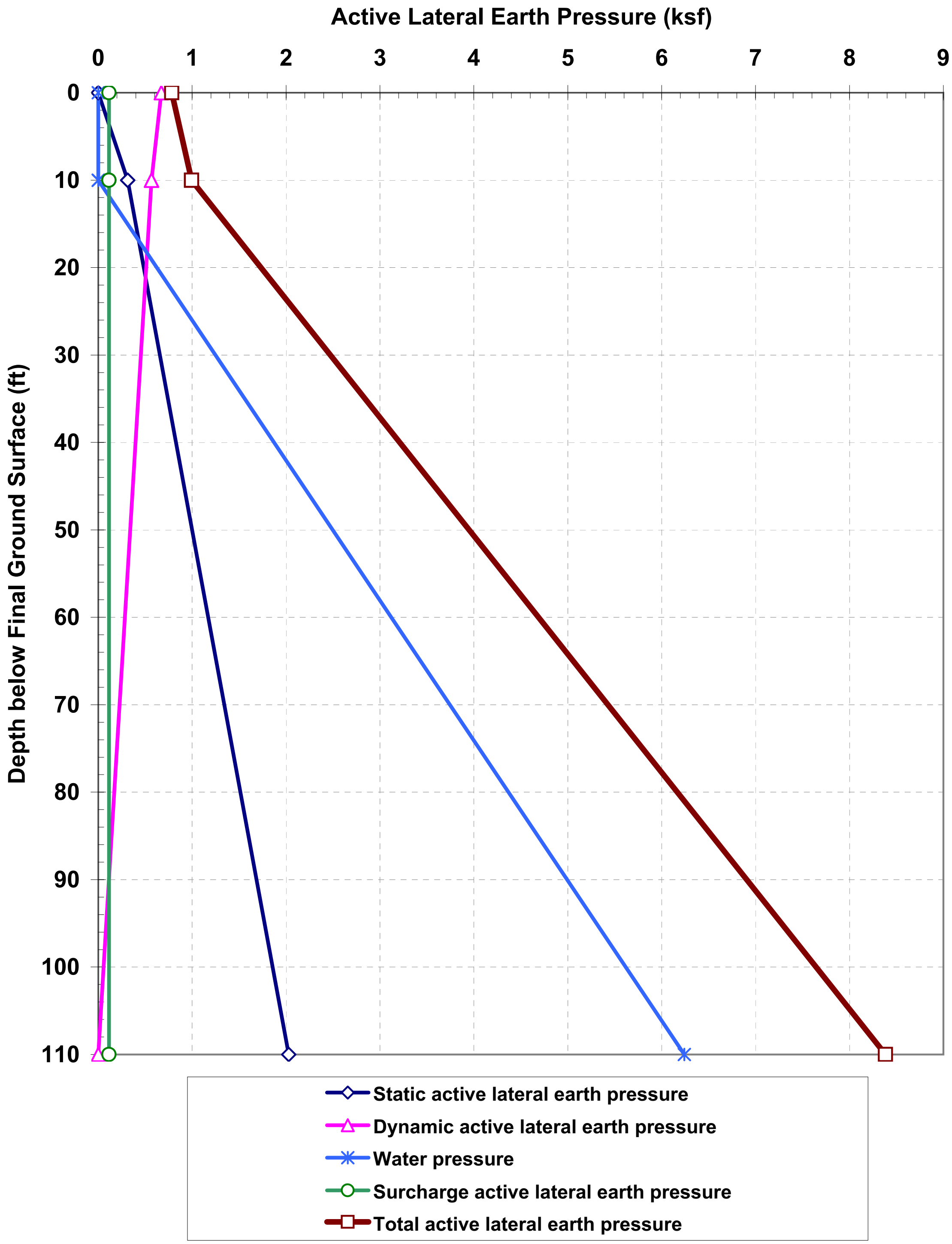


Figure 2.5.4-137 Active Lateral Earth Pressure Diagrams (Power Block Area)

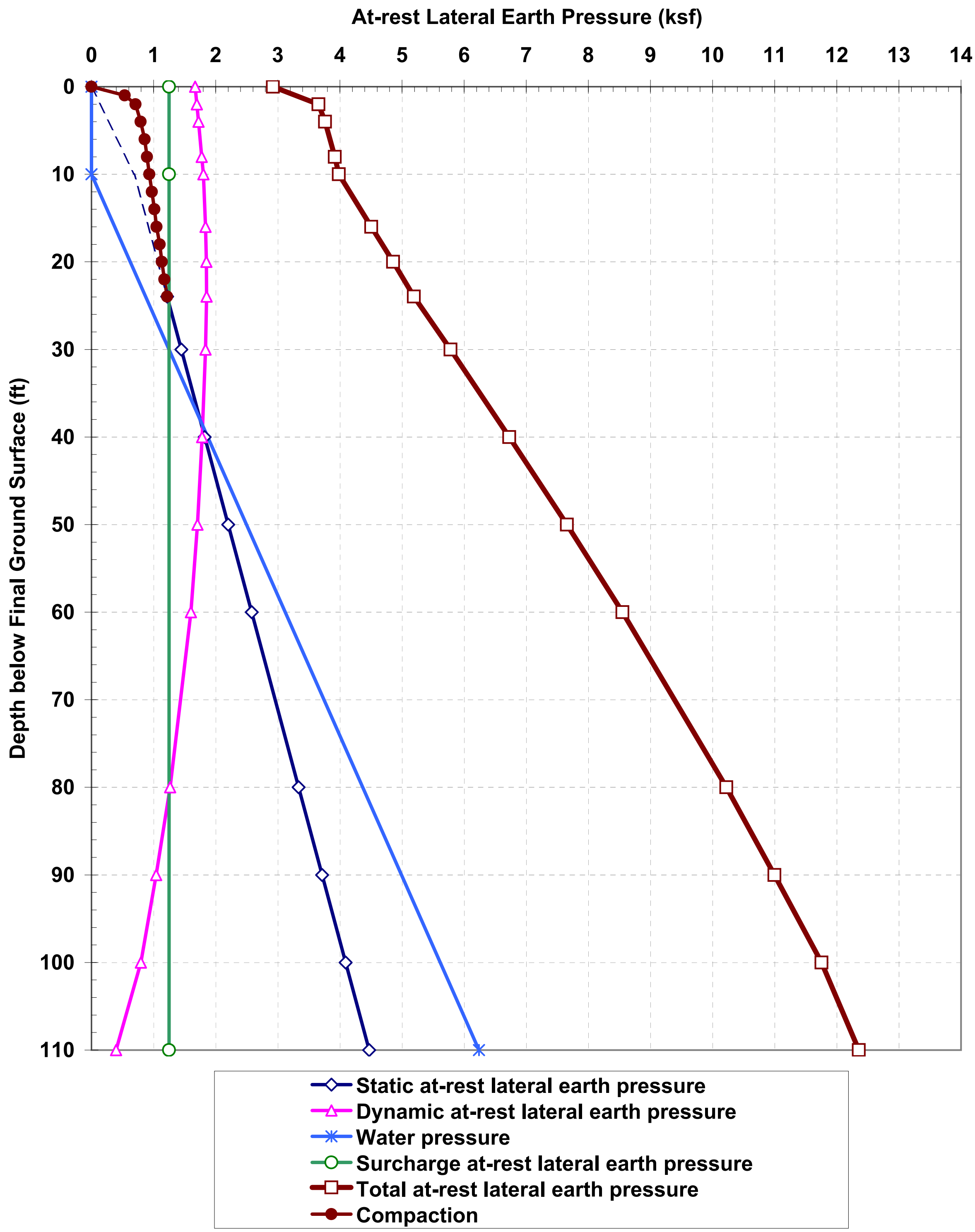


Figure 2.5.4-138 At-Rest Lateral Earth Pressure Diagrams (Power Block Area)

Appendix 2.5.4-A

Supplemental Subsurface Investigation Evaluation

(124 pages)

2.5.4-A Supplemental Subsurface Investigation Evaluation

This appendix contains a follow-on evaluation of VCS site power block area subsurface conditions based on the results of a supplemental subsurface investigation performed in early 2009 (Reference 2.5.4-3). Note that the initial subsurface investigation of the VCS site reported on in Subsection 2.5.4 accommodates a typical two unit Light Water Reactor (LWR) power block area arrangement (with an integral ultimate heat sink (UHS) structure), and included a cooling basin to the south. See References 2.5.4-1 and 2.5.4-2 for data related to the initial investigation. The supplemental subsurface investigation performed in early 2009 and discussed in this appendix was planned and executed to support investigation of other power block area arrangements, including various other typical LWR plant layouts (with independent seismic Category I UHS structures). See Reference 2.5.4-3 for data related to the supplemental investigation.

Selected tables and figures from Subsection 2.5.4 are updated in this appendix to illustrate the changes in power block area subsurface profiles and design properties resulting from the addition of the 2009 supplemental investigation data into a combined body of investigation data (initial investigation plus supplemental investigation). For ease of comparing the original tables and figures contained in Subsection 2.5.4, with those updated to include the supplemental investigation data, the tables and figures in this appendix use the same table or figure number as those employed in the main body of Subsection 2.5.4, with an embedded “A” to indicate that the particular table or figure is a part of this appendix. Note that in all cases, the changes in power block area subsurface profiles and design properties determined using the combined body of investigation data (initial investigation plus supplemental investigation) are minor.

Note also that cooling basin-related portions of Subsection 2.5.4 (including text, tables, and figures) are not affected by the supplemental subsurface investigation work. Supplemental subsurface investigation was not required in the cooling basin area, given that the cooling basin arrangement investigated initially was also adequate to accommodate the other considered plant layouts.

2.5.4-A-1 Supplemental Investigation Work; Updated Field and Laboratory Testing Summaries

The 2009 supplemental investigation work (Reference 2.5.4-3) included, among other things:

- Drilling 94 additional investigatory borings (B-3100 and B-3200 series borings), most with Standard Penetration Test (SPT) sampling, and some additionally collecting undisturbed samples (36 undisturbed samples) using a Shelby push sampler or a Pitcher sampler, depending on the material sampled, to a maximum depth of 407 feet.

- Performing 12 additional Cone Penetration Tests (CPTs) (C-3100 and C-3200 series CPTs) to a maximum depth of 109 feet.

- Performing geophysical logging in four dedicated borings (B-3170A Offset, B-3185A Offset, B-3270A Offset, and B-3285A Offset), consisting of all of the following geophysical tests: suspension P-S velocity logging, natural gamma, long and short normal resistivity, single point resistance, spontaneous potential, and three-leg caliper, to a maximum depth of 315 feet.

- Conducting SPT hammer energy measurements for each of the 10 drilling rigs employed or re-employed at the site.

- Performing laboratory classification and index testing, strength testing, compressibility testing, and chemical testing of selected soil samples.

The types and numbers of field and laboratory tests considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are summarized in the following:

- Table 2.5.4-A-1 Field Testing Summary
- Table 2.5.4-A-14 Laboratory Testing Summary
- Table 2.5.4-A-36 As-Built Boring Information
- Table 2.5.4-A-38 Undisturbed Sample Details
- Table 2.5.4-A-40 As-Built Cone Penetration Test Information
- Figure 2.5.4-A-1 Subsurface Investigation Location Plan

2.5.4-A-2 Soil Strata Statistics and Subsurface Stratification

Changes to soil strata layer thicknesses and top surface elevations considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are summarized in the following:

- Table 2.5.4-A-3 Soil Strata Thicknesses and Base Elevations

Note that average strata layer thicknesses, considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation):

- Typically vary between –2 feet and +1 foot (i.e., within –10 percent and +5 percent) of the initial investigation average values reported in Subsection 2.5.4, to the maximum depth of drilling undertaken in the supplemental investigation (407 feet in the case of Boring B-3131). This statement pertains to Stratum Clay 1 (Top) through Stratum Clay 11, inclusive.

- Remain unchanged between the maximum depth of drilling undertaken in the supplemental investigation (407 feet in the case of Boring B-3131) and the maximum depth of drilling undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A and Boring B-2274A). This statement pertains to Stratum Sand 12 through Stratum Sand 18, inclusive.

- Remain unchanged (i.e., were not measured) below the maximum depth of drilling undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A and Boring B-2274A). This statement pertains to soil strata deeper than Stratum Sand 18.

These variations in average strata layer thicknesses over the full depth of the evaluated subsurface profile are minor.

Changes to subsurface stratification considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are further illustrated in the following:

- Figure 2.5.4-3 Subsurface Profile Legend
- Figure 2.5.4-A-4 Subsurface Profile Plan
- Figure 2.5.4-A-5 Subsurface Profile A; Unit 1 (North-South)
- Figure 2.5.4-A-6 Subsurface Profile B; Unit 1 (East-West)
- Figure 2.5.4-A-7 Subsurface Profile B'; Unit 1 (East-West)
- Figure 2.5.4-A-9 Subsurface Profile C; Unit 2 (North-South)
- Figure 2.5.4-A-10 Subsurface Profile D; Unit 2 (East-West)
- Figure 2.5.4-A-11 Subsurface Profile D'; Unit 2 (East-West)

Note that Figure 2.5.4-3 is a legend figure repeated here from Subsection 2.5.4, for reference. Note also the addition here (versus Subsection 2.5.4) of Subsurface Profile B' (Figure 2.5.4-A-7) and Subsurface Profile D' (Figure 2.5.4-A-11), illustrating the subsurface stratification at possible UHS areas for reactor designs that require an external UHS, that were not covered in the initial investigation. From the figures referenced above, the variations in subsurface stratification over the full depth of the evaluated subsurface profile are minor.

2.5.4-A-3 SPT Resistance (N) Value Statistics

Changes to uncorrected SPT N-values and corrected SPT $(N_1)_{60}$-values considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are summarized in the following:

- Table 2.5.4-A-5 Uncorrected SPT N-values
- Table 2.5.4-A-7 Energy Transfer Ratios/Hammer Energy Corrections

- Table 2.5.4-A-8 Corrected SPT $(N_1)_{60}$-Values
- Table 2.5.4-A-10 Corrected SPT $(N_1)_{60}$-Values Selected for Design
- Figure 2.5.4-A-21 Uncorrected SPT N-Values; Unit 1
- Figure 2.5.4-A-23 Uncorrected SPT N-Values; Unit 2
- Figure 2.5.4-A-27 Corrected SPT $(N_1)_{60}$-Values; Unit 1
- Figure 2.5.4-A-29 Corrected SPT $(N_1)_{60}$-Values; Unit 2

Note that average corrected SPT $(N_1)_{60}$-Values, considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation):

- Typically vary between –7 blows per foot and +6 blows per foot (i.e., within –17 percent and +10 percent) of the initial investigation average values reported in Subsection 2.5.4, to the maximum depth of drilling undertaken in the supplemental investigation (407 feet in the case of Boring B-3131). This statement pertains to Stratum Clay 1 (Top) through Stratum Clay 11, inclusive.

- Remain unchanged between the maximum depth of drilling undertaken in the supplemental investigation (407 feet in the case of Boring B-3131) and the maximum depth of drilling undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A and Boring B-2274A). This statement pertains to Stratum Sand 12 through Stratum Sand 18, inclusive.

- Remain unchanged (i.e., were not measured) below the maximum depth of drilling undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A and Boring B-2274A). This statement pertains to soil strata deeper than Stratum Sand 18.

These variations in average corrected SPT $(N_1)_{60}$-Values over the full depth of the evaluated subsurface profile are minor.

2.5.4-A-4 CPT Parameter Statistics

Changes to corrected CPT q_t-Values and to normalized CPT q_{c1n}-Values, especially, considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are summarized in the following:

- Table 2.5.4-A-12 Cone Penetration Test q_t, q_{c1n}, f_s, and R_f-Values
- Figure 2.5.4-A-33 Corrected CPT q_t-Values; Unit 1
- Figure 2.5.4-A-34 Corrected CPT q_t-Values; Unit 2
- Figure 2.5.4-A-37 Normalized CPT q_{c1n}-Values; Unit 1
- Figure 2.5.4-A-38 Normalized CPT q_{c1n}-Values; Unit 2

Note that average normalized CPT q_{c1n}-Values, considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation):

- Typically vary between –3 and –1 (i.e., within –6 percent and –1 percent) of the initial investigation average values reported in Subsection 2.5.4, to the maximum depth of CPT undertaken in the supplemental investigation (109 feet in the case of CPT C-3201), which is similar to the maximum depth of CPT undertaken in the initial investigation (approximately 100 feet in the case of CPT C-2203). This statement pertains to Stratum Clay 1 (Top) through Stratum Sand 4, inclusive.

- Remain unchanged (i.e., were not measured) below the maximum depth of CPT undertaken in the initial investigation (approximately 100 feet in the case of CPT C-2203). This statement pertains to soil strata deeper than Stratum Sand 4.

These variations in average normalized CPT q_{c1n}-Values over the full depth of the evaluated subsurface profile are minor.

2.5.4-A-5 Shear Wave Velocity Statistics

Changes to shear (S) wave velocity statistics considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are summarized in the following:

- Table 2.5.4-A-51 — S-Wave Velocity Profile Numerical Values; Upper Approximately 600 Feet of Site Soils
- Figure 2.5.4-A-67 — Shear Wave Velocity versus Elevation; Unit 1; Upper Approximately 600 Feet of Site Soils
- Figure 2.5.4-A-68 — Shear Wave Velocity versus Elevation; Unit 2; Upper Approximately 600 Feet of Site Soils
- Figure 2.5.4-A-71 — Average S-Wave Velocity Profile; Unit 1
- Figure 2.5.4-A-72 — Average S-Wave Velocity Profile; Unit 2

Note that average shear wave velocities, considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation):

- Typically vary between –35 feet per second and +33 feet per second (i.e., within –3 percent and +2 percent) of the initial investigation average values reported in Subsection 2.5.4, to the maximum depth of geophysical logging undertaken in the supplemental investigation (315 feet in the case of Boring B-3170A Offset and Boring B-3270A Offset). This statement pertains to Stratum Clay 1 (Top) through Stratum Clay 9, inclusive.

- Remain unchanged between the maximum depth of geophysical logging undertaken in the supplemental investigation (315 feet in the case of Boring B-3170A Offset and Boring B-3270A Offset) and the maximum depth of geophysical logging undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A Offset and Boring B-2274A Offset). This statement pertains to Stratum Sand 10 through Stratum Sand 18, inclusive.
- Remain unchanged below the maximum depth of geophysical logging undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A Offset and Boring B-2274A Offset). This statement pertains to soil strata deeper than Stratum Sand 18.

These variations in average shear wave velocities over the full depth of the evaluated subsurface profile are minor.

2.5.4-A-6 Derived Engineering Properties

Changes to derived engineering properties considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are summarized in the following:

- Table 2.5.4-A-20 Undrained Shear Strength of Cohesive Soil Strata
- Table 2.5.4-A-26 Overconsolidation Ratios and Preconsolidation Pressures of Cohesive Soil Strata
- Table 2.5.4-A-28 High Strain Elastic Moduli Values
- Table 2.5.4-A-30 High Strain Shear Moduli Values
- Table 2.5.4-A-32 Geotechnical Engineering Parameters Selected for Design
- Figure 2.5.4-A-41 Atterberg Limits Test Results
- Figure 2.5.4-A-43 Plasticity Chart
- Figure 2.5.4-A-45 Undrained Shear Strengths of Cohesive Soil Strata from Laboratory Testing
- Figure 2.5.4-A-47 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 1
- Figure 2.5.4-A-48 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 2
- Figure 2.5.4-A-50 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area
- Figure 2.5.4-A-52 Preconsolidation Pressures of Cohesive Soil Strata from Laboratory Testing

- Figure 2.5.4-A-54 Overconsolidation Ratios of Cohesive Soil Strata from Laboratory Testing
- Figure 2.5.4-A-56 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 1
- Figure 2.5.4-A-57 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 2
- Figure 2.5.4-A-59 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area
- Figure 2.5.4-A-61 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 1
- Figure 2.5.4-A-62 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 2
- Figure 2.5.4-A-64 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area

Note that derived engineering properties, considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation):

- Typically vary insignificantly from the initial investigation values reported in Subsection 2.5.4, to the maximum depth of drilling undertaken in the supplemental investigation (407 feet in the case of Boring B-3131). Compare especially the geotechnical engineering parameters selected for design summarized in Table 2.5.4-32 of Subsection 2.5.4 versus the geotechnical engineering parameters selected for design summarized in Table 2.5.4-A-32 of this appendix. This statement pertains to Stratum Clay 1 (Top) through Stratum Clay 11, inclusive.

- Remain unchanged between the maximum depth of drilling undertaken in the supplemental investigation (407 feet in the case of Boring B-3131) and the maximum depth of drilling undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A and Boring B-2274A). This statement pertains to Stratum Sand 12 through Stratum Sand 18, inclusive.

- Remain unchanged (i.e., were not measured) below the maximum depth of drilling undertaken in the initial investigation (approximately 600 feet in the case of Boring B-2174A and Boring B-2274A). This statement pertains to soil strata deeper than Stratum Sand 18.

These variations in derived engineering properties over the full depth of the evaluated subsurface profile are minor.

2.5.4-A-7 Summary

Updated field and laboratory testing summaries and changes to soil strata statistics and subsurface stratification, SPT N-value statistics, CPT parameter statistics, shear wave velocity statistics, and derived engineering properties, considering the combined body of subsurface investigation data (initial investigation plus supplemental investigation) are summarized above, and are illustrated in the noted tables and figures. The variations in the various statistics, values, parameters, profiles, and design properties noted in the individual subsections, above, are minor and will not significantly alter the conclusions of follow-on engineering calculations (e.g., bearing capacity and settlement, construction dewatering, lateral earth pressure, liquefaction, soil column dynamic analysis, etc.) that are currently based on the initial subsurface investigation data. Note however for completeness, that these follow-on engineering calculations will be updated to use the combined body of subsurface investigation data (initial investigation plus supplemental investigation) as part of the COL application.

Table 2.5.4-A-1
Field Testing Summary (Power Block Area)[(a)]

Field Test	Industry Standard	No. of Tests
Borings	Reference 2.5.4-26 Reference 2.5.4-28	187
Standard Penetration Test Hammer Energy Measurements	Reference 2.5.4-10 Reference 2.5.4-27	115[(b)]
Cone Penetration Tests	Reference 2.5.4-29	50
Observation Wells	Reference 2.5.4-30 Reference 2.5.4-31	11
Test Pits	—	8
Field Electrical Resistivity Arrays	Reference 2.5.4-34 Reference 2.5.4-35	2
Suspension P-S Velocity Logging	Reference 2.5.4-52	14

(a) Includes field tests made at Unit 1, at Unit 2, and Outside the Power Block Area during both phases of field work.
(b) Measurements made on drilling rigs/SPT hammers employed at all site areas during both phases of field work.

Table 2.5.4-A-2
Not Used

Table 2.5.4-A-3 (Sheet 1 of 3)
Soil Strata Thicknesses and Base Elevations (Power Block Area)

Stratum	Statistics	Unit 1		Unit 2		Inside Power Block Area		Outside Power Block Area	
		Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)
Clay 1 (Top)	Minimum	32.5	18.5	36.9	22.8	32.5	18.5	44.9	12.4
	Maximum	61.7	47.6	57.6	43.5	61.7	47.6	68.2	34.6
	Average	51.4	28.4	51.3	29.0	51.4	28.7	59.0	20.6
Sand 1	Minimum	48.6	1.5	28.4	0.5	28.4	0.5	Absent	Absent
	Maximum	48.6	1.5	55.7	20.0	55.7	20.0	Absent	Absent
	Average	48.6	1.5	43.6	8.0	43.7	7.9	Absent	Absent
Clay 1 (Bottom)	Minimum	11.4	7.0	12.8	2.0	11.4	2.0	32.3	8.0
	Maximum	43.7	40.0	39.3	35.0	43.7	40.0	56.4	27.5
	Average	30.4	21.0	26.7	19.8	28.6	20.4	40.2	18.8
Sand 2	Minimum	-4.0	0.5	-7.5	1.5	-7.5	0.5	13.4	7.6
	Maximum	26.5	35.5	33.1	28.5	33.1	35.5	24.9	43.0
	Average	18.3	14.6	17.1	11.4	17.6	12.9	19.0	21.2
Clay 3	Minimum	-18.3	5.0	-25.4	3.0	-25.4	3.0	-10.1	22.1
	Maximum	15.3	50.0	2.6	45.0	15.3	50.0	-2.3	35.0
	Average	-4.5	25.0	-8.2	26.3	-6.4	25.7	-7.0	26.0
Sand 4	Minimum	-40.2	2.7	-49.3	5.0	-49.3	2.7	-31.2	7.0
	Maximum	-13.8	51.0	-24.7	37.8	-13.8	51.0	-15.3	28.9
	Average	-27.4	22.4	-36.0	25.8	-31.8	24.1	-23.9	16.5
Clay 5 (Top)	Minimum	-70.2	6.0	-65.6	2.2	-70.2	2.2	-50.1	5.0
	Maximum	-27.9	50.0	-40.9	31.0	-27.9	50.0	-23.6	22.0
	Average	-49.1	22.0	-52.2	16.2	-50.7	19.1	-39.7	15.8
Sand 5	Minimum	-81.0	1.0	-97.7	1.5	-97.7	1.0	-61.2	7.0
	Maximum	-48.9	36.5	-58.2	51.0	-48.9	51.0	-33.6	18.0
	Average	-66.0	17.5	-66.9	14.7	-66.5	15.9	-46.4	11.7
Clay 5 (Bottom)	Minimum	-98.3	-0.1	-118.8	2.7	-118.8	-0.1	-75.2	4.0
	Maximum	-55.7	40.0	-69.9	53.5	-55.7	53.5	-45.6	14.0
	Average	-77.9	16.8	-81.3	14.2	-79.4	15.6	-56.7	9.4
Sand 6	Minimum	-148.9	30.0	-173.8	11.0	-173.8	11.0	-113.2	38.0
	Maximum	-109.8	77.0	-98.3	102.0	-98.3	102.0	-112.6	67.0
	Average	-128.8	50.1	-138.6	55.5	-133.2	52.5	-112.9	52.5
Clay 7	Minimum	-189.3	17.2	-169.3	19.9	-189.3	17.2	-159.2	46.0
	Maximum	-150.8	65.5	-168.0	30.2	-150.8	65.5	-159.2	46.0
	Average	-167.8	36.8	-168.5	25.0	-167.9	35.3	-159.2	46.0

Table 2.5.4-A-3 (Sheet 2 of 3)
Soil Strata Thicknesses and Base Elevations (Power Block Area)

		Unit 1		Unit 2		Inside Power Block Area		Outside Power Block Area	
Stratum	Statistics	Base El. (feet)[a]	Thickness (feet)	Base El. (feet)[a]	Thickness (feet)	Base El. (feet)[a]	Thickness (feet)	Base El. (feet)[a]	Thickness (feet)
Sand 8	Minimum	-210.3	10.0	-221.4	30.9	-221.4	10.0	-184.2	25.0
	Maximum	-180.1	54.1	-177.9	100.1	-177.9	100.1	-161.8	49.2
	Average	-202.3	33.2	-208.1	64.2	-205.1	48.4	-173.0	37.1
Clay 9	Minimum	-268.9	33.0	-258.2	20.8	-268.9	20.8	-211.2	27.0
	Maximum	-238.7	64.0	-242.2	49.8	-238.7	64.0	-205.6	43.8
	Average	-245.4	40.7	-252.2	39.7	-249.0	40.1	-208.4	35.4
Sand 10	Minimum	-293.5	8.0	-298.2	23.5	-298.2	8.0	>-233.6	>18.0
	Maximum	-254.5	40.1	-281.5	47.3	-254.5	47.3	>-229.2	>28.0
	Average	-268.9	23.5	-289.5	36.3	-279.2	29.9	>-231.4	>23.0
Clay 11	Minimum	-328.3	72.1	-323.7	35.8	-328.3	35.8	—	—
	Maximum	-328.3	72.1	-323.7	35.8	323.7	72.1	—	—
	Average	-328.3	72.1	-323.7	35.8	326.0	54.0	—	—
Sand 12	Minimum	-346.4	18.1	-346.7	23.0	-346.7	18.1	—	—
	Maximum	-346.4	18.1	-346.7	23.0	-345.4	23.0	—	—
	Average	-346.4	18.1	-346.7	23.0	-346.5	20.6	—	—
Clay 13	Minimum	-421.9	75.5	-422.7	76.0	-422.7	75.5	—	—
	Maximum	-421.9	75.5	-422.7	76.0	-421.9	76.0	—	—
	Average	-421.9	75.5	-422.7	76.0	-422.3	75.8	—	—
Sand 14	Minimum	-454.7	32.8	-469.3	46.6	-469.3	32.8	—	—
	Maximum	-454.7	32.8	-469.3	46.6	-454.7	46.6	—	—
	Average	-454.7	32.8	-469.3	46.6	-462.0	39.7	—	—
Clay 15	Minimum	-465.9	11.2	-481.7	12.4	-481.7	11.2	—	—
	Maximum	-465.9	11.2	-481.7	12.4	-465.9	12.4	—	—
	Average	-465.9	11.2	-481.7	12.4	-473.8	11.8	—	—
Sand 16	Minimum	-480.9	15.0	-499.7	18.0	-499.7	15.0	—	—
	Maximum	-480.9	15.0	-499.7	18.0	-480.9	18.0	—	—
	Average	-480.9	15.0	-499.7	18.0	-490.3	16.5	—	—
Clay 17	Minimum	-507.2	26.3	-515.7	16.0	-515.7	16.0	—	—
	Maximum	-507.2	26.3	-515.7	16.0	-507.2	26.3	—	—
	Average	-507.2	26.3	-515.7	16.0	-511.4	21.2	—	—
Sand 18	Minimum	>-521.1	>13.9	>-520.1	>4.4	>-520.6	>4.4	—	—
	Maximum	>-521.1	>13.9	>-520.1	>4.4	>-521.1	>13.9	—	—
	Average	>-521.1	>13.9	>-520.1	>4.4	>-518.6	>9.15	—	—

Table 2.5.4-A-3 (Sheet 3 of 3)
Soil Strata Thicknesses and Base Elevations (Power Block Area)

Stratum	Unit 1		Unit 2		Inside Power Block Area		Outside Power Block Area	
	Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)	Base El. (feet)[(a)]	Thickness (feet)
Values for Use								
Clay 1(Top)	51.4	28.4	51.3	29.0	51.4	28.7	59.0	20.6
Sand 1	Absent[(b)]	Absent[(b)]	43.6	7.7	43.7	7.7	Absent	Absent
Clay 1 (Bottom)	30.4	18.2	26.7	16.9	28.6	15.2	40.2	18.8
Sand 2	18.3	12.2	17.1	9.7	17.6	10.9	19.0	21.2
Clay 3	-4.5	22.8	-8.2	25.3	-6.4	24.0	-7.0	26.0
Sand 4	-27.4	22.9	-36.0	27.8	-31.8	25.4	-23.9	16.5
Clay 5 (Top)	-49.1	21.7	-52.2	16.2	-50.7	18.9	-39.7	15.8
Sand 5	-66.0	16.9	-66.9	14.7	-66.5	15.8	-46.4	11.7
Clay 5 (Bottom)	-77.9	11.9	-81.3	14.4	-79.4	12.9	-56.7	9.4
Sand 6	-128.8	50.9	-138.6	57.4	-133.2	53.8	-112.9	52.5
Clay 7	-167.8	39.0	Absent[(c)]	Absent[(c)]	-167.9	34.7	-159.2	46.0
Sand 8	-202.3	34.4	-208.1	39.5	-205.1	37.2	-173.0	37.1
Clay 9	-245.4	43.2	-252.2	44.1	-249.0	43.9	-208.4	35.4
Sand 10	-268.9	23.5	-289.5	37.3	-279.2	30.2	>-231.4	>23.0
Clay 11	-328.3	59.4	-323.7	34.2	-326.0	46.8	—	—
Sand 12	-346.4	18.1	-346.7	23.0	-346.5	20.6	—	—
Clay 13	-421.9	75.5	-422.7	76.0	-422.3	75.8	—	—
Sand 14	-454.7	32.8	-469.3	46.6	-462.0	39.7	—	—
Clay 15	-465.9	11.2	-481.7	12.4	-473.8	11.8	—	—
Sand 16	-480.9	15.0	-499.7	18.0	-490.3	16.5	—	—
Clay 17	-507.2	26.3	-515.7	16.0	-511.4	21.2	—	—
Sand 18	>-521.1	>13.9	>-520.1	>4.4	>-520.6	>9.2	—	—

(a) Elevations are referenced to NAVD 88.

(b) Stratum Sand 1 was not encountered within the Unit 1 area except in C-3101, which was a single isolated occurrence. Thus, Sand 1 is concluded “absent” for Unit 1.

(c) Stratum Clay 7 was encountered in only four boreholes (B-3204, B-3205, B-3223, and B-3228), which are at isolated locations. As the geophysical measurements do not reflect the presence/properties of Stratum 7, it is concluded that Stratum 7 is “absent” for Unit 2.

Table 2.5.4-A-4
Not Used

Table 2.5.4-A-5 (Sheet 1 of 2)
Uncorrected SPT N-Values (Power Block Area)

Stratum	Statistics	Unit 1 N-Value (blows/foot)	Unit 2 N-Value (blows/foot)	Inside Power Block Area N-Value (blows/foot)	Outside Power Block Area N-Value (blows/foot)
Clay 1 (Top)	No. of Tests	581	617	1198	26
	Minimum	0	1	0	4
	Maximum	52	40	52	34
	Average	14	13	14	13
Sand 1	No. of Tests	Absent	70	70	Absent
	Minimum	—	12	12	—
	Maximum	—	99	99	—
	Average	—	28	28	—
Clay 1 (Bottom)	No. of Tests	309	286	595	21
	Minimum	9	10	9	10
	Maximum	50	52	52	52
	Average	18	19	18	21
Sand 2	No. of Tests	144	144	288	22
	Minimum	9	9	9	21
	Maximum	80	167	167	167
	Average	31	29	30	47
Clay 3	No. of Tests	367	406	773	26
	Minimum	9	8	8	13
	Maximum	>200	>200	>200	34
	Average	28	22	25	20
Sand 4	No. of Tests	264	275	539	14
	Minimum	5	16	5	11
	Maximum	>200	>200	>200	121
	Average	105	77	91	58
Clay 5 (Top)	No. of Tests	157	125	282	9
	Minimum	11	13	11	14
	Maximum	167	94	167	63
	Average	25	28	26	26
Sand 5	No. of Tests	89	123	212	4
	Minimum	17	7	7	25
	Maximum	>200	>200	>200	162
	Average	52	75	65	77
Clay 5 (Bottom)	No. of Tests	105	78	183	3
	Minimum	11	10	10	24
	Maximum	106	>200	>200	37
	Average	31	47	38	29
Sand 6	No. of Tests	266	257	523	19
	Minimum	7	14	7	27
	Maximum	>200	>200	>200	>200
	Average	96	122	109	90
Clay 7	No. of Tests	89	13	102	3
	Minimum	16	21	16	19
	Maximum	>200	>200	>200	43
	Average	63	66	64	31

Table 2.5.4-A-5 (Sheet 2 of 2)
Uncorrected SPT N-Values (Power Block Area)

Stratum	Statistics	Unit 1 N-Value (blows/foot)	Unit 2 N-Value (blows/foot)	Inside Power Block Area N-Value (blows/foot)	Outside Power Block Area N-Value (blows/foot)
Sand 8	No. of Tests	72	27	99	3
	Minimum	21	7	7	57
	Maximum	>200	>200	>200	125
	Average	108	111	110	94
Clay 9	No. of Tests	66	60	126	4
	Minimum	13	22	13	35
	Maximum	77	125	125	125
	Average	41	40	40	64
Sand 10	No. of Tests	20	30	50	2
	Minimum	30	26	26	90
	Maximum	>200	>200	>200	125
	Average	125	137	132	108
Clay 11	No. of Tests	32	39	71	Not Reached
	Minimum	24	16	16	—
	Maximum	167	90	167	—
	Average	43	36	39	—
Sand 12	No. of Tests	1	1	2	Not Reached
	Minimum	166	33	33	—
	Maximum	166	33	166	—
	Average	166	33	100	—
Clay 13	No. of Tests	4	4	8	Not Reached
	Minimum	33	25	25	—
	Maximum	86	46	86	—
	Average	51	38	44	—
Sand 14	No. of Tests	1	3	4	Not Reached
	Minimum	65	51	51	—
	Maximum	65	166	166	—
	Average	65	114	102	—
Clay 15	No. of Tests	2	Absent	2	Not Reached
	Minimum	52	—	52	—
	Maximum	58	—	58	—
	Average	55	—	55	—
Sand 16	No. of Tests	1	1	2	Not Reached
	Minimum	125	97	97	—
	Maximum	125	97	125	—
	Average	125	97	111	—
Clay 17	No. of Tests	1	2	3	Not Reached
	Minimum	46	68	46	—
	Maximum	46	94	94	—
	Average	46	81	69	—
Sand 18	No. of Tests	1	Not Measured	1	Not Reached
	Minimum	166	—	166	—
	Maximum	166	—	166	—
	Average	166	—	166	—

Table 2.5.4-A-6
Not Used

Table 2.5.4-A-7
Energy Transfer Ratios/Hammer Energy Corrections (Power Block Area; Cooling Basin)

Drilling Rig	Number Of Measurements	Min. ETR (%)[(a)]	Max. ETR (%)[(a)]	Average ETR (%)[(a)]	Hammer Energy Correction (ETR%/60%)
Initial Subsurface Investigation					
MACTEC Raleigh CME 55LC Track Rig (Serial No. MEC-02)[(b)]	7	81.1	86.0	84.4	1.41
MACTEC Atlanta CME 550 ATV Rig (Serial No. MEC-03)	4	87.1	92.0	90.7	1.51
MACTEC Atlanta CME 550x ATV Rig (Serial No. MEC-05)[(b)]	6	81.7	88.9	86.2	1.44
MACTEC Charlotte CME 75 Truck Rig (Serial No. MEC-09)	3	81.1	84.3	82.0	1.37
Miller Drilling CME 85 Truck Rig (Serial No. MEC-10)	3	88.6	90.6	89.3	1.49
Environmental Exploration CME 75 Truck Rig (Serial No. MEC-11)[(c)]	8	87.4	90.3	88.6	1.48
MACTEC Charlotte CME 45 Track Rig (Serial No. MEC-12)	3	72.3	80.6	73.9	1.23
MACTEC Raleigh CME 45 Track Rig (Serial No. MEC-13)	3	84.6	86.3	85.2	1.42
Environmental Exploration CME 750 ATV Rig (Serial No. 263048)	5	67.4	76.9	72.5	1.21
Supplemental Subsurface Investigation					
MACTEC Raleigh CME 55LC Track Rig (Serial No. MEC-02)	5	75.7	82.9	80.3	1.34
MACTEC Charlotte CME 550 ATV Rig (Serial No. ME-05)	5	69.1	72.6	70.6	1.18
Miller Drilling CME 750 ATV Rig (Serial No. 7)	6	80.3	90.0	84.3	1.41
MACTEC Atlanta CME 550 ATV Rig (Serial No. CME-08)[(b)]	9	75.1	88.6	82.2	1.37
MACTEC Raleigh CME 45C Track Rig (Serial No. MEC-12)	5	83.4	89.1	84.2	1.40
MACTEC Atlanta CME 55D Truck Rig (Serial No. MEC-20)[(b)]	13	75.7	84	82.4	1.37
MACTEC Raleigh CME 55 Track Rig (Serial No. MEC-21)[(b)]	10	85.7	90.9	87.8	1.46
MACTEC Atlanta CME 550X ATV Rig (Serial No. MEC-22)	5	86.6	90.6	88.3	1.47
Miller Drilling CME 75 Truck Rig (Serial No. 100)[(b)]	10	78.9	88.6	83.5	1.39
Miller Drilling CME 550 ATV Rig (Serial No. 353)	5	80.0	84.6	83.4	1.39

(a) Energy Transfer Ratio (ETR) is the percent of measured SPT hammer energy versus the theoretical SPT hammer energy (350 foot-pounds).
(b) Energy measurements made using both AW-J and NW-J drill rods.
(c) Energy measurements made using AW-J and Mayhew drill rods. Energy measurements made using Mayhew rods are not included here.

Table 2.5.4-A-8 (Sheet 1 of 2)
Corrected SPT $(N_1)_{60}$-Values (Power Block Area)

Stratum	Statistics	Unit 1 $(N_1)_{60}$-Value (blows/foot)	Unit 2 $(N_1)_{60}$-Value (blows/foot)	Inside Power Block Area $(N_1)_{60}$-Value (blows/foot)	Outside Power Block Area $(N_1)_{60}$-Value (blows/foot)
Clay 1 (Top)	No. of Tests	581	617	1198	26
	Minimum	0	2	0	7
	Maximum	84	58	58	47
	Average	20	19	20	21
Sand 1	No. of Tests	Absent	70	70	Absent
	Minimum	—	14	14	—
	Maximum	—	98	98	—
	Average	—	31	31	—
Clay 1 (Bottom)	No. of Tests	309	286	595	21
	Minimum	9	9	9	11
	Maximum	53	51	53	64
	Average	17	19	18	21
Sand 2	No. of Tests	144	144	288	22
	Minimum	8	9	8	17
	Maximum	72	142	142	165
	Average	27	25	26	39
Clay 3	No. of Tests	367	406	773	26
	Minimum	6	6	6	8
	Maximum	368	227	368	27
	Average	21	17	19	15
Sand 4	No. of Tests	264	275	539	14
	Minimum	3	12	3	5
	Maximum	69	52	69	66
	Average	69	52	60	35
Clay 5 (Top)	No. of Tests	157	125	282	9
	Minimum	0	8	0	9
	Maximum	96	60	96	40
	Average	15	17	16	16
Sand 5	No. of Tests	89	123	212	4
	Minimum	10	4	4	16
	Maximum	260	343	343	75
	Average	31	47	40	38
Clay 5 (Bottom)	No. of Tests	105	78	183	3
	Minimum	6	7	6	11
	Maximum	68	884	884	25
	Average	19	29	23	16
Sand 6	No. of Tests	266	257	523	19
	Minimum	4	9	4	16
	Maximum	612	1009	1009	151
	Average	57	77	67	52
Clay 7	No. of Tests	89	13	102	3
	Minimum	9	13	9	9
	Maximum	590	158	590	20
	Average	38	41	38	15

Table 2.5.4-A-8 (Sheet 2 of 2)
Corrected SPT $(N_1)_{60}$-Values (Power Block Area)

Stratum	Statistics	Unit 1 $(N_1)_{60}$-Value (blows/foot)	Unit 2 $(N_1)_{60}$-Value (blows/foot)	Inside Power Block Area $(N_1)_{60}$-Value (blows/foot)	Outside Power Block Area $(N_1)_{60}$-Value (blows/foot)
Sand 8	No. of Tests	72	27	99	3
	Minimum	13	4	4	27
	Maximum	642	465	465	75
	Average	65	69	67	54
Clay 9	No. of Tests	66	60	126	4
	Minimum	8	13	8	21
	Maximum	40	77	40	75
	Average	24	25	24	42
Sand 10	No. of Tests	20	30	50	2
	Minimum	18	17	17	42
	Maximum	223	371	223	75
	Average	77	86	82	59
Clay 11	No. of Tests	32	39	71	Not Reached
	Minimum	14	10	10	—
	Maximum	102	60	60	—
	Average	27	23	25	—
Sand 12	No. of Tests	1	1	2	Not Reached
	Minimum	100	22	22	—
	Maximum	100	22	100	—
	Average	100	22	61	—
Clay 13	No. of Tests	4	4	8	Not Reached
	Minimum	20	16	16	—
	Maximum	52	30	52	—
	Average	30	25	28	—
Sand 14	No. of Tests	1	3	4	Not Reached
	Minimum	39	33	33	—
	Maximum	39	109	109	—
	Average	39	75	66	—
Clay 15	No. of Tests	2	Absent	2	Not Reached
	Minimum	31	—	31	—
	Maximum	35	—	35	—
	Average	33	—	33	—
Sand 16	No. of Tests	1	1	2	Not Reached
	Minimum	75	64	64	—
	Maximum	75	64	75	—
	Average	75	64	69	—
Clay 17	No. of Tests	1	2	3	Not Reached
	Minimum	28	45	28	—
	Maximum	28	62	62	—
	Average	28	53	45	—
Sand 18	No. of Tests	1	Not Reached	1	Not Reached
	Minimum	100	—	100	—
	Maximum	100	—	100	—
	Average	100	—	100	—

Table 2.5.4-A-9
Not Used

Table 2.5.4-A-10
Corrected SPT $(N_1)_{60}$-Values Selected for Design (Power Block Area)

Stratum	Average Uncorrected N-Value (blows/foot)	Average Corrected $(N_1)_{60}$-Value (blows/foot)	Selected Corrected $(N_1)_{60}$-Value (blows/foot)[a]
Clay 1 (Top)	14	20	19[b]
Sand 1	28	31	31
Clay 1 (Bottom)	18	18	19[b]
Sand 2	30	26	26
Clay 3	25	19	19
Sand 4	91	60	60
Clay 5 (Top)	26	16	16[c]
Sand 5	65	40	40
Clay 5 (Bottom)	38	23	16[c]
Sand 6	109	67	67
Clay 7	64	38	38
Sand 8	110	67	67
Clay 9	40	24	24
Sand 10	132	82	82
Clay 11	39	25	25
Sand 12	100	61	61
Clay 13	44	28	28
Sand 14	102	66	66
Clay 15	55	33	33
Sand 16	111	69	69
Clay 17	69	45	45
Sand 18	166	100	100

(a) Selected $(N_1)_{60}$ values are limited to 100 blows per foot.
(b) A single $(N_1)_{60}$ value for Clay 1 (Top) and Clay 1 (Bottom) is selected.
(c) A single $(N_1)_{60}$ value for Clay 5 (Top) and Clay 5 (Bottom) is selected.

Table 2.5.4-A-11
Not Used

Table 2.5.4-A-12
Cone Penetration Test q_t, q_{c1n}, f_s, and R_f-Values (Power Block Area)

Stratum	Statistics	Unit 1				Unit 2				Inside Power Block Area				Outside Power Block Area			
		q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)	q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)	q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)	q_t (tsf)	q_{c1n}	f_s (tsf)	R_f (%)
Clay 1 (Top)	No. of Tests	1072	1072	1072	1072	1210	1210	1210	1210	2282	2282	2282	2282	62	62	62	62
	Minimum	3.5	5.6	0.0	0.1	3.1	4.9	0.0	0.1	3.1	4.9	0.0	0.1	10.8	17.3	0.1	0.5
	Maximum	136.2	173.6	6.9	8.0	128.3	146.5	6.1	8.0	136.2	173.6	6.9	8.0	57.6	77.4	2.6	8.0
	Average	42.6	44.7	2.2	5.1	36.9	40.0	1.7	4.8	39.6	42.2	1.9	4.9	40.7	41.6	1.8	4.5
Sand 1	No. of Tests	3	3	3	3	286	286	286	286	289	289	289	289	—	—	—	—
	Minimum	86.9	60.5	1.8	1.7	33.5	14.7	1.1	0.6	33.5	1.4	0.7	0.6	—	—	—	—
	Maximum	159.8	110.3	4.0	2.8	820.3	555.6	14.4	8.0	820.3	555.6	14.4	152.6	—	—	—	—
	Average	129.2	89.0	2.8	2.2	207.7	139.7	4.4	2.7	206.9	136.8	4.4	5.0	—	—	—	—
Clay 1 (Bottom)	No. of Tests	655	655	655	655	818	818	818	818	1473	1473	1473	1473	35	35	35	35
	Minimum	31.0	12.9	1.1	1.7	28.6	11.7	0.9	1.2	28.6	11.7	0.9	1.2	39.3	17.5	1.3	2.1
	Maximum	194.9	119.3	8.0	7.5	182.4	108.0	8.2	8.0	194.9	119.3	8.2	8.0	168.2	101.0	6.6	8.0
	Average	50.2	22.6	2.0	4.1	56.6	24.8	2.3	4.1	53.8	23.8	2.2	4.1	75.5	34.5	2.6	3.6
Sand 2	No. of Tests	342	342	342	342	362	362	362	362	704	704	704	704	22	22	22	22
	Minimum	42.0	14.9	1.0	0.7	33.1	10.2	0.9	0.5	33.1	10.2	0.9	0.5	119.9	55.3	2.2	1.1
	Maximum	485.2	289.0	11.9	8.0	746.9	414.5	16.0	7.9	746.9	414.5	16.0	8.0	545.9	295.9	12.2	7.0
	Average	169.6	97.1	4.1	2.7	221.8	124.1	4.4	2.2	196.4	111.0	4.2	2.5	305.9	166.7	6.3	2.4
Clay 3	No. of Tests	836	836	836	836	888	888	888	888	1724	1724	1724	1724	52	52	52	52
	Minimum	26.5	8.3	0.6	0.7	30.9	8.3	0.8	1.1	26.5	8.3	0.6	0.7	32.2	8.8	1.4	2.1
	Maximum	584.2	316.3	10.4	8.0	214.3	109.5	9.4	8.0	584.2	316.3	10.4	8.0	126.7	38.6	8.3	8.0
	Average	81.9	32.4	2.6	3.6	51.5	15.9	1.9	3.8	66.2	23.9	2.3	3.7	49.6	13.8	2.4	4.9
Sand 4[(a)]	No. of Tests	321	321	321	321	449	449	449	449	770	770	770	770	22	22	22	22
	Minimum	35.8	9.7	0.8	0.2	45.1	11.7	1.1	0.4	35.8	9.7	0.8	0.2	147.0	42.8	1.9	1.0
	Maximum	795.4	386.5	13.2	8.0	819.8	394.7	17.3	8.0	819.8	394.7	17.3	8.0	506.2	234.9	11.4	5.4
	Average	208.6	97.0	3.8	2.4	279.2	130.3	4.7	2.2	249.8	116.4	4.3	2.3	280.8	130.7	5.7	2.1

(a) Refusal was encountered at all CPT locations within Stratum Sand 4.

Table 2.5.4-A-13
Not Used

Table 2.5.4-A-14
Laboratory Testing Summary (Power Block Area)

Laboratory Test	Industry Standard	No. of Tests[a]
Natural Moisture Content	Reference 2.5.4-35	530 {3}
Atterberg Limits	Reference 2.5.4-36	463
Sieve and Hydrometer Analysis	Reference 2.5.4-37 Reference 2.5.4-38	436 {3}
Specific Gravity	Reference 2.5.4-39	98 {3}
Unit Weight	Included with Related ASTM Standards	87
Unconsolidated Undrained (UU) Triaxial Compressive Strength	Reference 2.5.4-40	47
Consolidated Undrained (CU) Triaxial Compressive Strength	Reference 2.5.4-41	5
Direct Shear Strength	Reference 2.5.4-42	14 {3}
Consolidation/Stress-Controlled	Reference 2.5.4-45	40
Moisture-Density Relationship/Modified Proctor Compaction	Reference 2.5.4-19	8 {6}
California Bearing Ratio	Reference 2.5.4-47	8
pH	Reference 2.5.4-48	86 {3}
Chloride Content	Reference 2.5.4-49	86 {3}
Sulphate Content	Reference 2.5.4-49	86 {3}
Resonant Column Torsional Shear (RCTS)	Reference 2.5.4-44	16

(a) Values shown in “{ }” symbols denote the numbers of tests made on bulk samples of structural fill materials.

Table 2.5.4-A-15
Not Used

Table 2.5.4-A-16
Not Used

Table 2.5.4-A-17
Not Used

Table 2.5.4-A-18
Not Used

Table 2.5.4-A-19
Not Used

Table 2.5.4-A-20
Undrained Shear Strengths of Cohesive Soil Strata (Power Block Area)

Values from Laboratory Tests			
Stratum	**Minimum s_u (ksf)**	**Maximum s_u (ksf)**	**Average s_u (ksf)**
Clay 1 (Top)	1.1	3.9	2.8
Clay 1 (Bottom)	2.4	5.0	3.7
Clay 3	2.4	4.3	3.2
Clay 5 (Top)	0.7	8.3	5.3
Clay 5 (Bottom)	2.9	6.5	4.9
Clay 7	6.5	6.5	6.5
Clay 9	1.5	13.5	6.7
Clay 11	3.8	7.8	5.9
Clay 13	6.1	6.1	6.1
Clay 15	Not Tested	Not Tested	Not Tested
Clay 17	Not Tested	Not Tested	Not Tested

Values from CPT Correlation			
Stratum	**Minimum s_u (ksf)**	**Maximum s_u (ksf)**	**Average s_u (ksf)**
Clay 1 (Top)	0.3	10.3	2.7
Clay 1 (Bottom)	2.3	9.4	3.8
Clay 3	1.8	13.1	4.0
Clay 5 (Top)	Not Reached	Not Reached	Not Reached
Clay 5 (Bottom)	Not Reached	Not Reached	Not Reached
Clay 7	Not Reached	Not Reached	Not Reached
Clay 9	Not Reached	Not Reached	Not Reached
Clay 11	Not Reached	Not Reached	Not Reached
Clay 13	Not Reached	Not Reached	Not Reached
Clay 15	Not Reached	Not Reached	Not Reached
Clay 17	Not Reached	Not Reached	Not Reached

Values from SPT Correlation		
Stratum	**Selected Corrected $(N_1)_{60}$-Value (blows/foot)**	**Calculated s_u (ksf)**
Clay 1 (Top)	20	2.5
Clay 1 (Bottom)	18	2.3
Clay 3	19	2.4
Clay 5 (Top)	16	2.0
Clay 5 (Bottom)	23	2.9
Clay 7	38	4.8
Clay 9	24	3.0
Clay 11	25	3.1
Clay 13	28	3.5
Clay 15	33	4.1
Clay 17	45	5.6

Values Selected for Use	
Stratum	**Selected s_u (ksf)**
Clay 1 (Top)	3.2
Clay 1 (Bottom)	3.2
Clay 3	3.0
Clay 5 (Top)	3.0
Clay 5 (Bottom)	3.0
Clay 7	6.0
Clay 9	4.0
Clay 11	5.0
Clay 13	5.0
Clay 15	4.1
Clay 17	5.6

Table 2.5.4-A-21
Not Used

Table 2.5.4-A-22
Not Used

Table 2.5.4-A-23
Not Used

Table 2.5.4-A-24
Not Used

Table 2.5.4-A-25
Not Used

Table 2.5.4-A-26
Overconsolidation Ratios and Preconsolidation Pressures of Cohesive Soil Strata (Power Block Area)

Stratum	Average OCR			Average P'c (ksf)	
	From Consolidation Tests	From CPTs	Values for Use	From Consolidation Tests	Values for Use
Clay 1	2.7	4.9	3.0	8.9	8
Clay 3	2.0	1.9	2.0	14.8	15
Clay 5	1.2	—	1.2	14.7	15
Clay 7	1.2	—	1.2	20.9	21
Clay 9	2.2	—	2.2	29.3	29
Clay 11	1.3	—	1.3	38.9	40
Clay 13	1.4	—	1.4	45.6	45
Clay 15	—	—	1.3	—	47
Clay 17	1.3	—	1.3	50.7	50

Table 2.5.4-A-27
Not Used

Table 2.5.4-A-28
High Strain Elastic Moduli Values (Power Block Area)

E-Values (ksf)				
Stratum	**From $(N_1)_{60}$**	**From s_u**	**From V_s**	**Values for Use**
Clay 1(Top)	—	1920	1488	2010
Sand 1	1116	—	1271	1190
Clay 1 (Bottom)	—	1920	2726	2010
Sand 2	936	—	1236	1090
Clay 3	—	1800	4222	3010
Sand 4	2160	—	2783	2470
Clay 5 (Top)	—	1800	4382	3030
Sand 5	1440	—	1877	1660
Clay 5 (Bottom)	—	1800	4124	3030
Sand 6	2412	—	2369	2390
Clay 7	—	3600	6135	4870
Sand 8	2736	—	3033	2880
Clay 9	—	2400	5289	3840
Sand 10	2952	—	2909	2930
Clay 11	—	3000	4239	3620
Sand 12	2196	—	3632	2910
Clay 13	—	3000	6307	4650
Sand 14	2376	—	3616	3000
Clay 15	—	2460	7841	5150
Sand 16	2484	—	3407	2950
Clay 17	—	3360	10,007	6680
Sand 18	3600	—	4328	3960

Table 2.5.4-A-29
Not Used

Table 2.5.4-A-30
High Strain Shear Moduli Values (Power Block Area)

Stratum	G (ksf)
Clay 1	690
Sand 1	460
Sand 2	420
Clay 3	1040
Sand 4	950
Clay 5	1040
Sand 5	640
Sand 6	920
Clay 7	1680
Sand 8	1110
Clay 9	1320
Sand 10	1130
Clay 11	1250
Sand 12	1120
Clay 13	1600
Sand 14	1150
Clay 15	1780
Sand 16	1130
Clay 17	2300
Sand 18	1520

Table 2.5.4-A-31
Not Used

Table 2.5.4-A-32 (Sheet 1 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[a]	Clay 1	Sand 1	Sand 2	Clay 3	Sand 4
Average thickness, feet	43.9[b]	7.7	10.9	24.0	25.4
USCS symbol	CL, CH	SC	SC, SM, ML	CL, CH, SC	SC, SC-SM
Natural moisture content (MC), %	20	16	18.5	23	17.5
Total unit weight (γ_{total}), pcf	129	135	135	119	132
Fines content, %	80	40	40	75	25
Liquid limit (LL), %	53	N/A[c]	N/A[c]	51	N/A[c]
Plasticity index (PI), %	35	N/A[c]	N/A[c]	30	N/A[c]
Uncorrected SPT N-value, bpf	16	28	30	25	91
Corrected SPT $(N_1)_{60}$-value, bpf	19	31	26	19	60
Shear wave velocity, ft/sec	792	1080	1065	1025	1616
Undrained shear strength (s_u), ksf	3.2	N/A[c]	N/A[c]	3	N/A[c]
Friction angle (Φ'), degree	N/A[c]	33	33	N/A[c]	37
Elastic modulus (high strain) (E), ksf	2010	1190	1090	3010	2470
Shear modulus (high strain) (G), ksf	690	460	420	1040	950
Shear modulus (low strain) (G_{max}), ksf	2557	4890	4755	3883	10,705
Earth Pressure Coefficients					
Active (K_a)	0.50	0.30	0.30	0.50	0.25
Passive (K_p)	2.00	3.40	3.40	2.00	4.00
At Rest (K_0)	0.70	0.45	0.45	0.70	0.40
Coefficient of sliding	0.30	0.40	0.40	0.30	0. 45
Consolidation Properties					
C_c (C_r)	0.171 (0.0299)	N/A[c]	N/A[c]	0.240 (0.047)	N/A[c]
Void ratio, e_o	0.54	N/A[c]	N/A[c]	0.90	0.48
P_c', ksf (OCR)	8 (3)	N/A[c]	N/A[c]	15 (2)	N/A[c]

Table 2.5.4-A-32 (Sheet 2 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[(a)]	Clay 5	Sand 5	Sand 6	Clay 7	Sand 8
Average thickness, feet	31.8[(b)]	15.8	53.8	34.7	37.2
USCS symbol	CH, CL	SC, SC-SM	SC, SP-SM	CH, CL, SC	SC, SC-SM
Natural moisture content (MC), %	25	20	19	21	21
Total unit weight (γ_{total}), pcf	127	132	132	127	132
Fines content, %	85	25	15	75	30
Liquid limit (LL), %	60	N/A[(c)]	N/A[(c)]	51	N/A[(c)]
Plasticity index (PI), %	40	N/A[(c)]	N/A[(c)]	30	N/A[(c)]
Uncorrected SPT N-value, bpf	32	65	109	64	110
Corrected SPT $(N_1)_{60}$-value, bpf	20	40	67	38	67
Shear wave velocity, ft/sec	1125	1327	1491	1434	1687
Undrained shear strength (s_u), ksf	3	N/A[(c)]	N/A[(c)]	6	N/A[(c)]
Friction angle (Φ'), degree	N/A[(c)]	36	39	N/A[(c)]	36
Elastic modulus (high strain) (E), ksf	3030	1660	2390	4870	2880
Shear modulus (high strain) (G), ksf	1040	640	920	1680	1110
Shear modulus (low strain) (G_{max}), ksf	5026	7219	9113	8110	11,667
Earth Pressure Coefficients					
Active (K_a)	0.50	0.25	N/A[(c)]	N/A[(c)]	N/A[(c)]
Passive (K_p)	2.00	3.80	N/A[(c)]	N/A[(c)]	N/A[(c)]
At Rest (K_0)	0.70	0.40	N/A[(c)]	N/A[(c)]	N/A[(c)]
Coefficient of sliding	0.30	0.45	N/A[(c)]	N/A[(c)]	N/A[(c)]
Consolidation Properties					
C_c (C_r)	0.169 (0.035)	N/A[(c)]	N/A[(c)]	0.227 (0.037)	N/A[(c)]
Void ratio, e_o	0.6	N/A[(c)]	N/A[(c)]	0.64	0.49
P_c', ksf (OCR)	15 (1.2)	N/A[(c)]	N/A[(c)]	21 (1.2)	N/A[(c)]

Table 2.5.4-A-32 (Sheet 3 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[(a)]	Clay 9	Sand 10	Clay 11	Sand 12	Clay 13	Sand 14
Average thickness, feet	43.9	30.2	46.8	20.6	75.8	39.7
USCS symbol	CH, CL	SM, SC	CH, CL	SM	CH, ML	SC, SM
Natural moisture content (MC), %	23.5	N/A[(c)]	28	14.5	27.5	22
Total unit weight (γ_{total}), pcf	126	132	119	132	126	132
Fines content, %	90	25	85	25	95	30
Liquid limit (LL), %	59	N/A[(c)]	63	N/A[(c)]	67	N/A[(c)]
Plasticity index (PI), %	35	N/A[(c)]	40	N/A[(c)]	40	N/A[(c)]
Uncorrected SPT N-value, bpf	40	132	39	100	44	102
Corrected SPT $(N_1)_{60}$-value, bpf	24	82	25	61	28	66
Shear wave velocity, ft/sec	1272	1652	1146	1846	1361	1842
Undrained shear strength (s_u), ksf	4	N/A[(c)]	5	N/A[(c)]	5	N/A[(c)]
Friction angle (Φ’), degree	N/A[(c)]	38	N/A[(c)]	36	N/A[(c)]	36
Elastic modulus (high strain) (E), ksf	3840	2930	3620	2910	4650	3000
Shear modulus (high strain) (G), ksf	1320	1130	1250	1120	1600	1150
Shear modulus (low strain) (G_{max}), ksf	6331	11,188	4854	13,970	7248	13,909
Earth Pressure Coefficients						
Active (K_a)	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]
Passive (K_p)	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]
At Rest (K_0)	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]
Coefficient of sliding	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]	N/A[(c)]
Consolidation Properties						
C_c (C_r)	0.23 (0.03]	N/A[(c)]	0.343 (0.041)	N/A[(c)]	0.190 (0.038)	N/A[(c)]
Void ratio, e_o	0.71	N/A[(c)]	0.96	N/A[(c)]	0.68	N/A[(c)]
P_c’, ksf (OCR)	29 (1.3)	N/A[(c)]	40.0 (1.4)	N/A[(c)]	45.0 (1.4)	N/A[(c)]

Table 2.5.4-A-32 (Sheet 4 of 4)
Geotechnical Engineering Parameters Selected for Design (Power Block Area)

Parameter[a]	Clay 15	Sand 16	Clay 17	Sand 18	Structural Fill (CW&A#4)
Average thickness, feet	11.8	16.5	21.2	>9	N/A[c]
USCS symbol	CH	SM, SC	CL, CH	SM	GW-GC
Natural moisture content (MC), %	22.5	N/A[c]	18.5	13	6
Total unit weight (γ_{total}), pcf	126	132	131	132	138
Fines content, %	95	25	75	25	7
Liquid limit (LL), %	69	N/A[c]	46	N/A[c]	N/A[c]
Plasticity index (PI), %	45	N/A[c]	30	N/A[c]	N/A[c]
Uncorrected SPT N-value, bpf	55	111	69	166	N/A[c]
Corrected SPT $(N_1)_{60}$-value, bpf	33	69	45	100	30[d]
Shear wave velocity, ft/sec	1479	1788	1793	2015	700/1000[e]
Undrained shear strength (s_u), ksf	4.1	N/A[c]	5.6	N/A[c]	N/A[c]
Friction angle (Φ'), degree	N/A[c]	38	N/A[c]	40	39
Elastic modulus (high strain) (E), ksf	5150	2950	6680	3960	1100
Shear modulus (high strain) (G), ksf	1780	1130	2300	1520	400
Shear modulus (low strain) (G_{max}), ksf	8560	13,105	13,079	16,644	2100/4280[f]
Earth Pressure Coefficients					
Active (K_a)	N/A[c]	N/A[c]	N/A[c]	N/A[c]	0.23
Passive (K_p)	N/A[c]	N/A[c]	N/A[c]	N/A[c]	4.40
At Rest (K_0)	N/A[c]	N/A[c]	N/A[c]	N/A[c]	0.50
Coefficient of sliding	N/A[c]	N/A[c]	N/A[c]	N/A[c]	0.55
Consolidation Properties					
C_c (C_r)	0.190 (0.038)	N/A[c]	0.126 (0.020)	N/A[c]	N/A[c]
Void ratio, e_o	0.68	N/A[c]	0.80	N/A[c]	N/A[c]
P_c', ksf (OCR)	47.0 (1.3)	N/A[c]	50.0 (1.2)	N/A[c]	N/A[c]

(a) The values tabulated above are for use as guideline only. Reference should be made to specific boring and CPT logs and laboratory test results for appropriate modifications at specific locations and for specific calculations.
(b) Thicknesses of Clay 1 (Top) and Clay 1 (Bottom) are combined. Thicknesses of Clay 5 (Top) and Clay 5 (Bottom) combined.
(c) N/A indicates that the property is either not measured or not applicable.
(d) Estimated values.
(e) Value varies with depth: 700 ft/sec for the upper 15 feet; 1000 ft/sec for depths from 15 feet to 110 feet (the deepest excavation).
(f) Value varies with depth: 2100 ksf for the upper 15 feet; 4280 ksf for depths from 15 feet to 110 feet.

Table 2.5.4-A-33
Not Used

Table 2.5.4-A-34
Not Used

Table 2.5.4-A-35
Not Used

Table 2.5.4-A-36 (Sheet 1 of 6)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[(a)]	Easting (feet)[(a)]	Ground Surface Elevation (feet)[(b)]	Depth (feet)	Base Elevation (feet)[(b)]
Power Block Area	**(Unit 1)**				
B-2150	13,412,560.45	2,599,590.93	80.44	150.00	–69.56
B-2151	13,412,636.54	2,599,654.12	80.41	200.00	–119.59
B-2152	13,412,705.76	2,599,720.24	80.26	150.00	–69.74
B-2153	13,412,821.99	2,599,842.54	80.23	150.10	–69.87
B-2154	13,412,450.91	2,599,619.84	80.54	150.00	–69.46
B-2155	13,412,471.13	2,599,698.69	80.36	150.00	–69.64
B-2156	13,412,548.01	2,599,760.77	80.25	201.50	–121.25
B-2157	13,412,623.72	2,599,823.05	80.07	150.00	–69.93
B-2158	13,412,749.59	2,599,928.77	80.45	100.00	–19.55
B-2159	13,412,476.54	2,599,788.95	80.40	211.50	–131.10
B-2160	13,412,180.67	2,599,627.24	80.43	200.00	–119.57
B-2161	13,412,263.41	2,599,698.18	80.49	150.00	–69.51
B-2162A	13,412,385.92	2,599,799.34	80.16	202.80	–122.64
B-2162A Offset	13,412,378.65	2,599,792.16	80.05	210.00	–129.95
B-2163	13,412,463.50	2,599,862.07	79.85	150.00	–70.15
B-2164	13,412,537.94	2,599,925.58	80.38	151.40	–71.02
B-2165	13,412,661.24	2,600,035.28	80.13	150.00	–69.87
B-2166	13,412,109.03	2,599,713.14	80.50	150.00	–69.50
B-2167	13,412,192.20	2,599,781.27	80.19	150.00	–69.81
B-2168	13,412,294.30	2,599,891.10	80.12	201.50	–121.38
B-2169	13,412,350.21	2,599,938.43	79.47	400.00	–320.53
B-2170	13,412,413.86	2,599,989.72	79.68	300.00	–220.32
B-2170R	13,412,396.19	2,599,989.32	79.18	300.00	–220.82
B-2171	13,412,488.43	2,600,092.96	80.03	81.50	–1.47
B-2171R	13,412,479.95	2,600,074.23	79.97	300.00	–220.03
B-2172	13,412,096.23	2,599,829.90	80.10	100.00	–19.90
B-2173	13,412,224.54	2,599,944.52	79.59	300.00	–220.41
B-2174A	13,412,299.46	2,600,000.64	80.11	601.00	–520.89
B-2174A Offset	13,412,316.51	2,599,991.79	79.28	617.00	–537.72
B-2174UD	13,412,276.56	2,600,005.51	78.58	301.40	–222.82
B-2174UDR	13,412,303.29	2,600,012.41	78.98	593.00	–514.02
B-2175	13,412,370.49	2,600,062.81	80.12	200.00	–119.88
B-2176A	13,412,511.69	2,600,175.17	79.81	200.00	–120.19
B-2176A Offset	13,412,522.55	2,600,178.10	79.99	210.00	–130.01

Table 2.5.4-A-36 (Sheet 2 of 6)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[a]	Easting (feet)[a]	Ground Surface Elevation (feet)[b]	Depth (feet)	Base Elevation (feet)[b]
Power Block Area	**(Unit 1) (cont.)**				
B-2177	13,412,196.92	2,600,000.49	79.61	150.00	–70.39
B-2178	13,412,315.44	2,600,107.24	79.53	151.10	–71.57
B-2179	13,412,424.96	2,600,168.71	79.78	200.00	–120.22
B-2180	13,412,247.39	2,600,062.56	78.85	200.00	–121.15
B-2181	13,412,143.28	2,600,062.56	79.24	151.30	–72.06
B-2182A	13,412,219.77	2,600,133.20	79.69	399.80	–320.11
B-2182A Offset	13,412,209.92	2,600,137.01	79.70	410.00	–330.30
B-2182UD	13,412,207.39	2,600,143.80	79.47	401.90	–322.43
B-2183	13,412,265.91	2,600,166.16	79.63	151.30	–71.67
B-2184	13,412,295.45	2,600,305.41	79.71	151.20	–71.49
B-2285	13,412,682.80	2,600,322.38	80.35	151.20	–70.85
B-3101	13,412,433.30	2,599,834.66	79.78	300.50	–220.72
B-3101UD	13,412,439.45	2,599,827.43	79.78	291.50	–211.72
B-3102	13,412,513.20	2,599,902.00	79.86	200.00	–120.14
B-3103	13,412,938.79	2,599,652.69	80.02	150.00	–69.98
B-3104	13,412,202.33	2,599,516.82	80.64	300.10	–219.46
B-3105	13,412,124.15	2,599,612.05	80.50	300.30	–219.80
B-3120	13,412,271.47	2,599,685.23	79.96	200.00	–120.04
B-3121	13,412,285.94	2,599,732.88	80.10	200.00	–119.90
B-3122	13,412,236.14	2,599,763.21	79.98	200.00	–120.02
B-3123	13,412,303.63	2,599,850.58	80.09	404.00	–323.91
B-3124	13,412,384.10	2,599,937.33	79.58	299.80	–220.22
B-3125	13,412,466.08	2,599,991.90	78.10	299.90	–221.80
B-3126	13,412,174.89	2,599,783.81	79.94	200.10	–120.16
B-3127	13,412,252.85	2,599,968.07	79.71	402.30	–322.59
B-3128	13,412,354.30	2,600,018.94	79.35	402.40	–323.05
B-3129	13,411,995.23	2,599,817.41	79.80	150.00	–70.20
B-3130	13,412,171.36	2,599,965.05	79.71	150.30	–70.59
B-3131	13,412,262.16	2,600,044.89	78.91	406.80	–327.89
B-3132	13,412,156.19	2,600,019.76	79.32	401.60	–322.28
B-3133	13,412,232.17	2,600,080.73	78.41	400.00	–321.59
B-3134	13,412,307.93	2,600,144.95	79.67	401.50	–321.83
B-3150	13,412,363.96	2,599,708.26	80.09	200.00	–119.91
B-3151	13,412,601.54	2,599,907.98	78.55	200.00	–121.45
B-3152	13,412,666.93	2,599,964.39	79.66	200.00	–120.34

Table 2.5.4-A-36 (Sheet 3 of 6)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[a]	Easting (feet)[a]	Ground Surface Elevation (feet)[b]	Depth (feet)	Base Elevation (feet)[b]
Power Block Area (Unit 1) (cont.)					
B-3170A	13,411,920.22	2,599,278.60	80.20	300.50	–220.30
B-3170A Offset	13,411,915.24	2,599,287.68	80.12	315.00	–234.88
B-3171	13,411,943.98	2,599,565.10	79.94	175.00	–95.06
B-3172	13,411,885.94	2,599,615.55	79.89	175.00	–95.11
B-3173	13,411,880.20	2,599,376.72	80.23	175.00	–94.77
B-3174	13,411,986.60	2,599,453.62	80.39	300.00	–219.61
B-3175	13,411,911.53	2,599,430.38	80.27	249.80	–169.53
B-3176	13,412,070.79	2,599,439.29	80.46	175.00	–94.54
B-3177	13,411,787.89	2,599,435.89	80.19	300.00	–219.81
B-3178	13,412,145.80	2,599,455.30	80.34	175.00	–94.66
B-3179	13,412,080.02	2,599,530.84	80.10	20.00	60.10
B–3179B	13,412,088.18	2,599,525.43	80.19	250.20	–170.01
B-3180	13,411,994.56	2,599,329.41	80.42	175.00	–94.58
B-3181	13,412,057.76	2,599,554.50	80.01	175.00	–94.99
B-3182	13,411,777.24	2,599,588.12	79.75	175.00	–95.25
B-3183	13,411,924.45	2,599,713.35	79.90	173.80	–93.90
B-3184	13,411,652.94	2,599,602.59	80.17	300.00	–219.83
B-3185A	13,411,833.03	2,599,722.22	79.77	250.00	–170.23
B-3185A Offset	13,411,826.65	2,599,726.94	79.58	265.00	–185.42
B-3186	13,411,693.36	2,599,689.25	79.64	175.00	–95.36
B-3187	13,412,013.89	2,599,728.28	79.95	151.00	–71.05
B-3194	13,411,840.05	2,599,813.20	79.48	173.70	–94.22
Power Block Area (Unit 2)					
B-2250	13,413,327.46	2,600,233.62	81.05	151.30	–70.25
B-2251	13,413,404.52	2,600,297.97	80.79	210.00	–129.21
B-2252	13,413,478.24	2,600,360.51	80.74	153.40	–72.66
B-2253	13,413,587.94	2,600,484.98	80.86	150.00	–69.14
B-2254	13,413,216.45	2,600,262.92	80.54	151.40	–70.86
B-2255	13,413,238.32	2,600,340.81	80.67	151.30	–70.63
B-2256	13,413,314.37	2,600,403.14	80.26	200.00	–119.74
B-2257	13,413,389.48	2,600,466.52	80.78	151.40	–70.62
B-2258	13,413,515.61	2,600,571.48	80.75	100.00	–19.25
B-2259	13,413,243.36	2,600,432.64	80.35	210.00	–129.65
B-2260	13,412,945.84	2,600,269.60	80.71	198.90	–118.19
B-2261	13,413,029.99	2,600,340.99	80.50	151.50	–71.00

Table 2.5.4-A-36 (Sheet 4 of 6)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[(a)]	Easting (feet)[(a)]	Ground Surface Elevation (feet)[(b)]	Depth (feet)	Base Elevation (feet)[(b)]
Power Block Area	**(Unit 2) (cont.)**				
B-2262A	13,413,146.75	2,600,442.41	80.42	200.00	–119.58
B-2262A Offset	13,413,146.80	2,600,433.53	80.57	210.00	–129.43
B-2263	13,413,227.48	2,600,506.73	80.43	151.10	–70.67
B-2264	13,413,303.45	2,600,569.40	80.51	151.00	–70.49
B-2265	13,413,424.28	2,600,677.27	80.60	154.00	–73.40
B-2266	13,412,873.85	2,600,353.67	80.67	149.50	–68.83
B-2267	13,412,957.87	2,600,424.20	80.74	149.50	–68.76
B-2268	13,413,056.37	2,600,528.54	80.58	200.00	–119.42
B-2269	13,413,117.17	2,600,582.50	80.45	403.30	–322.85
B-2269UD	13,413,092.19	2,600,593.55	80.06	402.10	–322.04
B-2270	13,413,179.24	2,600,633.41	80.62	300.00	–219.38
B-2271	13,413,253.44	2,600,735.25	80.46	301.20	–220.74
B-2272	13,412,863.17	2,600,472.73	80.22	100.00	–19.78
B-2273	13,412,991.36	2,600,585.49	80.69	399.40	–318.71
B-2274A	13,413,066.34	2,600,642.97	80.86	594.70	–513.84
B-2274A Offset	13,413,070.52	2,600,633.47	80.34	620.00	–539.66
B-2274UD	13,413,047.70	2,600,652.45	80.41	607.70	–527.29
B-2275	13,413,133.62	2,600,702.31	80.49	199.50	–119.01
B-2276A	13,413,276.30	2,600,822.55	80.53	199.50	–118.97
B-2276A Offset	13,413,289.36	2,600,817.99	80.63	210.00	–129.37
B-2277	13,412,961.61	2,600,644.66	80.60	150.30	–69.70
B-2278	13,413,084.23	2,600,745.84	80.69	151.40	–70.71
B-2279	13,413,192.06	2,600,811.88	80.28	198.80	–118.52
B-2280	13,413,014.25	2,600,704.09	80.57	198.10	–117.53
B-2281	13,412,908.71	2,600,705.43	80.42	150.00	–69.58
B-2282A	13,412,970.74	2,600,757.69	80.31	400.00	–319.69
B-2282A Offset	13,412,962.40	2,600,766.39	80.46	410.00	–329.54
B-2283	13,413,031.52	2,600,808.58	80.40	151.20	–70.80
B-2284	13,413,060.61	2,600,948.44	80.42	150.00	–69.58
B-3201	13,413,199.23	2,600,478.73	80.51	301.50	–220.99
B-3202	13,413,278.38	2,600,546.43	80.05	200.00	–119.95
B-3203	13,413,704.80	2,600,295.99	80.75	151.50	–70.75
B-3204	13,412,969.79	2,600,159.57	80.32	300.50	–220.18
B-3205	13,412,890.30	2,600,253.76	80.12	299.60	–219.48
B-3220	13,413,038.65	2,600,329.99	80.34	201.40	–121.06

Table 2.5.4-A-36 (Sheet 5 of 6)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[(a)]	Easting (feet)[(a)]	Ground Surface Elevation (feet)[(b)]	Depth (feet)	Base Elevation (feet)[(b)]
Power Block Area	**(Unit 2) (cont.)**				
B-3221	13,413,050.44	2,600,375.52	80.01	200.10	–120.09
B-3222	13,413,000.60	2,600,409.71	79.96	199.80	–119.84
B-3223	13,413,068.13	2,600,491.68	80.33	400.00	–319.67
B-3224	13,413,149.85	2,600,580.51	80.00	300.00	–220.00
B-3225	13,413,231.70	2,600,635.22	79.87	300.00	–220.13
B-3226	13,412,942.00	2,600,423.84	80.40	199.80	–119.40
B-3227	13,413,022.23	2,600,606.30	80.10	401.00	–320.90
B-3228	13,413,109.76	2,600,679.85	80.32	400.00	–319.68
B-3229	13,412,764.61	2,600,458.23	80.11	148.90	–68.79
B-3230	13,412,942.18	2,600,604.56	80.28	149.90	–69.62
B-3231	13,413,029.48	2,600,686.21	80.19	400.00	–319.81
B-3232	13,412,922.28	2,600,661.21	80.51	400.00	–319.49
B-3233	13,412,996.09	2,600,724.96	80.10	400.50	–320.40
B-3234	13,413,073.73	2,600,787.16	80.56	404.00	–323.44
B-3234UD	13,413,081.49	2,600,780.76	80.57	394.80	–314.23
B-3250	13,413,129.73	2,600,351.61	80.07	200.20	–120.13
B-3251	13,413,367.88	2,600,552.94	80.26	200.90	–120.64
B-3252	13,413,433.44	2,600,606.15	80.28	199.80	–119.52
B-3270A	13,413,806.35	2,600,963.12	80.63	300.80	–220.17
B-3270A Offset	13,413,799.21	2,600,956.76	80.15	315.00	–234.85
B-3271	13,413,662.26	2,601,056.45	80.22	175.00	–94.78
B-3272	13,413,580.96	2,600,954.08	80.26	180.00	–99.74
B-3273	13,413,726.75	2,601,028.78	80.34	176.00	–95.66
B-3274	13,413,659.47	2,600,812.95	80.10	300.00	–219.90
B-3275	13,413,717.05	2,600,944.49	80.69	175.00	–94.31
B-3276	13,413,655.40	2,600,721.81	80.50	175.00	–94.50
B-3277	13,413,665.44	2,601,131.40	80.17	300.70	–220.53
B-3278	13,413,658.66	2,600,844.38	80.18	175.00	–94.82
B-3279	13,413,517.67	2,600,996.95	79.73	150.00	–70.27
B-3280	13,413,800.24	2,600,844.41	80.49	175.00	–94.51
B-3281	13,413,568.70	2,600,821.85	79.96	175.00	–95.04
B-3282	13,413,584.99	2,601,102.66	80.24	249.90	–169.66
B-3283	13,413,436.23	2,600,979.48	80.27	175.00	–94.73
B-3285A	13,413,442.17	2,601,072.10	80.14	250.10	–169.96
B-3285A Offset	13,413,451.41	2,601,067.99	80.14	265.00	–184.86

Table 2.5.4-A-36 (Sheet 6 of 6)
As-Built Boring Information (Power Block Area)

Boring Number	Northing (feet)[(a)]	Easting (feet)[(a)]	Ground Surface Elevation (feet)[(b)]	Depth (feet)	Base Elevation (feet)[(b)]
Power Block Area	**(Unit 2) (cont.)**				
B-3286	13,413,498.60	2,601,204.05	80.08	174.50	–94.42
B-3287	13,413,394.33	2,600,911.93	80.34	150.00	–69.66
B-3288	13,413,285.93	2,601,038.97	80.19	151.00	–70.81
B-3289	13,413,160.23	2,600,933.39	80.44	150.00	–69.56
B-3290	13,413,566.86	2,601,255.83	80.52	300.00	–219.48
B-3291	13,412,951.38	2,600,555.75	80.21	150.10	–69.89
B-3292	13,413,352.05	2,601,079.59	80.52	174.90	–94.38
Outside Power	**Block**				
B-08	13,415,809.85	2,598,937.51	81.71	150.00	–68.29
B-10	13,418,474.15	2,604,736.80	77.69	150.20	–72.51
B-2185	13,412,320.56	2,600,808.84	79.48	151.10	–71.62
B-2301A	13,414,429.68	2,596,278.37	81.23	300.00	–218.77
B-2301	13,414,414.60	2,596,251.62	80.79	310.00	–229.21
B-2307A	13,420,888.12	2,603,157.79	76.75	299.40	–222.65
B-2307	13,420,917.89	2,603,184.91	76.38	310.00	–233.62

(a) Northings and Eastings are referenced to the Texas South Central State Plane (Zone 4204) projected coordinate system, using a horizontal datum of NAD 83 and are in U.S. Survey Feet.

(b) Elevations are referenced to NAVD 88.

Table 2.5.4-A-37
Not Used

Table 2.5.4-A-38 (Sheet 1 of 5)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[(a)]
Power Block Area	**(Unit 1)**				
B-2174UD	UD1	CL	Clay 1 (Top)	10.0	68.6
B-2174UD	UD2	CH	Clay 1 (Bottom)	30.0	48.6
B-2174UD	UD3	CL	Clay 3	75.0	3.6
B-2174UD	UD4	CL	Sand 4	90.0	–11.4
B-2174UD	UD5	CL	Sand 4	92.0	–13.4
B-2174UD	UD6	SP-SC	Sand 4	95.0	–16.4
B-2174UD	UD7	CH	Clay 5 (Top)	115.0	–36.4
B-2174UD	UD8	SM	Sand 6	145.0	–66.4
B-2174UD	UD9	SM	Sand 6	180.0	–101.4
B-2174UD	UD10	SM	Sand 6	183.0	–104.4
B-2174UD	UD11	SM	Sand 6	206.0	–127.4
B-2174UD	UD12	SM	[Sand 6]/ Clay 7	210.0	–131.4
B-2174UD	UD13	CH	Sand 8	245.0	–166.4
B-2174UD	UD14	CH	Sand 8	245.8	–167.2
B-2174UD	UD15	SC	Sand 8	265.0	–186.4
B-2174UD	UD16	CH	Clay 9	300.0	–221.4
B-2174UDR	UD17	CH (Top); SP (Bottom)	Clay 9/ [Sand 10]	319.3	–240.3
B-2174UDR	UD18	SP	Sand 10	324.8	–245.8
B-2174UDR	UD19	CH	Clay 11	334.9	–255.9
B-2174UDR	UD20	CH	Clay 11	359.1	–280.1
B-2174UDR	UD21	CH	Clay 11	397.7	–318.7
B-2174UDR	UD22	CH	Sand 12	409.6	–330.6
B-2174UDR	UD23	CL	Sand 12	419.5	–340.5
B-2174UDR	UD24	No Recovery	Clay 13	425.0	–346.0
B-2174UDR	UD25	No Recovery	Clay 13	442.0	–363.0
B-2174UDR	UD26	CH	Clay 13	445.0	–366.0
B-2174UDR	UD27	CH	Clay 13	490.0	–411.0
B-2174UDR	UD28	SC (Top); SM (Bottom)	Sand 14	525.0	–446.0
B-2174UDR	UD29	CH	Clay 15	550.0	–471.0
B-2174UDR	UD30	CH	Clay 17	570.0	–491.0
B-2174UDR	UD31	CH (Top); SM (Bottom)	Sand 18	590.5	–511.5
B-2182UD	UD1	CL	Clay 1 (Top)	10.0	69.5

Table 2.5.4-A-38 (Sheet 2 of 5)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[(a)]
Power Block Area	**(Unit 1) (cont.)**				
B-2182UD	UD2	No Recovery	Clay 1 (Top)	13.0	66.5
B-2182UD	UD3	CH	Clay 1 (Top)	16.0	63.5
B-2182UD	UD4	No Recovery	Clay 1 (Top)	30.0	49.5
B-2182UD	UD5	CH	Clay 1 (Top)	33.0	46.5
B-2182UD	UD6	CL	Clay 1 (Top)	37.0	42.5
B-2182UD	UD7	SC (Top); SP (Bottom)	Clay 3	65.0	14.5
B-2182UD	UD8	SC (Top); CH (Bottom)	Clay 3	68.0	11.5
B-2182UD	UD9	CH	Sand 4	85.0	–5.5
B-2182UD	UD10	CH	Sand 4	90.0	–10.5
B-2182UD	UD11	CL	Sand 4	90.5	–11.0
B-2182UD	UD12	CL (Top); SP-SM (Bottom)	Sand 4	95.0	–15.5
B-2182UD	UD13	SC	Clay 5 (Top)	120.0	–40.5
B-2182UD	UD14	ML	[Clay 5 (Top)]/ Sand 5	123.0	–43.5
B-2182UD	UD15	ML	Clay 5 (Bottom)	145.0	–65.5
B-2182UD	UD16	SM	Sand 6	180.0	–100.5
B-2182UD	UD17	CL	Clay 7	215.0	–135.5
B-2182UD	UD18	CH	Clay 7	218.0	–138.5
B-2182UD	UD19	SM	Sand 8	240.0	–160.5
B-2182UD	UD20	SC-SM	Sand 8	242.0	–162.5
B-2182UD	UD21	No Recovery	Sand 8	265.0	–185.5
B-2182UD	UD22	CH	Sand 8	270.0	–190.5
B-2182UD	UD23	No Recovery	Sand 8	275.0	–195.5
B-2182UD	UD24	CH	Clay 9	300.0	–220.5
B-2182UD	UD25	CH	Clay 9	303.0	–223.5
B-2182UD	UD26	CL	Clay 9	320.0	–240.5
B-2182UD	UD27	CH (Top); SC (Bottom)	Clay 9	323.0	–243.5
B-2182UD	UD28	CH	Clay 9	330.0	–250.5
B-2182UD	UD29	CH	Clay 9	333.0	–253.5
B-2182UD	UD30	CL	Clay 9	340.0	–260.5
B-2182UD	UD31	CL	Clay 9	343.0	–263.5
B-2182UD	UD32	SP-SC (Top); SP (Bottom)	Sand 10	350.0	–270.5

Table 2.5.4-A-38 (Sheet 3 of 5)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[(a)]
Power Block Area	**(Unit 1) (cont.)**				
B-2182UD	UD33	CH	Clay 11	380.0	–300.5
B-2182UD	UD34	CH	Clay 11	383.0	–303.5
B-2182UD	UD35	CH	Clay 11	390.0	–310.5
B-2182UD	UD36	CH	Clay 11	393.0	–313.5
B-2182UD	UD37	CL	Clay 11	400.0	–320.5
B-3101UD	UD-1	CL	Clay 1 (Top)	8.0	71.78
B-3101UD	UD-2	CH	Clay 1 (Bottom)	30.0	49.78
B-3101UD	UD-3	SP (Top); CH (Bottom)	Sand 2	50.0	29.78
B-3101UD	UD-4	SP	Sand 2	53.0	26.78
B-3101UD	UD-5	CH (Top); SP (Bottom)	Clay 3	72.0	7.78
B-3101UD	UD-6	SP	Sand 4	100.0	–20.22
B-3101UD	UD-7	CH	Clay 5 (Top)	115.0	–35.22
B-3101UD	UD-8	CH	Clay 5 (Top)	120.0	–40.22
B-3101UD	UD-9	CH	Clay 5 (Top)	125.0	–45.22
B-3101UD	UD-10	CL	Clay 5 (Top)	126.0	–46.22
B-3101UD	UD-11	SP	Sand 5	149.0	–69.22
B-3101UD	UD-12	CH	Clay 5 (Bottom)	154.0	–74.22
B-3101UD	UD-13	CL	Clay 5 (Bottom)	159.0	–79.22
B-3101UD	UD-14	SC-SM	Sand 6	209.0	–129.22
B-3101UD	UD-15	CH	Clay 7	229.0	–149.22
B-3101UD	UD-16	CL	Clay 7	279.0	–199.22
B-3101UD	UD-17	CL	Clay 7	289.0	–209.22
Power Block Area	**(Unit 2)**				
B-2269UD	UD1	CL	Clay 1 (Top)	10.0	70.1
B-2269UD	UD2	CH	Clay 1 (Top)	13.0	67.1
B-2269UD	UD3	CL	Sand 1	30.0	50.1
B-2269UD	UD4	CL	Sand 1	33.0	47.1
B-2269UD	UD5	CH	Clay 1 (Bottom)	50.0	30.1
B-2269UD	UD6	CH	Clay 1 (Bottom)	53.0	27.1
B-2269UD	UD7	CH	Clay 3	70.0	10.1
B-2269UD	UD8	CH	Clay 3	73.0	7.1
B-2269UD	UD9	CH	[Sand 4]/ Clay 5 (Top)	120.0	–39.9
B-2269UD	UD10	CH	Clay 5 (Top)	123.0	–42.9

Table 2.5.4-A-38 (Sheet 4 of 5)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[(a)]
Power Block Area	**(Unit 2) (cont.)**				
B-2269UD	UD11	CH	Sand 5	150.0	–69.9
B-2269UD	UD12	CH	Clay 5 (Bottom)	153.0	–72.9
B-2269UD	UD13	No Recovery	Clay 5 (Bottom)	165.0	–84.9
B-2269UD	UD14	SC	Sand 8	216.0	–135.9
B-2269UD	UD15	SC	Sand 8	216.2	–136.1
B-2269UD	UD16	SC	Sand 8	280.0	–199.9
B-2269UD	UD17	SC	Sand 8	283.2	–203.1
B-2269UD	UD18	CL	Clay 11	375.0	–294.9
B-2269UD	UD19	CH	Clay 11	380.0	–299.9
B-2269UD	UD20	CH	Clay 11	400.0	–319.9
B-2274UD	UD1	CL	Clay 1 (Top)	10.2	70.2
B-2274UD	UD2	CH	Sand 1	29.8	50.6
B-2274UD	UD3	CH	Clay 3	64.9	15.5
B-2274UD	UD4	CH	Clay 3	67.0	13.4
B-2274UD	UD5	CL	Clay 3	89.8	–9.4
B-2274UD	UD6	No Recovery	Clay 3	94.9	–14.5
B-2274UD	UD7	SP	[Clay 3]/ Sand 4	97.4	–17.0
B-2274UD	UD8	CH	Clay 5 (Top)	120.0	–39.6
B-2274UD	UD9	SC	Clay 5 (Bottom)	146.1	–65.7
B-2274UD	UD10	CH	Sand 6	180.0	–99.6
B-2274UD	UD11	No Recovery	Sand 6	214.4	–134.0
B-2274UD	UD12	SC	Sand 8	221.1	–140.7
B-2274UD	UD13	CL	Sand 8	240.0	–159.6
B-2274UD	UD14	SC	Sand 8	265.0	–184.6
B-2274UD	UD15	SC	Sand 8	276.0	–195.6
B-2274UD	UD16	CH	Clay 9	300.0	–219.6
B-2274UD	UD17	MH	Clay 9	320.0	–239.6
B-2274UD	UD18	SM	Sand 10	330.1	–249.7
B-2274UD	UD19	SM	Sand 10	350.1	–269.7
B-2274UD	UD20	MH	Clay 11	380.0	–299.6
B-2274UD	UD21	CH	Clay 11	390.0	–309.6
B-2274UD	UD22	CH	Clay 11	400.0	–319.6
B-2274UD	UD23	CL	Sand 12	420.0	–339.6
B-2274UD	UD24	CH	Clay 13	480.0	–399.6
B-2274UD	UD25	CH	Sand 14	520.0	–439.6

Table 2.5.4-A-38 (Sheet 5 of 5)
Undisturbed Sample Details (Power Block Area)

Boring Number	Sample Number	USCS Group	Stratum	Sample Top Depth (feet)	Sample Top Elevation (feet)[a]
Power Block Area	**(Unit 2) (cont.)**				
B-2274UD	UD26	CL	Clay 17	580.0	–499.6
B-2274UD	UD27	SP-SC	Sand 18	600.0	–519.6
B-2274UD	UD28	SP	Sand 18	605.0	–524.6
B-3234UD	UD-1	CH	Clay 1 (Top)	20.0	60.60
B-3234UD	UD-2	CL	Clay 1 (Bottom)	35.0	45.60
B-3234UD	UD-3	CH	Clay 1 (Bottom)	50.0	30.60
B-3234UD	UD-4	CH	Clay 1 (Bottom)	53.8	26.80
B-3234UD	UD-5	CH	Clay 3	70.0	10.60
B-3234UD	UD-6	SP	Sand 4	90.0	–9.40
B-3234UD	UD-7	SP	Sand 4	105.0	–24.40
B-3234UD	UD-8	CH	Clay 5 (Top)	125.0	–44.40
B-3234UD	UD-9	CH	Clay 5 (Bottom)	150.0	–69.40
B-3234UD	UD-10	SW	Sand 6	163.0	–82.40
B-3234UD	UD-11	SP-SM	Sand 6	168.8	–88.20
B-3234UD	UD-12	CH	Sand 6	180.0	–99.40
B-3234UD	UD-13	SP	Sand 8	213.0	–132.40
B-3234UD	UD-14	SM	Sand 8	216.8	–136.20
B-3234UD	UD-15	SM	Sand 8	260.0	–179.40
B-3234UD	UD-16	CH	Clay 9	305.0	–224.40
B-3234UD	UD-17	CH	Sand 10	343.0	–262.40
B-3234UD	UD-18	CH	Sand 10	345.8	–265.20
B-3234UD	UD-19	CH	Clay 11	393.0	–312.40

(a) Elevations are referenced to NAVD 88.

“[ ]” = Minor component of a sample crossing two strata.

Table 2.5.4-A-39
Not Used

Table 2.5.4-A-40 (Sheet 1 of 2)
As-Built Cone Penetration Test Information (Power Block Area)

CPT Number	Northing (feet)[(a)]	Easting (feet)[(a)]	Ground Surface Elevation (feet)[(b)]	Depth (feet)	Base Elevation (feet)[(b)]
Power Block Area	**(Unit 1)**				
C-2101	13,412,774.10	2,599,705.86	80.12	94.60	–14.48
C-2102S	13,412,550.23	2,599,702.26	80.17	91.90	–11.73
C-2103	13,412,715.32	2,599,852.09	77.68	93.40	–15.72
C-2104S	13,412,187.52	2,599,704.22	80.10	71.50	8.60
C-2105	13,412,269.09	2,599,774.92	80.19	88.00	–7.81
C-2106	13,412,291.55	2,599,955.62	79.59	296.40	–216.81
C-2106S	13,412,296.36	2,599,958.27	79.51	79.30	0.21
C-2107	13,412,304.73	2,600,042.26	79.96	95.30	–15.34
C-2108	13,412,425.89	2,600,105.91	79.78	93.30	–13.52
C-2109S	13,412,545.94	2,600,138.83	79.93	90.00	–10.07
C-2110	13,412,478.15	2,600,217.10	80.00	92.90	–12.90
C-2111	13,412,225.65	2,600,089.78	78.04	16.70	61.34
C-2111A	13,412,224.80	2,600,089.84	78.14	33.90	44.24
C-2111B	13,412,225.10	2,600,087.29	78.28	38.40	39.88
C-2111C	13,412,238.89	2,600,087.16	78.04	85.80	–7.76
C-2111D	13,412,212.18	2,600,086.06	79.22	95.50	–16.28
C-2112	13,412,358.60	2,600,185.71	79.55	99.70	–20.15
C-2113	13,412,251.45	2,600,231.11	79.31	96.80	–17.49
C-2214	13,412,587.86	2,600,280.45	79.86	93.60	–13.74
C-2215	13,412,539.13	2,600,425.19	79.83	92.60	–12.77
C-3101	13,411,985.89	2,599,505.85	79.87	74.87	5.00
C-3102	13,412,109.22	2,599,642.04	80.03	95.14	–15.11
C-3110	13,411,774.14	2,599,769.00	79.19	77.10	2.09
Power Block Area	**(Unit 2)**				
C-2201	13,413,541.97	2,600,349.92	80.62	98.70	–18.08
C-2202S	13,413,315.91	2,600,345.61	80.42	93.00	–12.58
C-2203	13,413,489.00	2,600,490.16	80.56	100.00	–19.44
C-2204S	13,412,953.12	2,600,347.76	80.35	55.00	25.35
C-2204SA	13,412,954.25	2,600,354.46	80.30	91.00	–10.70
C-2204SB	13,412,963.86	2,600,351.20	80.18	90.00	–9.82
C-2205	13,413,036.37	2,600,417.96	80.39	95.00	–14.61
C-2206	13,413,081.83	2,600,615.27	80.22	247.20	–166.98
C-2206S	13,413,071.11	2,600,604.08	80.63	93.80	–13.17
C-2207	13,413,071.18	2,600,687.06	80.39	90.60	–10.21

Table 2.5.4-A-40 (Sheet 2 of 2)
As-Built Cone Penetration Test Information (Power Block Area)

CPT Number	Northing (feet)[a]	Easting (feet)[a]	Ground Surface Elevation (feet)[b]	Depth (feet)	Base Elevation (feet)[b]
Power Block Area	**(Unit 2) (cont.)**				
C-2208	13,413,191.48	2,600,748.18	80.54	96.00	–15.46
C-2209S	13,413,311.92	2,600,780.51	80.27	90.00	–9.73
C-2210	13,413,244.43	2,600,858.74	80.30	33.00	47.30
C-2210A	13,413,246.80	2,600,860.38	79.87	99.60	–19.73
C-2211	13,412,992.38	2,600,730.80	80.20	93.00	–12.80
C-2212	13,413,123.28	2,600,827.18	80.44	83.00	–2.56
C-2213	13,413,017.49	2,600,874.63	80.46	97.30	–16.84
C-3201	13,413,646.69	2,600,904.17	79.87	109.25	–29.38
C-3204	13,413,340.70	2,600,979.03	79.99	87.07	–7.08
C-3205	13,413,222.51	2,600,985.88	80.12	95.73	–15.61
C-3206	13,413,096.81	2,600,879.63	80.31	62.34	17.97
C-3207	13,412,840.47	2,600,672.65	79.99	77.30	2.69
C-3208	13,412,902.67	2,600,610.62	80.08	90.75	–10.67
C-3209	13,413,406.91	2,601,142.50	80.26	85.37	–5.11
C-3211	13,413,000.85	2,600,359.97	79.98	85.43	–5.45
C-3212	13,412,998.23	2,600,496.82	80.22	90.94	–10.72
Outside Power	**Block**				
C-2216	13,414,151.27	2,600,733.87	80.54	96.70	–16.16

(a) Northings and Eastings are referenced to NAD 83.
(b) Elevations are referenced to NAVD 88.

Table 2.5.4-A-41
Not Used

Table 2.5.4-A-42
Not Used

Table 2.5.4-A-43
Not Used

Table 2.5.4-A-44
Not Used

Table 2.5.4-A-45
Not Used

Table 2.5.4-A-46
Not Used

Table 2.5.4-A-47
Not Used

Table 2.5.4-A-48
Not Used

Table 2.5.4-A-49
Not Used

Table 2.5.4-A-50
Not Used

Table 2.5.4-A-51 (Sheet 1 of 3)
S-Wave Velocity Profile Numerical Values; Upper Approximately 600 Feet of Site Soils (Power Block Area)

Stratum	Top El. (feet)[(a)]	Base El. (feet)[(a)]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Median V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	No. of Tests
Power Block	**(Unit 1)**							
Fill I	95.0	90.0	—	—	—	597	176	—
Fill II	90.0	85.0	—	—	—	708	209	—
Fill III	85.0	80.0	—	—	—	783	232	—
Clay 1 (Top)	80.0	51.5	1100	276	715	722	161	94
Sand 1	—	—	—	—	—	—	—	—
Clay 1 (Btm)	51.5	30.5	1560	470	830	863	228	93
Sand 2	30.5	18.5	1283	570	940	979	165	30
Clay 3	18.5	-4.5	1760	710	1030	1054	188	120
Sand 4	-4.5	-27.0	5380	687	1650	1853	863	87
Clay 5 (Top)	-27.0	-49.0	1650	700	1040	1045	194	62
Sand 5	-49.0	-66.0	1540	870	1135	1137	153	46
Clay 5 (Btm)	-66.0	-77.5	1650	850	1245	1229	250	58
Sand 6	-77.5	-128.5	5600	920	1420	1566	548	199
Clay 7	-128.5	-167.5	2060	800	1480	1434	331	63
Sand 8	-167.5	-202.0	5130	980	1530	1656	588	99
Clay 9	-202.0	-245.0	1660	990	1285	1281	433	72
Sand 10	-245.0	-268.5	2220	1160	1650	1667	278	23
Clay 11	-268.5	-328.0	1750	820	1160	1173	192	59
Sand 12	-328.0	-346.0	2030	1580	1820	1821	127	11
Clay 13	-346.0	-421.5	2310	1020	1325	1410	263	46
Sand 14	-421.5	-454.5	2040	1540	1795	1780	136	20
Clay 15	-454.5	-465.5	1800	1100	1600	1523	245	7
Sand 16	-465.5	-480.5	1980	1720	1740	1814	109	9
Clay 17	-480.5	-507.0	2030	1180	1605	1623	318	16
Sand 18	-507.0	-520.0	2380	1830	1970	2022	190	9
Power Block	**(Unit 2)**							
Fill I	95.0	90.0	—	—	—	597	176	—
Fill II	90.0	85.0	—	—	—	708	209	—
Fill III	85.0	80.0	—	—	—	783	232	—
Clay 1 (Top)	80.0	51.0	1160	167	630	646	170	98
Sand 1	51.0	43.5	1350	738	1079	1129	154	32
Clay 1 (Btm)	43.5	26.5	1300	550	950	944	196	79
Sand 2	26.5	16.5	1470	750	1115	1129	163	40
Clay 3	16.5	-8.5	1670	490	980	999	276	134
Sand 4	-8.5	-36.5	1850	900	1300	1347	221	77
Clay 5 (Top)	-36.5	-52.5	2870	790	1035	1151	342	66
Sand 5	-52.5	-67.5	2490	1140	1540	1530	229	43

Table 2.5.4-A-51 (Sheet 2 of 3)
S-Wave Velocity Profile Numerical Values; Upper Approximately 600 Feet of Site Soils (Power Block Area)

Stratum	Top El. (feet)[(a)]	Base El. (feet)[(a)]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Median V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	No. of Tests
Power Block	**(Unit 2) (cont.)**							
Clay 5 (Btm)	-67.5	-81.5	1740	790	1055	1066	170	46
Sand 6	-81.5	-139.0	3400	490	1370	1424	355	220
Clay 7	—	—	—	—	—	—	—	—
Sand 8	-139.0	-208.5	3000	970	1710	1711	333	128
Clay 9	-208.5	-252.5	1750	990	1255	1261	147	60
Sand 10	-252.5	-290.0	2020	1270	1660	1645	192	51
Clay 11	-290.0	-324.0	1410	910	1100	1102	113	36
Sand 12	-324.0	-347.0	2190	1610	1860	1866	147	14
Clay 13	-347.0	-423.0	2270	1050	1280	1312	184	46
Sand 14	-423.0	-470.0	2400	1370	1870	1885	196	29
Clay 15	-470.0	-482.0	1560	1360	1410	1436	88	7
Sand 16	-482.0	-500.0	1980	1540	1750	1765	125	11
Clay 17	-500.0	-516.0	2120	1950	2060	2050	63	10
Sand 18	-516.0	-520.0	2040	1940	2000	1993	50	3
Power Block	**(Units 1 & 2)**							
Fill I	95.0	90.0	—	—	—	597	176	—
Fill II	90.0	85.0	—	—	—	708	209	—
Fill III	85.0	80.0	—	—	—	783	232	—
Clay 1 (Top)	80.0	51.5	1160	167	675	683	170	192
Sand 1	51.5	43.5	1350	738	1079	1080	154	32
Clay 1 (Btm)	43.5	28.5	1560	470	860	900	217	172
Sand 2	28.5	17.5	1470	570	1060	1065	179	70
Clay 3	17.5	-6.5	1760	490	1010	1025	240	254
Sand 4	-6.5	-32.0	5380	687	1460	1616	693	164
Clay 5 (Top)	-32.0	-51.0	2870	700	1040	1100	284	128
Sand 5	-51.0	-66.5	2490	870	1290	1327	276	89
Clay 5 (Btm)	-66.5	-79.5	1740	790	1105	1157	232	104
Sand 6	-79.5	-133.5	5600	490	1380	1491	462	419
Clay 7	-133.5	-168.0	2060	800	1480	1434	331	63
Sand 8	-168.0	-205.0	5130	970	1630	1687	462	227
Clay 9	-205.0	-249.0	1750	990	1275	1272	139	132
Sand 10	-249.0	-279.0	2220	1160	1660	1652	221	74
Clay 11	-279.0	-326.0	1750	820	1130	1146	169	95
Sand 12	-326.0	-346.5	2190	1580	1840	1846	138	25
Clay 13	-346.5	-422.5	2310	1020	1310	1361	231	92
Sand 14	-422.5	-462.0	2400	1370	1840	1842	180	49
Clay 15	-462.0	-474.0	1800	1100	1445	1479	183	14
Sand 16	-474.0	-490.5	1980	1540	1745	1788	118	20

Table 2.5.4-A-51 (Sheet 3 of 3)
S-Wave Velocity Profile Numerical Values; Upper Approximately 600 Feet of Site Soils (Power Block Area)

Stratum	Top El. (feet)[(a)]	Base El. (feet)[(a)]	Max. V_s (ft/sec)	Min. V_s (ft/sec)	Median V_s (ft/sec)	Avg. V_s (ft/sec)	Std. Dev. (ft/sec)	No. of Tests
Power Block	**(Units 1 & 2) (cont.)**							
Clay 17	–490.5	–511.5	2120	1180	1950	1793	324	26
Sand 18	–511.5	–520.0	2380	1830	1985	2015	164	12
Outside	**Power Block Area**							
Clay 1 (Top)	80.0	63.5	1122	583	847	841	187	12
Sand 1		—	—	—	—	—	—	—
Clay 1 (Btm)	63.5	49.5	1402	586	1172	1102	264	17
Sand 2	49.5	16.5	1783	875	1262	1292	232	40
Clay 3	16.5	–6.0	1478	741	1019	1081	207	27
Sand 4	–6.0	–25.0	3125	1135	1426	1588	509	23
Clay 5 (Top)	–25.0	–33.5	1307	877	1111	1094	128	10
Sand 5	–33.5	–47.5	2343	1048	1320	1438	388	18
Clay 5 (Btm)	–47.5	–60.5	1624	854	1256	1243	221	16
Sand 6	–60.5	–113.0	2232	1038	1396	1481	292	64
Clay 7	–113.0	–159.0	1754	1120	1367	1386	159	29
Sand 8	–159.0	–173.0	5965	940	1745	2093	1173	45
Clay 9	–173.0	–208.5	2044	1079	1618	1616	262	42
Sand 10	–208.5	–231.5	2076	1267	1302	1504	324	13

(a) Elevations are referenced to NAVD 88.

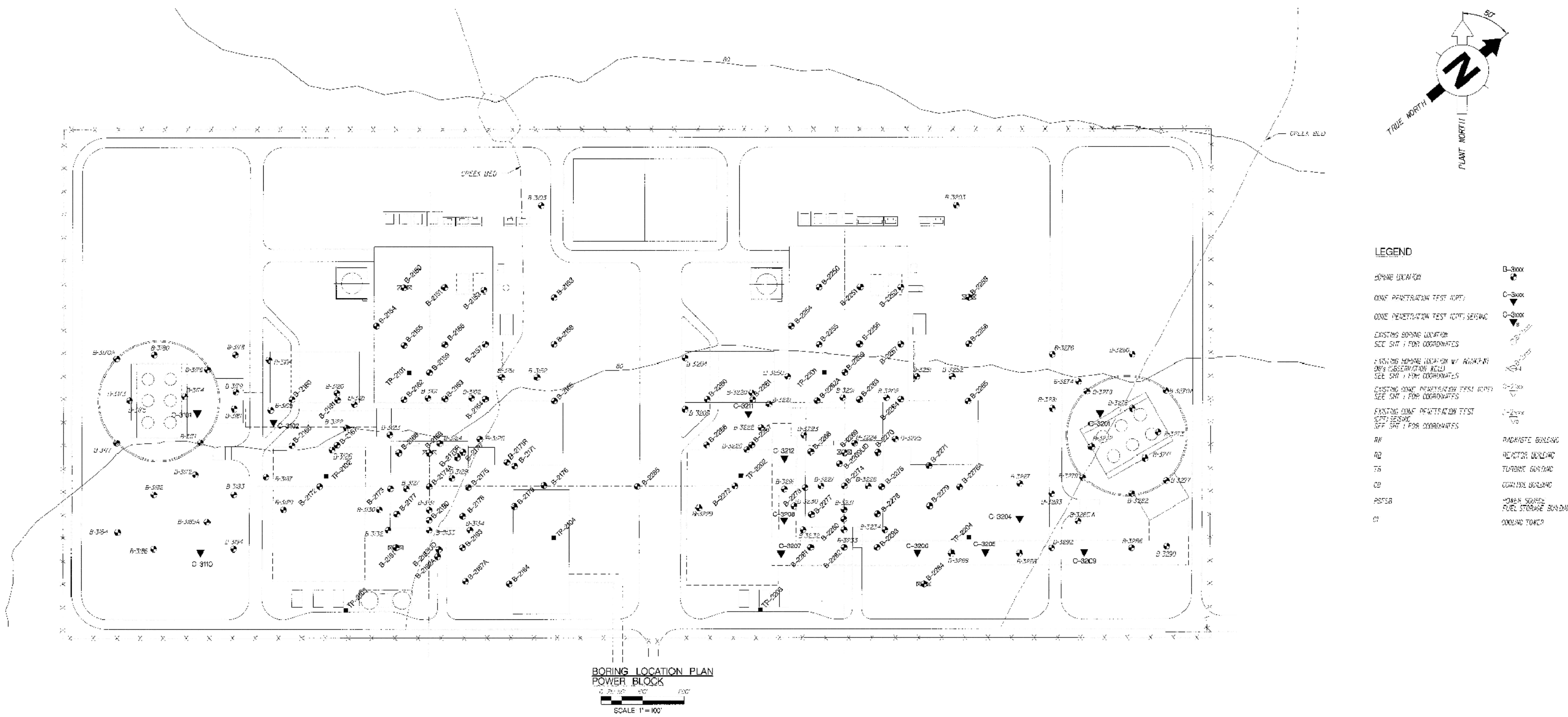


Figure 2.5.4-A-1 Subsurface Investigation Location Plan (Power Block Area) (Typical Dual Unit LWR (with an Independent UHS) Layout Shown)

Figure 2.5.4-A-2 Not Used

Figure 2.5.4-A-3 Not Used

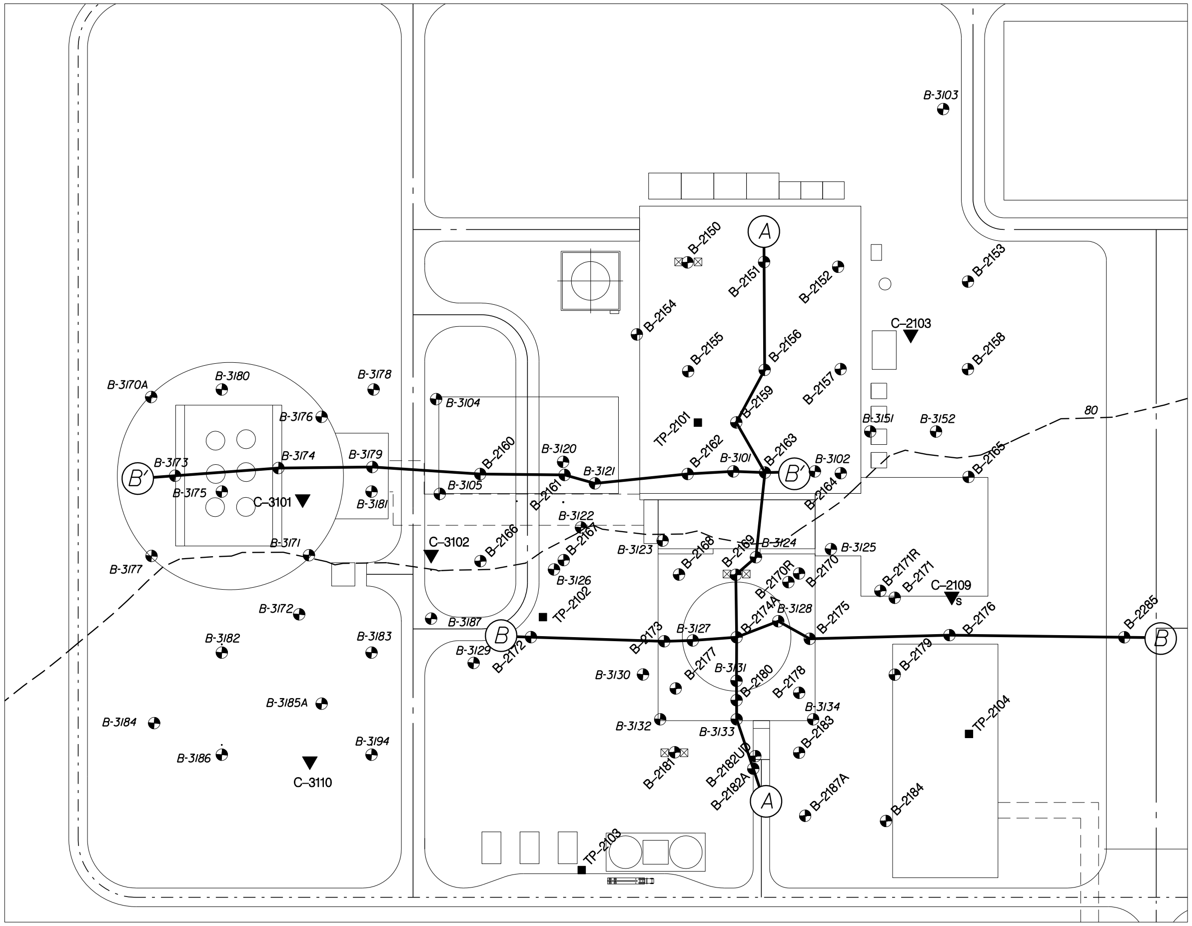


Figure 2.5.4-A-4 Subsurface Profile Plan (Power Block Area) (Typical Dual Unit LWR (with an Independent UHS) Layout Shown) (Sheet 1 of 2)

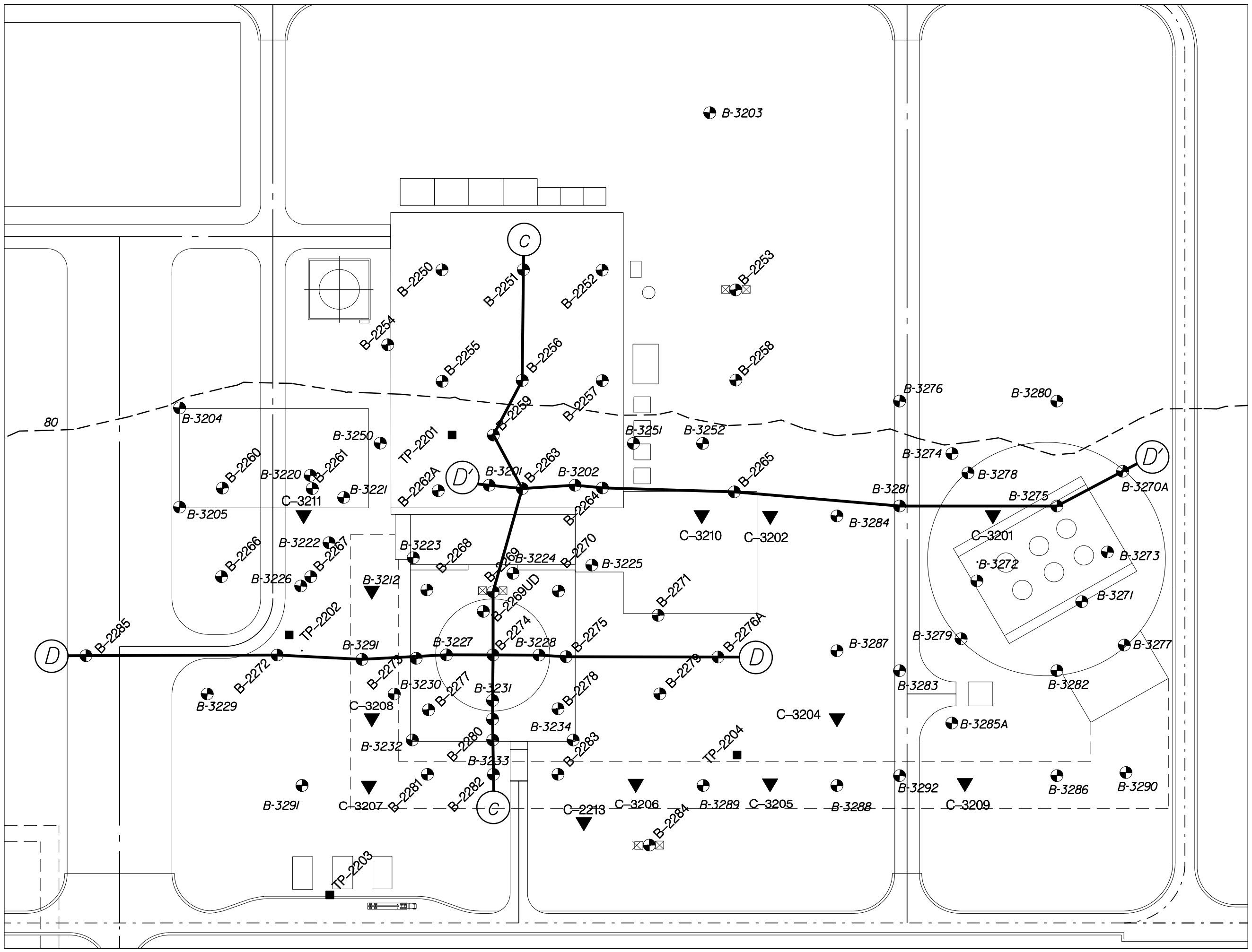


Figure 2.5.4-A-4 Subsurface Profile Plan (Power Block Area) (Typical Dual Unit LWR (with an Independent UHS) Layout Shown (Sheet 2 of 2)

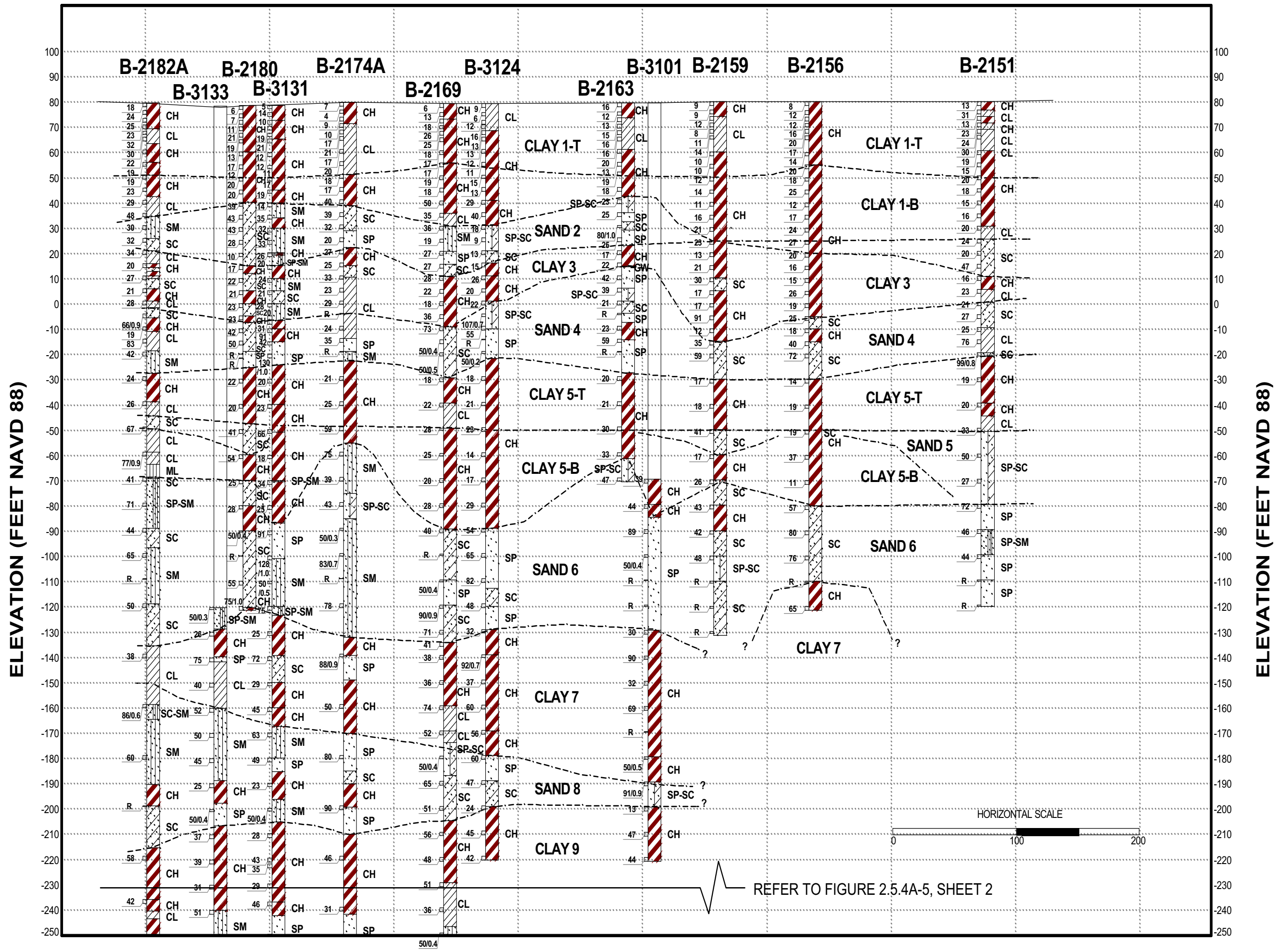


Figure 2.5.4-A-5 Subsurface Profile A; Unit 1 (North-South) (Power Block Area) (Sheet 1 of 2)

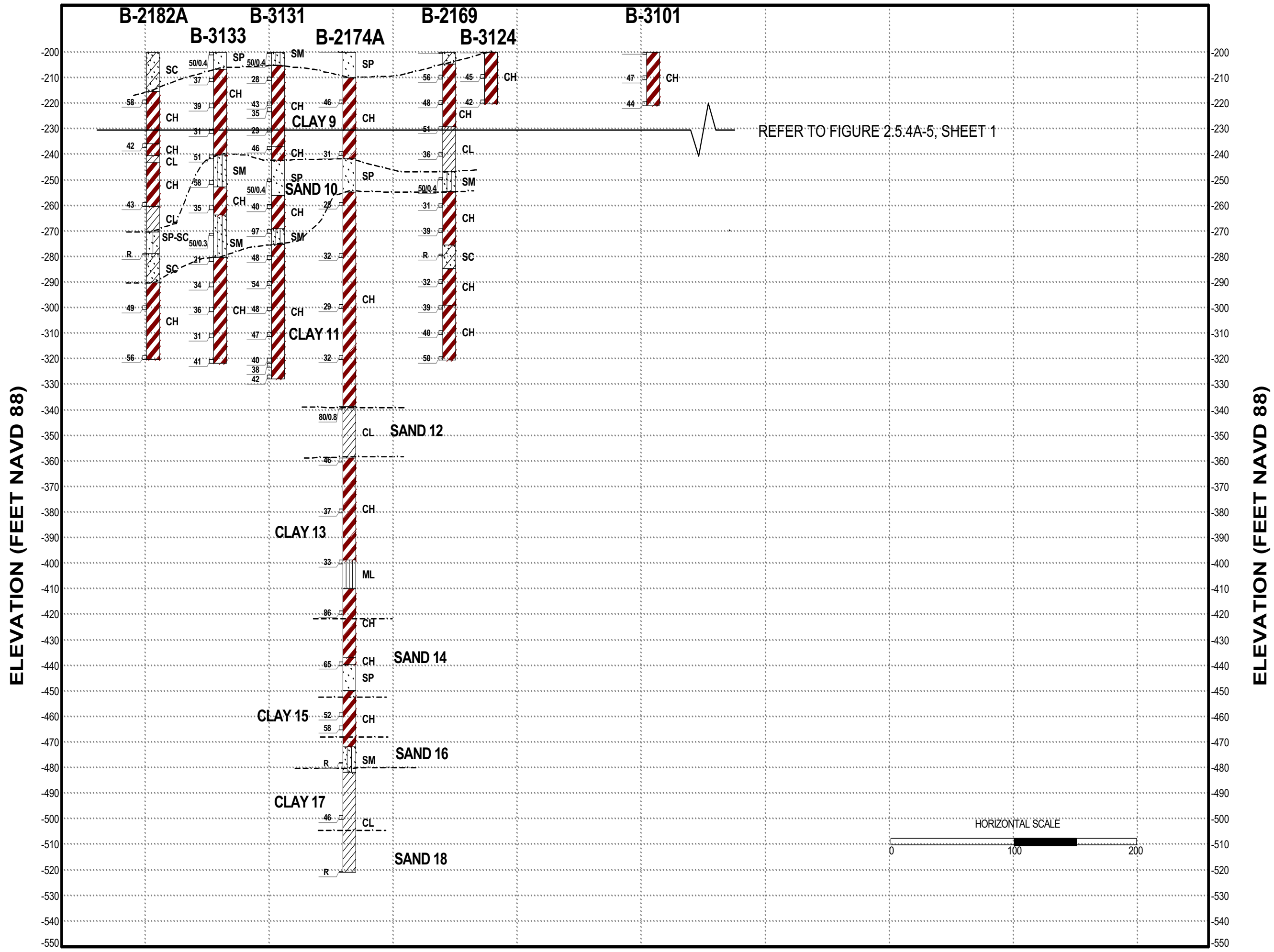


Figure 2.5.4-A-5 Subsurface Profile A; Unit 1 (North-South) (Power Block Area) (Sheet 2 of 2)

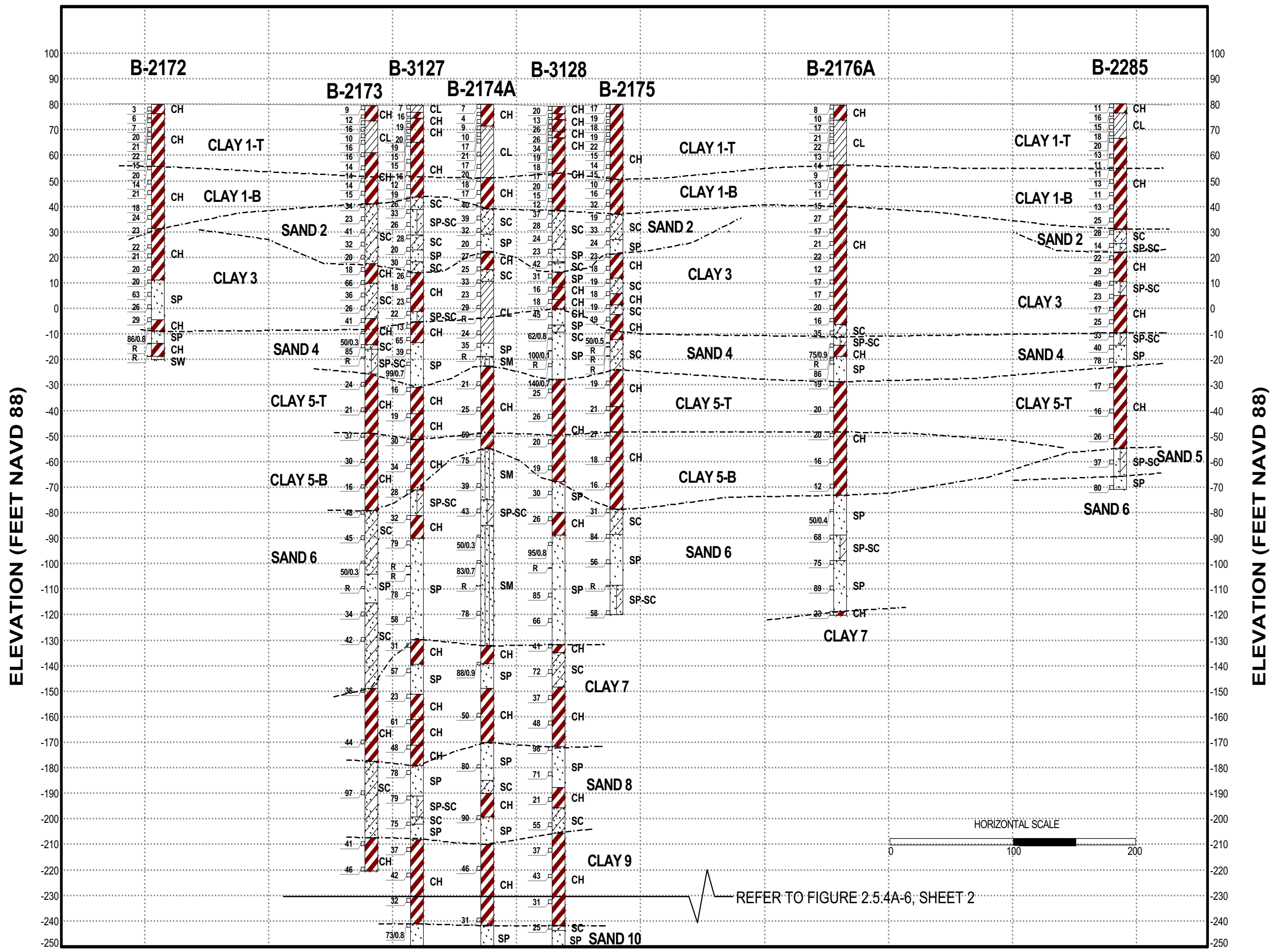


Figure 2.5.4-A-6 Subsurface Profile B; Unit 1 (East-West) (Power Block Area) (Sheet 1 of 2)

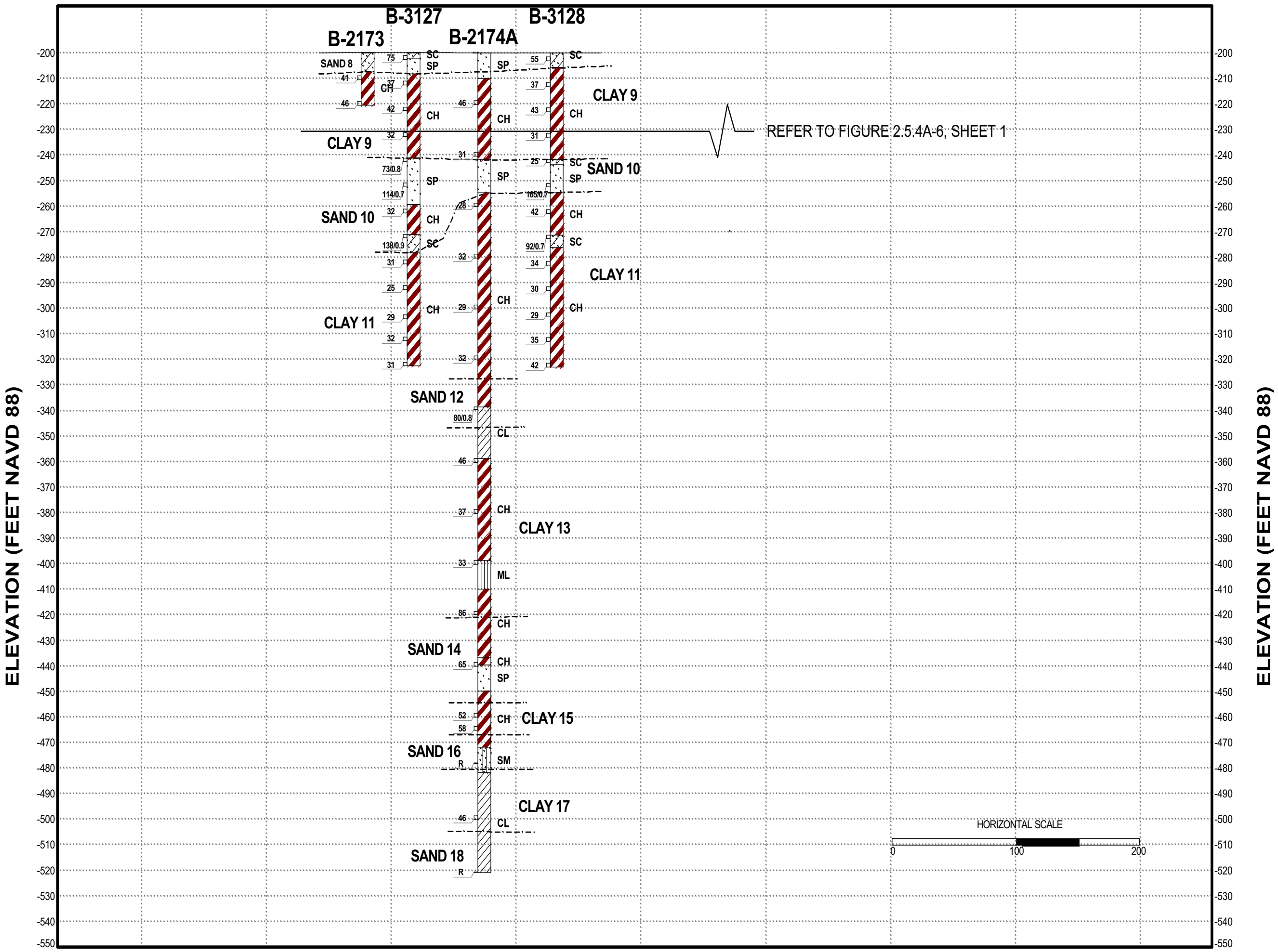


Figure 2.5.4-A-6 Subsurface Profile B; Unit 1 (East-West) (Power Block Area) (Sheet 2 of 2)

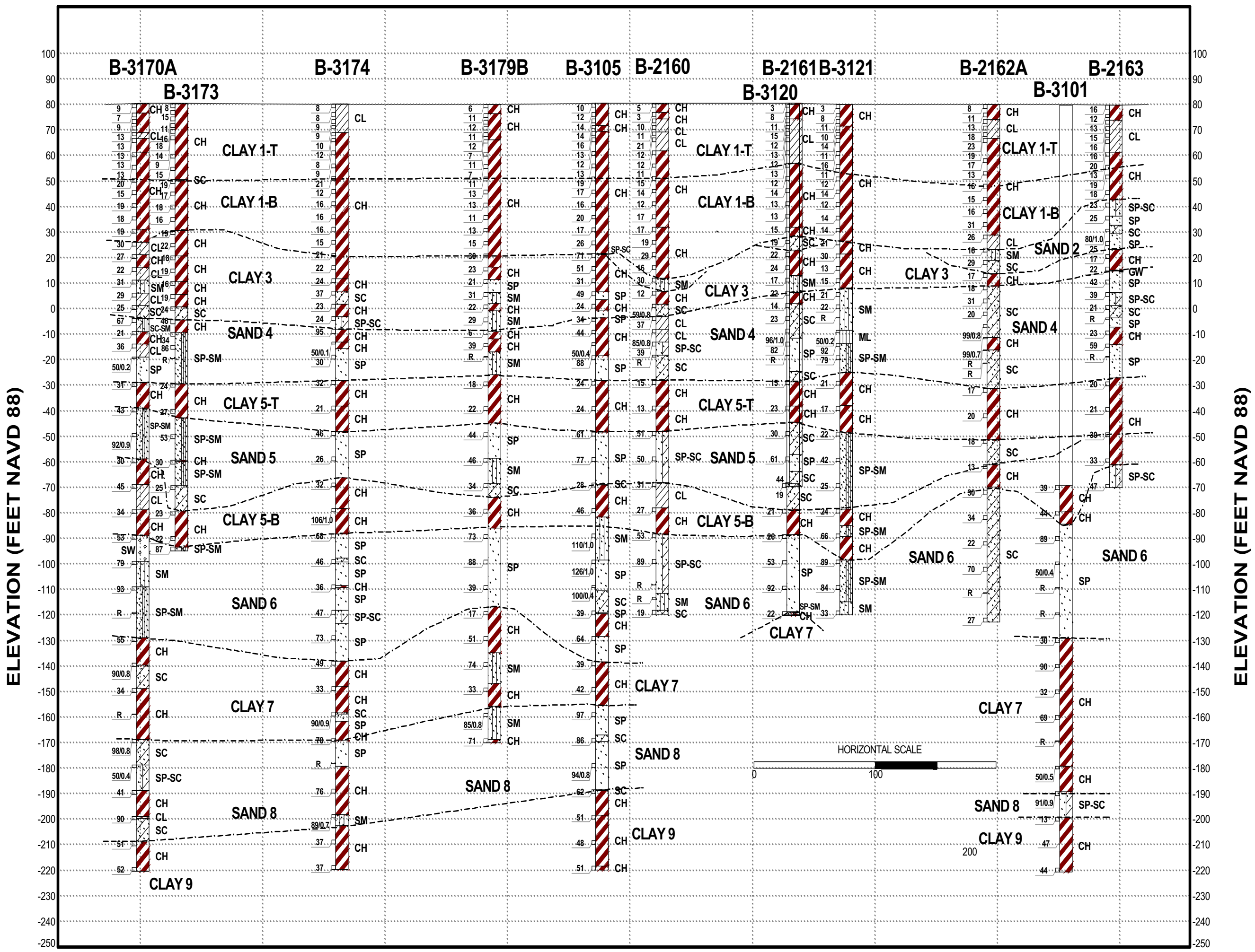


Figure 2.5.4-A-7 Subsurface Profile B'; Unit 1 (East-West) (Power Block Area)

Figure 2.5.4-A-8 Not Used

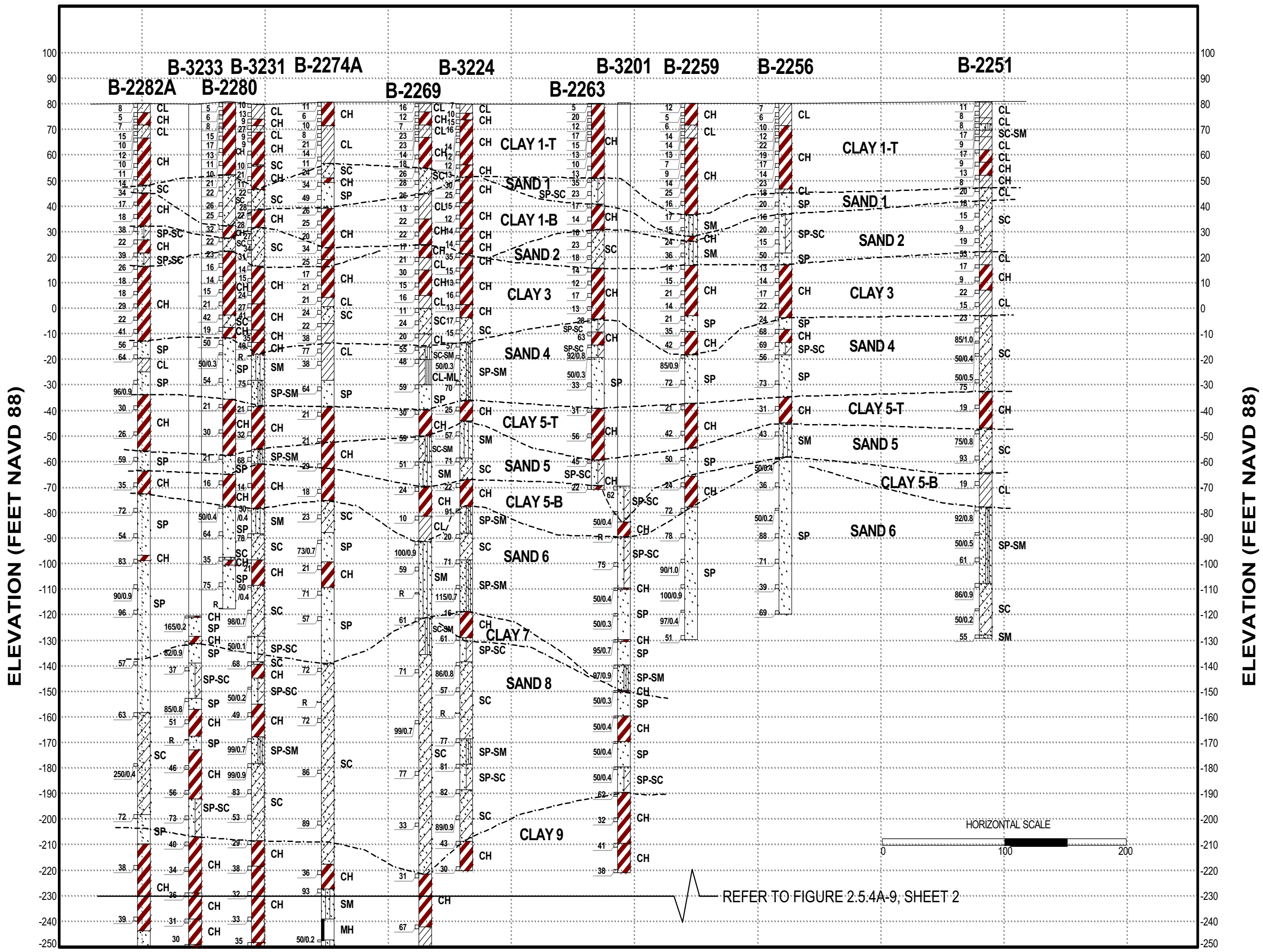


Figure 2.5.4-A-9 Subsurface Profile C; Unit 2 (North-South) (Power Block Area) (Sheet 1 of 2)

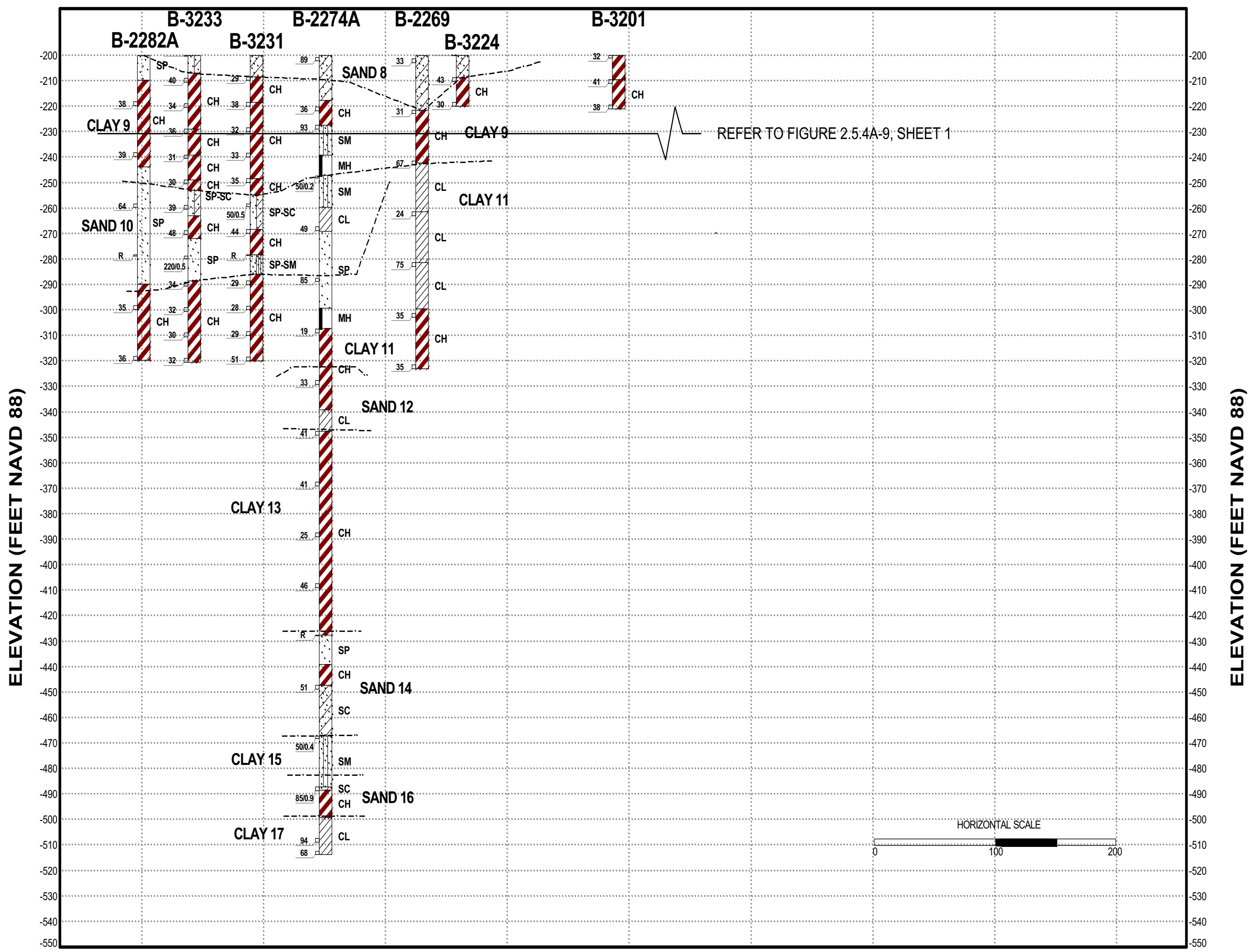


Figure 2.5.4-A-9 Subsurface Profile C; Unit 2 (North-South) (Power Block Area) (Sheet 2 of 2)

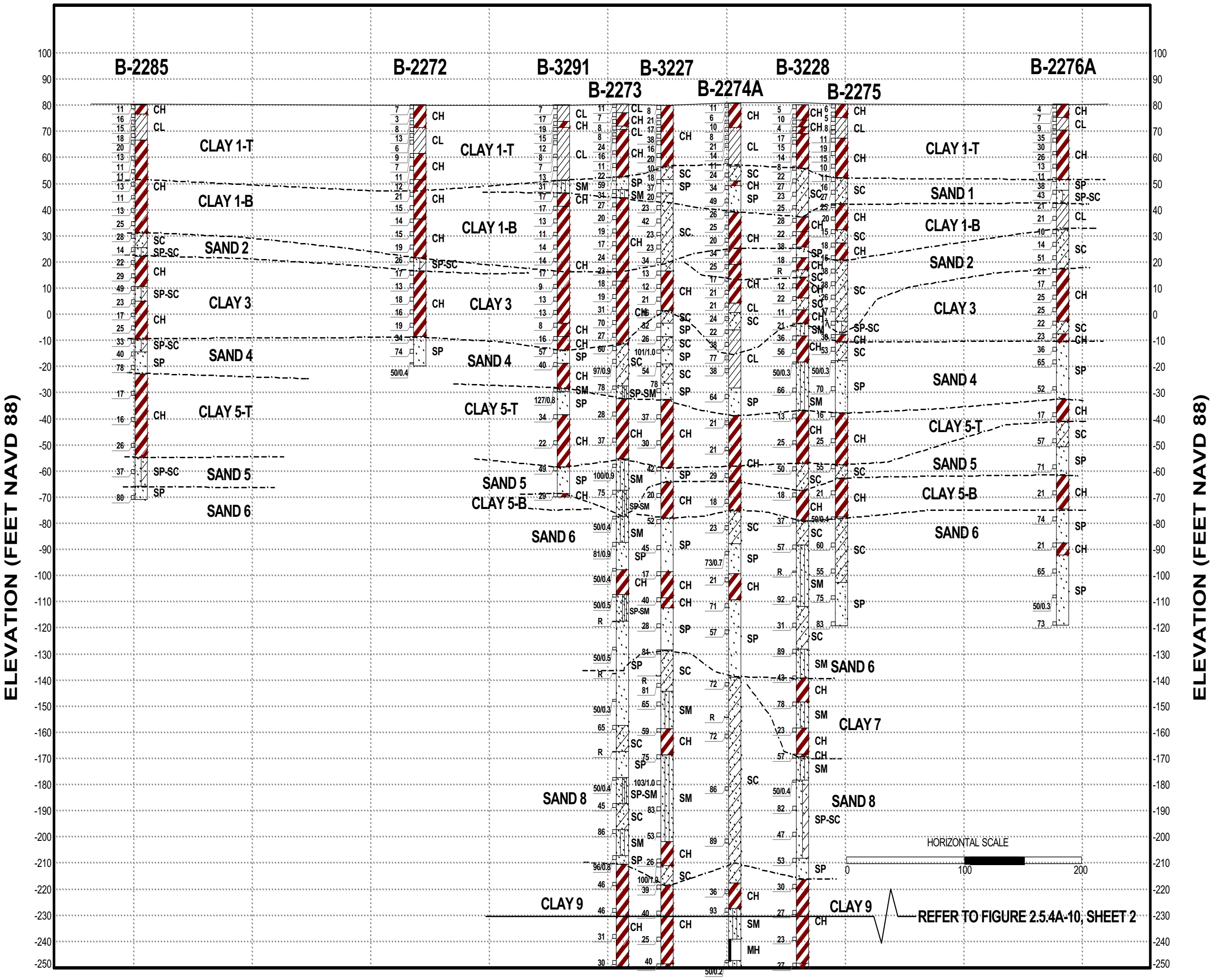


Figure 2.5.4-A-10 Subsurface Profile D; Unit 2 (East-West) (Power Block Area) (Sheet 1 of 2)

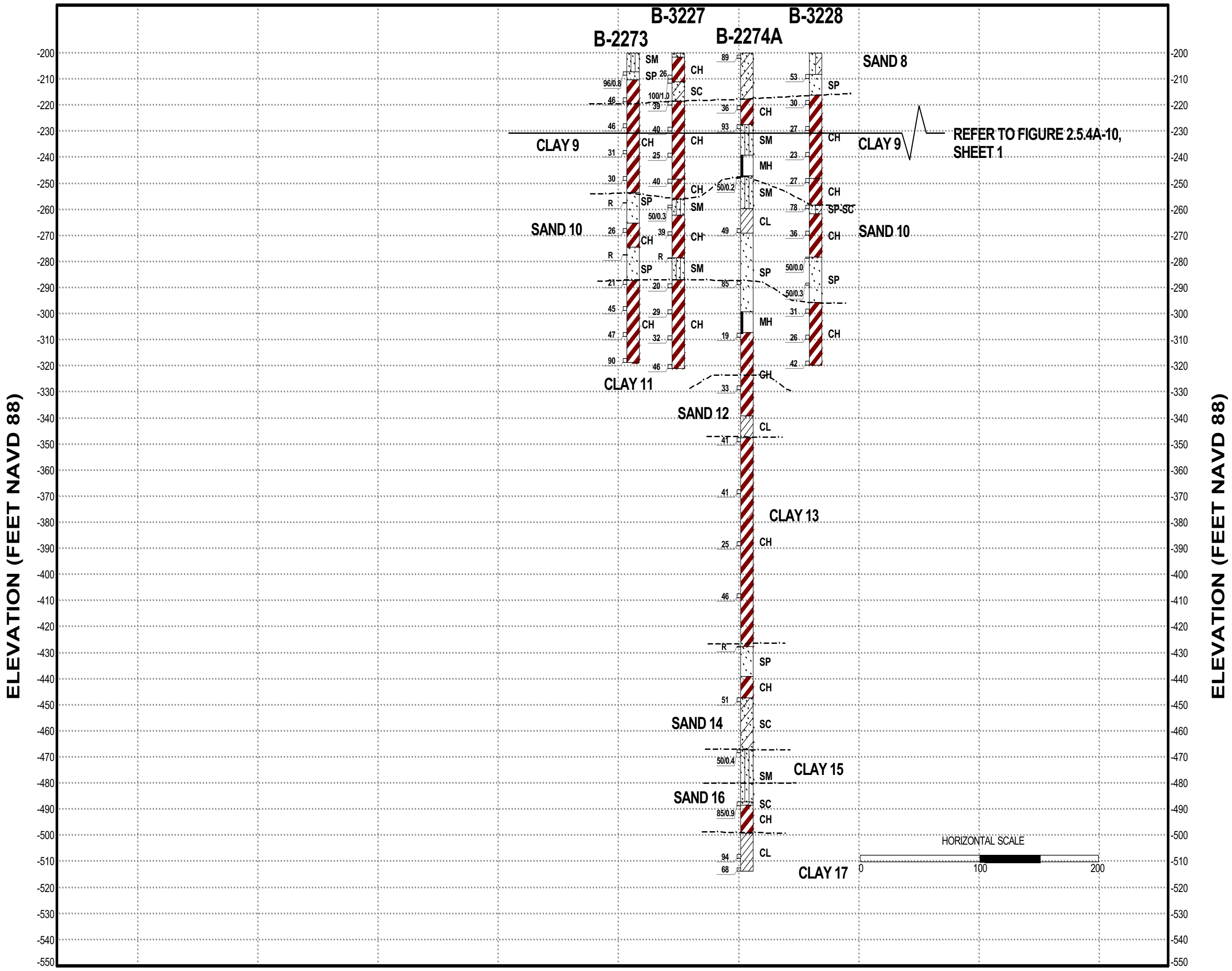


Figure 2.5.4-A-10 Subsurface Profile D; Unit 2 (East-West) (Power Block Area) (Sheet 2 of 2)

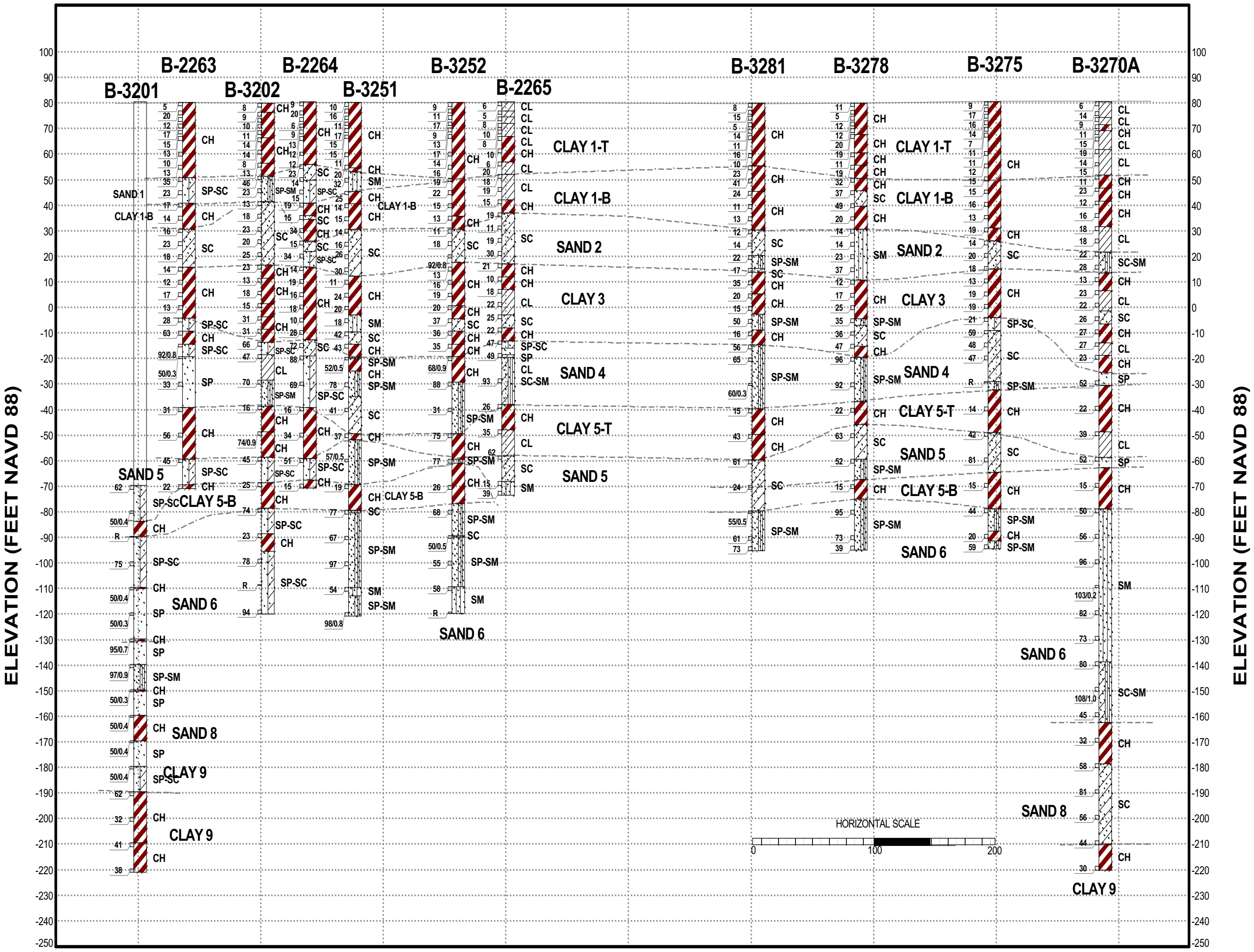


Figure 2.5.4-A-11 Subsurface Profile D'; Unit 2 (East-West) (Power Block Area)

Figure 2.5.4-A-12 Not Used

Figure 2.5.4-A-13 Not Used

Figure 2.5.4-A-14 Not Used

Figure 2.5.4-A-15 Not Used

Figure 2.5.4-A-16 Not Used

Figure 2.5.4-A-17 Not Used

Figure 2.5.4-A-18 Not Used

Figure 2.5.4-A-19 Not Used

Figure 2.5.4-A-20 Not Used

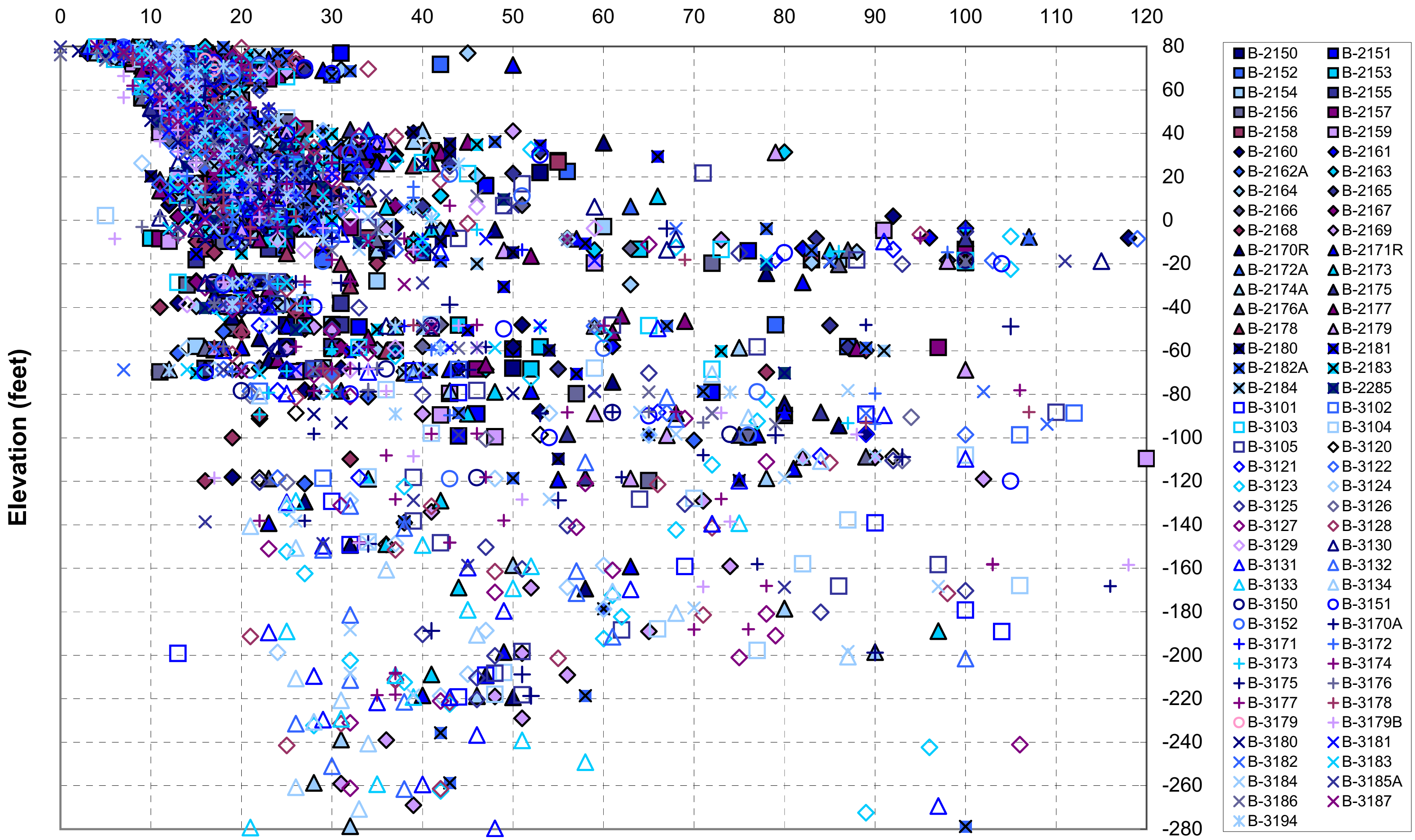


Figure 2.5.4-A-21 Uncorrected SPT N-Values; Unit 1 (Power Block Area)

Figure 2.5.4-A-22 Not Used

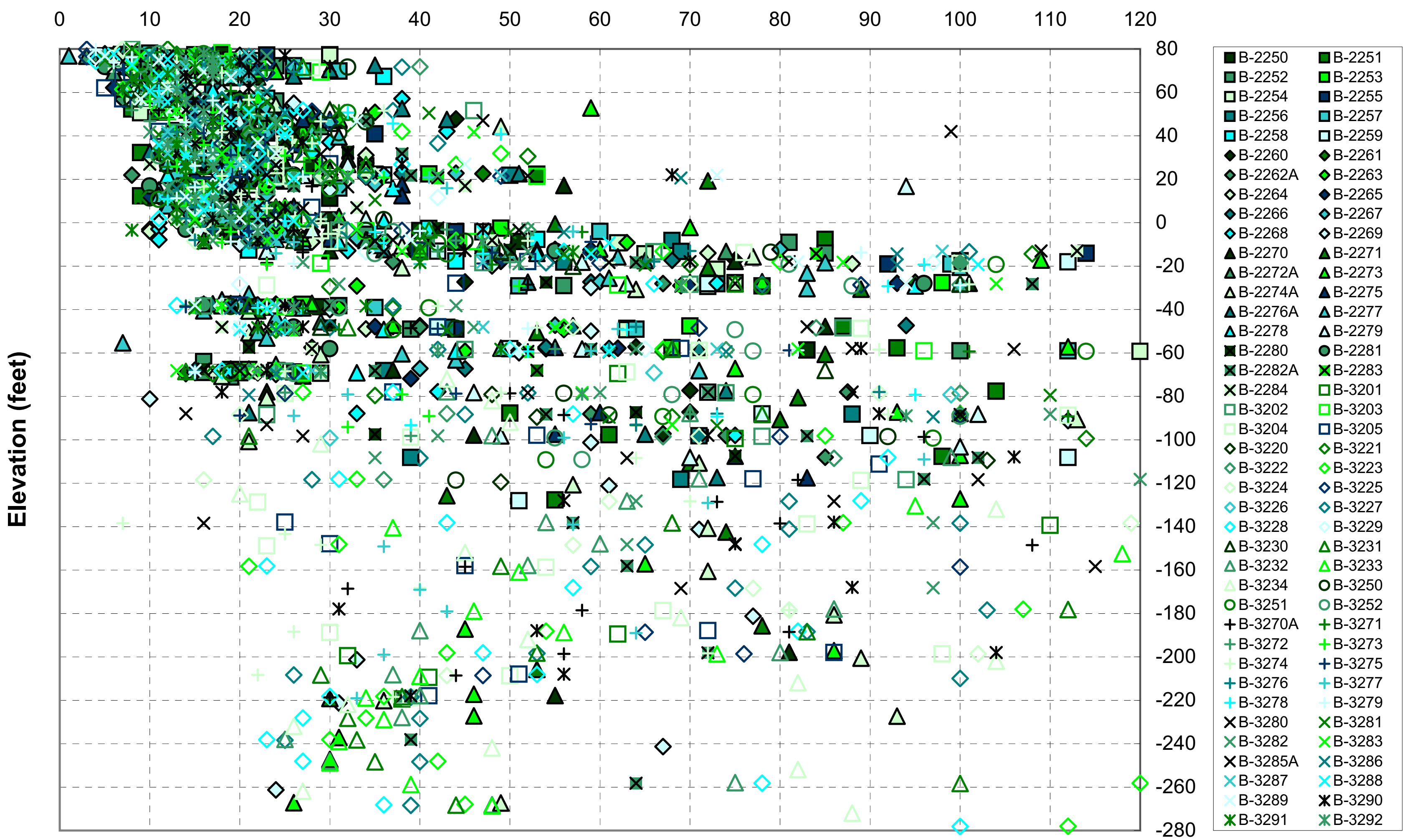


Figure 2.5.4-A-23 Uncorrected SPT N-Values; Unit 2 (Power Block Area)

Figure 2.5.4-A-24 Not Used

Figure 2.5.4-A-25 Not Used

Figure 2.5.4-A-26 Not Used

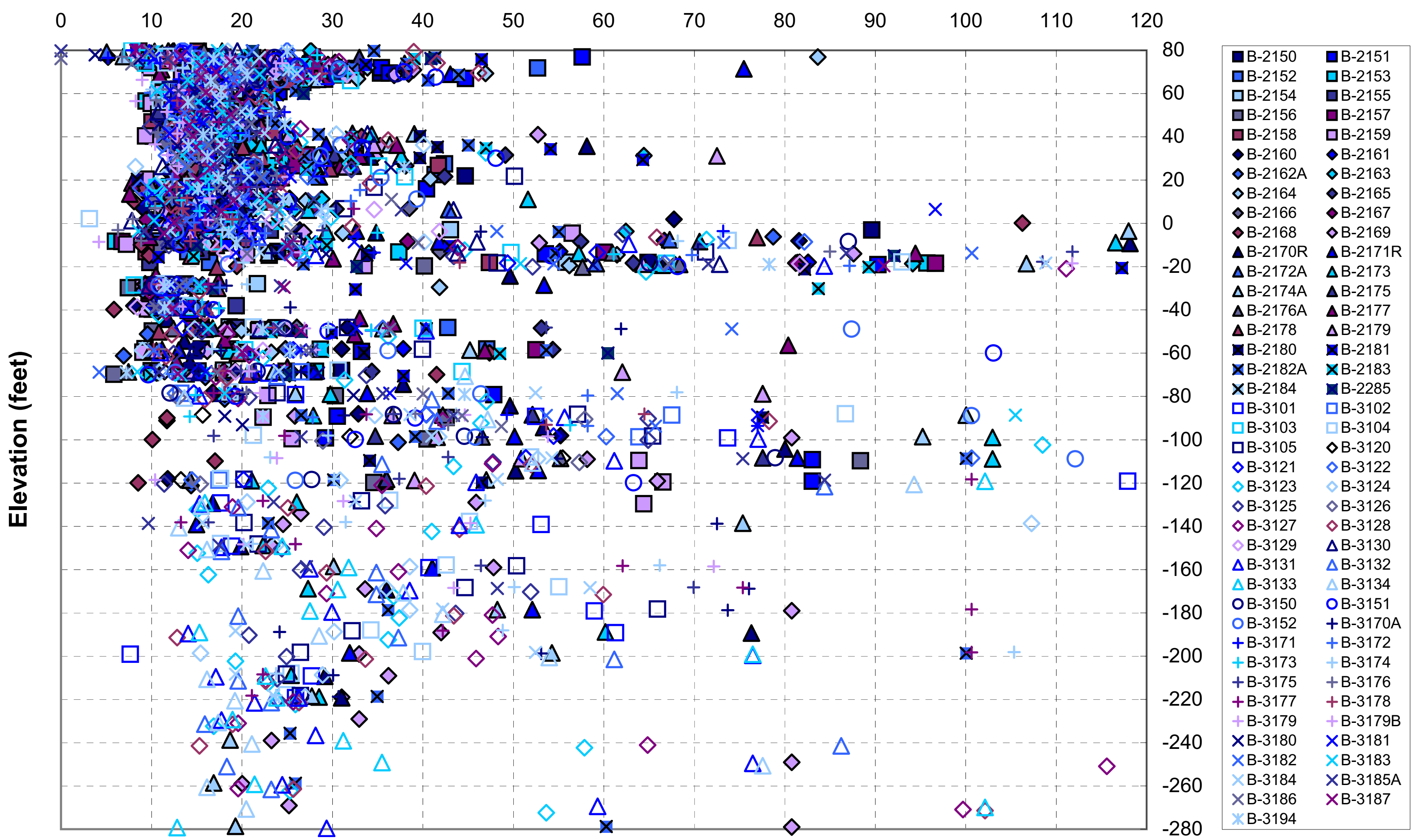


Figure 2.5.4-A-27 Corrected SPT $(N_1)_{60}$-Values; Unit 1 (Power Block Area)

Figure 2.5.4-A-28 Not Used

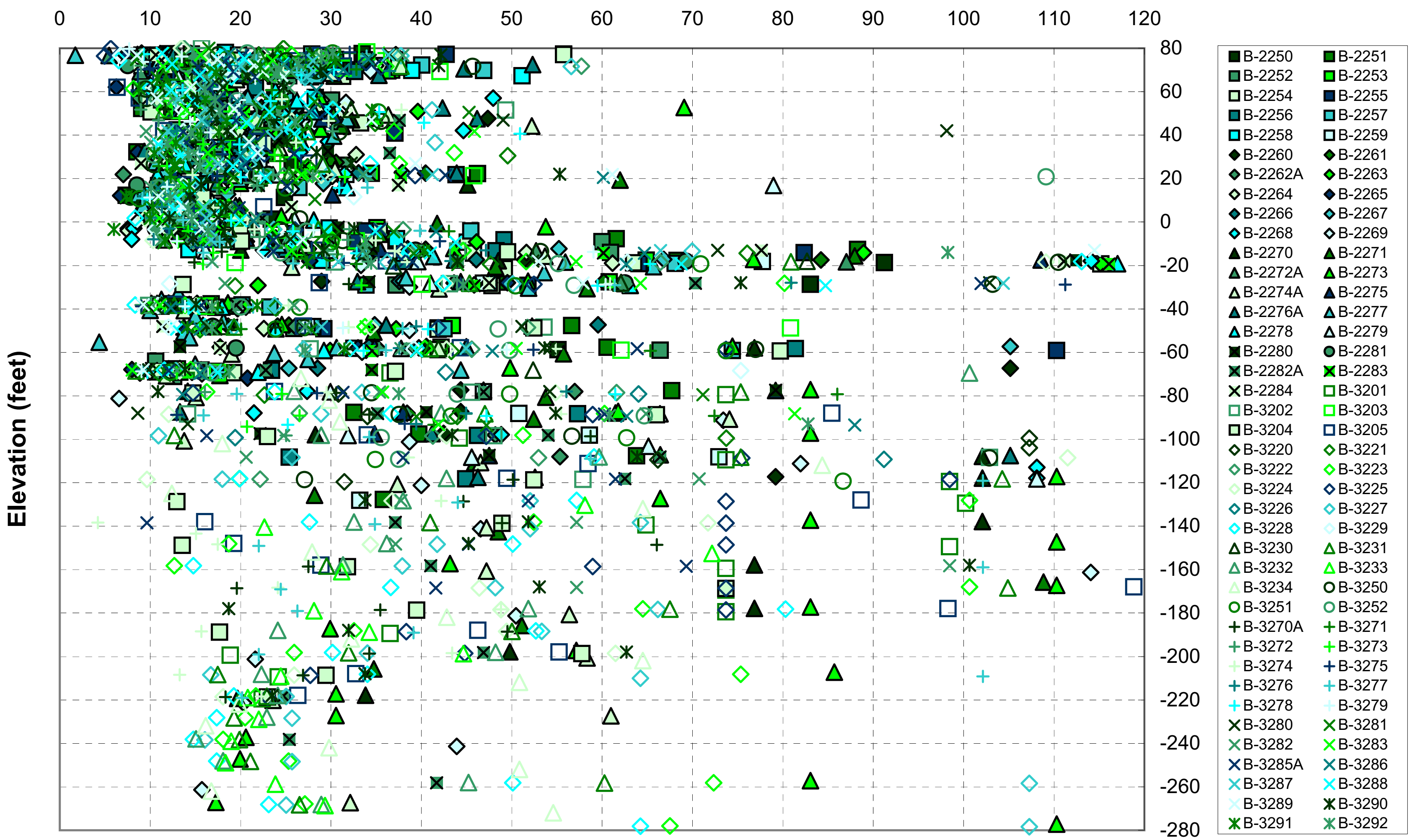


Figure 2.5.4-A-29 Corrected SPT $(N_1)_{60}$-Values; Unit 2 (Power Block Area)

Figure 2.5.4-A-30 Not Used

Figure 2.5.4-A-31 Not Used

Figure 2.5.4-A-32 Not Used

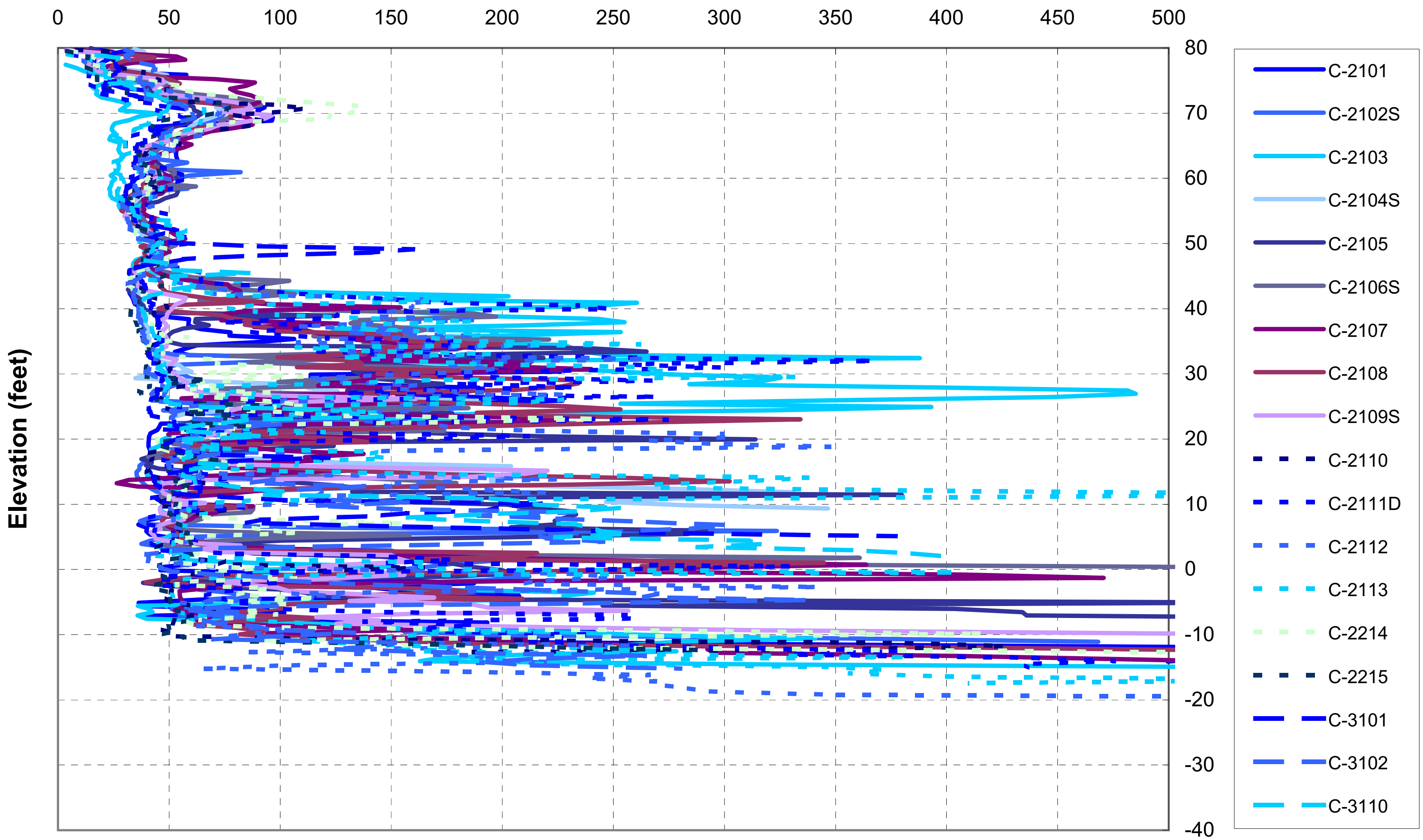


Figure 2.5.4-A-33 Corrected CPT q_t-Values; Unit 1 (Power Block Area)

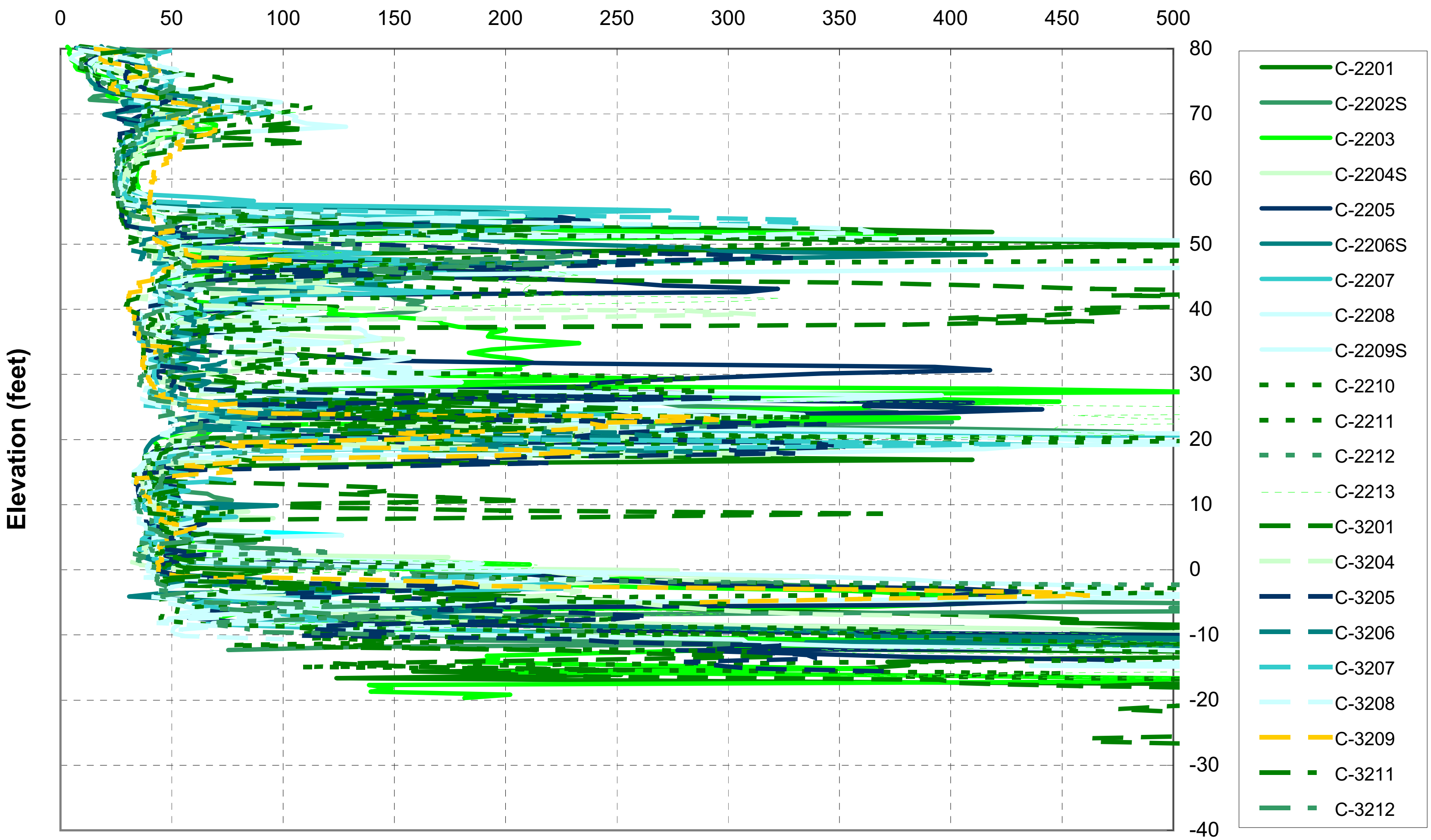


Figure 2.5.4-A-34 Corrected CPT q_t-Values; Unit 2 (Power Block Area)

Figure 2.5.4-A-35 Not Used

Figure 2.5.4-A-36 Not Used

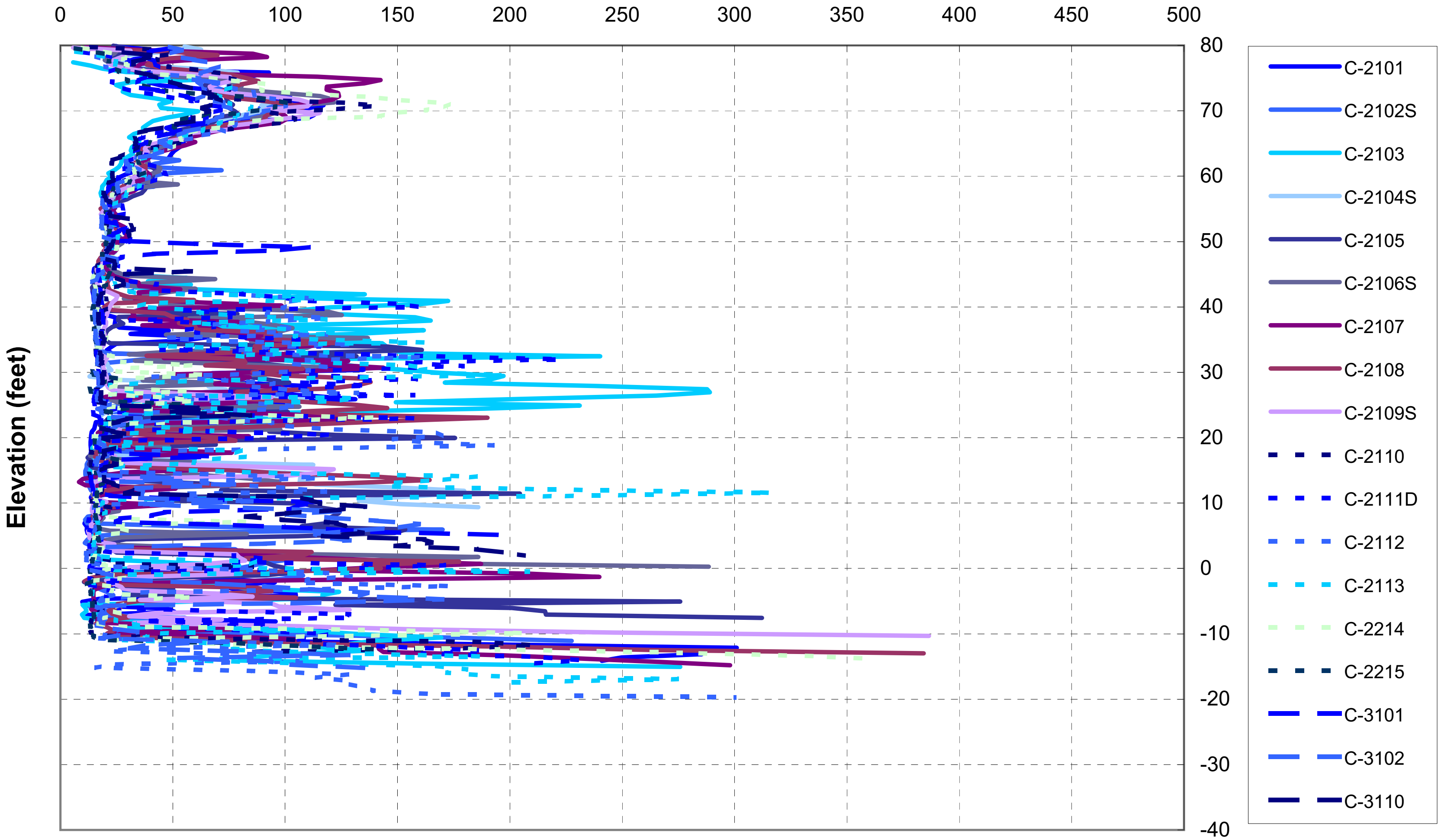


Figure 2.5.4-A-37 Normalized CPT q_{c1n}-Values; Unit 1 (Power Block Area)

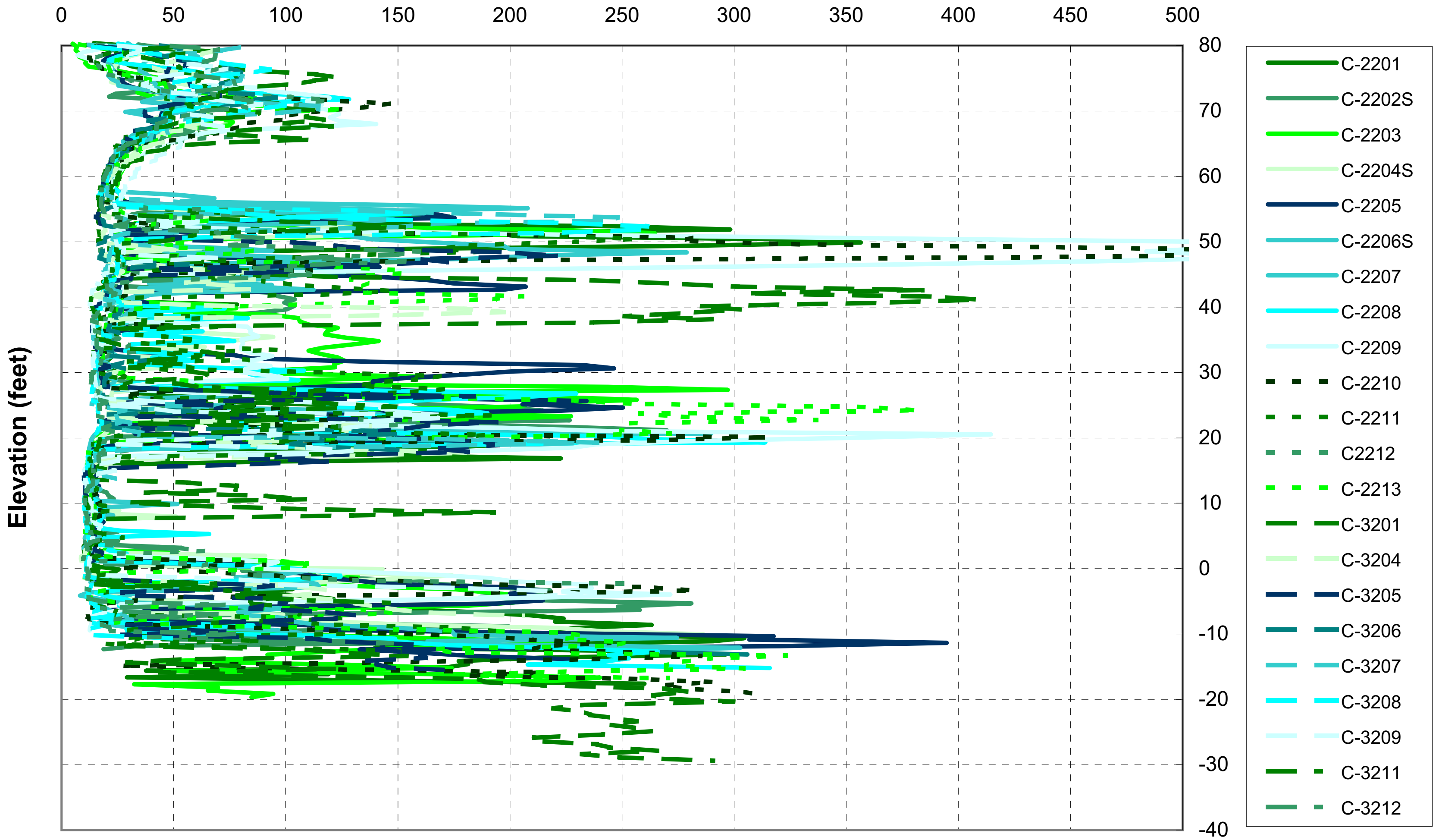


Figure 2.5.4-A-38 Normalized CPT q_{c1n}-Values; Unit 2 (Power Block Area)

Figure 2.5.4-A-39 Not Used

Figure 2.5.4-A-40 Not Used

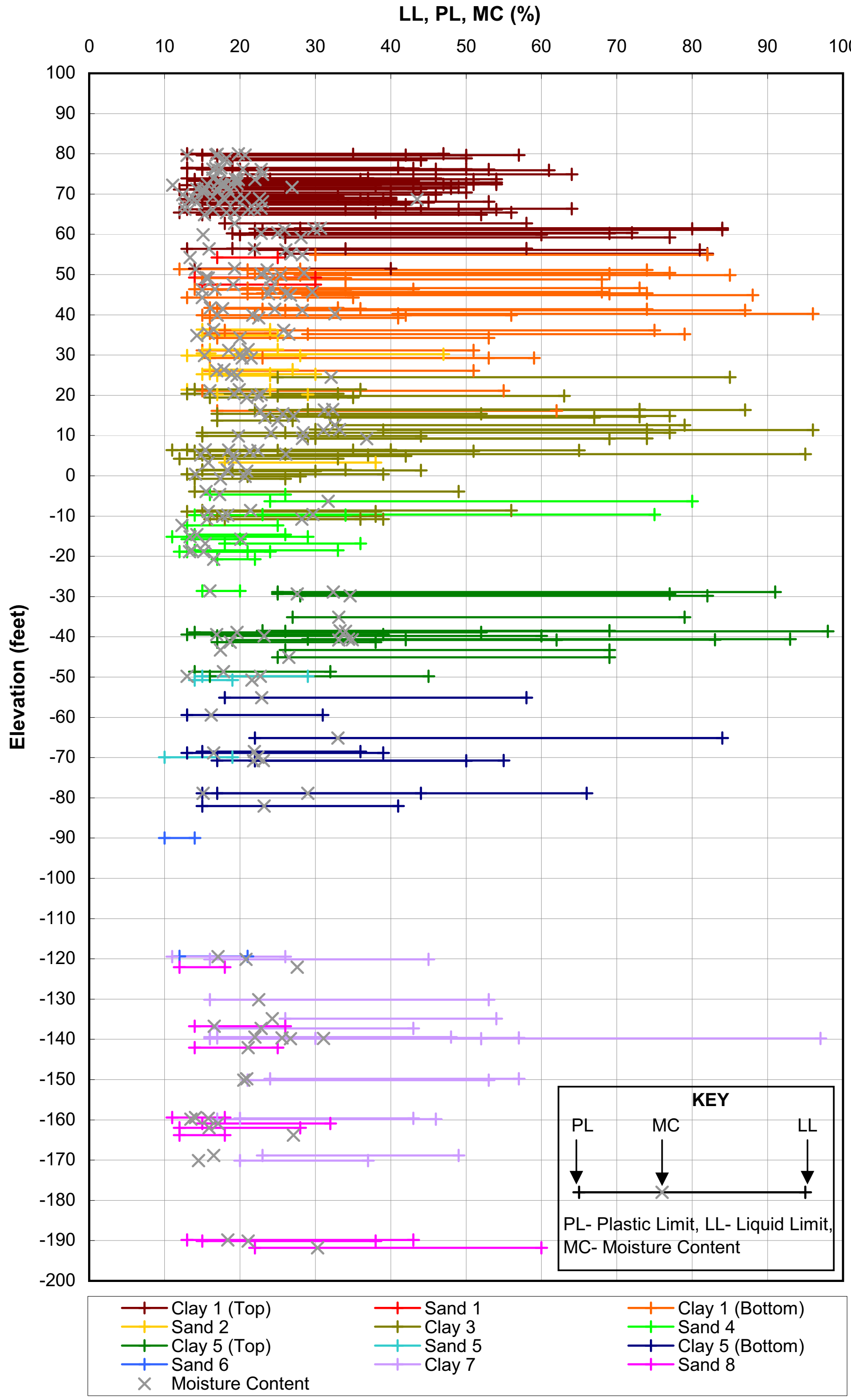


Figure 2.5.4-A-41 Atterberg Limits Test Results (Power Block Area) (Sheet 1 of 4)

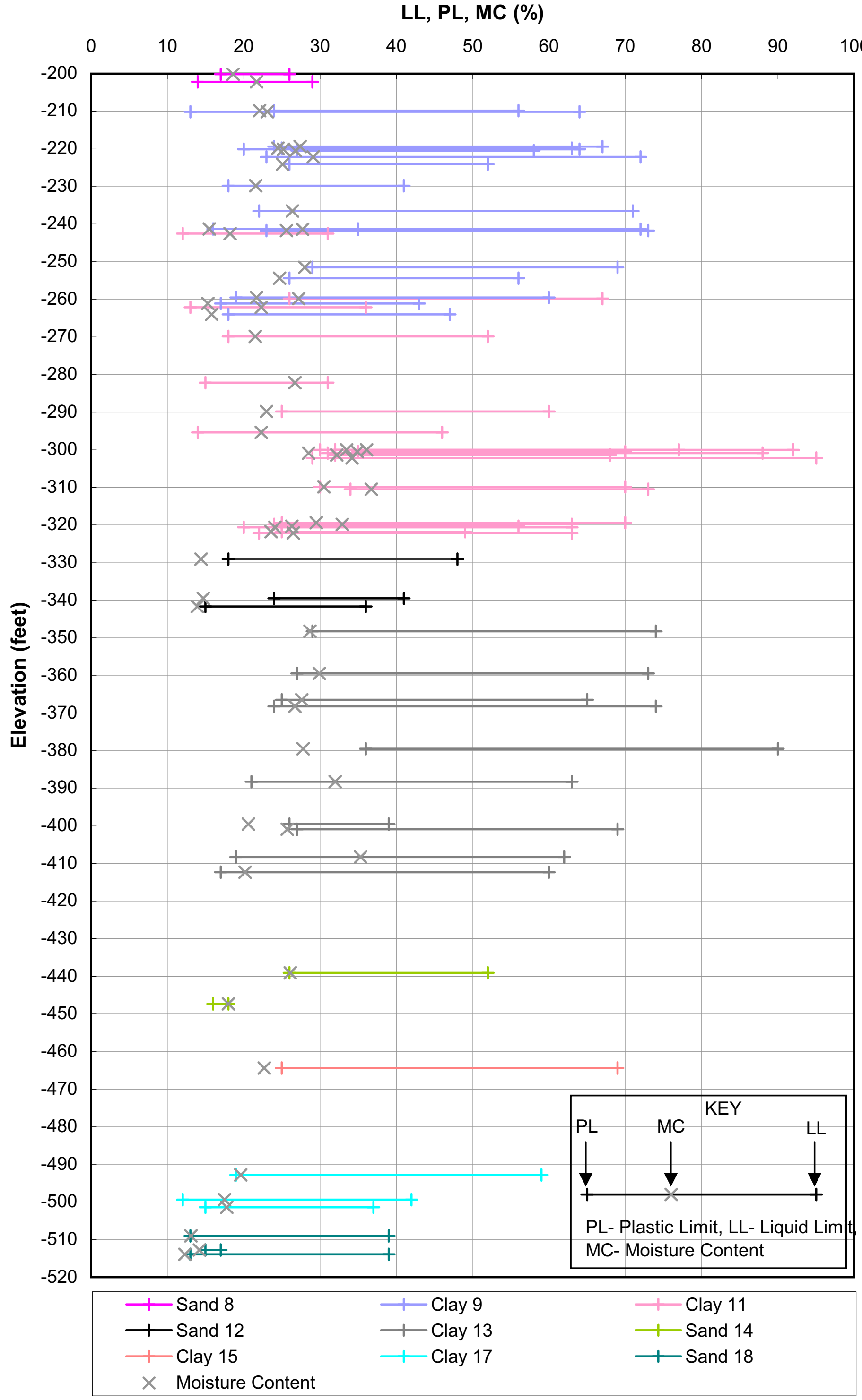


Figure 2.5.4-A-41 Atterberg Limits Test Results (Power Block Area) (Sheet 2 of 4)

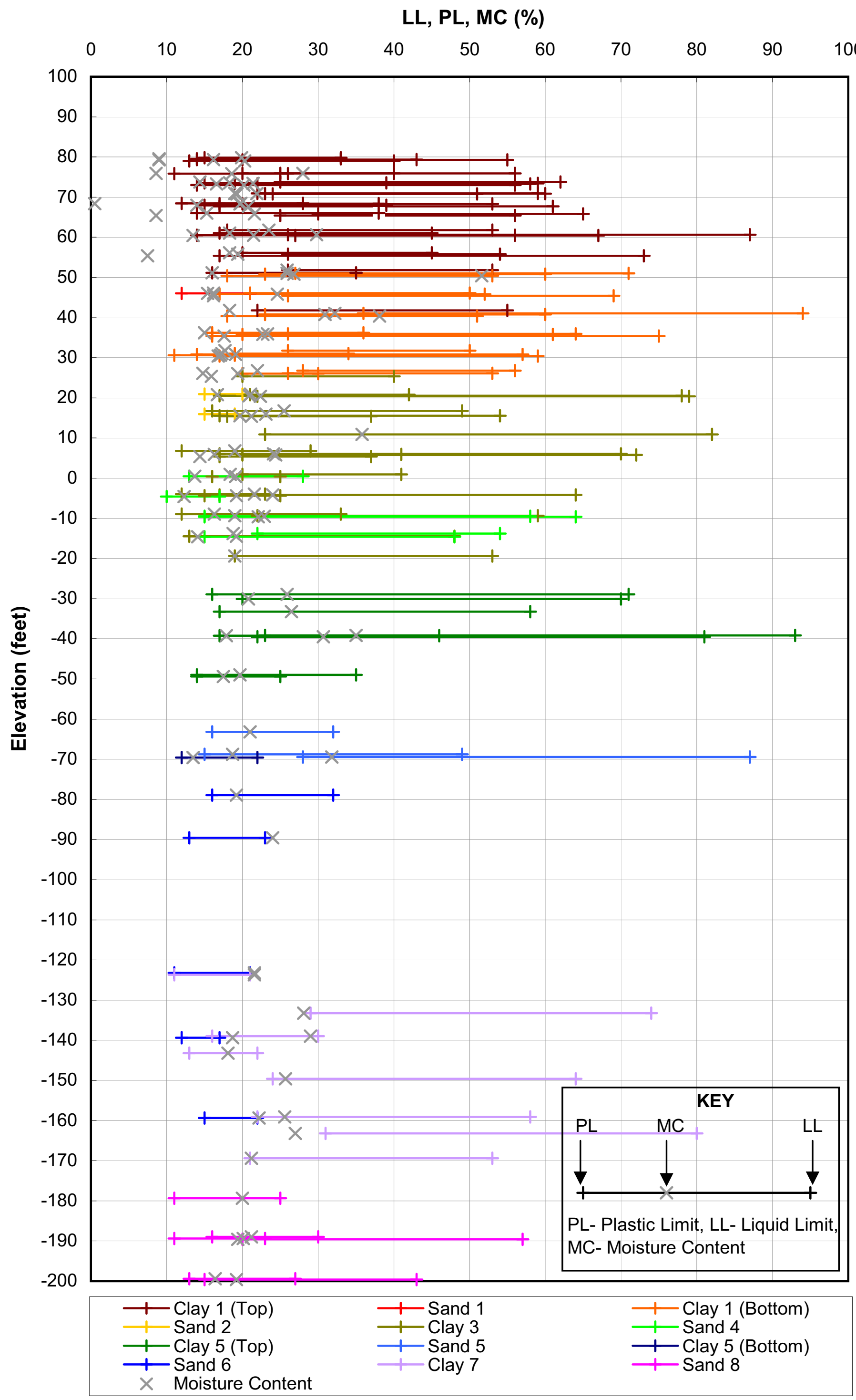


Figure 2.5.4-A-41 Atterberg Limits Test Results (Power Block Area) (Sheet 3 of 4)

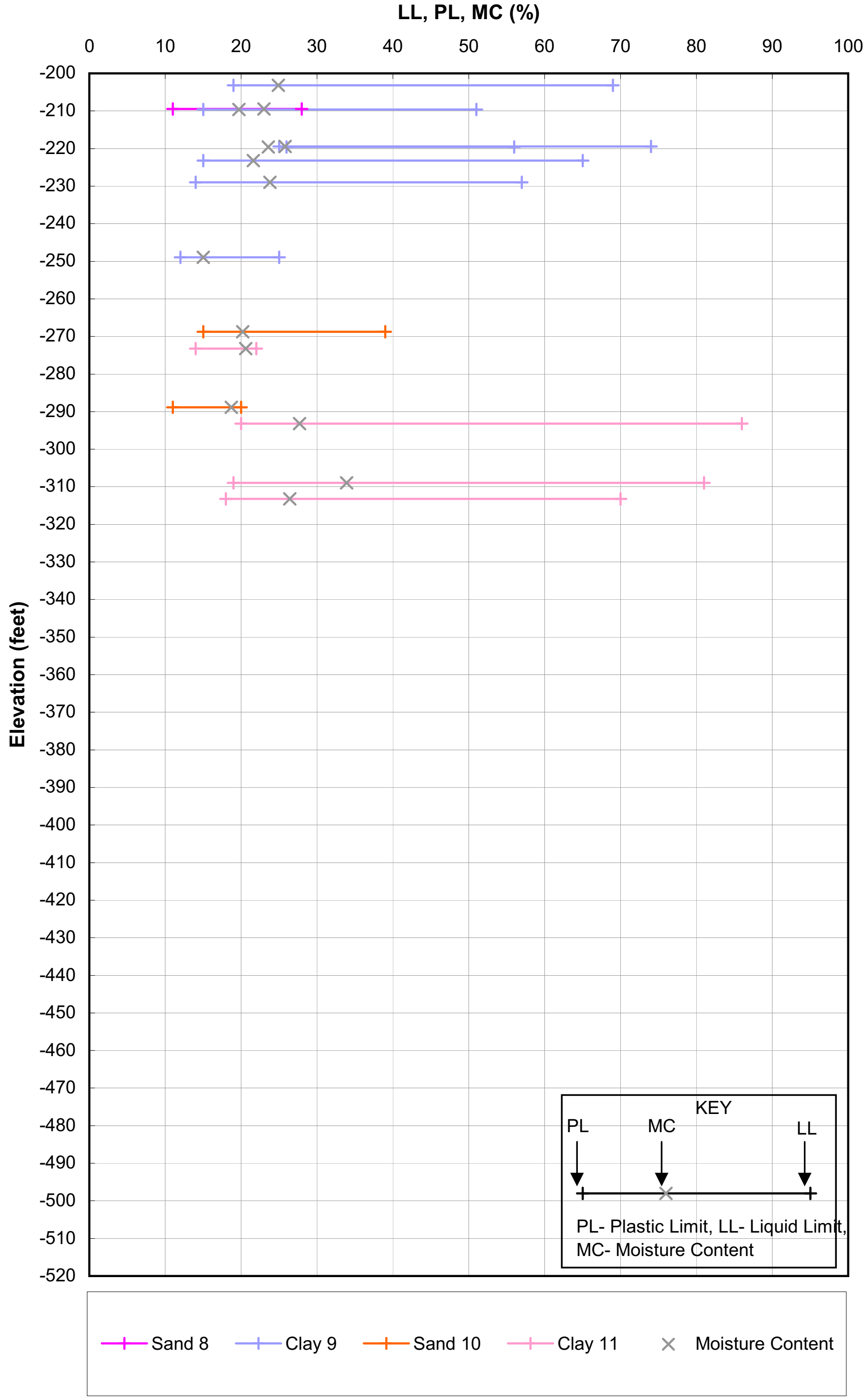


Figure 2.5.4-A-41 Atterberg Limits Test Results (Power Block Area) (Sheet 4 of 4)

Figure 2.5.4-A-42 Not Used

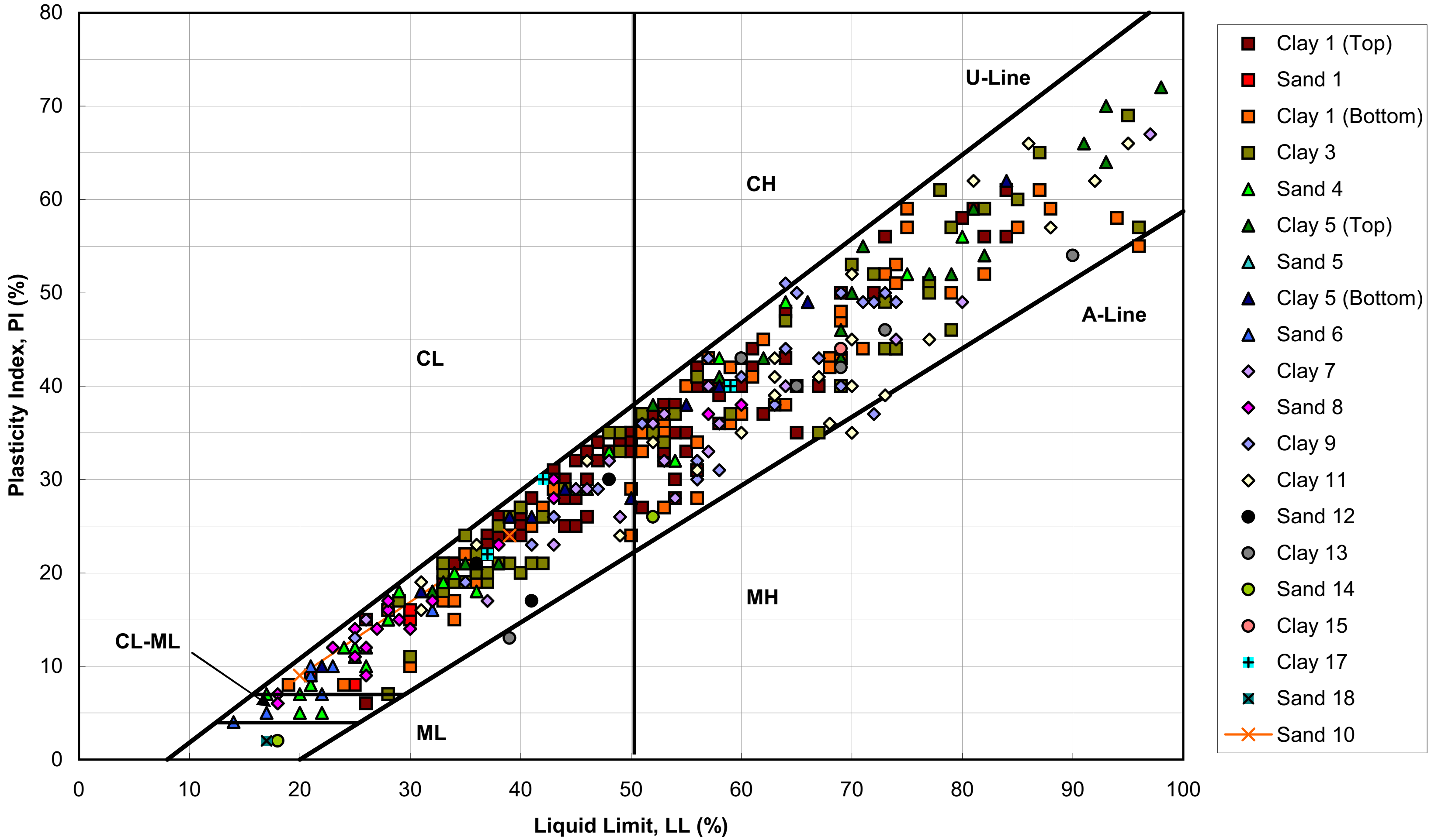


Figure 2.5.4-A-43 Plasticity Chart (Power Block Area)

Figure 2.5.4-A-44 Not Used

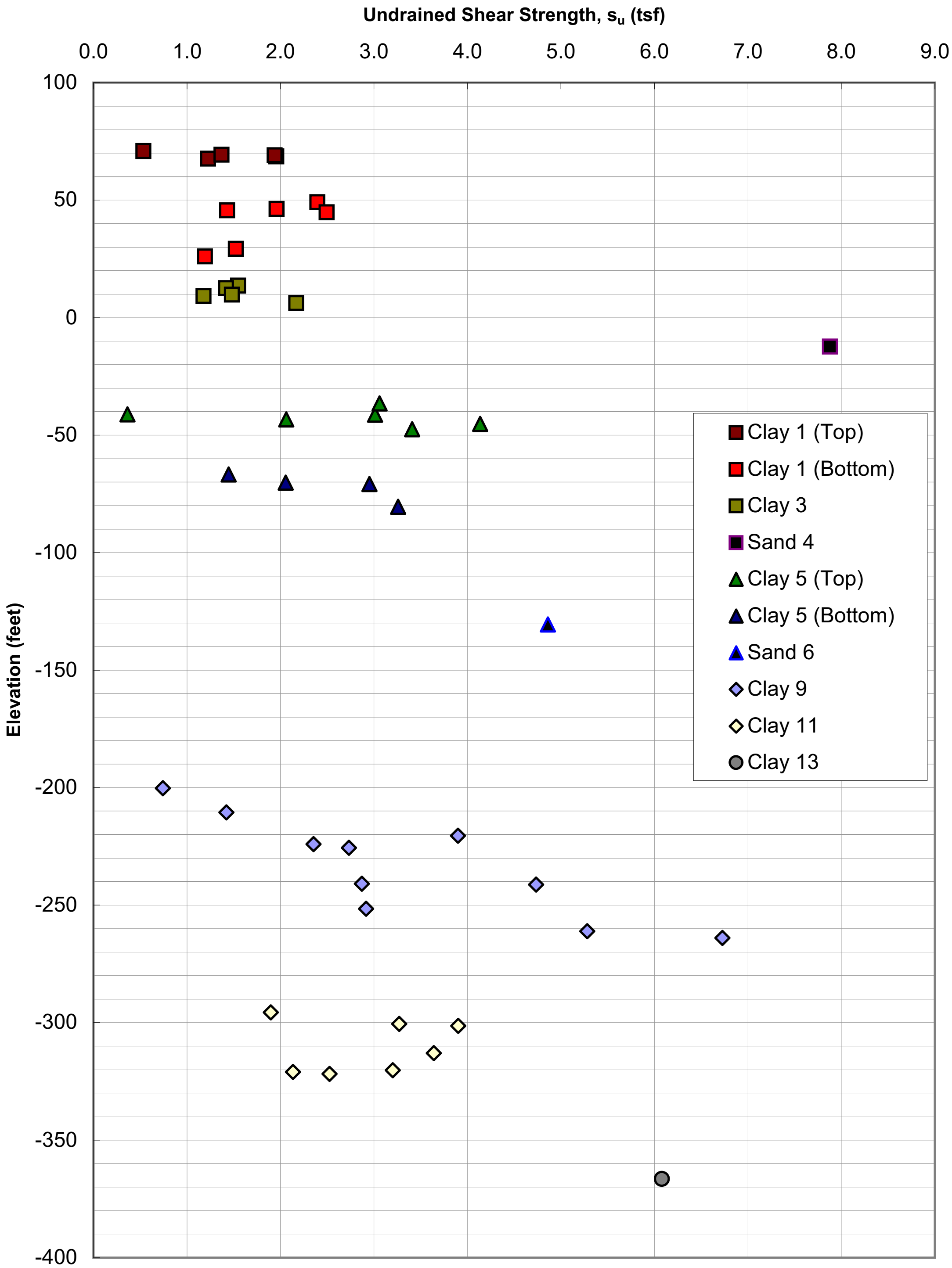


Figure 2.5.4-A-45 Undrained Shear Strengths of Cohesive Soil Strata from Laboratory Testing (Power Block Area)

Figure 2.5.4-A-46   Not Used

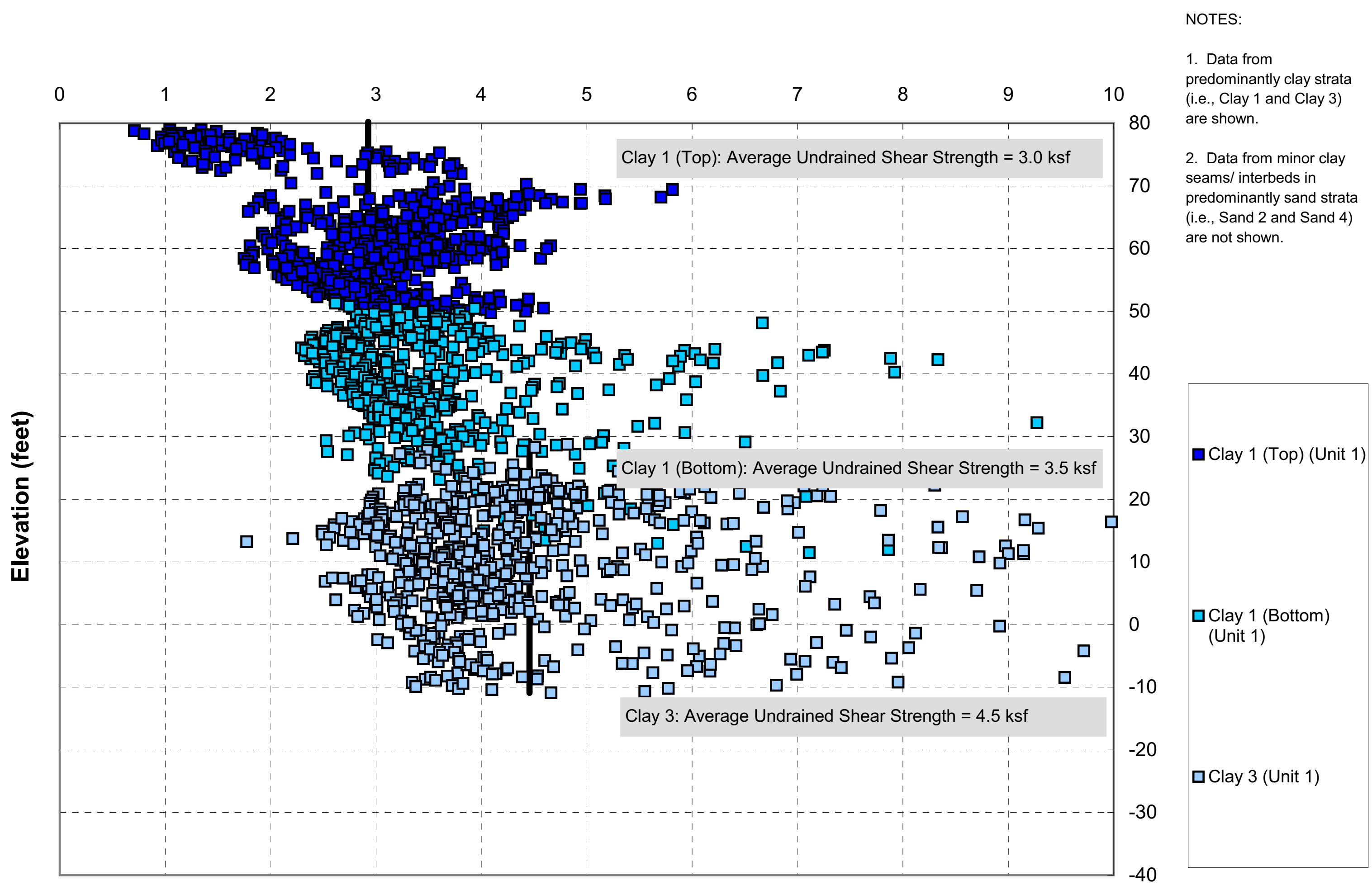
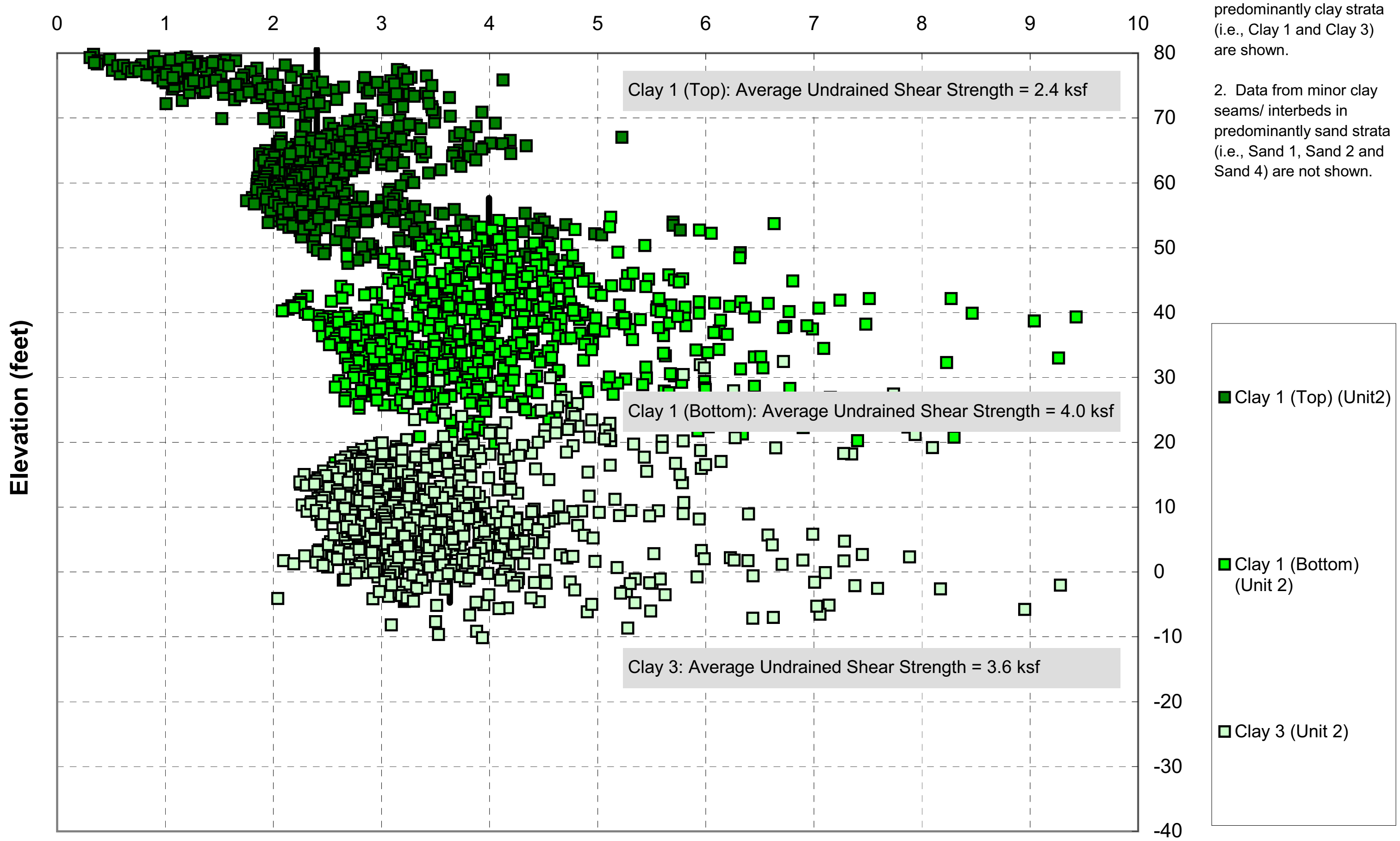


Figure 2.5.4-A-47 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 1 (Power Block Area)



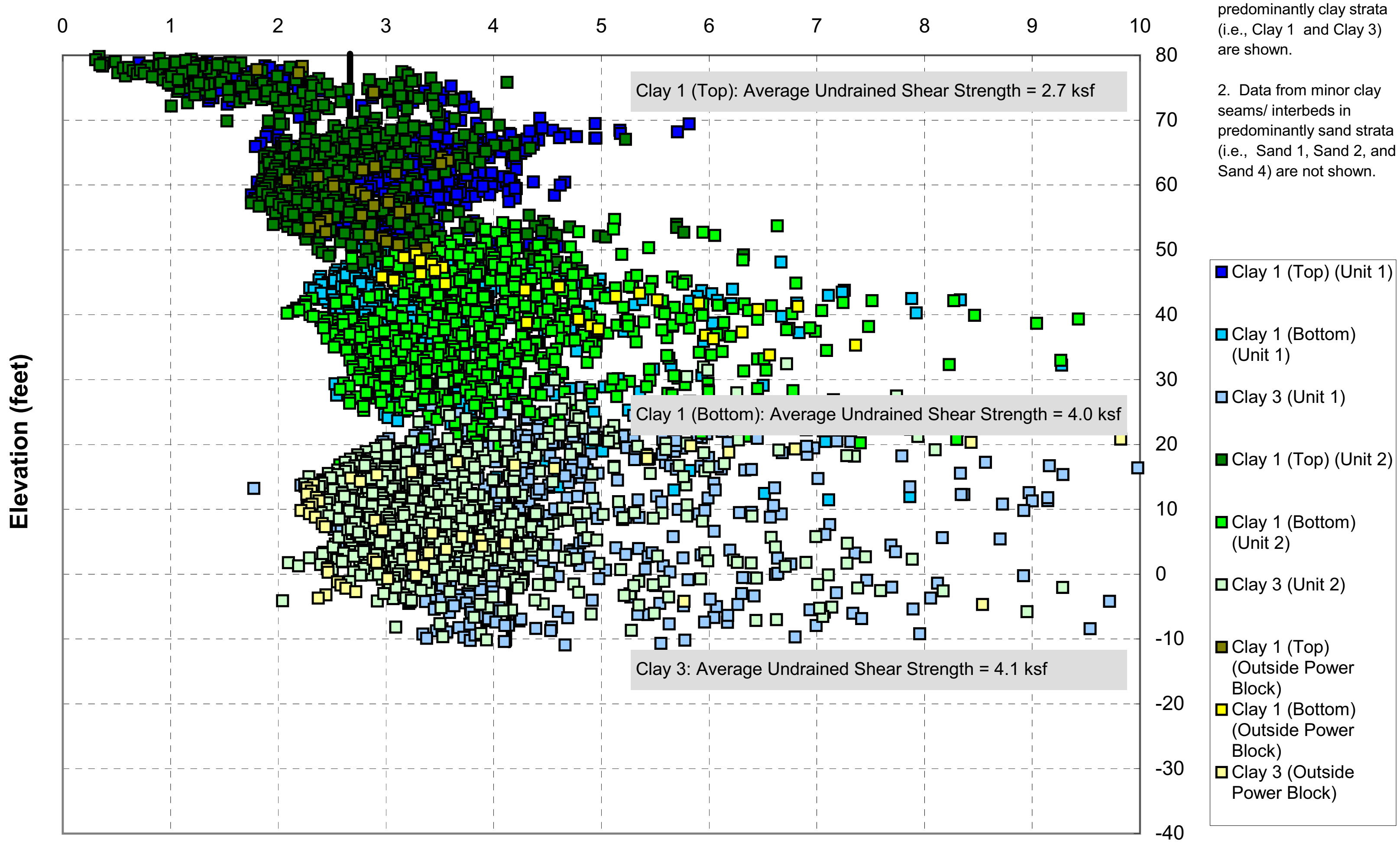
NOTES:

1. Data from predominantly clay strata (i.e., Clay 1 and Clay 3) are shown.

2. Data from minor clay seams/ interbeds in predominantly sand strata (i.e., Sand 1, Sand 2 and Sand 4) are not shown.

Figure 2.5.4-A-48 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 2 (Power Block Area)

Figure 2.5.4-A-49 Not Used



NOTES:

1. Data from predominantly clay strata (i.e., Clay 1 and Clay 3) are shown.

2. Data from minor clay seams/ interbeds in predominantly sand strata (i.e., Sand 1, Sand 2, and Sand 4) are not shown.

Figure 2.5.4-A-50 Undrained Shear Strengths of Cohesive Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area

Figure 2.5.4-A-51 Not Used

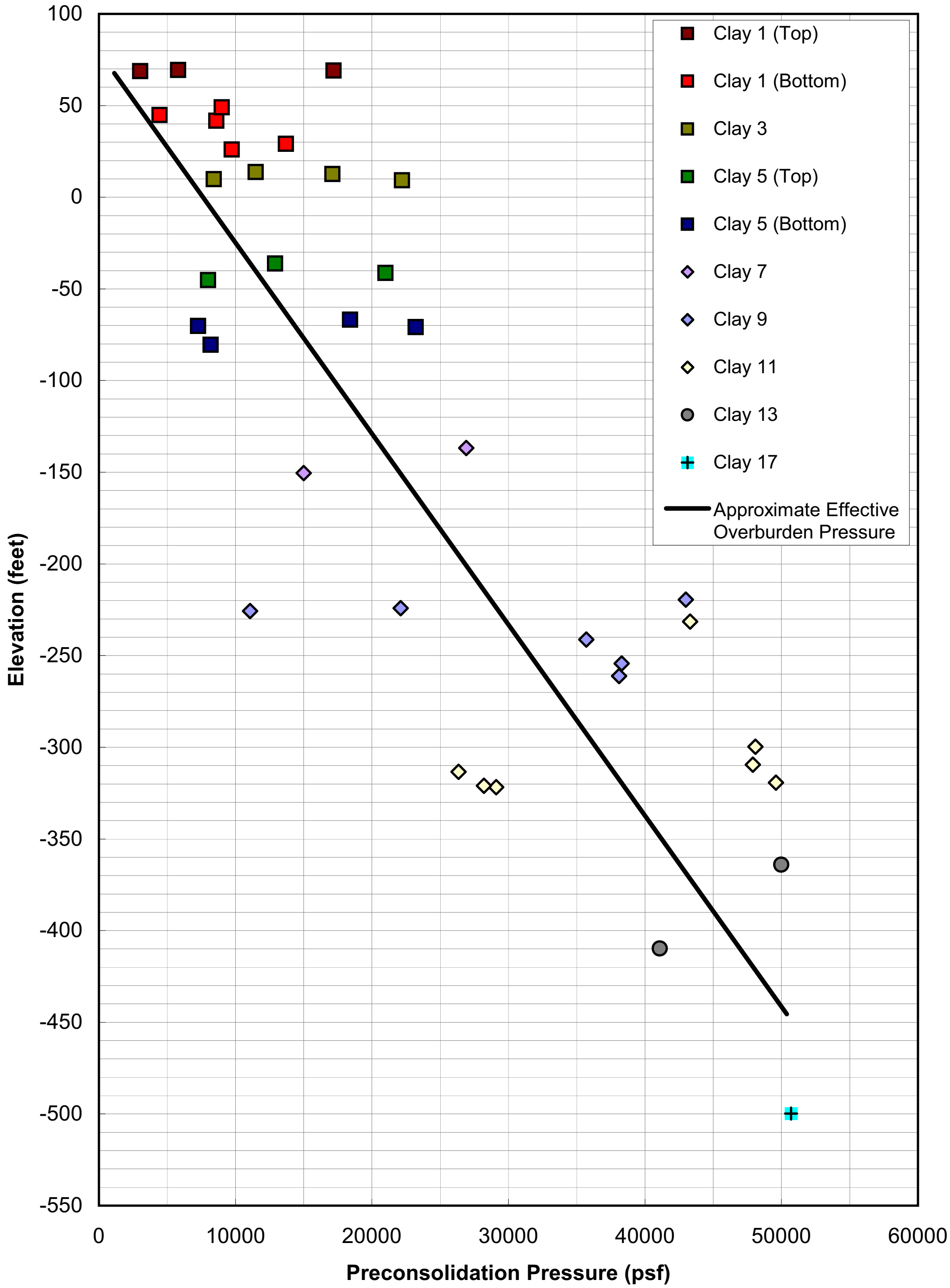


Figure 2.5.4-A-52 Preconsolidation Pressures (Pc') of Cohesive Soil Strata from Laboratory Testing (Power Block Area)

Figure 2.5.4-A-53 Not Used

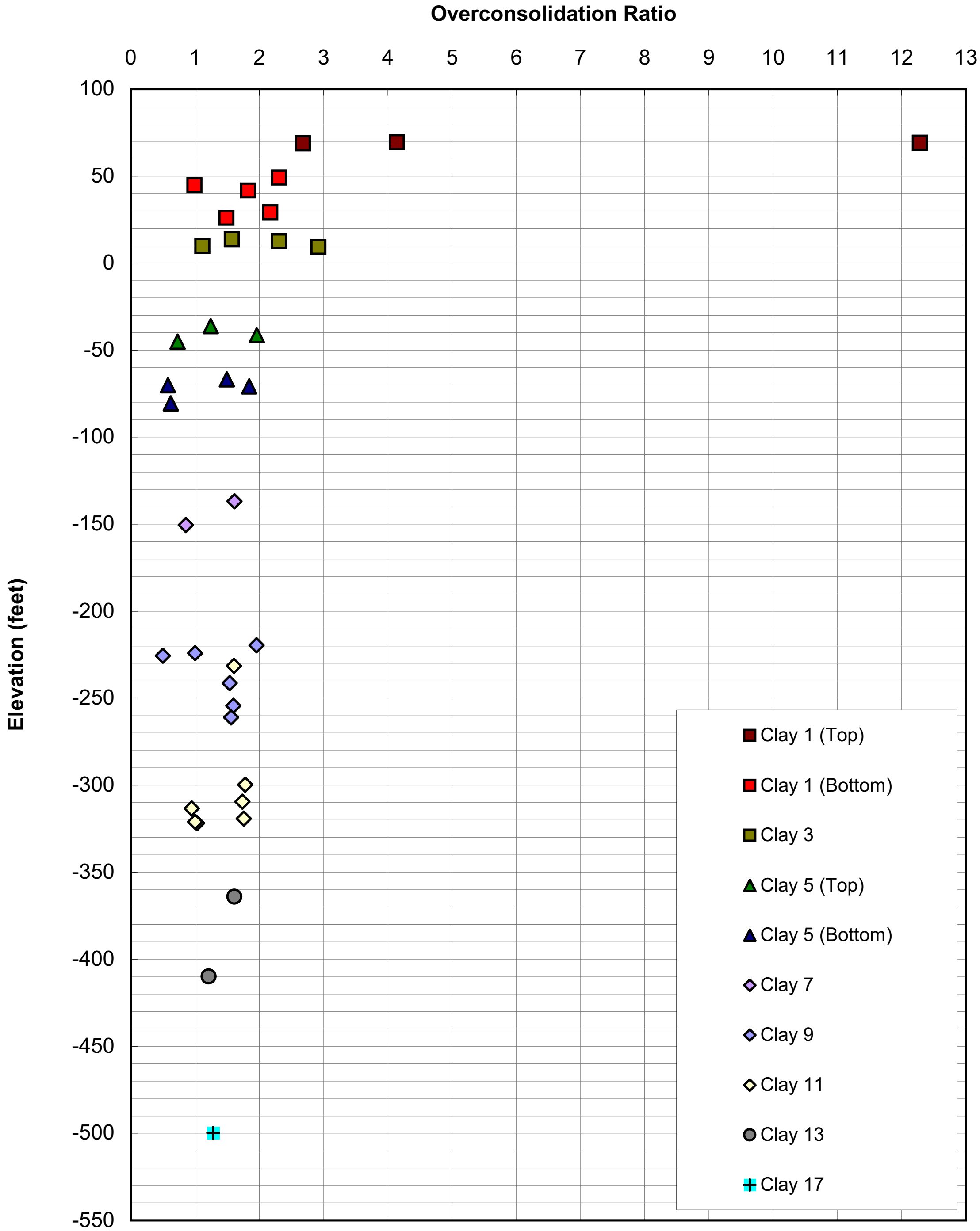


Figure 2.5.4-A-54 Preconsolidation Pressures (Pc') of Cohesive Soil Strata from Laboratory Testing (Power Block Area)

Figure 2.5.4-A-55 Not Used

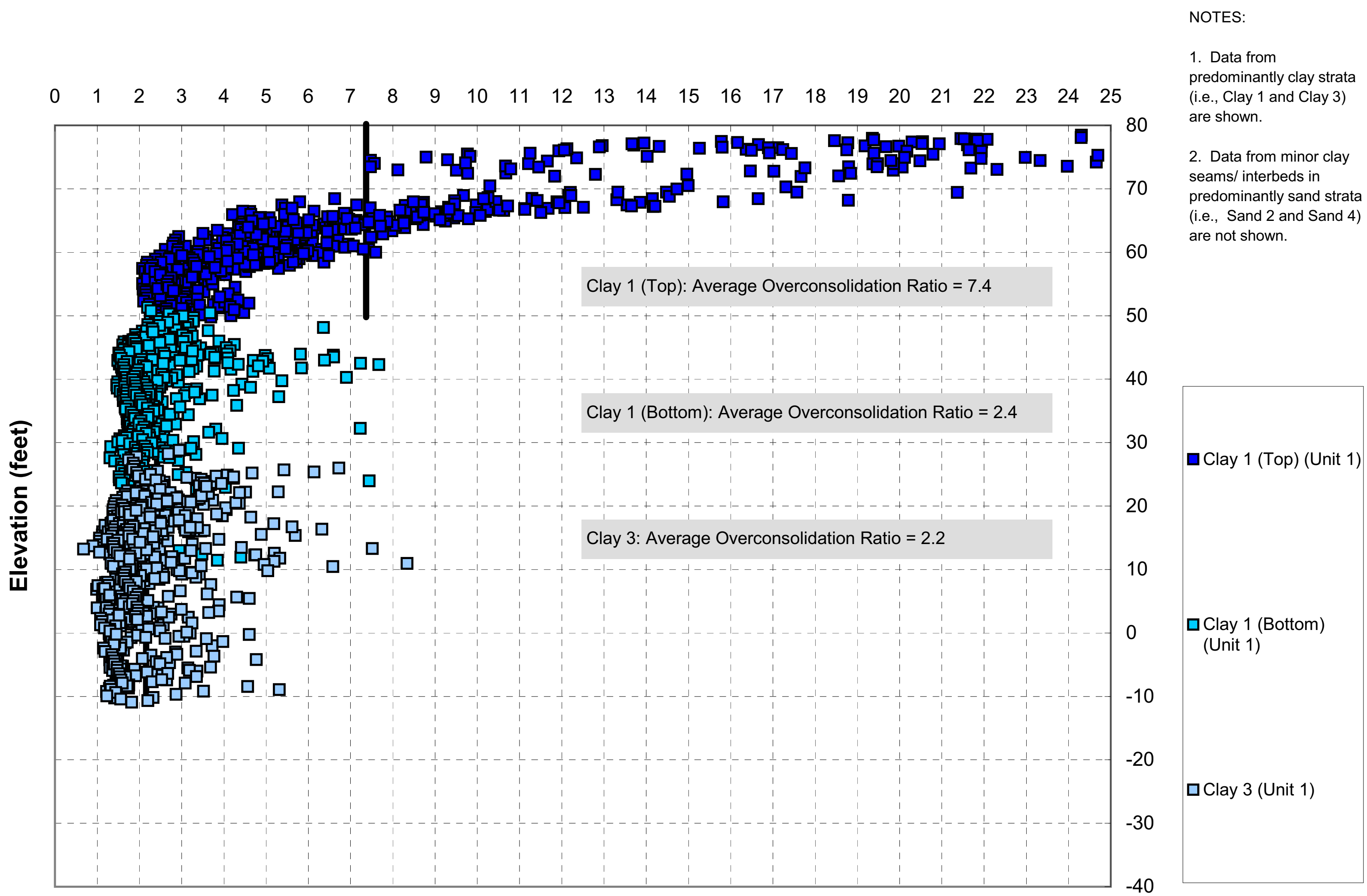


Figure 2.5.4-A-56 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 1 (Power Block Area)

NOTES:

1. Data from predominantly clay strata (i.e., Clay 1 and Clay 3) are shown.

2. Data from minor clay seams/ interbeds in predominantly sand strata (i.e., Sand 1, Sand 2 and Sand 4) are not shown.

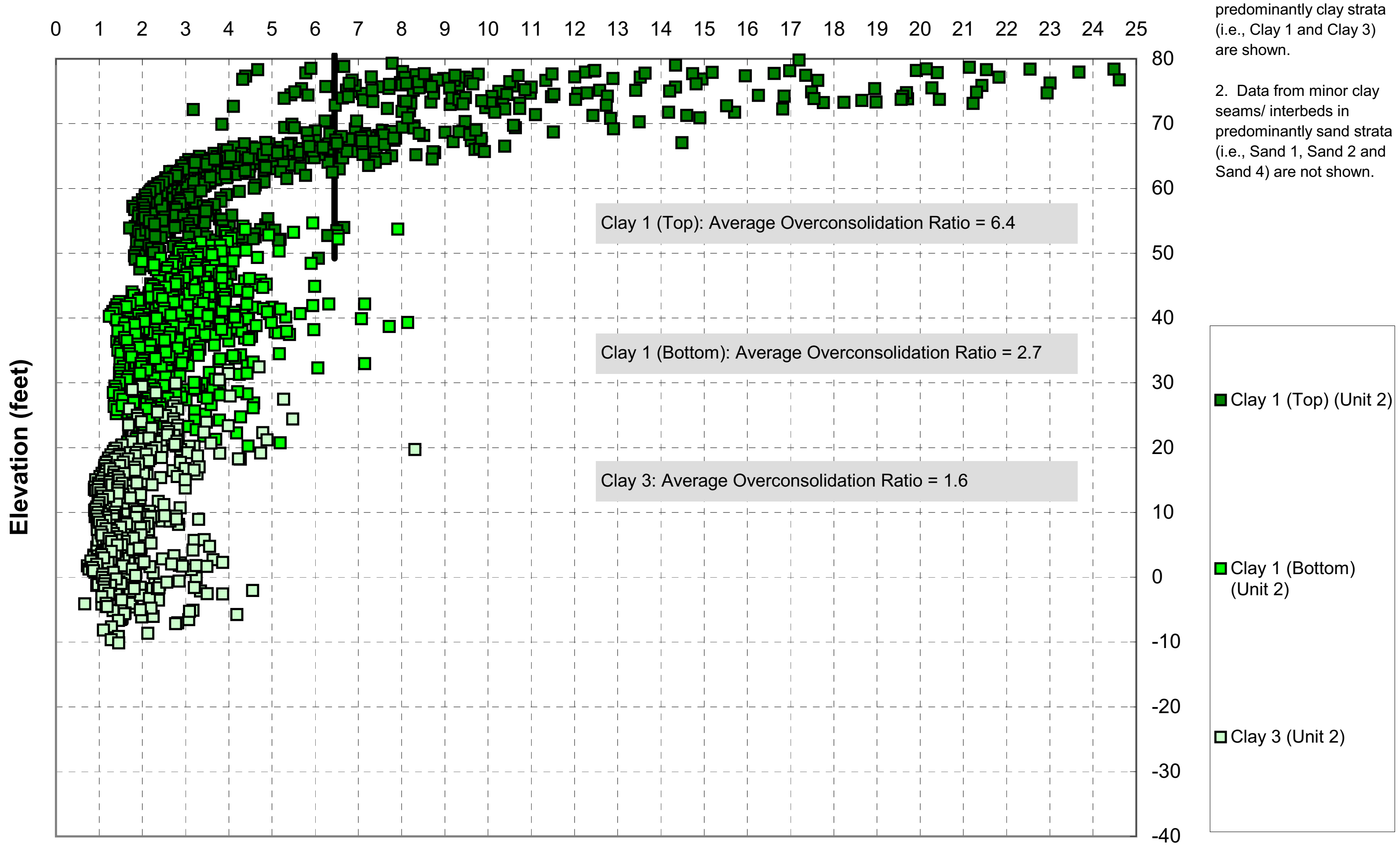


Figure 2.5.4-A-57 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 2 (Power Block Area)

Figure 2.5.4-A-58   Not Used

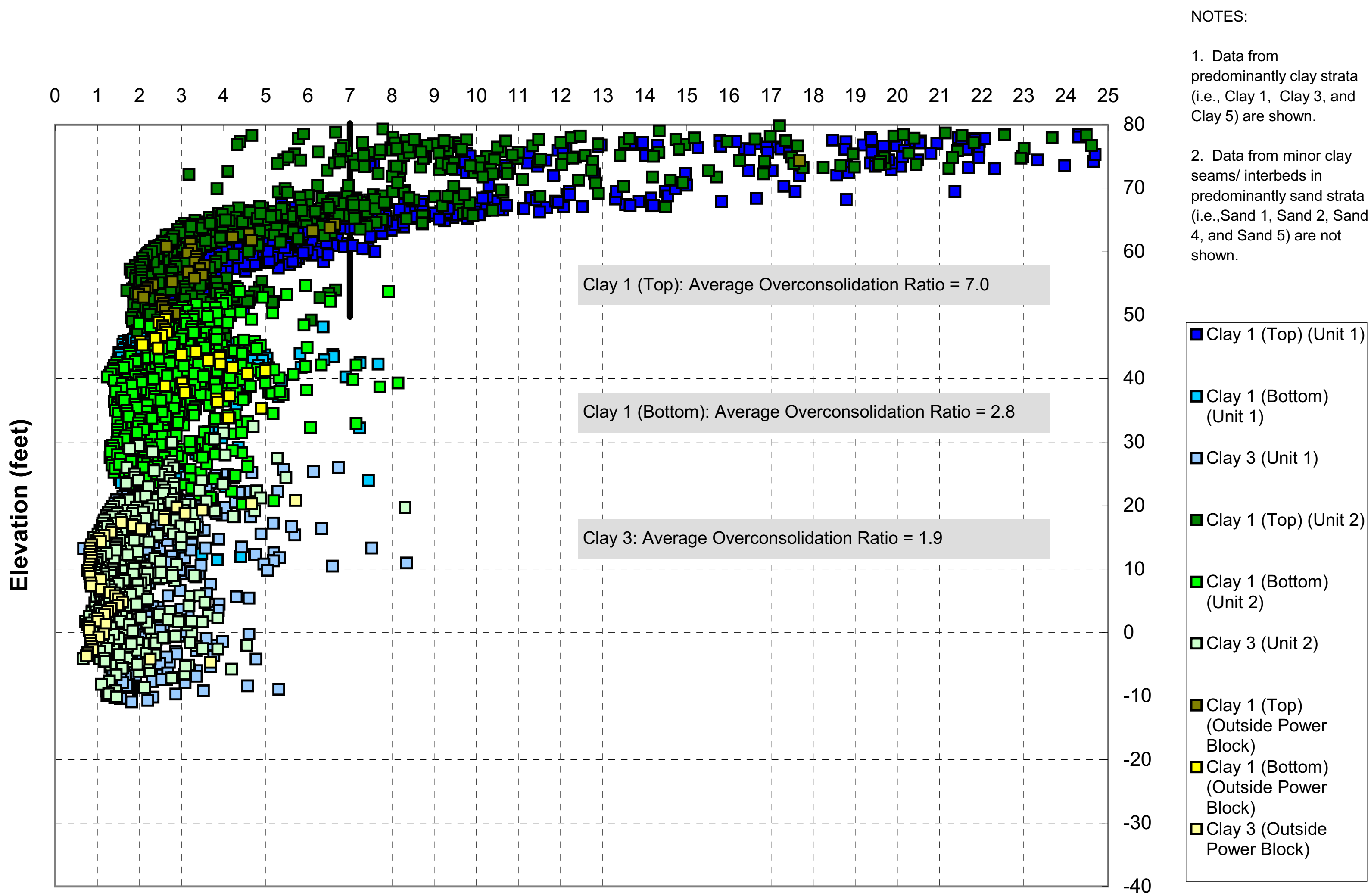


Figure 2.5.4-A-59 Overconsolidation Ratios of Cohesive Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area

Figure 2.5.4-A-60 Not Used

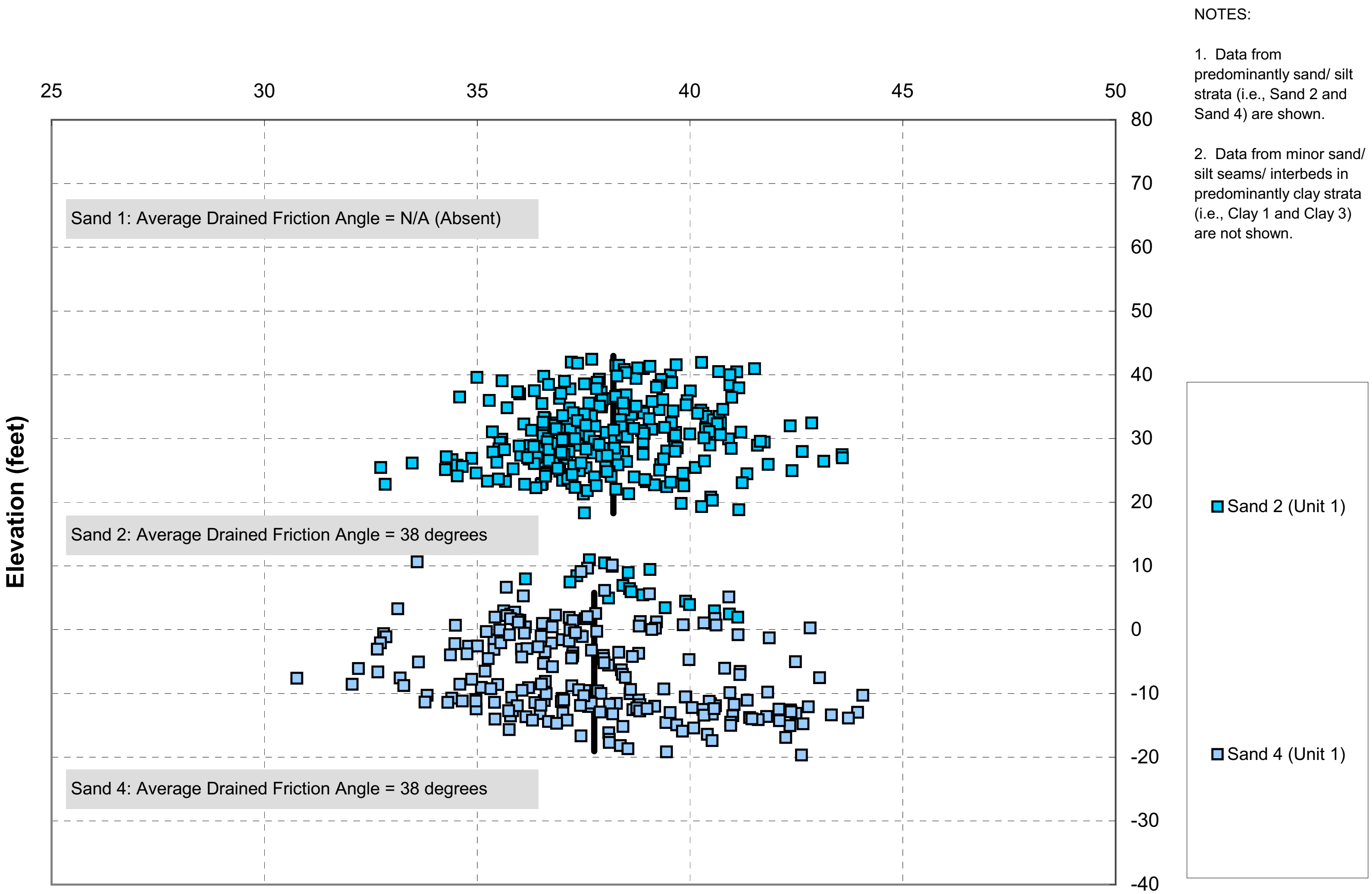


Figure 2.5.4-A-61 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 1 (Power Block Area)

NOTES:

1. Data from predominantly sand/ silt strata (i.e., Sand 1, Sand 2, and Sand 4) are shown.

2. Data from minor sand/ silt seams/ interbeds in predominantly clay strata (i.e., Clay 1 and Clay 3) are not shown.

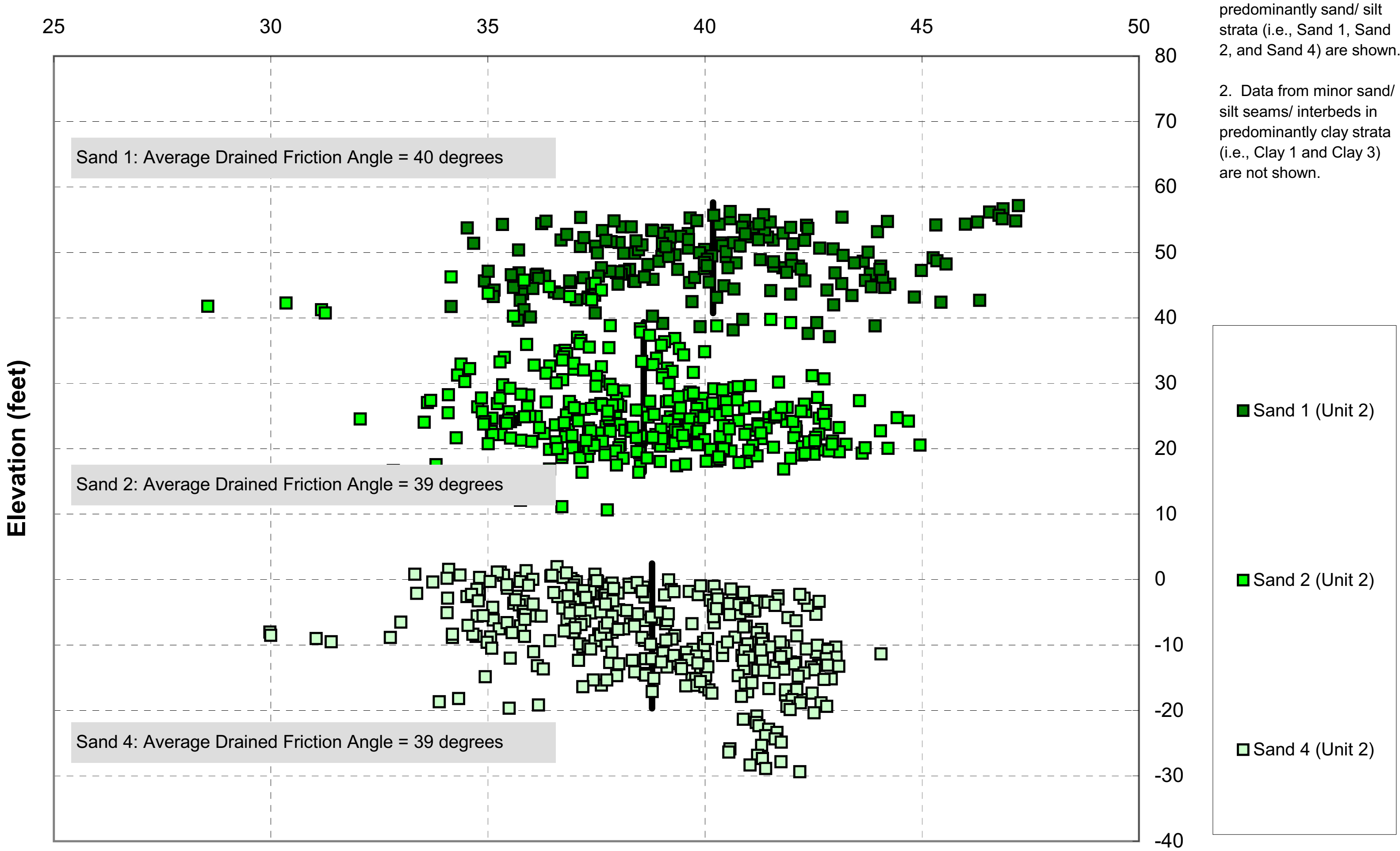
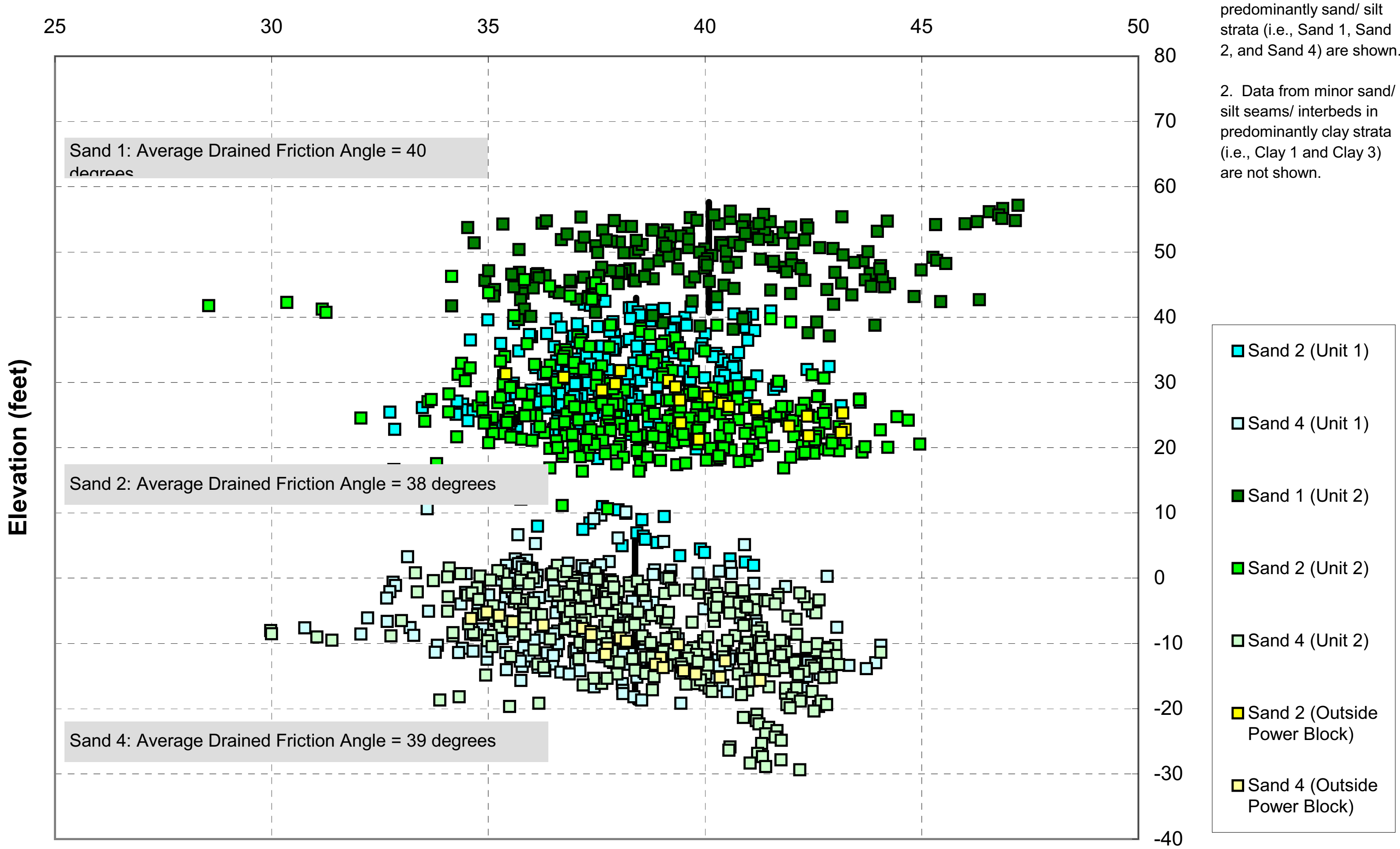


Figure 2.5.4-A-62 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 2 (Power Block Area)

Figure 2.5.4-A-63 Not Used



NOTES:

1. Data from predominantly sand/ silt strata (i.e., Sand 1, Sand 2, and Sand 4) are shown.

2. Data from minor sand/ silt seams/ interbeds in predominantly clay strata (i.e., Clay 1 and Clay 3) are not shown.

Figure 2.5.4-A-64 Drained Friction Angles (Phi') of Cohesionless Soil Strata from CPT Data; Unit 1, Unit 2, and Investigations Outside Power Block Area

Figure 2.5.4-A-65 Not Used

Figure 2.5.4-A-66 Not Used

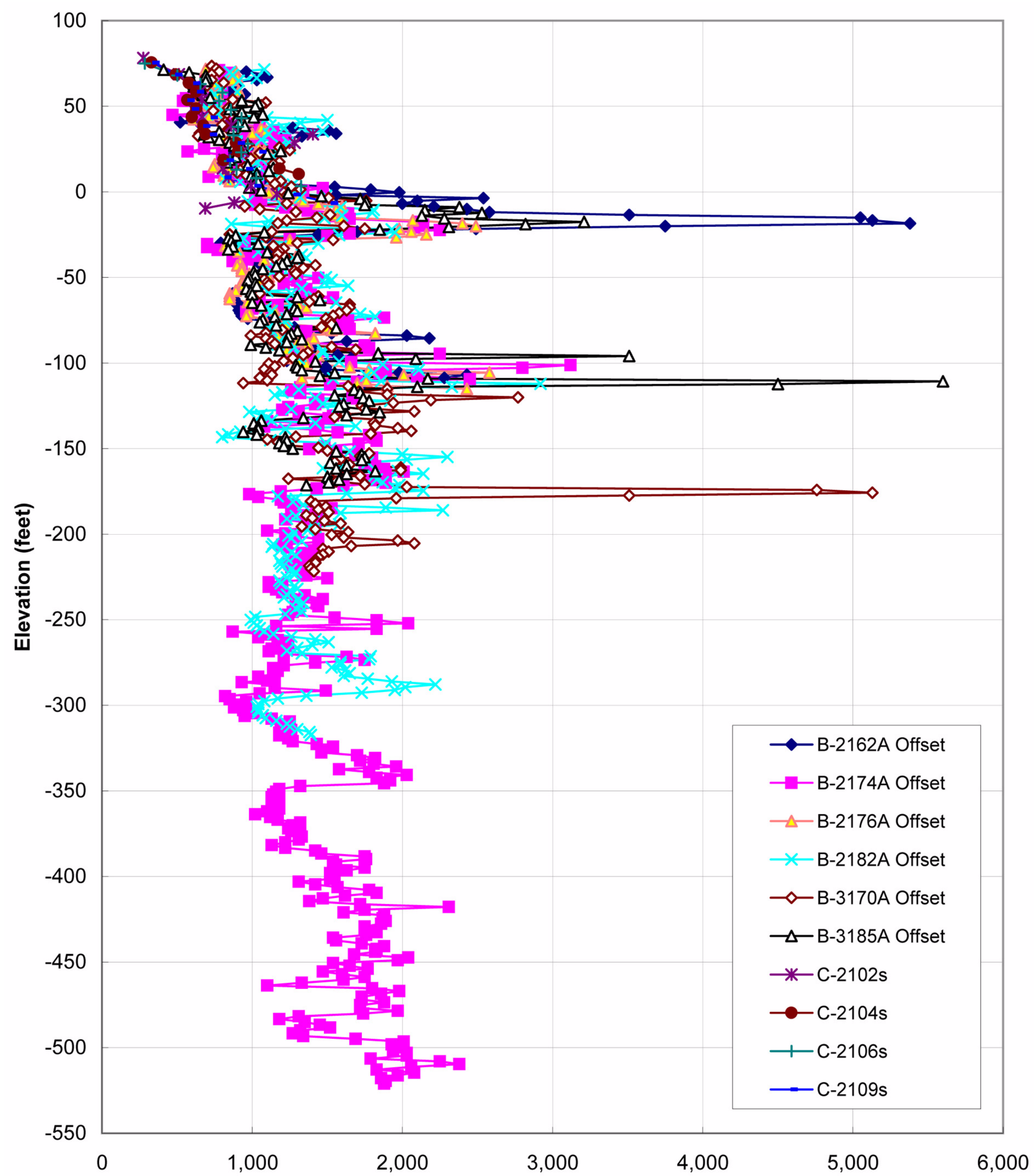


Figure 2.5.4-A-67 S-Wave Velocity versus Elevation; Unit 1; Upper Approximately 600 Feet of Site Soils (Power Block Area)

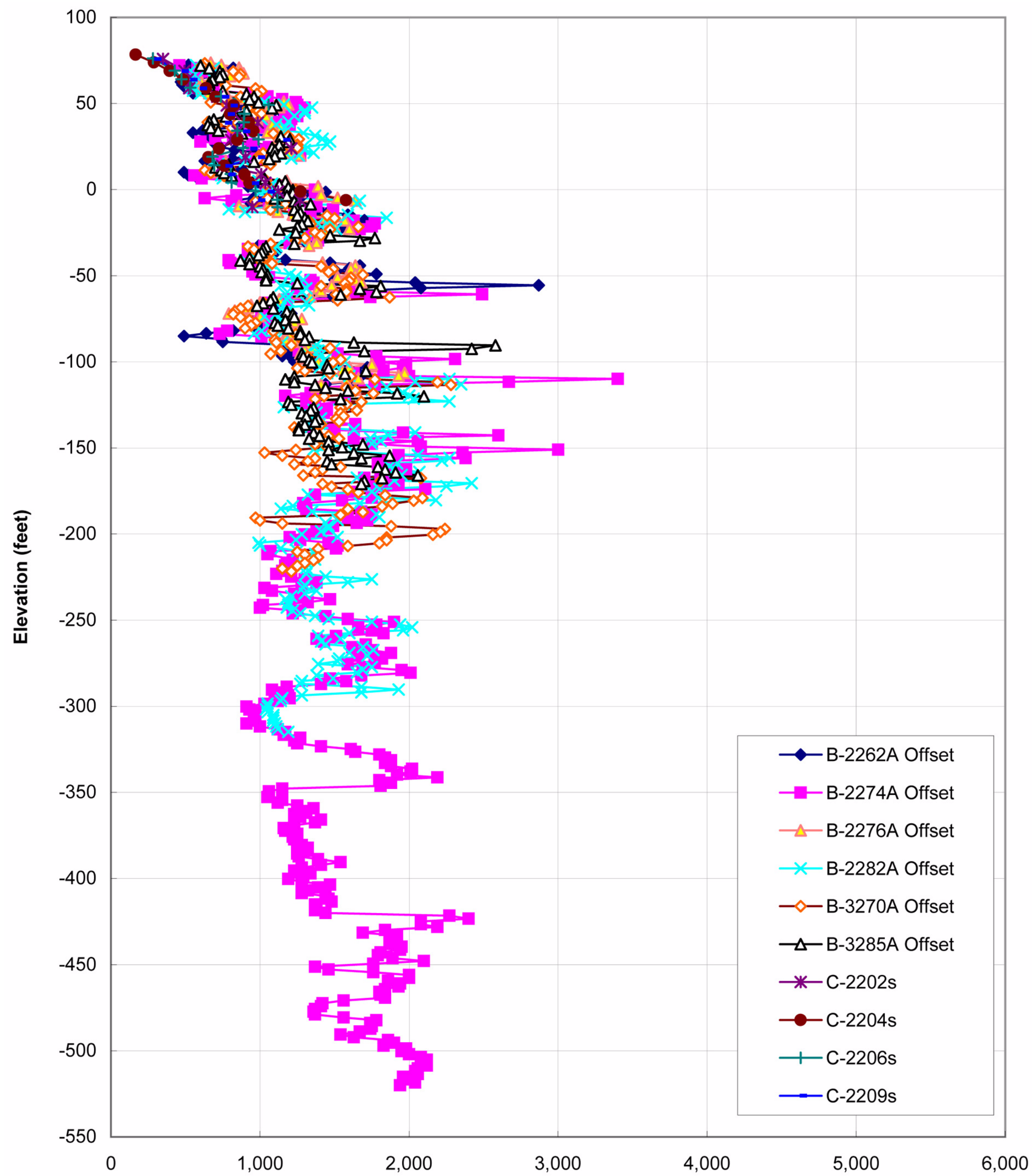


Figure 2.5.4-A-68 S-Wave Velocity versus Elevation; Unit 2; Upper Approximately 600 Feet of Site Soils (Power Block Area)

Figure 2.5.4-A-69 Not Used

Figure 2.5.4-A-70 Not Used

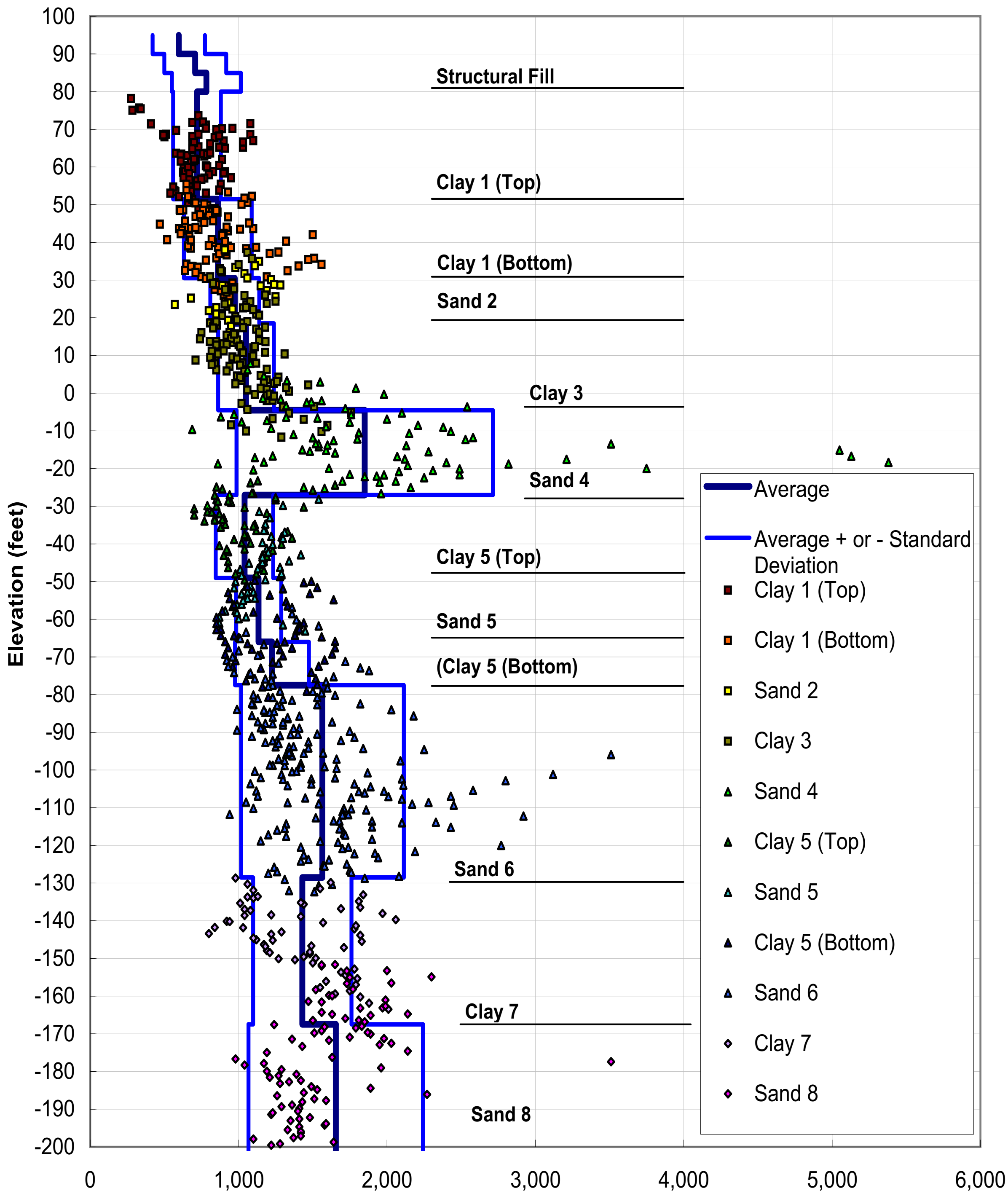


Figure 2.5.4-A-71 Average S-Wave Velocity Profile; Unit 1 (Power Block Area) (Sheet 1 of 2)

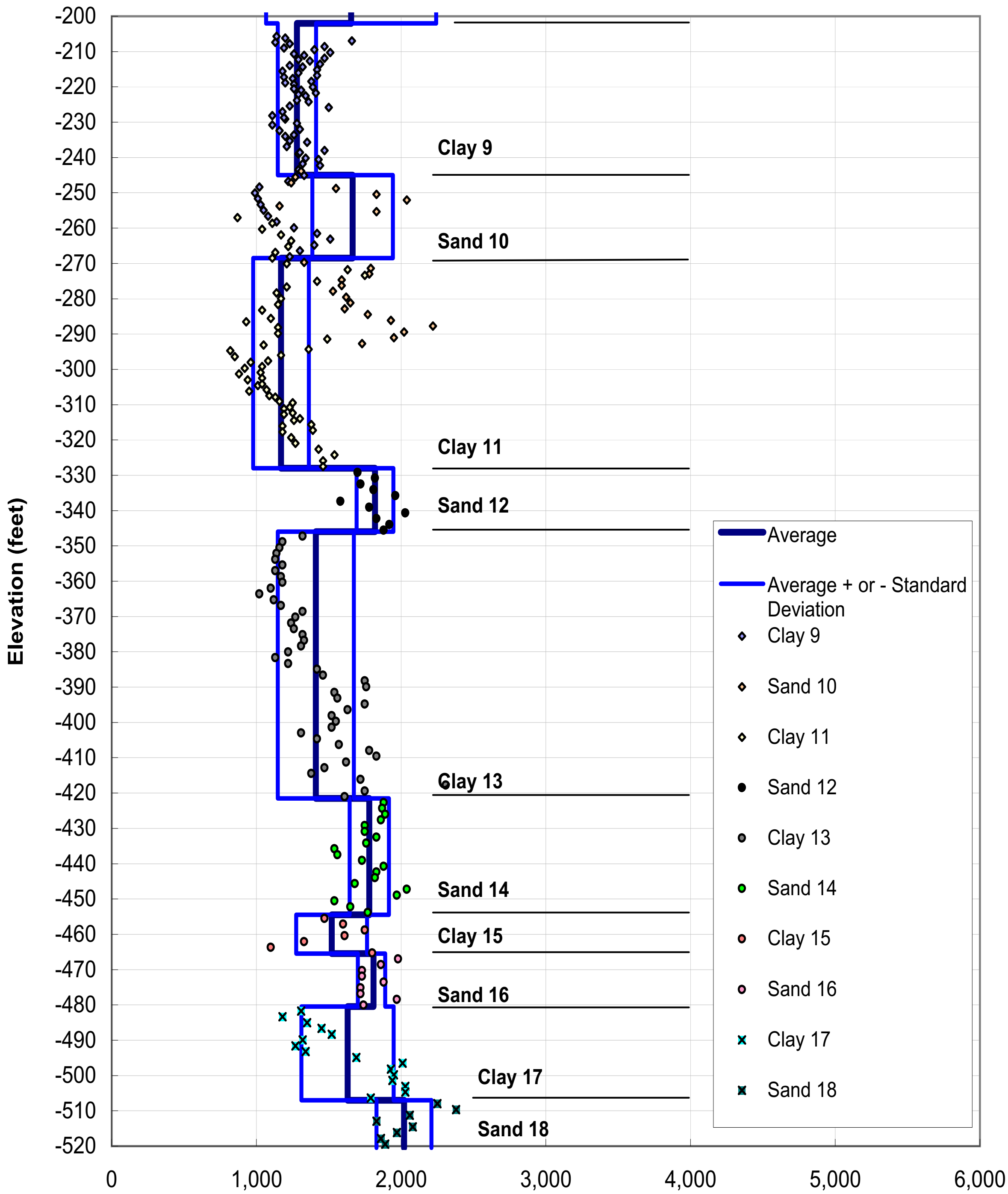


Figure 2.5.4-A-71 Average S-Wave Velocity Profile; Unit 1 (Power Block Area) (Sheet 2 of 2)

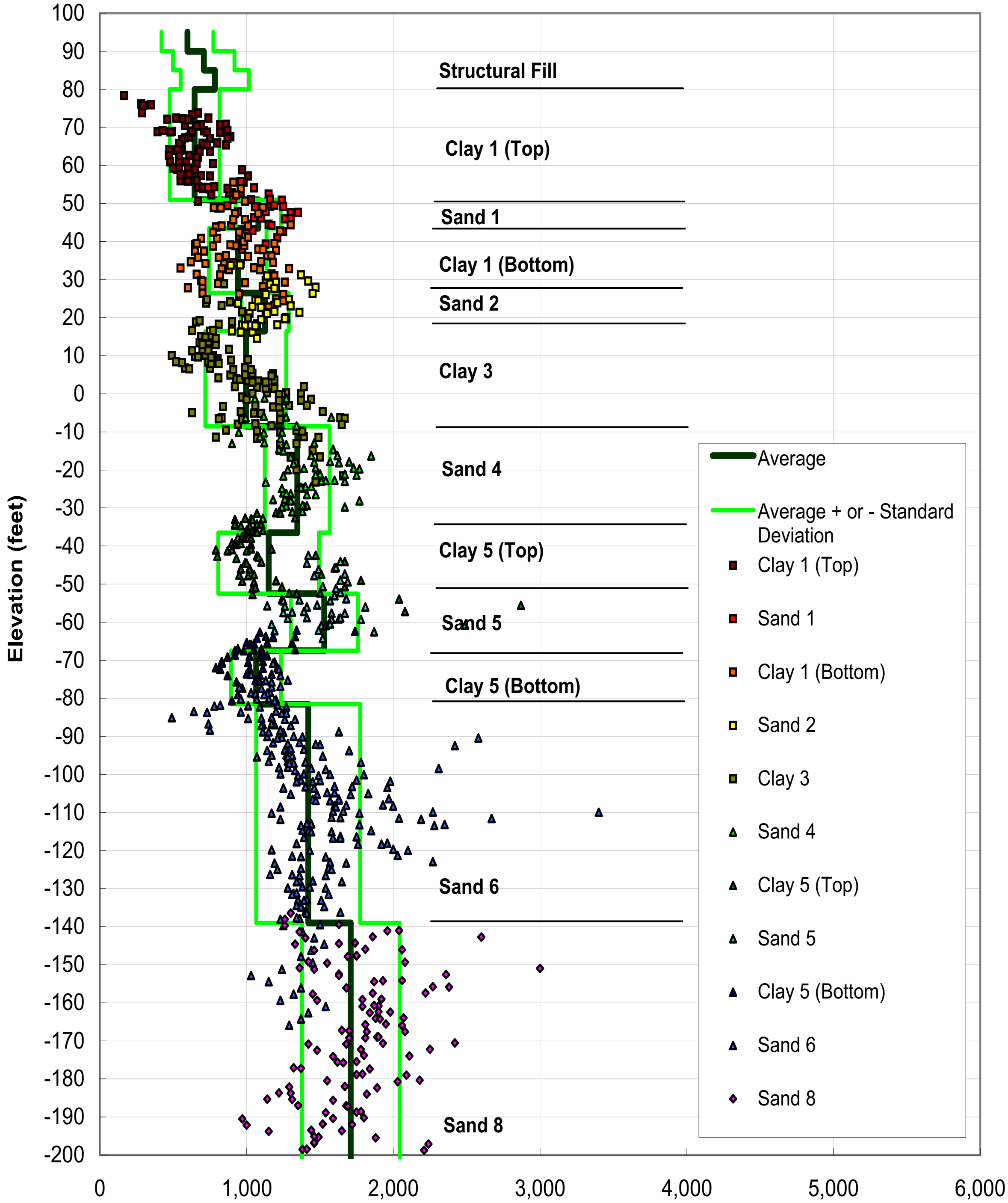


Figure 2.5.4-A-72 Average S-Wave Velocity Profile; Unit 2 (Power Block Area) (Sheet 1 of 2)

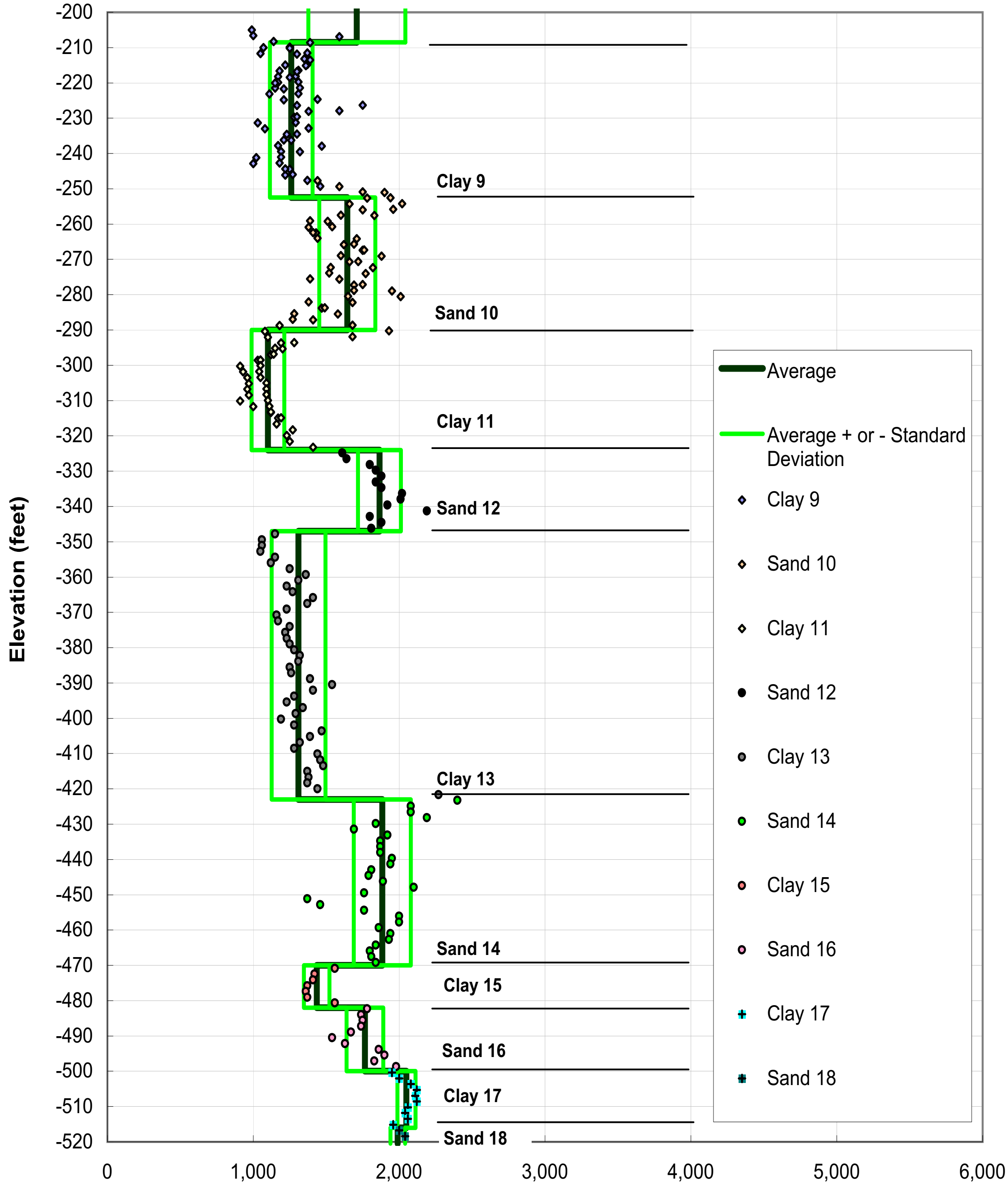


Figure 2.5.4-A-72 Average S-Wave Velocity Profile; Unit 2 (Power Block Area) (Sheet 2 of 2)